Symposium: Creative Cognition

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Introduction

Creativity is the generation of products and ideas that are new, valuable, and surprising. Interdisciplinary research in cognitive science makes it clear that creativity does not have to be the mysterious result of divine inspiration. Rather, we can investigate the mental processes that have creative results. This symposium will discuss creativity from a combination of disciplinary vantage points, including philosophy, psychology, neuroscience, and computer modeling. We will try to answer questions such as the following: What are the most important cognitive processes involved in producing creative results? Do these cognitive processes operate in the same way across the many domains of creativity, including science, technology, the arts, and social innovation? How can understanding of cognitive processes be used to enhance creativity? Is creativity amenable to computer modeling? Is there an optimal level of creativity at the individual and social level?

Will Bridewell

Will Bridewell earned his PhD in Computer Science in 2004 from the University of Pittsburgh, where he developed a simple method for detecting negation in medical records and a unique approach to explaining anomalies in scientific data. He then moved to Stanford University where he conducted research in computational scientific discovery and socially aware inference. In 2013, he joined the Naval Research Laboratory to investigate the interaction between attention and perception in cognition.

For the symposium, he will discuss his research on computational systems that construct mathematical models from scientific data. The need for human-encoded knowledge limited the capabilities of early versions of these systems. More specifically, the rigidity of this knowledge provided hard constraints not only on the form of the constructed models but also on the space of potential solutions, calling any attribution of creativity into question. However, recent versions possess the capacity to learn knowledge from their modeling experiences. This knowledge improves their ability to account for data in later tasks. In this context, he will identify how such systems can violate their own constraints to create models by exploring outside-the-box solutions.

Liane Gabora

Liane Gabora, an Associate Professor of Psychology at the University of British Columbia, has over 130 publications on the mechanisms underlying creativity and the cultural evolution of creative ideas. She has lectured on creativity worldwide and secured funding for her research totaling over one million dollars from sources in Canada, Europe, and the USA.

She will present a theory of creativity, honing theory, according to which the creative mind is a self-organizing, autopoietic structure, and the creative impulse stems from its self-mending tendencies. She will present converging evidence for honing theory from neuroscience, studies of painting and analogy formation, a mathematical theory of concepts that incorporates their contextual, non-compositional nature, and an agent-based computer model of the birth and evolution of ideas. In this computer model the cultural evolution of ideas is not open-ended unless agents can chain simple ideas into more complex ones. The adaptive value and diversity of new ideas increases when agents can (1) shift between convergent and divergent processing modes, or (2) adjust their ratio of inventing to imitating over time in accordance with the success of their creative ideas. She will show that individual creative styles are recognizable not just within a domain, but across domains (e.g., if we know someone's writing style we are more likely than chance to know which artworks were

created by them). Finally she will present a creative application of cognitive science research to mobile app development.

David Kirsh

David Kirsh has been studying creativity in two very different domains: in everyday life from a situated cognition perspective it is assumed that humans exercise small scale creativity all the time, every time they make a novel responses to a situation, including answering questions speaking thoughtfully, finding novel formulations of thoughts. The second domain is high art. For the last six years he has been doing a close ethnographic study of the choreographer Wayne McGregor (resident choreographer of the Royal Ballet) when he makes a new dance on his own contemporary company Random Dance. His process is studied by recording all studio activity with 5 to 8 high definition cameras, examine diaries and notes of the dancers, choreographer and associate choreographer and record dozens of interviews each 'making' period. the video captured is then coded and analyzed. Phenomena of general interest to cognitive science are common, but creative activity is widespread and displayed through interaction between choreographer and dancers, or between the dancers themselves.

In the symposium, he will cover three topics: 1) McGregor's personal creative process - how he makes new dance phrases, focusing particularly on the techniques he uses to draw ideas out of the dancers; 2) the importance of using different modalities to think in - how sound, kinesthetic, visual and gestural modalities all play a special role in facilitating new ways of thinking about a movement; 3) distributed creativity - how the movements that find their way into the final piece are generated collaboratively, and especially how new movement ideas emerge from interaction between a few dancers or dancers and choreographer.

Paul Thagard

Paul Thagard's previous work has combined philosophy of science, psychology, computer modeling, and neuroscience to investigate many cognitive processes relevant to creativity, including analogy, hypothesis formation, and conceptual combination. He has looked at creativity in scientific discovery, technological innovation, artistic imagination, and social innovation.

For the symposium, he will describe new work on the problem of procedural creativity, which involves the generation of new methods in addition to new concepts and new hypotheses. He will propose that the generation of new methods in science, technology, art, and society requires the formation of rules using identifiable cognitive processes. The generation of new methods often operates as follows. (1) Start with goals that indicate a specific problem to be solved. (2) Try to solve the problem by processes such as rule-based reasoning, association, analogy, and combining representations. (3) Arrive at a specific solution to the specific problem. (4) Generalize the successful problem solution into a method of the form: If your goal is to solve a problem of this type, then use a solution of the type discovered. Sometimes, however, procedural creativity works when a successful method is adapted to apply to a new problem, generating a new method. Examples of methods that have been developed by these kinds of cognitive creativity include statistical inference in science, vaccination in technology, impressionism in painting, and universal health care in social innovation.

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