

## The Cognition of Creativity

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What is creativity? What is it not? This paper briefly summarizes a great deal of research on the cognitive processes underlying creative thought and action. Although some evidence suggests that some people may simply be more creative than others, understanding the cognition involved when people create can help us all to learn to be more creative. Includes tips for encouraging and nurturing creativity within your organization.

### What Is Creativity?

Although we all know what we think we mean by the term creativity, it can actually mean very different things to different people. Some would insist that creativity occurs only rarely within the lives of a relatively few quite bizarre—perhaps even weird—individuals. Others maintain that anyone can be creative with the right direction and experience. Still others would disagree about whether creativity is more the product of an isolated genius or a collective ability to exploit the meaning already inherent within a society's culture. Finally, some might argue that creativity must imply novelty or originality, producing something beyond or outside any available categories or comparisons.

We might also explore definitional distinctions for creativity across different constituencies. Corporate executives would almost certainly equate creativity with intellectual property, or IP. They might

measure the creativity of their organization by the number of patents secured, copyrights obtained or trademarks granted. On the other hand, writers, artists or musicians would most likely argue that creativity involves unusual skills or abilities, highly influential material within their domains of expertise, or work that stands out as particularly noteworthy for a variety of reasons—either to experts or novices. Most people would agree that creativity seems to be rare—whether considering individual life spans or comparing individuals across society.

In an attempt to make sense of all these differing views, let's examine some of the research evidence that has accumulated on creativity. Trying to understand creativity has produced a vast literature spanning psychology, anthropology, biology, archaeology, sociology, business, literature, the arts, architecture, design, and several other disciplines. This brief review of the large amount of information available will

concentrate on a psychological perspective more than any other, but all the perspectives add important dimensions to the concept. Psychologists primarily study topics from an individual's point of view, but recent work has begun to appreciate the larger contexts in which creativity occurs and their role in its manifestation.

### What Creativity Isn't

Rather than providing a positive definition, it might first be easier to dispel many of the persistent myths about creativity, thus clearly indicating what it is not. From the current evidence, it appears that creativity rarely if ever involves completely new or original concepts or ideas. Instead, most creative work efficiently integrates existing information into unusual syntheses or juxtapositions, together with only incremental novelty. The notion of an isolated genius with special powers who consistently stuns the world with great insights, inventions, or ideas--as if by magic--has likewise not enjoyed much empirical support. The bulk of the evidence points instead to the many influences that together produce the ability to build on past accomplishments, approach problems in novel ways, and entertain multiple--perhaps even conflicting--alternative solutions. In this regard, Sir Isaac Newton once remarked, "If I have seen farther than other men, it is because I have stood on the shoulders of giants."

Although creativity can be incremental in relation to its historical context or involve great leaps of imagination, it seems most often to be incremental. In fact, original ideas that jump too far beyond currently available conceptual frameworks are typically ignored or even vilified. There is some controversy over whether popularity alone can indicate evidence of creativity, or whether expert knowledge and information must also be considered. At least it appears safe to say that for something to be truly creative, it must have both a source and

an audience. Analogous to the oft-noted mystery regarding sound without anyone present to hear it, creativity must be appreciated by someone to be considered creative. Otherwise, it might be merely original or novel.

However, novelty and originality figure prominently in many investigations of creativity. In fact, some studies have evaluated "degree" of creativeness specifically in terms of statistical or actuarial rarity. Something's being new or original certainly fits with most people's conception of creativity, but a little more thought reveals that it's an inadequate definition. For example, just because there are more yellow cars than purple ones doesn't mean that purple is thus a more creative color for cars. No doubt there are more "stick" houses than trailers, but few architects would argue that modular homes are more creative due to their scarcity. Nonetheless, novelty enjoys a time-honored position within most acts of creativity.

### A Working Definition

Researchers tend to agree that in addition to being original, something must also be useful, influential, and involve concentrated effort over an extended period of time to be truly creative.<sup>1</sup> Quirky fads seem to be excluded by this definition, but other investigators insist that slang and other "pop" culture such as movie dialogue or a hit song that ultimately has a broader impact on language or lifestyle qualifies as being creative.

As the emphasis shifts from individual creators to the larger contexts of their creations, the definition of what constitutes creativity may widen to include more of the content of popular media and entertainment.

But to corporate executives and other sociopolitical leaders, creativity must ultimately improve society: Creating jobs in the economy, curing disease, decreasing

crime, raising the standard of living, or improving human relationships--among many other laudable goals. Within individual organizations, the term "creativity" is usually reserved for those behaviors resulting in innovations or inventions that initiate or maintain company success (e. g., profitability, market share, competitors' mimicry, employee recruitment & retention). Are there any implications for decision-makers from all this research on creativity that can increase the likelihood of its occurrence in their organizations?

The answer is a tentative "Yes," but before we can delineate some of those applications, let's outline some of the different research approaches to creativity. Investigators distinguish between "mundane" and "exceptional" creativity. The former is often studied under controlled laboratory conditions, while the latter necessarily involves studying individual examples of creativity in their historical or contemporary contexts. Studies of "mundane" creativity seek to understand the cognitive structures and processes involved when anyone behaves in creative ways, while studies of "exceptional" creativity try to determine if any unique features or attributes characterize outstanding examples of creativity. Thankfully there are some areas of agreement in the results from these two different approaches.

First, analogy and metaphor appear to play an important role in creative behavior. Analogies and metaphors relate things that on the surface do not appear to be very similar, but the use of an analogy or metaphor typically requires a comparison at a higher level of abstraction, thus allowing the similarity to be appreciated. For example, the observation, "When Carl stepped to the podium, he confronted a sea of faces" implies a comparison between crowds of people and very large bodies of water. From the simple definitions of

"crowd" and "sea" no immediate similarities exist. However, the analogy creates similarity at the level of "large expanses" and can then be easily understood.

Studies have demonstrated that problem solving in general can be improved by the use of relevant analogies, similes, and metaphors. In addition, much of the research evaluating outstanding historical instances of creative genius (e. g., Kepler, Galileo, Newton, Picasso, Leonardo da Vinci, Einstein, Michelangelo) has found that the comparison processes underlying metaphors and analogies figure prominently in the accomplishments of these luminaries.

Second, the cognitive processes underlying "mundane" and "exceptional" creativity appear to differ more in terms of quantity than quality. This is good news, because it means that all of us can learn to be more creative. These underlying processes include: 1) Conceptual Combination; 2) Conceptual Expansion; 3) Metaphor; and 4) Analogy & Mental Modeling. There are obvious similarities among these creative behaviors as already noted, but we will explore examples of each separately to aid discussion.

### Conceptual Combination

This involves the combining of concepts (usually words) to form a completely new concept. For example, Darwin's term "natural selection" built on the prevailing knowledge of artificial selection as used by breeders to influence subsequent generations of animals or plants. His creative new concept suggested that such an apparently intentional process might also occur without design interference, hence "natural selection." Slang often employs this approach as well, as in "asphalt jungle." An important implication from findings in this area involves the importance of diversity in experiences and abilities within and across individuals to provide

fertile conditions for the occurrence of useful combinations.

### Conceptual Expansion

Children's growing understanding of the world and language through development provides the most obvious example of conceptual expansion. However, anyone involved in learning something new also participates in conceptual expansion. Interestingly, research evidence suggests severe limitations on most people's ability to jump very far beyond their current knowledge framework. For example, when children were asked to draw or describe imaginary animals, their attempts reflected many of the fundamental properties of species known to them. Essentially the same results have been reproduced using adult subjects as well. An interesting implication from this research is that in order to be creative in an influential way, new ideas must relate to existing knowledge structures and familiar concepts, or they may not be recognized or accepted as useful.

### Metaphor

The use of metaphor not only requires creativity on the part of the originator; it also can increase the creative experience of those comprehending the metaphor. Metaphors can thus at the same time be an example of creativity and also act as catalysts to spur further creative language. Metaphors, like analogies, usually demand that a comparison between the related entities be made at a higher conceptual level of abstraction for the implied similarity to be constructed. "You must accept the thorns with the roses" suggests a comparison between life's experiences and a rose bush. While easily understood by most adults, young children can get side-tracked by the surface definitions of the terms involved.

Interestingly, the myth that children tend to be naturally more creative than adults and

are subsequently stifled by the educational system has not survived close scrutiny. Both children and adults tend to be influenced by their current conceptual knowledge structures. Again, the implication for business leaders is that diverse, extensive prior experience among one's employees can foster creativity within the organization. Much like the acquisition of expertise, it would appear there is no substitute for accumulating vast amounts of knowledge in fostering creative breakthroughs.

### Analogy and Mental Modeling

Lord Ernest Rutherford's comparison of a hydrogen atom to a planetary system (the nucleus as the "sun" surrounded by orbiting electrons) made use of analogy; many other examples of the creative use of analogy could be given. Investigators of creativity have distinguished between "near" and "far" analogies. An example of a "near" analogy might be comparing Romeo and Juliet with West Side Story, while an example of a "far" analogy could be Kepler's comparisons between light from the sun and the vis motrix (motive force; gravity was unknown at the time). Some investigators have argued that "far" analogies—those comparing categories that are highly conceptually distinct—are more important in creativity than "near" analogies, but recent evidence suggests this view may be too simplistic.

Mental models can enhance creativity by providing a rich context in which to explore novel words, terms, ideas, and concepts. More elaborate cognitive frameworks in which to embed novel ideas or objects allow many more alternative directions for their potential development or enhancement to be explored and compared. There is recent evidence that groups of people who share a mental model of their task outperform groups whose members do not share the same mental model. Again, a variety of experiences and responsibilities seems to promote more extensive, detailed mental

models for the resulting stored conceptual structures.

### Recent Developments & Further Implications

An important remaining controversy pertains to the degree of independence from concrete, physical experience that human conceptual behavior actually enjoys. B. F. Skinner and the other behaviorists argued that language and thought are simply behaviors grounded in the evolutionary and personal past of individual people. In this view, concepts and the words that came to symbolize them should reflect actual, bodily interactions with the environment. However, early work in cognitive psychology treated language in general and the formation of concepts in particular as convenient abstractions in the mind, only arbitrarily related to perceptual and behavioral interaction with the world. Language concepts that seem to lump arbitrary (dissimilar) items together provide evidence for this perspective. For example, in one Australian aboriginal language, one category word includes women, fire, and dangerous things. In-laws aside, most people would not immediately apprehend the perceptual similarities defining this classification. Such illustrations seem to argue that conceptual language can have derivative meaning in the abstract— independent of actual similarities among the objects symbolized.

However, many other researchers insist that such extreme examples constitute the exception rather than the rule, and that the majority of concepts do simply reflect distinctions inherently present in the world of experience. Indeed, more contemporary work has begun to resurrect and enlarge on the behaviorists' views. According to some current accounts of the usefulness of analogies, metaphors, and similar comparison processes in creative thought, the meanings of words and concepts depend in important ways on a foundation of actual bodily experience.

For example, the term "comprehend," a virtual synonym for "understand," comes from the Latin *comprehendere*, which literally means "to seize" or "to grasp." Recent theoretical and empirical work suggests that many analogies and metaphors create meaning by ultimately being grounded in actual bodily experience in this way. Consider the statement, "I stand for affirmative action." While we readily accept an abstract meaning for the term "stand" in this instance, such meaning may ultimately derive from situations where people indicate their preferences by literally standing. The meanings of metaphors and other creative expressions may in important respects be similarly embodied.

If bodily experience could be related to producing or understanding creative expressions, then it might be useful to allow workers entrusted with acting creatively to behave in a variety of ways while at work other than sitting down all day.

An additional attribute of creative endeavors involves their multifaceted and sometimes serendipitous nature. Lucky juxtapositions sometimes contribute to creative invention, but this usually occurs in an environment that systematically fosters rigorous exploration, thorough investigation, and broad knowledge acquisition. In addition to the role of accident in creation, research has not yet delineated each of the relevant structuring forces on the creative process, nor exactly how these may interact. Other remaining questions include, Can the process of creativity be usefully studied separately from its consequences? How can the effort, persistence, and motivation necessary for maintaining creativity best be initiated and sustained? Exactly how are completely new ideas produced and comprehended? How can we optimally understand and overcome our individual and collective conceptual inertias?

Finally, what roles do emergence (chaos

theory) and change play in creativity? These areas may indeed prove to be the most fruitful for future inquiry since the explosive variety of creativity in the natural world appears to reflect fundamentally emergent phenomena—the unpredictable outcomes from complex, adaptive systems. If complexity theory proves to be applicable to organizational behavior and other human creative endeavors, some of the influences on creativity may involve higher levels of abstraction and determination above the level of individuals and perhaps even groups of workers. How to characterize—much less predict—these possible coalescing eddies of conceptual convergence and divergence in the psychosocial fabric of an organization remains a mystery at present.

In conclusion, some intriguing "detective" work has revealed that some of the most celebrated historical instances of creativity—such as Kekulé's analogy to a snake swallowing its tail for the structure of the benzene molecule—may have involved unintentional reconstructions after the fact. In other words, creators may fabricate analogies after arriving at their productive conclusions, and then unwittingly remember the analogy as formative of their ideas, when in fact it served primarily as a useful illustration a posteriori to help others understand their discovery. Likewise for groups involved in the creative process: The conceptual scaffolding so necessary and important during group interactions serves as only a temporary support structure for producing useful analogies. Most of the details of this process are subsequently lost after the creative outcome is obtained.

### Applications:

1) Creativity usually comes from an extensive, diverse knowledge base rather than from eccentric or inherently gifted individuals with a bent toward bizarre imagery. Increasing the diversity of workers' cultural and ethnic backgrounds and their

areas of expertise, and using interdisciplinary, cross-functional teams should enhance creativity within your organization. It is important that such teams have shared goals to fully leverage their diversity and the opportunity for creative combinations and synergies. Other important factors in leveraging group synergies involve training group members as a unit and sharing information about each group member's particular area(s) of expertise.

2) Creativity depends both on its production and its appreciation. Context can be just as important as content. Thus, being very familiar with trends in the larger society can improve creativity by ensuring its relevance to an audience. Being creative can involve new insights about the recipients of your ideas as well as the ideas themselves being original or novel. Pursue sensitivity to the sociocultural milieu that provides the broader context for your organization's functions.

3) Metaphors and analogies appear to be important in the creative process. Their usefulness depends not only on their novelty and originality, but also on how cleverly they integrate with existing knowledge structures and available information. Creativity thus involves incremental progress as much as surprising leaps of logic. Exploring combinations of ideas as well as ideas in isolation can be a useful strategy.

4) Creativity may be related to physical activity and bodily experience; thus, a variety of behavioral pursuits and opportunities might contribute to being creative.

5) Creativity may depend on group interaction, particularly to prevent less useful ideas from being pursued. Individuals working alone quickly manifest a vested interest in their ideas and a bias toward confirming information. Collective contributions to creativity seem particularly important when tasks are well known and

participants have a high degree of expertise. Explanations of creativity tend more and more to rely on the importance of the broader social context in which it occurs. Diverse, autonomous, motivated, cohesive groups with a collective purpose can result in creative production in any organization.

6) Conscious access to the process of creating appears to be lost soon after an outcome or resolution. It might thus be important to provide high-quality tools to support collective cognition and collaboration, thereby improving the quality of group interactions and capturing them while they are occurring.

7) Creativity may thrive on noticing how unlike things might be related. Only experienced workers have an adequate understanding of multiple organizational levels and processes to leverage creative opportunities for synergy. Recruitment and retention of workers with an extensive, diverse knowledge base—both inside and outside of your business—can increase the likelihood of creativity in your workforce.

8) Although creativity does not appear to be correlated with intelligence, it does seem to be related to certain personality characteristics. Some of these include independence, nonconformity, being unconventional—even bohemian, being open to new experiences, having wide interests, having both cognitive and behavioral flexibility, and a disposition toward risk-taking. These findings have important implications for the tendency among corporate executives differentially to hire and promote individuals who reflect those executives' opinions, preferences, and lifestyles. Diversity—not conformity—is the watchword of creativity.

9) Creativity depends critically on the initiation and maintenance of activity—usually over extended periods of time. It is thus important for corporate

leaders to analyze carefully both the implicit and explicit incentive systems currently operating within their organizations. Does the intrinsic and extrinsic reward structure encourage creative, innovative behaviors? Taking risks? Or does it rather exert pressure toward the status quo, toward safe havens of normal, ordinary conduct? Does it adequately reward useful creativity while at the same time effectively pruning bizarreness for its own sake?

10) Since creativity often involves unusual associations or novel integrations across conceptual boundaries, open sharing of knowledge and information across corporate entities may be very important. While competition for limited resources in some cases can be motivating, it also tends to promote the hoarding of ideas and lessons learned. Encouraging the sharing of best practices as well as mistakes widely within your company can help to eliminate redundancies of effort and prevent the repetition of unproductive pursuits, while providing an atmosphere for synergy, remote reference, and the fertile interaction of ideas.

11) Initiating and maintaining creativity as an explicit corporate goal actually involves an inherent conundrum: The origin of "command and control" corporate structures hails from the industrial revolution when Frederick Taylor—among others—conceived of social organizations that could be arranged so that individual workers would mindlessly contribute to abstract goals defined by executive management and thus collectively operate just like a grand, glorious machine. Some evidence indicates that true genius and creativity depends as much on superior innate abilities as on characteristics acquired through diligent effort, and so to encourage creativity, corporations must intentionally identify, recruit, retain, and reward creative individuals; creativity can't be process-engineered.

12) Some evidence suggests that daydreaming and fantasy may be related to creativity. Whether creative people daydream more or daydreaming can make ordinary people more creative has not yet been determined; however, it seems reasonable that to encourage creativity, some freedom from tight schedules and deadlines may be important. To increase the likelihood of creativity, the effectiveness and efficiency of repetition and "standard operating procedures" must be balanced with the time and flexibility to explore and innovate for its own sake.

<sup>1</sup>A recent definition from a compendium on creativity: "Creativity may even be better thought of as the entire system by which processes [conceptual combination, conceptual expansion, metaphor, analogy, mental model construction] operate on [psychological, social, & cultural] structures to produce outcomes that are novel but nevertheless rooted in existing knowledge" Ward, Smith & Vaid (1997), p. 18.

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