VIDEO GAMES AND CREATIVITY
Explorations in Creativity Research

Series Editor

James C. Kaufman
VIDEO GAMES
AND
CREATIVITY

Edited by

GARO P. GREEN
California State University,
San Bernardino, CA, USA

AND

JAMES C. KAUFMAN
Neag School of Education,
University of Connecticut,
Storrs, CT, USA
Dedication

In dedication and memory of Linda A. Jackson, PhD (1939–2014)
To Lynda Weinman, my dear friend, for showing me that true success and happiness come from sharing what you know with others with authenticity and generosity—GPG

For my niece, Kate Singleton, whose poetry, resiliency, humor, and passion inspire me, with love—JCK
Contributors

Mario Barajas  Department of Didactics and Educational Organization, University of Barcelona, Barcelona, Spain
Erin L. Beatty  Defence Research and Development Canada, Toronto Research Centre, Toronto, ON, Canada
Katharina-Marie Behr  Department of Communication, University of California Santa Barbara, Santa Barbara, CA, USA
Jorge A. Blanco-Herrera  Department of Psychology, Iowa State University, Ames, IA, USA
Fran C. Blumberg  Division of Psychological & Educational Services, Fordham University, New York, NY, USA
Nicholas D. Bowman  Communication Studies, West Virginia University, Morgantown, WV, USA
Beomkyu Choi  Educational Psychology, University of Connecticut, Storrs, CT, USA
Michael Cook  Department of Computing, Imperial College, London, UK
David H. Cropley  Defence and Systems Institute (DASI), University of South Australia, Adelaide, SA, Australia
Christopher J. Ferguson  Department Chair Psychology, Stetson University, DeLand, FL, USA
Frédérique Frossard  Department of Didactics and Educational Organization, University of Barcelona, Barcelona, Spain
Alexander I. Games  Microsoft Corporation, Inc., Redmond, WA, USA
Douglas A. Gentile  Department of Psychology, Iowa State University, Ames, IA, USA
Garo P. Green  California State University, San Bernardino, CA, USA
Christopher L. Groves  Department of Psychology, Iowa State University, Ames, IA, USA
Karla R. Hamlen  Department of Curriculum and Foundations, Cleveland State University, Cleveland, OH, USA
Richard Huskey  Department of Communication, University of California Santa Barbara, Santa Barbara, CA, USA
Linda A. Jackson  Michigan State University, East Lansing, MI, USA
James C. Kaufman  Neag School of Education, University of Connecticut, Storrs, CT, USA
Yoon J. Kim  Instructional Systems and Learning Technologies, Florida State University, Tallahassee, FL, USA
Rachel Kowert  University of Münster, Münster, Germany
Ann M. Lewis  Department of Psychology, Iowa State University, Ames, IA, USA
Casey O’Donnell  Department of Media and Information, Michigan State University, East Lansing, MI, USA
Valerie J. Shute  Instructional Systems and Learning Technologies, Florida State University, Tallahassee, FL, USA
Stephen T. Slota  Educational Psychology, University of Connecticut, Storrs, CT, USA
Grant Tavinor  Faculty of Environment, Society and Design, Lincoln University, Lincoln, New Zealand
Roger Travis  Educational Psychology, University of Connecticut, Storrs, CT, USA
Anna Trifonova  Department of Didactics and Educational Organization, University of Barcelona, Barcelona, Spain
Oshin Vartanian  Department of Psychology, University of Toronto Scarborough, Toronto, ON, Canada
Thomas B. Ward  Department of Psychology, University of Alabama, Tuscaloosa, AL, USA
René Weber  Department of Communication, University of California Santa Barbara, Santa Barbara, CA, USA
Michael F. Young  Educational Psychology, University of Connecticut, Storrs, CT, USA
A book like this is only possible through the hard work and expertise of many passionate expert contributors, and we were fortunate enough to work with some of the very best and brightest. We were humbled by their expertise and knowledge on video games and creativity, their willingness to consider our feedback, and their endless passion for sharing what they know with others. We learned a lot and enjoyed the process immensely. We would also like to thank Nikki Levy at Academic Press for her support for this book and the Explorations in Creativity Research series. We would also like to thank Barbara Makinster and Caroline Johnson for their attention to detail, keeping us on schedule, and the many gentle reminders when we were late! Garo would like to thank his partner, Mark, for his endless support and putting up with the constant mess of papers on the dining room table. James would like to thank his friends and colleagues at the University of Connecticut and his family for their continued support.
Video Games and Creativity: An Introduction

Garo P. Green, James C. Kaufman

WHY VIDEO GAMES AND CREATIVITY?

During the last few decades, and especially in the last 10 years, video games have increasingly become a ubiquitous part of society across the globe. Much of this increase has been due to the global proliferation of mobile devices, which has put thousands of engaging and visually stimulating video games within our grasp 24/7. At the surface, it’s clear that video games are a form of creative expression and entertainment, but we wanted to know more about the underlying relationships between video games and creativity. For example, can video games be used to develop or enhance creativity? Is there a place for video games in the classroom? What types of creativity are needed to develop video games? More specifically, while video games can be sources of entertainment, the role of video games in the classroom has emerged as an important component of improving our education system. The research and development of game-based learning has revealed the power of using games to teach and promote learning. In parallel, and not surprisingly, the role and importance of creativity in everyday life has also been identified as a requisite skill for success. From personal expression, to innovative problem solving, to successful product development, and economic prosperity, creativity is a vital skill needed for individuals to flourish and solve many of society’s biggest challenges.

Both video games and creativity are topics so complex, deep, and nuanced that hundreds of books and thousands of scholarly research articles have been published on each topic. While there are several scholarly “handbooks” that focus on these two topics separately, we couldn’t find one that focused exclusively on the many intersections between video games and creativity. Given the importance of these two topics in contemporary society we believed the relationships that exist between video games and creativity were so important and numerous that it warranted a book with this focus.

WHAT’S COVERED IN THIS BOOK?

The biggest challenge in writing a book about a topic so complex and deep is including enough content to be interesting while covering it deeply enough to be informative to a wide range of readers. A book
like this is never complete, and this one is certainly no exception. We have to constantly make tradeoffs between focus and page count/cost. While we would have liked to include many more sections and chapters, we decided to focus on three key areas: Creativity and Video Game Play, Creativity and Video Games in Education, and Creativity and Video Game Development. These sections will provide enough foundational knowledge for readers new to this topic, while allowing us to go deep enough in a few core areas to make it informative to a broad range of readers.

This book is divided into three sections:

- **Part 1—Creativity and Video Game Play** focuses on creativity while playing video games. This section begins with *Video Games and Creativity*, by Linda A. Jackson and Alex I. Games, and provides a great introduction to the topics and will help new readers get up to speed quickly. *The Impact of Video Game Play on Human (and Orc) Creativity*, by Nicholas D. Bowman, Rachel Kowert, and Christopher J. Ferguson, provides a detailed history of video games and illustrates how video game play is more than a form of entertainment, including how video game play is associated with creativity. *Video Games and Malevolent Creativity: Does One Thing Lead to Another?*, by David H. Cropley, is a fascinating look at the relationship (or lack thereof) between video games and malevolent creativity. This chapter examines what is known about video game play and the influence on learning, including creativity and antisocial behavior. *Problem Solving through “Cheating” in Video Games*, by Karla R. Hamlen and Fran C. Blumberg, examines how cheating in video games is a form of problem solving (functional creativity). This chapter provides a detailed explanation of the types of cheating, including the moral implications within video game play. *Opportunities and Challenges in Assessing and Supporting Creativity in Video Games*, by Yoon Jeon Kim and Valerie J. Shute, illustrates the many opportunities for creativity within video game play, while articulating the challenges with assessing these creative activities, and provides a real-world solution with Physics Playground. *Content, Collaboration, and Creativity in Virtual Worlds*, by Thomas B. Ward, examines the various creativity opportunities available in Social Virtual Worlds (SVWs), including video games such as *Second Life* and others. This chapter provides a unique perspective into the online and interactive communities that have developed around SVWs and creative opportunities that exist within these virtual environments, such as content creation.

- **Part 2—Creativity and Video Games in Education** is focused on how video games can be used to teach and enhance creativity within education. This section begins with *Teaching Creativity: Theoretical
Models and Applications, by Jorge A. Blanco-Herrera, Chris Groves, Annie M. Lewis, and Douglas A. Gentile. This chapter is a great introduction to this section and illustrates how video games can teach, including a model of learning and how video games follow learning principles. Teachers Designing Learning Games: Impact on Creativity, by F. Frossard, A. Trifonova, and M. Barajas, is a comprehensive examination of how teacher-designed video games can enhance creative pedagogies, including real-world examples from their own experiences. Cognitive Brain Training, Video Games, and Creativity, by Oshin Vartanian and Erin L. Beatty, provides a summary of research on video games and how they enhance motor skills, auditory processing, spatial imagery, and visual processing. This chapter concludes by illustrating how these enhancements are related to creativity and can be a mechanism for improving creativity. Game Narrative, Interactive Fiction, and Storytelling: Creating a “Time for Telling” in the Classroom, by Michael F. Young, Stephen T. Slota, Roger Travis, and Beomykyu Choi, examines the role of narrative in video games and game-based learning solutions, including how video game narratives can be used as a tool to nurture teacher and student creativity.

Part 3—Creativity and Video Game Development is focused on the creative opportunities that exist during the video game development process. This section begins with Creating Code Creatively: Automated Discovery of Game Mechanics Through Code Generation, by Michael Cook, a fascinating examination of video game rules and system design, along with the “mechanics,” including many real-world creative solutions implemented by video games developers. This chapter illustrates one of the lesser known, but equally important, relationships between video games and creativity. Patented Creativity: Reflecting on Video Game Patents, by Casey O'Donnell, provides another unique perspective into the relationship between video games and creativity by examining how video game developers have used functional creativity (problem solving) to differentiate and patent their products, including several real-world examples. Tension and Opportunity: Creativity in the Video Gaming Medium, by Grant Tavinor, is a fascinating examination of the natural and structural tensions that exist in the video game development process and how creativity is needed to develop appropriate solutions. Creative Interactivity: Customizing and Creating Game Content, by Katharina-Maria Behr, Richard Husky, and Rene Weber, illustrates how customization and creation of video game content can occur after a video game has been released and why these processes represent a creative dimension of video game interactivity.
IS THIS BOOK FOR YOU?

At the most general level, this book is for anyone interested in the many associations between video games and creativity, and there are many. That said, this book has been written and developed by scholars and academic researchers with expertise in video games and creativity. As such, it will be most appealing to other scholars and researchers with similar interests, including educators searching for ways to incorporate video games into their curriculum. Both undergraduate and graduate student researchers will find this book helpful in learning about contemporary video game and creativity research and future research opportunities. It is our hope that anyone that reads this book will find it both informative and enjoyable to read.

COMPANION WEBSITE

We’ve created a companion website for this book at www.videogamesandcreativity.com, where you can connect with the contributing authors, share feedback, find book updates and errata, and find more information about video games and creativity research. Please check this site for updates or if you’d like to connect with the editors or any of the contributors.

ABOUT THE EXPLORATION IN CREATIVITY RESEARCH SERIES

This book is part of a series of written and edited books that highlight exciting and topical areas within creativity research. Other books in this series either published or forthcoming include *Creativity in Engineering* by David Cropley, *Domain Specificity in Creativity* by John Baer, and *Animal Creativity and Innovation*, edited by Allison B. Kaufman and James C. Kaufman.
CHAPTER 1

Video Games and Creativity

Linda A. Jackson¹ and Alexander I. Games²

¹Michigan State University, East Lansing, MI, USA
²Microsoft Corporation, Inc., Redmond, WA, USA

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WHAT IS CREATIVITY?

There is no doubt that creativity is the most important human resource of all. Without creativity, there would be no progress, and we would be forever repeating the same patterns. Edward de Bono (Lucas, 2003)

Before any discussion of the effects of video game playing on creativity it is important to define what we mean by creativity. From a historical perspective, Wallis (1926) is credited with the first formal theory of creativity. In Wallas’s stage model, creative insights and illuminations are explained by a process consisting of five stages: (1) preparation—preparatory work on a problem that focuses the individual’s mind on the problem and explores the problem’s dimensions; (2) incubation—where the problem is internalized into the unconscious mind and nothing appears externally to be happening; (3) intimation—the creative person gets a “feeling” that a solution is on its way; (4) illumination or insight—where the creative idea bursts forth from its preconscious processing into conscious awareness; and (5) verification—where the idea is consciously verified, elaborated, and then applied. Wallas considered creativity to be a legacy of the evolutionary process which allowed humans to quickly adapt to rapidly changing environments. Simonton (1999) provides an updated perspective on this view in his book, Origins of genius: Darwinian perspectives on creativity.

In 1927, Alfred North Whitehead wrote the first scholarly book on creativity, Process and reality, reprinted in 1978. He is credited with having coined the term “creativity,” still the preferred currency of exchange in literature, science, and the arts. In a later article titled “Creativity syndrome: Integration, application, and innovation,” Mumford and Gustafon (1988) argued that, in many ways, the ultimate concern in studies of creativity is the production of novel, socially valued products. They suggested that an integration and reorganization of cognitive structures is likely to underlie major creative contributions and that the application of existing
cognitive structures is likely to underlie minor contributions. Extending this interpretation to the processes traditionally held to underlie individual differences in creativity, they noted that both major and minor forms of creativity require a number of different knowledges, skills, and abilities. Furthermore, effective translation of ideas into action will depend on a variety of individual (Person) and situational (Environmental) factors.

Two important issues raised in Mumford and Gustafon’s (1988) article concern the roles of intelligence and divergent thinking in creativity. They concluded, as have many researchers since then, that intelligence is important to creativity “up to a point,” beyond which greater intelligence does not lead to greater creativity (Habibollah, Rohani, Aizan, Sharir, & Kumar, 2010; O’Hara & Sternberg, 1999; Silvia, 2008). Divergent thinking, on the other hand, is critical to creativity. It was Guilford (1950, 1967a) who first drew the distinction between convergent and divergent thinking. Convergent thinking is the ability to apply rules to arrive at a single “correct” solution to a problem, such as the answer to an achievement test question. This process is systematic and linear. Divergent thinking, on the other hand, involves the creative generation of multiple answers to a set of problems. It occurs in a spontaneous, free-flowing, “nonlinear” manner. It is sometimes used as a synonym for creativity in the psychological literature but, as Mumford and Gustafon (1988) and other researchers later pointed out, there is far more to creativity than divergent thinking (Csikszentmihalyi, 1999; Kozbelt, Beghetto, & Runco, 2010; Meusburger, Funke, & Wunder, 2009; Mumford, 2003; Runco & Albert, 2010; Sternberg, Kaufman, & Pretz, 2002).

In a later summary of the scientific research, Mumford suggested that “Over the course of the last decade we seem to have reached a general agreement that creativity involves the production of novel, useful products.” Creativity can also be defined “as the process of producing something that is both original and worthwhile characterized by expressiveness and imagination” (Mumford, 2003, p. 110; see also Csikszentmihalyi, 1999, 2009; Lubart & Mouchiroud, 2003; Meusburger et al., 2009; Runco & Albert, 2010; Sternberg, 2006; Torrance, 1995). The product of creativity may take many forms and is not limited to a particular subject or area. Beyond these general commonalities, authors vary in how they conceptualize creativity and, consequently, in how they measure it.

Another popular perspective on creativity is that it involves four qualities: (1) Person—characteristics; (2) Process—preferences associated with aspects of the creative process; (3) Products—qualities of creative products; and (4) Press (Environment)—factors in the environment that facilitate creative performance (Puccio & Murdock, 1999). Amabile (1996), on the other hand, argues for a model of creativity where the interaction between personal and social influences leads to three factors whose presence or absence can enable or hinder creative performance: (1) The presence or absence of
individual domain-relevant skills in the activity that requires creativity; (2) The individual’s engagement in creativity-relevant processes such as abandoning well-rehearsed performance scripts and exploring new angles for extended periods; and (3) The degree to which the activity would be intrinsically motivating to the individual versus compelled by extrinsic factors. All of these qualities should be considered in the measurement of creativity.

THEORIES OF CREATIVITY

Ten Theoretical Approaches to Creativity

Kozbelt et al. (2010) provided a comprehensive review of 10 popular theoretical approaches to creativity. They are Developmental theories, Psychodynamic theories, Economic theories, Stage and Componential theories, Cognitive theories, Theories Based on Problem Solving and Expertise, Problem-Finding theories, Evolutionary theories, Typological theories, and Systems theories.

Developmental theories maintain that creativity develops over time, mediated by an interaction among the four “Ps”: Person, Process, Products, and Press (Environment) (Helson, 1999; Subotnik & Arnold, 1996; Weisberg, 2006a, 2006b). Psychodynamic theories argue that creativity can be measured reliably, differentiating it from related constructs (e.g., IQ) and highlighting its domain-specific nature (Guilford, 1968; Wallach & Kogan, 1965). Economic theories state that creative ideation and behavior are influenced by market forces and cost–benefit analysis (Rubenson & Runco, 1992; Sternberg & Lubart, 1992). Stage and componential process theories maintain that creativity proceeds through a series of stages and that this process has linear and recursive elements (Amabile, 1999; Runco & Chand, 1995). Cognitive theories focus on ideational thought processes as fundamental to creative persons and accomplishments (Fink, Ward, & Smith, 1992; Mednick, 1962). Problem-solving and expertise theories argue that creative solutions to ill-defined problems result from a rational process which relies on general cognitive processes and domain expertise (Ericsson, 1999; Simon, 1966, 1972; Weisberg, 1999, 2006a, 2006b). Problem-finding theories maintain that creative people proactively engage in a subjective and exploratory process of identifying problems to be solved (Getzels & Csikszentmihalyi, 1976; Runco, 1994). Evolutionary theories hold that creativity results from the evolutionary processes of blind generation and selective retention (i.e., natural selection; Campbell, 1960; Simonton, 1988, 1999).
1. CREATIVITY AND VIDEO GAME PLAY

Typological theories maintain that creators vary in key individual differences which are related to both macro- and micro-level factors and can be classified via typologies (Galenson, 2001, 2006; Kozbelt, 2008a–c).

Systems theories hold that creativity results from a complex system of interacting and interrelated factors (Csikszentmihalyi, 1988; Gruber, 1981; Sawyer, 2006).

Honing Theory

Honing theory, developed by Gabora (Gabora, 1995, 1997, Gabora & Aerts, 2002), posits that creativity arises due to the self-organizing, self-mending nature of a worldview, and that it is by way of the creative process that an individual hones an integrated worldview. Honing theory places equal emphasis on the externally visible creative outcome and the internal cognitive restructuring brought about by the creative process. Indeed, one factor that distinguishes honing theory from other theories is that it focuses not just on restructuring as it pertains to the conception of the task, but also on the individual’s worldview. When faced with a creatively demanding task, there is an interaction between the conception of the task and the worldview. The conception of the task changes through interaction with the worldview, and the worldview changes through interaction with the task. This interaction is reiterated until the task is complete, at which point not only is the task conceived of differently, but the worldview is subtly or dramatically changed.

Explicit–Implicit Interaction Theory

He’lie and Sun (2010) proposed this theory as a unified framework for understanding creativity in problem solving. It represents an attempt to provide a more unified explanation of phenomena relevant to creativity by reinterpreting and integrating various fragmentary existing theories of incubation and insight. The explicit–implicit interaction (EII) theory relies mainly on five basic principles: (1) the coexistence of and difference between explicit and implicit knowledge; (2) the simultaneous involvement of implicit and explicit processes in creative tasks; (3) the redundant representation of explicit and implicit knowledge; (4) the integration of the results of explicit and implicit processing; and (5) the iterative and possibly bidirectional nature of processing.

Computational Theory

Jurgen Schmidhuber’s formal theory of creativity is based on a computational perspective. It postulates that creativity, curiosity, and
interestingness are by-products of a simple computational principle for measuring and optimizing learning progress (Schmidhuber, 2006, 2010, 2012). Consider an agent able to manipulate its environment and thus its own sensory inputs. The agent can use a black box optimization method such as reinforcement learning to learn (through informed trial and error) sequences of actions that maximize the expected sum of its future reward signals. There are extrinsic reward signals for achieving externally given goals, such as finding food when hungry. But Schmidhuber’s objective function to be maximized also includes an additional, intrinsic term to model what he calls “wow-effects.” They motivate purely creative behavior even in the absence of external goals.

**MEASUREMENT OF CREATIVITY**

Since the 1950s, researchers have developed an array of methods for measuring creativity (Batey, 2012; Puccio, Argona, Daley, & Fonseza, 2010). In general, creativity can be measured by Self-Assessments, Ratings Scales, Interviews, Checklists, Peer, Parent, Teacher Ratings/Nominations, Observations, Products, Personality Tests, Biographical Sketches, Aptitude and Ability Tests, Awards, Acceleration, Mentorship, Enrichment Programs, and Problem Finding/Solving. There are several widely used approaches to the measurement of creativity, each with its strengths and weaknesses (Batey & Furnham, 2006; Boden, 2004; Cooper, 1991; Cropley, 2000; Hocevar & Bachelor, 1989; Michael & Wright, 1989; Simonton, 2012; Zeng, Proctor, & Salvendy, 2011).

**APPROACHES TO THE MEASUREMENT OF CREATIVITY**

The Psychometric Approach

Guilford’s (1950) pioneering work on creativity launched what is referred to as the psychometric approach to its measurement. In 1967, he developed the Guilford Test of Divergent Thinking, remnants of which can be found in the most popular psychometric measures used today, the Torrance Tests of Creative Thinking (TTCT) (Torrance, 1974), which we used in our research (Jackson et al., 2012). Briefly, Guilford proposed the following measures to capture the concept: (1) Plot Titles—participants are given the plot of a story and asked to write original titles; (2) Quick Response—a word-association test scored for uncommonness; (3) Figure Concepts—participants were given simple drawings of objects and individuals and asked to find qualities or features that are common to two or more drawings, scored for uncommonness; (4) Unusual Uses—finding
unusual uses for common everyday objects; (5) Remote Associations—participants are asked to find a word between two given words (e.g., Hand__Call); and (6) Remote Consequences—participants are asked to generate a list of consequences of unexpected events. Additional psychometric measures of creativity are discussed later.

Social-Personality Approach

This approach uses personality traits, such as independence of judgment, self-confidence, attraction to complexity, esthetic orientation, and risk-taking as measures of an individual’s creativity. A meta-analysis by Feist (1998) showed that creative people tend to be “more open to new experiences, less conventional and less conscientious, more self-confident, self-accepting, driven, ambitious, dominant, hostile and impulsive.” Of these characteristics, openness to new experiences, conscientiousness, self-acceptance, hostility, and impulsivity make the strongest contribution to the creative personality (Batey & Furnham, 2006). Consistent with these findings, within the framework of the Big Five Personality Factors (Costa & McCrae, 1992) openness to experience has been most consistently related to a variety of assessments of creativity (Batey, Furnham, & Safiullina, 2010).

Affective Approach

Some theories suggest that creativity is particularly susceptible to affective influences. “Affect” in this context refers to liking or disliking key aspects of the topic in question. This work largely follows from findings in psychology regarding the ways in which affective states are involved in human judgment and decision making (Winkielman & Knutson, 2007).

According to psychologist Alice Isen (Isen, Daubman, & Nowicki, 1987), positive affect has three primary effects on cognitive activity: (1) it makes additional cognitive material available for processing, increasing the number of cognitive elements available for association; (2) it leads to defocused attention and a more complex cognitive context, increasing the breadth of those elements that are treated as relevant to the problem; and (3) it increases cognitive flexibility, thereby increasing the probability that diverse cognitive elements will become associated. Taken together these processes lead positive affect to have a positive influence on creativity (Baas, De Dreu, & Nijstad, 2008; Davis, 2009).

On the other hand, there is also evidence that negative affect, as manifested in affective mental disorders such as depression, bipolar disorder, and addiction, is also associated with extreme forms of creativity (Ludwig, 1995). In a study of 1005 prominent twentieth century individuals from over 45 different professions, Ludwig found a slight but significant