Cognitive Processes in Creative Contexts

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Creativity depends on how people think. Obviously, it depends on many other factors as well, such as the environment, one's culture, and individual abilities (e.g., Sternberg 1988). Nonetheless, mental processes are, in our view, the essence and the engine of creative endeavors. Although there are many useful and productive approaches to understanding creativity, the creative cognition approach (Finke, Ward, and Smith 1992) focuses on the cognitive processes and structures that underlie creative thinking. This book unites the theoretical ideas and research findings of cognitive scientists who have studied various aspects of creative cognition.

One basic goal of the creative cognition approach is to improve understanding of creative processes by using the methods and concepts of cognitive science. Most of the contributors to this book would agree, however, that there is no single process that we can identify as the creative process. Instead, creative thinking encompasses special combinations and patterns of the same cognitive processes seen in other noncreative endeavors.

A second goal of the creative cognition approach is to learn more and raise new questions about cognition by examining it in creative contexts. For example, research on how creative thinking is inhibited or blocked may stimulate new ideas about how noncreative thinking is inhibited. The creative use of categories may yield insights about the way categories in general are represented. Theoretical models for inducing new ideas may have implications for models of text comprehension. Just as ecological approaches have uncovered important properties of cognition by examining it in naturalistic contexts (Neisser 1982), so, too, does a creative cognition approach suggest new ideas about cognition by placing it in a creative context.

The creative cognition approach has roots in associationism (Thorndike 1911; Watson 1958), Gestalt psychology (Duncker 1945; Maier 1940; Wertheimer 1959), and computational modeling (Newell, Shaw, and Simon 1962). The associationist approach reflected a work ethic: more work should be rewarded with more products and greater success. Because creative behavior was conceived as generalizations of learned behaviors, it was thought that learning more associations should improve creativity. This work ethic can be seen in the more contemporary context of this book in chapters 2 and 3, by authors who

maintain that creative ideas are produced incrementally.

The Gestalt point of view, in contrast, posited special processes in creative thinking, particularly insight, which is a major topic of concern in chapters 3 through 7. These authors deal with such traditional issues as whether insight involves incremental processes or rapid restructuring and whether it plays any role in creative discovery.

Computational approaches to creativity have emphasized precisely defined operations that can yield the same sorts of ideas that are produced by creative humans. Although they consider different types of symbolic operations, chapters 9 through 11 deal with current computational approaches to creative cognition.

The claim that the same underlying structures and processes involved in noncreative cognition can explain creative thinking may be thought of as an approach for demystifying creativity. The hidden and fascinating ways in which new ideas are created may seem less mysterious when expressed in terms that are used to explain everyday cognition. The idea of demystification, however, presupposes that creative thinking is not an everyday activity and that noncreative cognition is perfectly well understood. Neither assumption is valid. On the contrary, creative thinking evidently involves many aspects of everyday cognition, and noncreative thinking remains somewhat mysterious. Creative cognition should therefore help our understanding of both creativity and cognition.

Finally, the creative cognition approach should lead to a better understanding of how to improve or optimize creativity. Whereas a personality approach is better suited to identifying creative people or assessing their creative talents, the creative cognition approach focuses on the cognitive processes themselves that lead to creativity. The better we understand these processes, the more we will be able to improve them. Furthermore, theories about creative cognitive processes should be empirically testable, as clearly demonstrated by many of the contributing authors.

The chapters in this book represent a diversity of interests in cognitive psychology and creativity. We begin with a contemporary treatment of the ancient issue of dreams. George Mandler ("Origins and Consequences of Novelty") considers the dream as a natural mechanism and model for the type of unstructured thinking that can produce novelty. Cognitive processes that occur during dreaming encourage new organizations, classifications, and concepts. Mandler also consid-

ers affect as an important consequence of novel thought rather than an irrelevant by-product of it.

Kenneth Bowers, Peter Farvolden, and Lambros Mermigis ("Intuitive Antecedents of Insight") tackle intuition and insight from a contemporary cognitive perspective. Blending theory and empirical research, they extend the idea that intuition can implicitly guide one to coherent ideas and correct solutions using incremental mechanisms, such as spreading activation. Also, using indirect measures of performance, they show that subjects make progress toward problem solutions without being aware they are doing so.

Robert Weisberg ("Case Studies of Creative Thinking: Reproduction versus Restructuring in the Real World") proposes that real-world creativity often involves incremental progress toward solutions rather than restructuring. Citing examples from artists and scientists, he traces the development of highly successful, creative ideas. Weisberg emphasizes the importance of using prior knowledge in creative thought, whether or not restructuring is involved.

In contrast to the incremental view of creative problem solving advocated by Bowers, Farvolden, and Mermigis and by Weisberg, Roger Dominowski ("Productive Problem Solving") asserts the importance of special insight processes in problem solving. Tracing ideas from early Gestalt work to contemporary research, Dominowski cites evidence of various forms of fixation and sudden insight and makes some general proposals about how insight problem solving can be improved.

Like Dominowski, Jonathan Schooler and Joseph Melcher ("The Ineffability of Insight") regard insight as a special process. Using protocols from subjects' verbalizations during insight and analytic problem solving, they find detrimental effects of verbalization only on insight problems. Their studies provide new methods for distinguishing insight problem solving from analytic problem solving.

Steven Smith ("Fixation, Incubation, and Insight in Memory and Creative Thinking") integrates a number of theoretical ideas from memory and problem solving, including interference and recovery, contextual fluctuation, plans as long-term knowledge structures, and memory probes, to provide a general description of recall, problem solving, and creative thinking. The patterns of cognition are used to explain fixation, incubation, and insight experiences. Smith provides relevant experimental evidence from tasks that involve memory and

creative idea generation.

Thomas Ward ("What's Old About New Ideas") also addresses creative idea generation but from the point of view of concept formation and representation. He proposes that imagination is not random but is structured by underlying conceptual constraints. He also argues that creative ideas are often a mixture of old and new information, and he uses principles of noncreative categorization to predict the established frameworks within which new variations will be embedded. Numerous laboratory studies of creative idea generation are described that reveal the conceptual structures that give rise to imaginative thinking.

Jennifer Freyd and Teresa Pantzer ("Static Patterns Moving in the Mind") relate dynamic perceptual properties of mental representations to dynamic aspects of creative thinking. These dynamic qualities are considered in the context of memory distortions and generating and interpreting "preinventive forms," rudimentary structures that can be used to develop creative ideas.

Peter Cheng and Herbert Simon ("Scientific Discovery and Creative Reasoning with Diagrams") also focus on visual representations as they discuss the use of diagrams in scientific discovery. Special qualities of these diagrams are embodied in a computational model that is capable of discovering scientific principles.

Roger Schank and Chip Cleary ("Making Machines Creative") use a different computational approach to creative thinking, modeling operations for comprehension and creative explanation. The models they discuss help to clarify the relation between comprehension and creativity.

Colin Martindale ("Creativity and Connectionism") provides a novel integration of ideas from diverse areas, such as primary and secondary process thinking, conditioning, genetic algorithms, chaos theory, and the thermodynamics of crystallography. Martindale characterizes remote association in terms of arousal in a connectionist framework, providing yet another computational approach to creative cognition.

Todd Lubart and Robert Sternberg ("An Investment Approach to Creativity: Theory and Data") present a multivariate investment approach to creative performance. Their theory states that creative individuals "buy low" by investing their efforts in new ideas that are not yet popular and "sell high" by moving on to new ideas once an

idea has become popular. Their studies show that those who are identified as more creative are more likely to risk judgment of their work for a high reward.

Ronald Finke ("Creative Realism") proposes that creativity must be more than fun and wild imagination; realistic impact is also essential. Distinguishing creative realism from creative idealism and conservative thinking, Finke details criteria for assessing and enhancing creative realism and discusses the concept in terms of "preinventive forms" generated in his creative visualization research.

In the final chapter ("Conclusion: Principles, Paradoxes, and Prospects for the Future of Creative Cognition") we summarize the major themes of the book, highlighting, and in some cases resolving some of the paradoxes of creativity research. We conclude by discussing the potential value of the creative cognition approach.

Each of the chapters deals with central issues in cognition and creativity. Many of them consider new ways in which creativity can be studied under controlled conditions. We hope that the creative cognition approach will help reveal the basic cognitive processes underlying creativity and will offer exciting new directions for contemporary work in human cognition.

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