Creativity in the Twenty First Century

Todd Lubart · Marion Botella · Samira Bourgeois-Bougrine · Xavier Caroff · Jérôme Guegan · Christophe Mouchiroud · Julien Nelson · Franck Zenasni *Editors*

Homo Creativus

The 7 C's of Human Creativity

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Contents

Homo Creativus: Introduction

Todd Lubart

Keywords *Homo creativus* · Creativity · 7 Cs · Creators · Creating · Collaboration · Context · Creations · Consumption · Curricula

Millions of years ago, the ancestors of modern humans appeared on earth. Over time, evolutionary processes led to several early human species, including most recently *Homo neanderthalensis*, which disappeared approximately 30,000 years ago. Since more than 300,000 years, modern *Homo sapiens* developed, and coexisted with *Homo neanderthalensis.* Recent evidence suggests that these groups were in contact with each other. Today, contemporary humans, *Homo sapiens* compared to numerous other species including distant cousins like chimpanzees, are distinguished by their advanced cognitive capacities to process information and think in complex ways. All modern humans are classified into the species *Homo sapiens.* The latin term, *Homo sapiens,* was attributed by Carl Linnaeus, a Swedish botanist and zoologist in his 1735 work *Systema Naturae* (a later; more complete edition was published in 1758).

«Human» corresponds to *Homo* in Latin, based on the adjective form *humanus*, translated initially into the French word «humain». *Sapiens*, in Latin, is translated as «wise» or «knowledgeable». It is interesting to note that the hallmark of intelligence since the eighteenth century was knowing a lot combined with the ability to reason in complex ways. In general, «smart» people act in appropriate ways to achieve their goals efficiently. They tend to have a large corpus of knowledge about the world, and more specifically this concerns their professional domain. Expertise in a field refers to advanced knowledge and know-how, and this expertise often requires years of study. In a metaphorical way, computers that have information processing routines operating logically on large databases are the natural extension of what homo sapiens do best.

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Schooling, which has been developing for thousands of years, was often based on a traditional approach in which an expert conveys knowledge to disciples. In most countries, mandatory schooling for youth developed in the past century. School became the place where people acquire knowledge and information processing skills. The traditional measures of intelligence that are the most widely used today, such as the Wechsler tests (WPPSI, WISC, WAIS) were designed to assess capacities to reason, think, and solve problems using knowledge in an efficient way. The main goal in this approach is to get correct answers as quickly as possible. These tests predict school performance, which itself predicts career and life success. However, the traditional view of homo sapiens as a «smart» species compared to most others is only part of the story.

This book focuses on another hallmark of homo sapiens, the ability to think in *original*, *adaptive* ways. This means that humans generate new knowledge. This creative side of humankind has been important since the beginning of time, and we might even claim that it is thanks to creative thought and action that the sociocultural world in which we live came to be. A few examples are the initial invention of tools for hunting and building. The invention of man-made shelters, the invention of techniques to control fire, cooking techniques, the invention of pottery, the invention of graphic and verbal communication including language, and later writing. Of course, this initial list is just the beginning of a long chain of inventions and creations that have led to all the artifacts that populate our daily life. However, the creative mind has also led to immaterial inventions that form the basis of culture, traditions, social rites and festivals. Concepts such as liberty, peace, crime or summer vacation are also human creations.

In terms of macroeconomic development, the shift from hunter-gatherers to agriculture and more sedentary lifestyles was a major creative event, as new techniques and tools led to this first «revolution», which was followed by the industrial revolution, and most recently by the digital revolution. It is now recognized that economic growth is tied to creative thinking that finds its way into innovative products or procedures. In this regard, the Solow residual formalized by the economist Robert Solow, indicates that long-term economic growth is not attributable simply to additional people or machines to produce more of the same goods. The «residual» growth that has characterized human society since its onset is, to an important extent, due to innovation, the translation of creative ideas into valuable novelty that is available in the marketplace (Artige & Lubart, 2020).

There is a growing literature on creativity in ancient times (Gabora & Kaufman, 2010; Hodder, 2020; Mithen, 2005). Advances and continuing discoveries have led to more and more evidence of our ancestors creativity, including the first stone tools invented 2.5 million years ago, more advanced stone tool innovations from 1.7 million years ago (Homo habilis), zigzag motifs carved on shells (540,000 years ago, Homo erectus), proof of techniques developed to master the use of fire and, burial sites funerary practices (400,000 years ago), ceremonial sites (175,000 years ago, Bruniquel cave), jewelry (100,000 years ago), geometric designs (75,000 years ago), cave art, oil lamps and musical instruments (35,000 years ago). In depth studies of creativity have been conducted. For example, Sofaer (2015) examined the process

of making clay objects, the nature and design of these objects, and the introduction of novel innovations in clay objects which also reflect social creativity in cultural practices, such as new culinary practices and funeral rituals.

This leads us to suggest that humans have an inherently creative nature. To highlight this idea, we use the term «*homo creativus*» (Lubart, 2012) Homo creativus reflects and emphasizes original thinking compared to the term Homo sapiens which focuses on «knowledge». In recent educational trends, "twenty-first century competencies" have been identified as the key skills that education can promote in our current century to favor professional and life success. Although many competencies can be listed as important for the twenty-first century, there are four that are always present, namely creativity, critical thinking, collaboration and communication (see www.p21.org).

The concept of creativity as a psychological construct has a long history. Creativity was conceived by some early theorists to have a divine origin, and human creators were seen as receptacles for divine inspiration. In some cases, cultural creation stories which specify how the world came into being show parallels with the way that human creativity is viewed on the individual level. Creativity can be conceived in terms of a competency, an ability, a potentiality, but it can also be used with a process, or product focus. Indeed, the history of the concept of creativity and its' diverse definitions have been the subject of inquiry, and illustrate a concept (creativity in this case) that was invented and developed over time (Dacey, 1999; Runco & Jaeger, 2012). The different chapters in this edited book present a set of currently-used definitions of creativity which share the basic focus on novel, original thinking that is contextually relevant and meaningful. However, there are various nuances that each specific definition offers, as readers will discover across the chapters.

Given that creativity is a broad concept and has been examined extensively in the scientific literature for more than a century (see Glaveanu, 2019), it is worthwhile to have a framework to structure inquiry about it. In other words, what are the different facets of homo creativus? Is it possible to conceptualize the study of creativity in a systematic way that reflects the existing literature and offers opportunities to expand on this literature in the future? The objective is a multidisciplinary framework on creativity studies to capture the rich diversity of topics and approaches. Our goal is to explore the topic of creativity much like early adventurers explored the globe.

In ancient times, those who visited all the different parts of the globe were said to have sailed the seven seas. Perhaps the earliest reference to the seven seas dates to 2300 BC, used by Enheduanna, a Sumerian high priestess in a hymn to Inanna, goddess of love, fertility and warfare. For the ancient Greeks, the Aegean, Adriatic, Mediterranean, Black, Red, and Caspian seas, as well as Persian Gulf comprised the 7 seas. After European explorers discovered North America, the Seven Seas began to refer to the Atlantic, Indian, Pacific, Mediterranean, Caribbean and Arctic seas, together with the Gulf of Mexico.

The Mesopotamians recorded the movement of seven celestial bodies, namely the Moon, Mercury, Venus, the Sun, Mars, Jupiter, and Saturn. These seven astronomical entities became to be known as the Seven Heavens—and an association, at least metaphorically, was seen with the seven seas on earth. Indeed, when the seven

celestial bodies moved, there were some effects on ocean tides. In diverse religious and cultural groups, the seven heavenly objects were in some cases also related to a metaphysical vision of heaven, with seven levels or parts.

Upon the 50th anniversary of Guilford's seminal article, the *Journal of Creative Behavior*, which started in 1967 and is the longest running journal devoted to creativity studies, organized a special issue. An analysis of the articles in the JCB from its inception showed that seven main topics could be identified (Lubart, 2017). Each one was denoted by a word starting with C, given that the overall concept was creativity studies. These are: Creators, Creating, Collaboration, Context, Creations, Consumption, and Curricula. We call them the 7 Cs of Creativity.

Creators refers to the individuals who engage in the production of original, valuable work. These agents may be working alone or collectively. Research on Creators has often investigated their characteristics in terms of personality, cognition, or affect. Much of the research adopted an individual differences approach, measuring specific characteristics such as mental flexibility, or openness through questionnaires or tests. These scores on the "ingredients" of creativity can then be related to individuals' expressions of creative thinking. Some work has compared and contrasted creative individuals in various professional sectors, such as artists, scientists, or entrepreneurs, looking at typical profiles of creative people in each field.

Creating focuses on the process of initiating, developing and bringing to fruition an original, meaningful work. All the thoughts and actions, organized in a temporal sequence compose the act of creating. Research on Creating has traditionally sought to trace the process stages and examine the specific process features that favor originality. Some work examined traces of creative activity through artists and scientists notebooks, such as the well-known study of Charles Darwin's notes from his exploratory voyage on the Beagle on the creation of his theory of evolution (Gruber & Barrett, 1974). Other work traced the activity during a creative task, such as observations of the actions engaged by art students who make a still-life (see Getzels & Csikszentmihalyi, 1976). Yet other work relied on self-reports, or introspective accounts of creative process engagement (Lubart, 2018).

Collaboration concerns the interaction between people, in terms of dyads, or groups engaged in creative work. Creating in a social setting includes the interactions with significant others during the creative process, such as an author interacting with his or her editor, a designer interacting with a client, or a student interacting with classmates during project work. Research has examined the kind of interactions that occur between members of collaborative groups, focusing often on teams engaged in brainstorming or improvisational music groups (see for example, Sawyer, 2014).

Context is the term that refers to the physical and social environment in which creativity occurs. The context includes family, school, professional settings as well as societal, cultural dimensions. Context can support or hinder creativity, it can also orient the content of the work. Research on Context has examined both micro and macro factors that impact creative activity, in some cases over generations and centuries of creative activity in a field. There is research, for example, that uses questionnaires about environmental characteristics (in the family, school and workplace), examining the links between the presence or absence of specific features

(e.g., support, rules, etc.) and level of creative activity. In addition, research using historiometric procedures has looked at relationships between measures of societal environmental characteristics (such as years of war, proximity to cultural centers, presence of eminent creative role models) and indicators of societal creative performance and accomplishment, such as the number of patents per decade, number of literary works, or number of recognized musical compositions (see Simonton & Ting, 2010).

Creations denotes the outcomes or productions that result from the act of engaging creativity. Creations have been studied in terms of their features, the criteria with which they are evaluated and how these productions are integrated into a field of work. Once the production exists it can evolve over time, interacting with other productions in the marketplace of creative works. Research on creative products has examined, for example, judges' explicit and implicit criteria, as well as the inter-judge agreement on evaluations of productions. Some research has also developed objective scoring procedures that allow a production to be evaluated compared to others based on the presence or absence of features in the work itself.

Consumption refers to the adoption of these creations in the social marketplace of ideas, practices and goods. The characteristics of early adopters of creative productions, the market conditions that favor the adoption of creative work, be it new ideas, processes or products, are examples of topics that have been researched within this «C». There is also work examining how the act of consuming can lead to the further development of creative productions beyond their initial intention.

Curricula focuses attention on the development of creativity. This «C» includes formal educational programs that may be designed for school or professional training, to boost creativity. A large set of creativity techniques exist and can be learned to enhance the creative process and its outcomes. However, there is also the possibility of informal education for creative development through extracurricular activities, such as game play, hobbies or exposure to creative role models These different educational paths as well as others have been studied. For example, some research looked at the impact of exposure to certain pedagogical methods, programs focusing specifically on educating creativity, or indirect educational experiences that can contribute to creative development.

It should be noted that all types of research methodologies ranging from case studies, qualitative studies, quantitative studies using correlational or experimental designs, and simulation studies have been or could be used to explore each of the 7 Cs. Also, earlier conceptual frameworks to describe the field of creativity are compatible with the 7 Cs, but offer slightly different perspectives. For example, Rhode's (1961) four «P's»–person, process, press, and product–map directly onto the 7 Cs. Glaveanu's (2013) five A's—Actor, Action, Artifact, Audience, Affordance—also align with the 7 Cs.

The co-editors of this current book have been collaborating over the past 25 years on creativity research and this volume illustrates some of the work conducted but more widely offers examples of current work on each C from a larger set of scholars. Consider now some examples of research conducted by the co-editors of this book.

Concerning the C of Creators, numerous studies were conducted to measure cognitive, conative and affective characteristics of individuals related to indicators of creative potential and achievements. These studies examined, for example, mental flexibility, tolerance of ambiguity and affective traits like affect intensity (Lubart et al., 2015; Zenasni et al., 2008). A line of studies led to the development of measures of creative potential, notably the EPoC battery, to measure divergent-exploratory and convergent-integrative creative ability in several domains (Lubart, Barbot et al., 2019).

Creating, the creative process, was studied by several co-editors of this book in multiple domains, including visual arts, science and engineering, design, musical composition, and screenwriting (Botella et al., 2013, 2018; Bourgeois-Bougrine et al., 2014; Glaveanu et al., 2013). The methods included interviews with accomplished creators in these domains, who described their creative process, self-report and observational studies of people engaged in creating work. Although there are specificities in the creative process for each domain and each task, it is possible to observe systematic trends that allow the creative process involved in successful, original work to be distinguished from the process that leads to more mundane work (Lubart, 2018).

Collaboration was examined in the context of small team creativity. For example, in some studies, several individuals worked together in brainstorming tasks and the interactions and output were compared to control conditions in which individuals work independently and their productions are simply combined in a fictitious "group". The quality of the exchanges and discussion in dyads and small groups can be examined, and some measures of creative collaboration were developed.

Over the years, the co-editors of this book have examined several facets of the environment that support or inhibit creativity. Some work looked at the family context, in terms of rules that parents have, the rigidity or flexible use of parental rules and the link with children's creative thinking. Other work, in school settings, looked at support for creative thinking in terms of teachers' attitudes and beliefs. Workplace environment was studied in part using questionnaires related to workplace creativity and perception of organizational climate (see Caroff et al., 2018). Another line, proposed a set of virtualized work settings, to see which contexts would be most conducive to creative output (Bourgeois-Bougrine et al., 2020; Guegan et al., 2017). Finally, additional work examined the impact of culture, studied mainly through variation in national cultures, across country settings, on the nature and amount of creative activity (Lubart et al., 2019).

The C of Creations was the object of several empirical studies of judges' criteria. In some of these studies, judges rated a set of productions, such as advertisements, on a series of criteria, including novelty, utility and aesthetic value. Some studies used specially created productions that included variations in the composition of the presented works. This line of research led to insights about judges' criteria, the weights that they attribute to various facets of creative productions, and the similarities between scores provided by judges compared to more objective assessment systems, such as the relative frequency of an idea calculated statistically compared to the frequency of other ideas in a set of work (Caroff & Besançon, 2008; Lubart et al., 2010).

Consumption is another essential C of the 7 Cs because the focus has traditionally been on the production of creative work, but the uptake and transformation of ideas in the marketplace is part of the complete picture. Working together with behavioral economists, this theme was explored in a series of studies. For example, more or less original goods were presented to the public, and the value placed on these productions was estimated for these future "consumers' of creative goods. In some work, consumption habits and attitudes toward original products, or those involving some consumer customization and creative input were studied. Furthermore, some research looked at ways that consumers may actually contribute to product design, as collaborators in the value chain of new products and service development (Decotter et al., 2018).

The last C, Curricula, was examined in research that looked at three main topics. First, some studies examined the developmental impact, using semi-longitudinal methods, of pedagogical approaches, such as Montessori and Freinet pedagogies on children's creative thinking (Besançon & Lubart, 2008). A second line of work looked at the effects of specific programs to boost creativity, such as interventions to help students develop mental flexibility or other characteristics that support creative thinking (Barbot et al., 2015; Besançon & Lubart, 2015). Finally, a third line of work looked at extra scholastic activities that may contribute to creative development. In particular, studies of board game play have been conducted (Mercier & Lubart, 2021).

The research cited for each C illustrates diverse work conducted, but it is also possible to examine two or more Cs together. This approach may yield further insights. For example, in some studies of the impact of virtual environments with participants represented by avatars, the basic effect of a stimulating work environment on creativity (the C of context) was examined in conjunction with the C of creators. In this work, participants were exposed to various kinds of virtual work environments, versus traditional real-life settings, and measures of individual differences of their personality and abilities were made. The results showed that the benefits of the virtual environment were particularly present for individuals who were relatively high on risk taking, compared to those low on risk taking who showed no special effect of the virtual environment compared to the "real-life" traditional one (Bourgeois-Bougrine et al., 2020). This interactive effect enhances the understanding of creativity thanks to a combined Context-Creator, multiple C investigation.

A bibliographic analysis of recent work published in 2020 provides an overview of work on creativity. To provide a specific example, the PsycINFO search engine was used. This search engine focuses on literature in psychology, but a similar analysis could be conducted in other fields or in a multidisciplinary manner. Although there were numerous books, book chapters and Ph.D. dissertations about creativity, the analysis here will focus first on peer-reviewed journal articles. To conduct this analysis, the search term «creativity» as a keyword descriptor was used. The results are illustrative because other related keywords, such as divergent thinking, could also be used. In 2020, there were 661 articles with the keyword «creativity» that came from a range of journals.

Table 1 Psycinfo © number of records concerning creativity by decade

Time period	«Creativity»	Total database items	Percent for creativity
1951–1960	396	92,869	0.43
1961–1970	1823	155,434	1.17
1971–1980	2964	288,292	1.03
1981–1990	3743	483,783	0.77
1991–2000	4438	649,507	0.68
2001–2010	9412	1,220,931	0.77
2011–2020	11,634	1,848,528	0.63

These journals can be categorized into three sets. First, in the 2020 Psycinfo database, six journals focused directly on creativity. These were: the *Journal of Creative Behavior, Psychology of the Aesthetics, Creativity and the Arts, Creativity and Innovation Management, Thinking Skills and Creativity, Creativity Research Journal, Journal of Creativity in Mental Health.* Second, there were several general psychology journals that published articles on creativity: *Frontiers in Psychology, Current Psychology, Current Psychological Research and Reviews, Neuroimage, Plos One*. Finally, there were a large number of more specialized journals, often focused on a subdiscipline of psychology that published articles on creativity. Examples are *Personality and Individual Differences, Computers in Human Behavior, Psychoanalytic Dialogues, Organizational Behavior and Human Performance,* and *Education.*

It is interesting to note as well the overall trend in the psychology literature concerning articles on creativity. Here the generic search term «creativity» was used, without requiring that the term be a keyword. The number of items (peer-reviewed papers, books, chapters, dissertations) that had mentioned creativity in the title or abstract are indicated in Table 1, by 10-year periods, since Guilford's (1950) presidential address to APA. We can observe that there is an overall growth in the number of research items on creativity, ranging from 396 in the 1951–1960 period to 16,634 in the most recent decade, 2011–2020. This shows that there are 42 times more articles in the last ten years compared to the 1950–1960 period. However, it is important to note that the total number of entries in the Psycinfo database increased as well each decade, as the field of psychology has grown. The percentage of items concerning creativity compared to the total number of items remained relatively stable, ranging from 0.43 to 1.17% over the 70-year period examined. There is therefore more and more research on creativity, but it remains a relatively rare topic in psychology, representing less than one entry out of one hundred in the bibliographic database.

This book presents, therefore, a call to expand our knowledge of creativity, encompassing all 7 Cs of creativity. In this book, there are two chapters devoted to each C. For Creators, there is a chapter entitled "From Everyday Creativity to Eminent Cases of Creative Achievement in Professional Domain" by Dean Keith Simonton that addresses broad issues concerning creative people, eminent and non eminent. This chapter raises a series of fundamental questions that underlie current

debates in the literature today. The following chapter, entitled "Cognitive and Conative Profiles of Creative People" by Nils Myszkowski, Baptiste Barbot and Franck Zenasni, surveys the literature on creative individuals looking primarily at cognitive, conative and affective components that contribute to individual differences in creativity. A second section focuses on Creating. One chapter, entitled "The DA VINCI Model for the Creative Thinking Process" by Giovanni Emanuele Corazza and Sergio Agnoli presents a new theoretical model of the creative process and offers a synthesis of studies on the creative process. The other chapter in this section, entitled "Creative Processes in Five Domains: Art, Design, Scriptwriting, Music and Engineering" by Marion Botella, Franck Zenasni, Julien Nelson and Todd Lubart presents a series of results from empirical work on process tracing, to illustrate the sequence of thoughts and actions engaged in creative work. The third C is Collaboration. Here, Julien Nelson and Jérôme Guegan look at studies and models of "Creative Collaboration in Groups". Then, Vlad Glăveanu, in his chapter, "Creativity and Culture: Four (Mis)Understandings" offers a vision of culture as a collaborative setting in which all creative acts take place. Next, the C of Context is examined. First there is a chapter by Christophe Mouchiroud, Nils Myszkowski and Martin Storme, entitled "The Social Environment of Creativity" with special attention to family and several expanding layers of context. This is followed by the chapter "The Place to Be: Organizational Culture and Organizational Climate for Creativity" by Canan Ceylan and Jan Dul, which focuses specifically on concepts and research concerning work and professional environments. The C of Creations is examined in the following two chapters. Mark Runco in his chapter entitled "Types of Creativity", looks at a wide range of measures of creativity, with a focus on creative potential. Xavier Caroff and Justine Massu, in their contribution "The Black Box of the Consensual Assessment Technique: Some Questions and Doubts on the Subjective Rating of Creativity", examine questions related to the judgment of creativity, using the consensual assessment technique, applied to creative productions. The following section looks at the concept of consumption as related to creativity. A first contribution in this section, "Waste Creatively: The Intersection of Creativity and Consumerism" by Beth Hennessey, addresses broad societal issues of consumption of creative ideas and artifacts. The following chapter, "Creativity and Consumer Behavior: An Economic Analysis" by Louis Lévy-Garboua and Marco Gazel provides a behavioral economics perspective. The final section focuses on the C of curriculum. Here, an initial chapter by Katherine Cotter, Ronald Beghetto, and James Kaufman entitled "Creativity in the Classroom: Advice for Best Practices" looks at school and issues related to the development of creativity in educational settings. Then, the chapter by Gerard Puccio and Monika Modrzejewska-Świgulska entitled "Creative Problem Solving: From Evolutionary and Everyday Perspectives" examines the development of creativity through training focusing on creative problem-solving methods, including the acquisition of creative thinking techniques. This chapter situates the topic of curriculum in the historical work on the development of homo sapiens transitioning to Homo creativus. Finally, the concluding chapter by Samira Bourgeois-Bougrine brings together work and reflections of the combined 7 C's through an illustration of creativity in contemporary society. Taken together, the chapters in this edited book offer insights into

specific aspects of each C and illustrate the diversity of work that contributes to a scientific approach to creativity. Through the contributions in this volume, readers are invited to reflect on *Homo Creativus*, the human species denoted by its' creative nature.

References

Artige, L., & Lubart, T. (2020). Economic perspectives on creativity. In M. A. Runco & S. R. Pritzker (Eds.), *Encyclopedia of creativity*. Academic Press.

Barbot, B., Besançon, M., & Lubart, T. (2015). Creative potential in educational settings: Its nature, measure, and nurture. *Education 3–13*, *43*(4), 371–381.

Besançon, M., & Lubart, T. (2008). Differences in the development of creative competencies in children schooled in diverse learning environments. *Learning and Individual Differences, 18*(4), 381–389.

Besançon, M., & Lubart, T. (2015). *La créativité de l'enfant: évaluation et développement*. Mardaga.

Botella, M., Glaveanu, V., Zenasni, F., Storme, M., Myszkowski, N., Wolff, M., & Lubart, T. (2013). How artists create: Creative process and multivariate factors. *Learning and Individual Differences, 26*, 161–170.

Botella, M., Zenasni, F., & Lubart, T. (2018). What are the stages of the creative process? What visual art students are saying. *Frontiers in Psychology, 9*, 2266.

Bourgeois-Bougrine, S., Glaveanu, V., Botella, M., Guillou, K., De Biasi, P. M., & Lubart, T. (2014). The creativity maze: Exploring creativity in screenplay writing. *Psychology of Aesthetics, Creativity, and the Arts, 8*(4), 384.

Bourgeois-Bougrine, S., Richard, P., Burkhardt, J. M., Frantz, B., & Lubart, T. (2020). The expression of users' creative potential in virtual and real environments: An exploratory study. *Creativity Research Journal, 32*(1), 55–65.

Caroff, X., & Besançon, M. (2008). Variability of creativity judgments. *Learning and Individual Differences, 18*(4), 367–371.

Caroff, X., Massu, J., & Lubart, T. (2018). Measuring creativity at work. In *The Palgrave handbook of creativity at work* (pp. 3–22). Palgrave Macmillan.

Dacey, J. (1999). Concepts of creativity: A history. In M. A. Runco & S. R. Pritzker (Eds.), *Encyclopedia of creativity* (1st ed., pp. 309–322). Academic Press.

Decotter, D., Burkhardt, J. M., & Lubart, T. (2018, August). Evaluating users' creativity for service and needs identification in the field of emerging technologies: A comparison of two methods and two production conditions. In *Congress of the international ergonomics association* (pp. 983–989). Springer.

Gabora, L., & Kaufman, S. (2010). Evolutionary approaches to creativity. In J. C. Kaufman & R. J. Sternberg (Eds.) *Cambridge handbook of creativity* (pp. 279–300). Cambridge University Press.

Getzels, J. W., & Csikszentmihalyi, M. (1976). *The creative vision: A longitudinal study of problem finding in art.* Wiley.

Glăveanu, V. P. (2013). Rewriting the language of creativity: The Five A's framework. *Review of General Psychology, 17*(1), 69–81.

Glaveanu, V., Lubart, T., Bonnardel, N., Botella, M., De Biaisi, P. M., Desainte-Catherine, M., Georgsdottir, A., Guillou, K., Kurtag, G., Mouchiroud, C., Storme, M., Wojtczuk, A., & Zenasni, F. (2013). Creativity as action: Findings from five creative domains. *Frontiers in Psychology, 4*, 176.

Glaveanu, V. P. (Ed.). (2019). *The creativity reader*. Oxford University Press.

Gruber, H. E., & Barrett, P. H. (1974). *Darwin on man: A psychological study of scientific creativity*. EP Dutton.

Guegan, J., Nelson, J., & Lubart, T. (2017). The relationship between contextual cues in virtual environments and creative processes. *Cyberpsychology, Behavior, and Social Networking, 20*(3), 202–206.

Hodder, I. (Ed.). (2020). *Consciousness, creativity, and self at the dawn of settled life*. Cambridge University Press.

Lubart, T. (2012). Les ressorts psychologiques de la créativité. *Revue Économique et Sociale, 4*, 13–21.

Lubart, T. (2017). The 7 C's of creativity. *The Journal of Creative Behavior, 51*(4), 293–296.

Lubart, T. (Ed.). (2018). *The creative process: Perspectives from multiple domains*. Springer.

Lubart, T., Barbot, B., & Besançon, M. (2019). Creative potential: Assessment issues and the EPoC Battery/Potencial creativo: Temas de evaluación y batería EPoC. *Studies in Psychology, 40*(3), 540–562.

Lubart, T., Glaveanu, V. P., de Vries, H., Camargo, A., & Storme, M. (2019). Cultural perspectives on creativity. In J. C. Kaufman & R. J. Sternberg (Eds.), *The Cambridge Handbook of creativity* (pp. 421–447). Cambridge University Press.

Lubart, T., Mouchiroud, C., Tordjman, S., & Zenasni, F. (2015). *Psychologie de la créativité-2e édition* [Psychology of creativity, 2nd ed.]. Armand Colin.

Lubart, T., Pacteau, C., Jacquet, A. Y., & Caroff, X. (2010). Children's creative potential: An empirical study of measurement issues. *Learning and Individual Differences, 20*(4), 388–392.

Mercier, M., & Lubart, T. (2021). The effects of board games on creative potential. *The Journal of Creative Behavior, 55*(3), 875–885.

Mithen, S. (Ed.). (2005). *Creativity in human evolution and prehistory*. Routledge.

Rhodes, M. (1961). An analysis of creativity. *The Phi Delta Kappan*, *42*(7), 305–310.

Runco, M. A., & Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal, 24*(1), 92–96.

Sawyer, R. K. (2014). *Group creativity: Music, theater, collaboration*. Psychology Press.

Sofaer, J. (2015). *Clay in the Age of Bronze: Essays in the Archaeology of prehistoric creativity*. Cambridge University Press.

Simonton, D. K., & Ting, S. S. (2010). Creativity in Eastern and Western civilizations: The lessons of historiometry. *Management and Organization Review, 6*(3), 329–350.

Zenasni, F., Besançon, M., & Lubart, T. (2008). Creativity and tolerance of ambiguity: An empirical study. *The Journal of Creative Behavior, 42*(1), 61–73.

From Everyday Creativity to Eminent Cases of Creative Achievement in Professional Domains

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Creativity is ubiquitous. It is apparent in everyday problem solving, such as creatively modifying a recipe for a favorite dish after discovering too late that a crucial ingredient is absent from the pantry. Creativity is also evident in the most monumental achievements of human civilization, such Albert Einstein's general theory of relativity or Pablo Picasso's *Guernica*. Everyday manifestations have been styled "little-c creativity" and genius-level achievements "Big-C Creativity" (Simonton, 2013b; cf. Kaufman & Beghetto, 2009). It is frequently assumed that little-c and Big-C creativity simply anchor the extreme ends of some continuous scale with many grades between. Or, more accurately, zero creativity anchors the low point, and then the scale proceeds from the smallest to the largest magnitudes of creativity.

To illustrate, consider the Creative Achievement Questionnaire (CAQ), a popular self-report measure of creativity (Carson et al., 2005; see also Silvia et al., 2011). The scale assesses creativity in a broad range of domains: visual arts, music, creative writing, dance, drama, architecture, humor, scientific discovery, invention, and culinary arts—with each domain having its own subscale. Every subscale has a zero representing the utter absence of creativity in the domain, and from that low point advances to the lowest levels of little-c creativity, such as self-perceived creative acts, before moving to the lower levels of Big-C creativity, such as achievements that earn national recognition. Although none of the scales progress to the highest grades of Big-C creativity, as would be indicated by the Nobel Prize and similar international

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awards, that omission is understandable given the extreme rarity of such recognition among the participants who most frequently fill out the questionnaire (to wit, college students). Moreover, assessments of posthumous fame are not surprisingly omitted as well, given that the CAQ relies on *self*-reports! Nevertheless, the main point remains: The instrument assumes that creativity can be measured along a quantitative scale that begins at zero and ends at the highest levels of at least national recognition.

This chapter will argue that everyday creators and creative geniuses who produce achievements of the highest order differ not in degree but in kind. Unlike contrasts in intelligence, which are founded on an underlying continuum, contrasts in creativity often betray one or more discontinuities. The chapter's argument begins with the very definition of creativity and from there discusses cognitive processes, developmental antecedents, and individual differences.

1 Defining Creativity

Creativity researchers have put forward a dizzying diversity of definitions (Plucker et al., 2004). Most researchers probably subscribe to the "standard definition" that imposes two criteria: (a) novelty or originality and (b) usefulness, value, or appropriateness (Runco & Jaeger, 2012). Nonetheless, a sizable minority have argued for the definitional superiority of a three-criterion definition, where the third criterion amounts to "surprise" or at least "nonobviousness," to use the standard imposed by the United States Patent Office (Boden, 2004; Simonton, 2012b). This additional criterion is implemented to rule out original and useful ideas that merely emerge from the straightforward application of domain-specific expertise (e.g., Amabile, 1996), or what the Patent Office calls "ordinary skill in the art" (as defined at http://www.uspto.gov/web/offices/pac/mpep/documents/2100_2141_03.htm). For the purposes of discussion in the current chapter, I will adopt the following three-criterion definition: *An idea is creative to the extent that it is jointly original, useful, and surprising* (Simonton, 2013a). The insertion of the qualifier "jointly" means that the definition is multiplicative rather than additive. An idea cannot possibly be creative if it is commonplace, useless, or obvious.

Too many researchers stop with the definition, not realizing that specifying the criteria only solves half of the problem (Simonton, 2013b). The issue is not really settled until we also address the following question: *Who* decides whether an idea is jointly original, useful, and surprising? The answer is critical. To appreciate this fact, let us consider two different responses: (a) the person who generates the idea decides on its creativity or (b) the idea's creativity is decided by a consensus of persons in the position to make that judgment.

1.1 Personal Creativity

In the proverbial "Eureka!" moment, the creative individual realizes that he or she has come up with an idea that is original, useful, and surprising. The idea is considered *original* because it had a low initial probably, sufficiently low that it required a prolonged incubation period before finally popping into the mind. The idea is personally judged as *useful* because it solves the problem at hand, the problem that stimulated the search for a solution. And the idea is subjectively assessed as *surprising* because it was not obviously derivable from any given domain-specific expertise.

Such acts of *personal* creativity are purely cognitive, involving a subjective assessment of an idea's claim to originality, usefulness, and surprise. Because the creator alone decides, the judgment requires no "second opinion." Creativity is thus a strictly psychological rather than social phenomenon. If the researcher's focus is on everyday creativity, this personal assessment suffices. For example, the concept of personal creativity is implicit or explicit in self-report measures that request the person to self-identify instances of creativity in their own lives (e.g., Richards et al., 1988). Even so, it certainly could happen that the creator's self-perceptions are very much deceived. The idea may lack one of the three essential qualities. Persons tripping on psychedelics who believe that they can fly will discover their error should they jump out the second-story window. Naturally, this objection is removed if the idea's creativity is independently validated by others. If those others reach a consensus on the creativity, then the idea can be considered *consensually* creative (e.g., Amabile, 1996).

1.2 Consensual Creativity

An idea's creativity can be consensually certified in many different ways. Two friends might be backpacking in the woods, chatting about the best place to stop for the night. One of them comes up with an original, surprising, but still useful suggestion, to which other responds "That's a great idea!" Another example of an interpersonal consensual validation is when some wit becomes the "life of the party," spontaneously making up one joke after another that keeps everybody in stitches throughout the evening. Here humor becomes assessed for its originality, usefulness (aptness), and surprise. However, consensual creativity does not even require that the evaluator be walking the same path or occupying the same room as the creator. Since the advent of YouTube, an idea's creativity might be assessed by the degree to which the posted video "goes viral," as determined by the number of viewings by anonymous web-surfers. Alternatively, the creativity of an amateur musical composition might be gauged by the number of downloads. These consensual measures do not necessarily require any special domain-specific expertise on the part of either creators or evaluators. Hence, ideas that satisfy this level of creativity might be said to stand at the cusp between little-c and Big-C creativity. Unlike genuine Big-C creativity, the

creative ideas are very often ephemeral, vanishing as quickly as they appeared. The party wit's jokes might seem less funny on retelling the next day, eliciting the lame "well, you needed to be there." The number of "cute little kitty" videos that have come and gone may be uncountable.

Far more interesting and important are those occasions in which consensual creativity demands domain-specific expertise on the part of both creators and their evaluators. That expertise is required because the creators aim at making a creative contribution to a specific domain in the arts or sciences. The creators actually identify themselves as artists or scientists. Most often the evaluators are themselves creators operating in the same domain and thus provide the basis for "peer review" (Csikszentmihalyi, 2014). This circumstance certainly holds for the sciences, where both grant proposals and journal submissions are judged by peers who, at least in theory, have the expertise needed to have written similar proposals or submissions. Similarly, art works submitted for exhibitions or festivals are often evaluated by juries consisting of creative peers. But other times the evaluations are made by persons who acquire status as "gatekeepers" by establishing a portfolio of good judgments—such as art gallery owners, theater impresarios, orchestra directors, film studio executives, and critics of all kinds. Sometimes more than one evaluation is involved before the consensual evaluation is complete. Thus, a new invention might first face judgment by a patent examiner to determine whether it meets the criteria for patent protection, but then encounter another up-down assessment by a venture capitalist before the invention can become a consumer product. If the invention's production is halted by a patent infringement law suit, creativity may later be determined by a judge. Although these assessments vary greatly in specific application, they can all be said to apply to the consensual evaluation in a *professional* domain where the creativity of an idea constitutes an essential criterion for deciding that the idea makes a bona fide contribution to that domain. Creators in these domains are authentic *professionals* (cf. Kaufman & Beghetto, 2009).

It should be emphasized that consensual creativity introduces numerous complexities not found in personal creativity. First and foremost, consensual creativity is no longer a purely psychological phenomenon but rather has acquired an interpersonal and even sociocultural aspect. As a consequence, the two assessments need not agree (Simonton, 2013b). Anyone who has had their creative masterpiece ripped to shreds in peer review has experienced firsthand how discrepant these two judgments can be! Second, unlike personal creativity, consensual creativity presumes a *consensus*, and such an agreement may not be forthcoming, especially in low-consensus domains like the arts and the social sciences (Simonton, 2009, 2014b). Again, anybody who has submitted a manuscript for publication only to receive peer evaluations that are all over the place—from "accept as is" to "reject outright" recommendations—knows how pathetic the supposed consensus can be. This absence of agreement becomes even more conspicuous in creative domains where the evaluators often apply divergent criteria. Cinematic creativity, for example, can be assessed by either professional critics (film reviews) or filmmaking professionals (awards), which seldom converge on identical judgments (Simonton, 2011b). The former are outsiders, the latter insiders.

Last but not least, unlike personal creativity, the evaluation of consensual creativity can prove unstable over time (Runco et al., 2010). Although creative persons might change how they view their own ideas over the course of their careers, such reassessments must definitely cease at their deaths. In contrast, posthumous reevaluations are rather frequent in the case of consensual creativity (Ginsburgh & Weyers, 2014; Whipple, 2004). In the extreme case, the result is the once "neglected genius" who has to wait for posthumous acclaim. Obvious examples include Gregor Mendel, Emily Dickinson, and Frida Kahlo. Even if consensual assessments eventually stabilize in the long run, the assessments can become unstable for the first few decades after the creator's death. This instability must obviously operate without any psychological correlates within the individual creator. After the latter dies, his or her psychology has become fixed in stone.

These posthumous consensual assessments can occur because professional creativity generates overt products that become part of the historical record. Mendel published his genetic experiments in a scientific journal, enabling his results to be rediscovered 35 years later; Dickinson's poems were collected for publication after her death, thus allowing posterity to appreciate what her contemporaries had overlooked; and Kahlo's paintings began to show up in the permanent collections of major art museums, starting with a prescient purchase by the Louvre. If nothing is preserved to permit these continuing reassessments, then the creative individual will slip into obscurity, becoming an unknown to history (Lang & Lang, 1988). Hence, the prerequisite for Big-C creativity is a surviving body of creative work (see also Simonton, 1991).

2 Cognitive Processes

The last section ended with the assertion that consensual creativity, unlike personal creativity, is somewhat decoupled from individual psychology. This point needs elaboration. So imagine the following two scenarios.

In the first, an amateur backpacker finds himself stranded in a remote wilderness because of an unexpected storm that closes all nearby trails and roads for weeks. Forced to survive in an inhospitable environment, he creates a number of ingenious techniques to obtain food and shelter, as well as to attract attention from possible search teams flying overhead. Finally, he is rescued, and he tells his story of survival, including the inventory of original, useful, and surprising tools and behaviors. The seasoned rescuers listen with amazement, advising the backpacker that he should write his ordeal up for a backpacking magazine. In their informed judgment, his solutions to an urgent problem were truly creative. The backpacker follows their advice and eventually expands the essay into a full-fledged survival manual that becomes a national bestseller.

The second scenario starts out exactly the same way, but ends very differently. The fortunate backpacker climbs into the helicopter and begins proudly to tell his tale of survival creativity. Only in this alternative universe, his rescuers just roll their eyes,

advising him that he could have saved himself a lot of trouble if he had taken along a bestselling survival manual. They then show him a well-worn copy containing every single technique that he thought he had invented. Unlike in the previous scenario, where his personal creativity was validated as consensual creativity, in the second scenario his personal creativity remained only personal. At the consensual level his ideas displayed no originality, usefulness, or surprise.

Yet despite the difference in outcome in these two scenarios, the backpacker's cognitive processes prior to the rescue were exactly equivalent. The personal creativity was identical in both cases notwithstanding the stark contrast in consensual endorsement.

Actually, this hypothetical example has interesting parallels in the real world of Big-C creativity. The history of science has many instances of independent discovery and invention, or what has been called "multiples" (Lamb & Easton, 1984). Two or more individuals may come up with the same creative idea in complete ignorance of the redundancy at the domain level. Well-known examples are the independent invention of calculus by Isaac Newton and Gottfried Wilhelm Leibniz, the theory of evolution by natural selection proposed by Charles Darwin and Alfred Wallace, and the telephone by Alexander Graham Bell and Elisha Gray, the two inventors seeking patent protection on the exact same day. Such multiples often lead to priority disputes that end up getting resolved with one person getting all of the credit—such as happened with the telephone. Hence, personal creativity in one person received consensual validation whereas the personal creativity in another person did not even when the resulting creative ideas are comparable. If Gray had been quicker on the patent application trigger, these endorsements would have been reversed, and the famous Bell Telephone Company would have become the Gray Telephone Company. Even so, the cognitive processes they each engaged in would have been unchanged. In a sense, little-c creativity is out of synchrony with Big-C creativity.

The foregoing discussion did not actually mention what these cognitive processes might be. It turns out that there is not a single "creative process" but rather a multitude of processes or procedures involved. These can be divided into two classes, namely, those are specific to a given domain of creativity and those that can be found in virtually all domains. I will refer to the former as "procedures," because they invariably represent that category, whereas the latter I will call "processes," because they mostly fall into that category, albeit some procedures can be domain general as well.

2.1 Domain-Specific Procedures

Problem solving in any established domain utilizes a set of techniques or procedures. These are sometimes referred as "strong" methods because they most often guarantee a solution to a given problem (e.g., Klahr, 2000). Often these strong methods might even be considered *algorithmic*, that is, they entail a step-by-step procedure for obtaining a solution. Want the roots of a quadratic equation? Then just plug the three constants into the quadratic formula and do the required multiplications, additions,

subtractions, square root, and divisions (in the right order). Indeed, persons who create in the mathematical sciences must possess a huge toolbox of methods for solving mathematical problems. The tools involve basic algebra, differential and integral calculus, differential equations, matrix algebra, vector geometry, and diverse areas of higher mathematics. Scientists who lack the necessary set of procedures must often take on a mathematical collaborator to do the calculations or derivations, just as Einstein was obliged to do when he got in over his head working on his general theory of relativity.

In any case, although mathematical procedures are used in all mathematical sciences, the contents of each toolkit will depend on the specific discipline. Techniques that are the bread and butter of one science may serve as no more than a condiment in another. Structural equation models are popular in quantitative psychology but not in theoretical physics. More importantly, each science contains a set of methods that are unique to that science. For example, a chemist must know how to balance equations representing chemical reactions, such as the elementary $2H_2 + O_2 = 2H_2O$. A chemist specializing in a particular branch of chemistry, such as electrochemistry, will master problem-solving strong methods unique to that branch.

Domain-specific procedures are also apparent in the arts. Leonardo da Vinci's *Treatise on Painting* is crammed full of various devices, such as detailed instructions of how to translate a three-dimensional space into a two-dimensional representation via linear perspective and other techniques. Likewise, classical composers could not create without first knowing a great deal about harmony, counterpoint, instrumentation, and a host of other strong methods. If a melody does not play well on a particular instrument, the composer must either revise the melody or else pick a different instrument to play it.

Whatever the particulars, these domain-specific procedures separate the experts from novices or amateurs. The methods set a Picasso apart from a typical "Sunday painter," a Thomas Edison from a "garage tinkerer." Even so, by themselves these techniques cannot guarantee ideas that are original, useful, and surprising. On the contrary, to the extent that problem solving is entirely driven by strong methods, the solution may not be creative at all. Instead, the result will merely represent "reproductive" or "routine" thinking (cf. Wertheimer, 1945/1982). Art schools and music conservatories are full of instructors who can teach every textbook technique that an artist or composer needs to know, and yet neither the teachers nor their straight-A students may produce anything beyond ordinary "academic" art or music. Something more is necessary to "think outside the box" defined by domain-specific procedures.

2.2 Domain-Generic Processes

Empirical research has identified a large number of processes and procedures that appear to facilitate bona fide "productive" thinking in a diversity of domains in both the arts and the sciences (Simonton & Damian, 2013). These Simonton (2015)

recently listed as "divergent thinking, remote association, cognitive disinhibition, conceptual reframing, analogy formation, tinkering, play, combinatorial procedures, and both systematic and heuristic searches" (p. 3), where heuristic searches can include such techniques as hill climbing, means-end analysis, working backwards, and trial-and-error (Simonton, 2012a). In contrast, Ness (2013) identified several "tools" used by Big-C creators: finding the right question, changing point of view, broadening perspective, reversal, observation, analogy, juggling induction and deduction, dissecting the problem, recombination and rearrangement, the power of groups, and frame shifting. These two lists only partially overlap. Yet taken together they still do not exhaust the possibilities. On the basis of more than three decades of empirical research, Rothenberg (2015) has put forward the Janusian, Homospatial, and Sep-Con Articulation processes. All told, some of these correspond to basic cognitive processes, such as remote association (spreading activation) and cognitive disinhibition (reduced latent inhibition), whereas others constitute overt procedures, such as conceptual reframing, means-end analysis, and Sept-Con Articulation. That is, the latter can be deliberately implemented by the creative person.

Unlike domain-specific strong methods, these weak methods cannot guarantee a solution to any given problem. The processes and procedures merely represent possible means for obtaining a creative idea. Sometimes they work, but most times not. Worse yet, because these methods are so weak, it is impossible to predict in advance which route to a creative solution will actually succeed. That is the very reason why highly creative individuals need such a large inventory of tools. If one doesn't work, then another tool can be taken out and tried. If that fails as well, then it's time to pull out yet another tool. Hence, the trial-and-error heuristic must be raised to the superordinate status of a "meta-heuristic" (Simonton, 2011a). Or, speaking more broadly still, the most generic creative process or procedure is what Donald Campbell (1960) called "blind variation and selective retention" or BVSR. Each tool produces possibilities that must then be tested for their usefulness. When a tool no longer manages to generate potential solutions, the creator will need to switch to another approach, and go through BVSR all over again. In other words, BVSR operates at two levels: first, the generators of possibilities and, second, the possibilities produced by each generator. At either level, the creator is "blind" regarding usefulness, thereby requiring the introduction of a selection phase.

What renders BVSR the prime candidate for a domain-generic creativity is that it makes the creative process comparable to what Campbell (1960) styled "other knowledge processes" (p. 380). These processes also operate according to "selectionist principles" (Cziko, 1995). Because the organism cannot know in advance whether a given "variation" had any utility, the only option is to subject that variation to a generate-and-test cycle, retaining that variation that best survives that test. Roughly parallel even if not isomorphic processes can be seen in biological evolution, neurological development, the emergence of antibodies, and operant conditioning (Dennett, 1995; Rosenbaum, 2014; Simonton, 1999). The latter connection is especially crucial because BVSR can be directly connected with the "personal creativity"

of any organism capable of adapting to its environment (Epstein, 1990). Indeed, the main contrast between operant conditioning and creative thought is that in the latter case, "thought trials" are very often tested against internal representations rather than the external world (Dennett, 1995; Simonton, 2011a).

3 Developmental Antecedents

What enables a person to make a creative contribution to a professional domain in the arts or sciences? One answer concerns developmental antecedents—experiences and circumstances in childhood, adolescence, and sometimes early adulthood that enhance creative potential. Consistent with what said in the previous section on cognitive processes, some of these antecedents will be domain specific and others much more domain general. I now turn to examples of each.

3.1 Expertise Acquisition

Researchers have long indicated the importance of the so-called "10-year rule" (Ericsson, 1996). World-class Big-C creativity requires that an ambitious individual devote a long apprenticeship to study and practice to move well beyond the limitations of the mere novice, no matter how talented (Ericsson, 2014). This extensive training enables individuals to acquire the domain-specific procedures mentioned earlier, such as the mathematics necessary in domains like physics, chemistry, and some subdisciplines of biology. Naturally, much more than just problem-solving techniques are acquired during this learning and apprenticeship period. The person must also attain competence in the accumulated knowledge of the domain. In the sciences, for example, this knowledge includes empirical findings and formal theories. This domain-specific knowledge should then enable the young person to become aware of what kinds of ideas would most likely be considered original, useful, and surprising by peers or gatekeepers for the domain.

One might conclude that the acquisition of domain-specific expertise would result in an equivalence between personal and consensual assessments of an idea's creativity. For instance, scientists would be socialized into knowing not just what ideas are publishable in the best journals but also what ideas are highly most likely to be cited. Yet as pointed out earlier, domains differ tremendously in their degree of consensus. Even in high-consensus domains such as the "hard" sciences, the agreement is always far from perfect (Simonton, 2004). A high-profile illustration is Einstein's relativity theory. Although some physicists accepted the new paradigm, many others were just as opposed. This opposition was strong enough to deny him the Nobel Prize for Physics through a whole decade of failed nominations. Even after his general relativity theory received a spectacular empirical confirmation in 1919, the Nobel selection committee could not reach a consensus. Finally, a compromise

was reached allowing Einstein to receive the Nobel in 1921, 11 years after his first nomination. The compromise? The prize citation would not explicitly mention relativity theory, but instead solely mentioned his 1905 work on the photoelectric effect. The omission of relativity was perceived as an insult to Einstein and his supporters! Of course, now the special and general relativity theories are considered among the cornerstones of modern physics and astronomy.

Einstein's long uphill climb to full professional acceptance was not unique. Max Planck experience with his new quantum theory led him to observe that "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it" (Planck, 1949, pp. 33–34). Likewise, Charles Darwin noted with respect to his theory of evolution that he did not "expect to convince experienced naturalists whose minds are stocked with a multitude of facts all viewed, during a long course of years, from a point of view directly opposite to mine" but instead he looked "with confidence to the future, – to the young and rising naturalists, who will be able to view both sides of the question with impartiality" (Darwin, 1860/1952, p. 240).

Planck's comment is often paraphrased more humorously in the statement that "science advances one funeral at a time." Eventually, Planck and Darwin, like Einstein, were vindicated in their own lifetimes.

In discussing domain-specific expertise acquisition it is crucial to note that the "10-year rule" does not come anywhere close to representing a "rule," but rather only describes a rough statistical average subject to conspicuous individual differences (Simonton, 2000). Some creators can master the requisite expertise in less than half the time whereas others will take twice as long. This cross-sectional variance partly reflects substantial variation in innate talent, as defined by relevant cognitive and dispositional variables that accelerate or retard the acquisition process (Simonton, 2008b). Substantial talent thus enables a student or apprentice to "get better faster." Another exception to the rule is no less important, namely, the "more bang for the buck" effect (Simonton, 2014a). Two persons with the same expertise will differ greatly in the magnitude of creativity that they will generate from that expertise. For example, Einstein did not know more than the average theoretical physicist of his day, and arguably knew appreciably less, but he certainly managed to augment his knowledge with a creative imagination going far beyond that of his contemporaries. By relaxing certain constraints of classical physics—such as Newton's assumption of absolute space and time—Einstein was led to the relativity of space and time, and thus their linkage in four-dimensional space–time.

So what developmental antecedents might enable a creator to "think outside the box" defined by domain-specific expertise?

3.2 Diversifying Experiences

Sometime during early development creative talents will encounter "highly unusual and unexpected events or situations that are actively experienced and that push individuals outside the realm of 'normality'" (Ritter et al., 2012, p. 961). Such events or situations are called *diversifying experiences* (Damian & Simonton, 2014a). These experiences can adopt a variety of forms, provided they serve to disrupt conventional ways of thinking. Examples include (a) professional, ethnic, and geographic marginality as well as (b) developmental adversity, including parental loss at the family level and political instability at the societal level. Although the particular experiences will vary from one creative individual to another, their collective impact is to nurture the development of creative potential instead of producing an expert constrained by domain-specific expertise.

To be sure, diversifying experiences, particularly when they assume the form of extreme developmental adversity, can have repercussions more negative than positive (see, e.g., Damian & Simonton, 2014b). Hence arises the necessity of finding the "sweat spot" or optimum between too much and too little (Damian & Simonton, 2014a). Complicating matters yet further, the precise location of this optimal degree of diversifying experiences depends very much on the domain of creative achievement (Simonton, 2014b). In particular, diversifying experiences are much less important in the science than in the arts. For instance, highly eminent scientists tend to come from much more stable and culturally homogeneous home environments than do comparably eminent artists. This contrast can be seen in the different family backgrounds of Nobel laureates in the sciences versus the laureates in literature.

Although the bulk of the research relevant to this topic has been correlational rather than experimental, laboratory experiments also support a positive relation between diversifying experiences and creativity, at least in the short term (Damian & Simonton, 2014a). For example, creativity tends to be enhanced when participants are exposed to schema violating stimuli (e.g., Ritter et al., 2012). In the case of Big-C creators, naturally, these influences are just much bigger and longer termed, producing lifelong developmental consequences.

4 Individual Differences

It is customary to describe most individual-difference variables as exhibiting a "normal" or "Gaussian" distribution, as depicted by the iconic "bell-shaped curve" (Simonton, 2008a). Individual differences in intelligence offer a classic example (Herrnstein & Murray, 1994), a formal description that goes all the way back to Francis Galton (1869). Even if the cross-sectional distribution of little-c creativity might sometimes be described this way (cf. Nicholls, 1972), Big-C creativity cannot possibly have this distribution (e.g., Martindale, 1995). For instance, lifetime creative output is optimally described by the inverse power function known as Lotka's Law

(Egghe, 2005; Lotka, 1926). The modal output is a single creative product, after which the frequencies progressively decline with higher levels of productivity. One striking consequence of this distribution is that a very small percentage of the creators in any domain—the productive elite—are responsible for a disproportionate amount of the total achievements defining the domain. In rough terms, the top 10% will account for about half of all creative work—"rough" because the specific magnitude of the elitism depends on the domain of creativity.

This characteristic distribution then raises the question: Why not normal? Although inverse power distributions can be obtained by different means, one possibility is especially intriguing from the standpoint of this chapter. If an outcome variable is a multiplicative product (rather than the additive summation) of two or more variables, then the resulting variable will *not* be normally distributed but instead will be highly skewed. This happens even when all the component variables are normally distributed, but the output distribution becomes even more extreme if some of those component variables are themselves highly skewed. Especially critical is the fact that many contributing factors will exert "veto power" over the product in the sense that if that factor is close to zero, then the product must also be near zero. For example, if a person has no domain-specific expertise whatsoever in a given area, the likelihood of any creative contribution becomes nil no matter how brilliant that person might be.

The question has now become a different one: What are some of the factors that might contribute multiplicatively to creative productivity? The complete list is probably quite long as well as highly contingent on the specific domain. Hence, here would like to concentrate on just two that seem most germane to the distinction between little-c and Big-C creativity. These two are motivation and personality.

4.1 Motivation

Imagine someone who is extremely intelligent but who also seems really unmotivated to do anything. Would such a person put in the decade of extensive study and practice to master the knowledge and skills required for creative achievement in a domain? Would this unmotivated individual produce work after work, submitting each to vicissitudes of peer review, including the inevitable revisions? Would such a person keep on going if major obstacles stood in the path to success, including vicious criticism or utter neglect? The answers to these questions is an obvious and uniform "no!".

Galton (1869) mentioned the supreme importance of motivation when he noted that the true genius "will, urged by an inherent stimulus, climb the path that leads to eminence, and has strength to reach the summit – one which, if hindered or thwarted, will fret and strive until the hindrance is overcome, and it is again free to follow its labour-loving instinct" (p. 38). Later, when Cox (1926) systematically studied the personality traits of 100 geniuses, she noted "that high but not the highest intelligence, combined with the greatest degree of persistence, will achieve greater eminence than

the highest degree of intelligence with somewhat less persistence" (p. 187). More recent research would describe this directed drive as "GRIT," which is defined as the "perseverance and passion for long-term goals" (Duckworth et al., 2007, p. 1087). Persons who score low on GRIT, when they learn that the 10-year rule might stand between them and eventual success, decide to change their long-term goal—opting to party instead of practice!

Notice that this motivational trait is both domain specific and generic at the same time. On the generic side, all domains of eminent achievement, creative or otherwise, require the individual to engage in this persistent effort toward a major goal. Even champions of the National Spelling Bee have to exhibit GRIT (Duckworth et al., 2010). Yet on the domain specific side, this motivational persistence is usually confined to a particular domain or set of interrelated domains. Even polymaths tend to impose some restrictions on the scope of their endeavors. It must be remembered that Leonardo da Vinci may have contributed to a huge range of domains, from painting to science and from anatomy to engineering, yet everything that his curiosity touched was seen through an artist's eye, as revealed in his drawings. Indeed, in his *Treatise on Painting* he attacks poetry as inferior to painting, probably because the former could not conform to his spatial-visual intelligence.

4.2 Personality

Research on the "creative personality" hypothesizes that creative people differ from non creative people. This hypothesis is tested several different ways. At the little-c level, scores on standard personality tests might be correlated with scores on various creativity measures, such as divergent thinking (e.g., Carson et al., 2005). Less common is psychometric research that applies personality assessment to samples that include Big-C creators along with somewhat less distinguished colleagues (e.g., Cattell & Drevdahl, 1955). Rarer still are those investigations that apply at-a-distance personality measurement techniques to universally renowned creative geniuses (Song & Simonton, 2007). For example, the latter methods have been applied to figures as notable as René Descartes, Isaac Newton, Charles Darwin, Johann Wolfgang von Goethe, Michelangelo, and Ludwig van Beethoven (Cox, 1926; see also Cassandro & Simonton, 2010). Besides these sample contrasts, investigators will often differ in the particular personality traits or factors that are assessed. Alternative instruments alone include the Minnesota Multiphasic Personality Inventory, the Eysenck Personality Questionnaire, the Cattell 16 Personality Factors Questionnaire, and the Revised NEO Personality Inventory (Feist, 2014).

Even if the results of this vast empirical literature are too rich to review in this limited space, meta-analyses permit us to draw some general conclusions (see, especially, Feist, 1998). First, creative individuals cannot be described by a single personality profile, but instead the profile varies across domains of creative achievement. For instance, it has long been known that artistic creators tend to have identifiably

different personalities than do scientific creators (e.g., Cox, 1926; Raskin, 1936; Simonton, 2014e). Second, not only can little-c creators be distinguished from Big-C creators, but also personality contrasts are found between the Biggest-C creators and those Big-C creators who are far less acclaimed (i.e., still uppercase but smaller font size). Hence, when we speak of the creative personality, it is essential to distinguish both the domain and the magnitude of creative achievement (Simonton, 2009).

The last point can be illustrated via the frequently hypothesized relation between creativity and psychopathology. This so-called "mad-genius controversy" is centuries old and continues to the present day (Kaufman, 2014). Unfortunately, much of the research on this question is either methodologically inadequate or conceptually confused (Simonton, 2019). An example of the latter is a recent formal analysis of the "Mad-genius paradox" (Simonton, 2014d). Too many investigators conflate two propositions: (a) creative people are more mentally healthy than non creative people and (b) highly creative people are more mentally healthy than less creative people. Yet if creativity is measured by the production of creative products, then it can be shown that these two statements are orthogonal to each other (Simonton, 2014d). In particular, because of Lotka's Law discussed earlier, the first proposition can be true even though the second proposition is false! Hence, research supporting the first proposition does not logically contradict the substantial amount of research supporting the second proposition (Simonton, 2014c). Persons who produce more creative products can display more psychopathology than those who produce fewer creative products even when those who produce creative products exhibit less psychopathology than those who produce no creative products. Moreover, because the single most important predictor of eminence in a domain is total lifetime creative productivity (Albert, 1975; Simonton, 1997), psychopathology can increase with achieved eminence without contradicting the first proposition!

An empirical example of this last point is found in a recent historiometric study of 204 Big-C creators (Simonton, 2014e). Using independent quantitative assessments of both achieved eminence and (largely) subclinical psychopathology and subjecting the scientists, thinkers, writers, artists, and composers to separate trend analyses, the five curves graphed in Fig. 1 obtained. The following two points should be observed. First, the eminence-psychopathology function varies across domains. As expected, for instance, the most eminent scientists exhibit lower levels of psychopathology than do the most eminent artists. Second, although two creative domains show positive monotonic relations (viz. artists and writers), the other three domains display single-peaked nonmonotonic functions (viz. scientists, composers, and thinkers), with the peaks located at different levels of psychopathology. Where the most eminent scientists are found in the mild range, the most eminent thinkers are located in the severe range, with the most eminent composers falling between these two domains.

Despite these two conclusions, the results viewed in Fig. 1 do not contradict the proposition that highly eminent creators as a group might be more mentally healthy than the general population of noncreators (or even little-c creators). Anyone who asserts otherwise is committing a serious non sequitur. Achieved eminence, like creative productivity, is highly skewed so that the Biggest-C creators at the upper tail of the distribution represent an extremely small percentage of all Big-C creators.

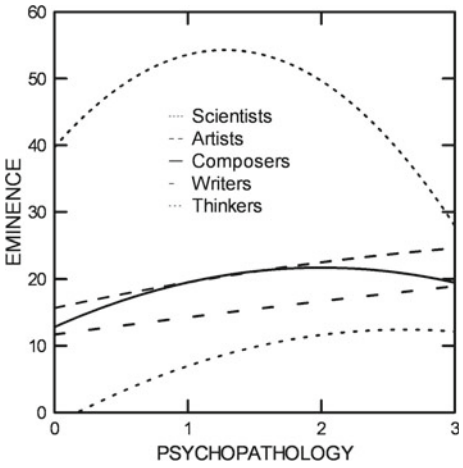

Fig. 1 From top to down, the psychopathology-eminence functions are presented for 42 scientists, 40 artists, 50 composers, 49 writers, and 23 thinkers. Psychopathology is measured on a 0–3 scale (none to severe; Post, 1994) whereas eminence is assessed on a 1–100 scale (Murray, 2003). Adapted from "More Method in the Mad-Genius Controversy: A Historiometric Study of 204 Historic Creators," by D. K. Simonton, 2014, *Psychology of Aesthetics, Creativity, and the Arts, 8*, p. 58. Copyright 2014 by American Psychological Association

5 Conclusion

This chapter has been specifically devoted to understanding the differences between everyday creativity and highly eminent creative achievement in professional domains. We started by defining creativity, which definition led to the distinction between personal and consensual creativity. Consensual creativity was then shown to prove far complex in operation than personal creativity because the consensual assessment may operate at different levels and time frames—from immediate interpersonal reactions to posthumous evaluations by posterity. The distinction between personal and consensual creativity is not equivalent to the distinction between little-c and Big-C creativity because the latter requires a more demanding consensus, a consensus initially based on professional peers and gatekeepers. Furthermore, just as little-c creators can vary in their amount of creativity, so can Big-C creators, and even more so. The biggest Big-C creators are those who largely define world civilizations (Murray, 2003).

Once these definitional issues were presented, we then examined (a) cognitive processes and procedures (both domain specific and domain generic), developmental antecedents (especially expertise acquisition and diversifying experiences), and individual differences (in productivity, motivation, and personality). This review of the empirical and theoretical literature indicated the severe complexities involved in attaining eminence as a creator in professional domains. Unlike general intelligence, which can be conceived as a continuous scale from the lowest to the highest levels of

"Spearman's *g*" (e.g., from four standard deviations below the mean to four standard deviations above the mean), the transition from zero creativity to little-c creativity and then to various grades of Big-C creativity is riddled with incongruities. A case in point is the mad-genius paradox where highly creative persons can exhibit more psychopathology than less creative persons even when creative persons as a group may display less psychopathology than noncreative persons. An even more decisive discontinuity involves domain-specific expertise, which clearly separates the "men and women" from "the girls and the boys" when it comes to ascending the personal creativity of amateurs to the consensual creativity of world-class creative geniuses.

The implications of these findings for future research are obvious. Investigators cannot naively assume that psychometric studies of little-c creativity automatically generalize to Big-C creativity, nor are historiometric studies of Big-C creativity instantly applicable to little-c creativity. Instead, more effort is needed to demarcate the discontinuities that occur along the way from the littlest creativity, little creativity, medium creativity, big creativity, and the biggest creativity.

References

Albert, R. S. (1975). Toward a behavioral definition of genius. *American Psychologist, 30*, 140–151.

Amabile, T. M. (1996). *Creativity in context: Update to the social psychology of creativity*. Westview.

Boden, M. A. (2004). *The creative mind: Myths & mechanisms* (2nd ed.). Routledge.

Campbell, D. T. (1960). Blind variation and selective retention in creative thought as in other knowledge processes. *Psychological Review, 67*, 380–400.

Carson, S., Peterson, J. B., & Higgins, D. M. (2005). Reliability, validity, and factor structure of the creative achievement questionnaire. *Creativity Research Journal, 17*, 37–50.

Cassandro, V. J., & Simonton, D. K. (2010). Versatility, openness to experience, and topical diversity in creative products: An exploratory historiometric analysis of scientists, philosophers, and writers. *Journal of Creative Behavior, 44*, 1–18.

Cattell, R. B., & Drevdahl, J. E. (1955). A comparison of the personality profile (16 P. F.) of eminent researchers with that of eminent teachers and administrators, and of the general population. *British Journal of Psychology, 46*, 248–261.

Cox, C. (1926). *The early mental traits of three hundred geniuses*. Stanford University Press.

Csikszentmihalyi, M. (2014). The systems model of creativity and its applications. In D. K. Simonton (Ed.), *The Wiley handbook of genius* (pp. 533–545). Wiley.

Cziko, G. A. (1995). *Without miracles: Universal selection theory and the second Darwinian revolution*. MIT Press.

Damian, R. I., & Simonton, D. K. (2014a). Diversifying experiences in the development of genius and their impact on creative cognition. In D. K. Simonton (Ed.), *The Wiley handbook of genius* (pp. 375–393). Wiley.

Damian, R. I., & Simonton, D. K. (2014b, August 4). Psychopathology, adversity, and creativity: Diversifying experiences in the development of eminent African-Americans. *Journal of Personality and Social Psychology*. Advance online publication. https://doi.org/10.1037/pspi0000011

Darwin, C. (1952). The origin of species by means of natural selection. In R. M. Hutchins (Ed.), *Great books of the western world* (Vol. 49, pp. 1–251). Encyclopaedia Britannica. (Original second edition published 1860).

Dennett, D. C. (1995). *Darwin's dangerous idea: Evolution and the meanings of life*. Simon & Schuster.

Duckworth, A. L., Kirby, T., Tsukayama, E., Berstein, H., & Ericsson, K. A. (2010). Deliberate practice spells success: Why grittier competitors triumph at the National Spelling Bee. *Social Psychological and Personality Science, 2*, 174–181.

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). *GRIT: Perseverence and passion for long-term goals.*

Egghe, L. (2005). *Power laws in the information production process: Lotkaian informetrics.* Elsevier.

Epstein, R. (1990). Generativity theory and creativity. In M. Runco & R. Albert (Eds.), *Theories of creativity* (pp. 116–140). Sage.

Ericsson, K. A. (1996). The acquisition of expert performance: An introduction to some of the issues. In K. A. Ericsson (Ed.), *The road to expert performance: Empirical evidence from the arts and sciences, sports, and games* (pp. 1–50). Erlbaum.

Ericsson, K. A. (2014). Creative genius: A view from the expert-performance approach. In D. K. Simonton (Ed.), *The Wiley handbook of genius* (pp. 321–349). Wiley.

Feist, G. J. (1998). A meta-analysis of personality in scientific and artistic creativity. *Personality and Social Psychology Review, 2*, 290–309.

Feist, G. J. (2014). Psychometric studies of scientific talent and eminence. In D. K. Simonton (Ed.), *The Wiley handbook of genius* (pp. 62–86). Wiley.

Galton, F. (1869). *Hereditary genius: An inquiry into its laws and consequences.* Macmillan.

Ginsburgh, V., & Weyers, S. (2014). Evaluating excellence in the arts. In D. K. Simonton (Ed.), *The Wiley handbook of genius* (pp. 511–532). Wiley.

Herrnstein, R. J., & Murray, C. (1994). *The bell curve: Intelligence and class structure in American life.* Free Press.

Kaufman, J. C. (Ed.). (2014). *Creativity and mental illness.* Cambridge University Press.

Kaufman, J. C., & Beghetto, R. A. (2009). Beyond big and little: The four C model of creativity. *Review of General Psychology, 13*, 1–13.

Klahr, D. (2000). *Exploring science: The cognition and development of discovery processes.* MIT Press.

Lamb, D., & Easton, S. M. (1984). *Multiple discovery.* Avebury.

Lang, G. E., & Lang, K. (1988). Recognition and renown: The survival of artistic reputation. *American Journal of Sociology, 94*, 79–109.

Lotka, A. J. (1926). The frequency distribution of scientific productivity. *Journal of the Washington Academy of Sciences, 16*, 317–323.

Martindale, C. (1995). Fame more fickle than fortune: On the distribution of literary eminence. *Poetics, 23*, 219–234.

Murray, C. (2003). *Human accomplishment: The pursuit of excellence in the arts and sciences, 800 B.C. to 1950.* HarperCollins.

Ness, R. B. (2013). *Genius unmasked*. Oxford University Press.

Nicholls, J. G. (1972). Creativity in the person who will never produce anything original and useful: The concept of creativity as a normally distributed trait. *American Psychologist, 27*, 717–727.

Planck, M. (1949). *Scientific autobiography and other papers* (F. Gaynor, Trans.). Philosophical Library.

Plucker, J. A., Beghetto, R. A., & Dow, G. T. (2004). Why isn't creativity more important to educational psychologists? Potentials, pitfalls, and future directions in creativity research. *Educational Psychologist, 39*, 83–96.

Post, F. (1994). Creativity and psychopathology: A study of 291 world-famous men. *British Journal of Psychiatry, 165*, 22–34.

Raskin, E. A. (1936). Comparison of scientific and literary ability: A biographical study of eminent scientists and men of letters of the nineteenth century. *Journal of Abnormal and Social Psychology, 31*, 20–35.

Richards, R., Kinney, D. K., Lunde, I., Benet, M., & Merzel, A. P. C. (1988). Assessing everyday creativity: Characteristics of the lifetime creativity scales and validation with three large samples. *Journal of Personality and Social Psychology, 54*, 476–485.

Ritter, S. M., Damian, R. I., Simonton, D. K., van Baaren, R. B., Strick, M., Derks, J. & Dijksterhuis, A. (2012). Diversifying experiences enhance cognitive flexibility. *Journal of Experimental Social Psychology*, *48*, 961–964.

Rosenbaum, D. A. (2014). *It's a jungle in there: How competition & cooperation in the brain shape the mind*. Oxford University Press.

Rothenberg, A. (2015). *Flight from wonder: An investigation of scientific creativity*. Oxford University Press.

Runco, M., & Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal, 21*, 92–96.

Runco, M. A., Kaufman, J. C., Halladay, L. R., & Cole, J. C. (2010). Changes in reputation and an index of genius, eminence, and creative talent. *Historical Methods, 43*, 91–96.

Silvia, P. J., Wigert, B., Reiter-Palmon, R., & Kaufman, J. C. (2011, May 30). Assessing creativity with self-report scales: A review and empirical evaluation. *Psychology of Aesthetics, Creativity, and the Arts.* Advance online publication. https://doi.org/10.1037/a0024071

Simonton, D. K. (1991). Latent-variable models of posthumous reputation: A quest for Galton's G. *Journal of Personality and Social Psychology, 60*, 607–619.

Simonton, D. K. (1997). Creative productivity: A predictive and explanatory model of career trajectories and landmarks. *Psychological Review, 104*, 66–89.

Simonton, D. K. (1999). *Origins of genius: Darwinian perspectives on creativity*. Oxford University Press.

Simonton, D. K. (2000). Creative development as acquired expertise: Theoretical issues and an empirical test. *Developmental Review, 20*, 283–318.

Simonton, D. K. (2004). Psychology's status as a scientific discipline: Its empirical placement within an implicit hierarchy of the sciences. *Review of General Psychology, 8*, 59–67.

Simonton, D. K. (2008a). Distribution, normal. In W. A. Darity, Jr. (Ed.), *International encyclopedia of the social sciences* (2nd ed., Vol. 2, pp. 415–417). Macmillan.

Simonton, D. K. (2008b). Scientific talent, training, and performance: Intellect, personality, and genetic endowment. *Review of General Psychology, 12*, 28–46.

Simonton, D. K. (2009). Varieties of (scientific) creativity: A hierarchical model of disposition, development, and achievement. *Perspectives on Psychological Science, 4*, 441–452.

Simonton, D. K. (2011a). Creativity and discovery as *blind* variation: Campbell's (1960) BVSR model after the half-century mark. *Review of General Psychology, 15*, 158–174.

Simonton, D. K. (2011b). *Great flicks: Scientific studies of cinematic creativity and aesthetics*. Oxford University Press.

Simonton, D. K. (2012a). Genius. In K. J. Holyoak & R. G. Morrison (Eds.), *Oxford handbook of thinking and reasoning* (pp. 492–509). Oxford University Press.

Simonton, D. K. (2012b). Taking the US patent office creativity criteria seriously: A quantitative three-criterion definition and its implications. *Creativity Research Journal*, *24*, 97–106.

Simonton, D. K. (2013a). Creative thought as blind variation and selective retention: Why sightedness is inversely related to creativity. *Journal of Theoretical and Philosophical Psychology, 33*, 253–266.

Simonton, D. K. (2013b). What is a creative idea? Little-c versus Big-C creativity. In J. Chan & K. Thomas (Eds.), *Handbook of research on creativity* (pp. 69–83). Edward Elgar.

Simonton, D. K. (2014a). Creative performance, expertise acquisition, individual-differences, and developmental antecedents: An integrative research agenda. *Intelligence, 45*, 66–73.

Simonton, D. K. (2014b). Hierarchies of creative domains: Disciplinary constraints on blind-variation and selective-retention. In E. S. Paul & S. B. Kaufman (Eds.), *The philosophy of creativity: New essays* (pp. 247–261). Oxford University Press.

Simonton, D. K. (2014c). The mad (creative) genius: What do we know after a century of historiometric research? In J. C. Kaufman (Ed.), *Creativity and mental illness* (pp. 25–41). Cambridge University Press.

Simonton, D. K. (2014d). The mad-genius paradox: Can creative people be more mentally healthy but highly creative people more mentally ill? *Perspectives on Psychological Science, 9*, 470–480.

Simonton, D. K. (2014e). More method in the mad-genius controversy: A historiometric study of 204 historic creators. *Psychology of Aesthetics, Creativity, and the Arts, 8*, 53–61.
Simonton, D. K. (2015). Thomas Alva Edison's creative career: The multilayered trajectory of trials, errors, failures, and triumphs. *Psychology of Aesthetics, Creativity, and the Arts, 9*, 2–14.
Simonton, D. K. (2019). Creativity and psychopathology: The tenacious mad-genius controversy updated. *Current Opinion in Behavioral Sciences, 27*, 17–21.
Simonton, D. K., & Damian, R. I. (2013). Creativity. In D. Reisberg (Ed.), *Oxford handbook of cognitive psychology* (pp. 795–807). Oxford University Press.
Song, A. V., & Simonton, D. K. (2007). Personality assessment at a distance: Quantitative methods. In R. W. Robins, R. C. Fraley, & R. F. Krueger (Eds.), *Handbook of research methods in personality psychology* (pp. 308–321). Guilford Press.
Wertheimer, M. (1982). *Productive thinking* (M. Wertheimer, Ed.). University of Chicago Press. (Original work published 1945).
Whipple, E. M. (2004). Eminence revisited. *History of Psychology, 7*, 265–296.

Cognitive and Conative Profiles of Creative People

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Keywords Multivariate approach · Individual differences · Cognition · Conation · Affect · Personality · Motivation

Based on the multivariate approach to creativity (Lubart, 1999; Sternberg & Lubart, 1993), a set of cognitive, conative and emotional characteristics can be identified as the psychological basis of creative potential. These characteristics combine in interactive ways to yield varying degrees of creative potential depending on creative tasks requirements. The large number of existing behavioral science studies, including neuropsychological research, permits a rich synthesis of the results leading to a set of key intellectual, personality, motivational and emotional facets that creative people show. The relative importance of these characteristics varies according to the nature of the creative work, and domain of endeavor.

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1 Cognitive Abilities and Creativity

Although the importance of the cognitive component in the profile of creative individuals has often been studied as a set of specific abilities involved in the creative process (e.g., Botella et al., 2013; Carlson & Gorman, 1992; Finke et al., 1996; Hayes, 1989; Myszkowski et al., 2014; Ward, 2007), one of the main debates regarding such a component is related to the relationship between general mental ability and creativity. But, beyond general mental ability, are there specific cognitive resources that promote creativity? Also, we may wonder if creativity is manifested in *how* one's cognitive abilities are used, rather than in their availability. In other words, creative individuals may tap into their cognitive resources differently.

2 Communalities Between General Mental Ability and Creative Potential

The relationships between creativity and general mental ability—or *g*—have been largely discussed from both theoretical and empirical points of view (Zenasni et al., 2016a, 2016b). Since creativity involves cognitive processes and information processing, it is clear that it depends on the cognitive abilities that significantly contribute to the production of ideas. Therefore, the two constructs, although relentlessly challenged in their respective definitions and measures, certainly overlap, because they both involve a problem-solving component (Corazza & Lubart, 2021; Sternberg, 2001). Indeed, when individuals take either a general mental ability test or a creativity measure—whether composed of divergent thinking tasks, like the Torrance Tests of Creative Thinking (Torrance, 1966, 2008), or composed of more integrative tasks (Lubart et al., 2011) involving creativity judgments of experts or trained novices (Storme et al., 2014) through the Consensual Assessment Technique (Amabile, 1983)—they face a set of problems for which they need to find solutions.

To solve such problems and address their environment, individuals have to engage in diverse mental activities that involve a range of cognitive abilities. Some mental activities are involved in both *g* measures and creativity measures, leading to an overlap. More specifically, on one hand, both *g* and creativity measures often involve idea production, where individuals have to solve a problem through the generation of many ideas—fluency—of different categories—flexibility—and that are rare or unusual—originality (Kaufman, 2015); on the other hand, creativity tasks require individuals to generate ideas that are not only novel and styled, but also useful (Besemer, 1998; Besemer & O'Quin, 1999; Besemer & Treffinger, 1981). This implies that, like in general mental ability tests, creative individuals have to address task constraints, which is also a common denominator of most definitions of general mental ability (Sternberg, 2001): Intelligent individuals and creative individuals are generally both defined as being capable of adapting to, and proposing appropriate solutions to various constraints.

The empirical consequences of this conceptual overlap are found in the wealth of research showing correlations between various creativity measures and general mental ability measures (e.g., Batey & Furnham, 2006; Jauk et al., 2013; Miroshnik & Shcherbakova, 2019; Myszkowski et al., 2015; Nusbaum & Silvia, 2011). It has notably been suggested that updating—the ability to refresh information in working memory—is the executive function that is the most common to *g* and creativity (Benedek et al., 2014), and thus explains these relations. However, the magnitude of the relations between *g* and creativity is typically small or moderate, suggesting that creativity has its own specificities and cannot be reduced to a manifestation of *g*.

2.1 The Specificity of Creative Cognition

Do creative individuals use their cognitive ability in the same way as others? In other words, do they create and find ideas because they have a different use of their abilities compared to other people? To answer this question, let us first note that researchers generally distinguish conceptually creativity from *g*. Notably, Wallach and Kogan's seminal work (1965) shows that children may present a high level of intelligence but a low level of creativity whereas some may present a high level of creativity and a low level of intelligence—in other words, creativity and intelligence are distinct constructs.

One of the explanations for the limited strength of the relation between general mental ability measures and creativity measures could be that intelligence measures hardly leave enough space for creativity-related cognitive activities (especially divergent thinking). This can be considered as a limitation of general mental ability measures, because it questions the extent to which they are fully able to predict achievement (Gajda et al., 2017; Kaufman, 2015), to which they really tap into an individual's potential (Kaufman et al., 2012), and to which they avoid biases (Kaufman, 2006, 2010; Kaufman et al., 2012). In addition, work focusing on the executive functions involved in creativity and *g* measures (Benedek et al., 2014) indicates that some executive functions are involved in creativity but not (or less) in *g*, notably inhibition—the ability to suppress dominant but incorrect responses. Another explanation can be found in the threshold theory (Guilford, 1967), according to which the correlation between general mental ability and creativity only exists below a critical intelligence level—corresponding to an IQ of approximately 120. Above this threshold, the correlation weakens or becomes null (Barron, 1961; Jauk et al., 2013; Jung et al., 2009; Karwowski et al, 2016; Leon, 1971; Preckel et al., 2006; Runco & Albert, 1986).

Another explanation for the modest relations between general mental ability tests and creativity measures is the potential attenuation of correlation effects due to the imperfect reliability of the instruments used to observe the relationships between the two constructs (Hunter & Schmidt, 2004), which is supported by the variability of observed correlations across studies that use different creativity measures. Additionally, the relation between the two constructs may be domain-specific: it may be more modest in some domains—for example those that are more applied or rely more

either on specific abilities, like domain expertise, or on the conative component, like artistic (Botella et al., 2013) or managerial (Myszkowski et al., 2015) creativity—and larger in other domains—for example domains, like engineering or science, where most contributions are more forward-incrementing (Sternberg, 2001) or integrating (Sternberg et al., 2002).

Finally, another explanation could be the fact that, although the constructs may be overlapping, the measures have, in general, been designed for different objectives. Typically, general mental ability measures are built for clinical settings, as diagnostic instruments, tools to predict school success, productivity and overall achievement; creativity measures, in contrast—in spite of their associations with psychopathology (Batey & Furnham, 2008)—are often considered as tests of "potential", with the perspective of stimulating (rather than predicting) human capacities, to drive innovation and to encourage individual self-actualization.

These various explanations show that, while relatively modest correlations are observed between measures of general mental ability and creativity, they may hide a bigger overlap between the cognitive abilities involved in *g* and creativity: Individuals who are capable of complex reasoning and abstract conceptualizations have an advantage when having to generate and apply useful solutions. But only to a certain extent: Creative products are useful, but are also novel. Therefore, general mental ability is only a prerequisite for creativity (Sternberg, 2001), and there are other elements to the cognitive component of creative potential and achievement (Zenasni et al., 2016a, 2016b) than *g*.

2.2 Other Abilities

One of the main challenges in establishing the "creative profile" of an individual—as well as in studying creativity in general—is the partial domain specificity of creativity (Baer, 1998). In other words, whereas research may support that a specific ability or trait is related to higher creativity, such a conclusion may only be valid in the creativity field of the study, and may not be generalizable to other fields. However, there is some communality between domains.

Expertise in a specific domain is not only a useful characteristic to judge creative products (Amabile, 1983; Storme et al., 2014): It is also an essential characteristic of creative individuals in many domains (Sternberg, 1998). This is because the creative process is facilitated by the presence of a referential (Botella et al., 2013), a structured network of preexisting ideas to combine or extend, as suggested by the structured imagination theory (Marsh et al., 1999; Smith & Ward, 1995; Ward, 1994; Wilkenfeld & Ward, 2001). Through such a structure, individuals build a system of rules, a network of possible wanderings (Newell and Simon, 1972)—for example, an even number of limbs and symmetry when creating animals in a drawing (Ward, 1994; Ward & Sifonis, 1997)—that they use to produce new ideas. However, it is useful to distinguish the different forms of creative production: When creating by forward incrementation or integration, or reinvention (Sternberg, 2001; Sternberg

et al., 2002), an expert with a great number of potential "wanderings" may find more useful and novel solutions than a novice, who would find already existing ideas without even realizing that they are not novel, or without assessing their usefulness correctly—put in another way, solutions that, although creative compared with the individual's own referential, are not creative at higher levels, using the larger social world (i.e., the population of all existing solutions) as a referential; in contrast, when creating by redefining and reinventing something, novice individuals may be less inclined to fall into the "trap" of non-original of existing paths. Thus, creativity may be observed in novices—mini- or little-c creativity (Kaufman & Beghetto, 2009)—as an individual's creative products can be compared to the individual's own referential, as much as it can be observed in experts or geniuses, for whom creative products are compared with the world as a reference point.

Apart from accumulated expertise in a specific domain, creativity relies also on perceptual and judgment abilities related to the field. Indeed, it is often suggested that a step in the creative process is that of judging ideas, in order to sort them, to discard the bad ones and keep—or combine—the good ones (Botella et al., 2013; Cropley, 2006). But the ability to judge products, which is part of the creative process, is not only related to accumulated knowledge one has. In other words, creativity judgment expertise is not only a function of how much exposure to or knowledge one has accumulated on a topic. For example, studies on the judgment of visual art tend to indicate that judgment could be a predictor of creativity (Myszkowski & Zenasni, 2016; Myszkowski et al., 2014). In any case, acumen when judging creative products and ideas is certainly a central aspect of creation. An example of this can be found in the way musicians and musical producers or movie directors ensure they have accurate monitoring equipment in order to perceive and predict the impact of the piece that is produced, or how painters or sculptors need to step away from their paintings to observe them from different points of view, or from a typical spectator's point of view. The ability to represent accurately structures in creative products (for example, rhythm and pitch in music, organizational balance and symmetry in visual arts) can help advance towards a more creative production. Nevertheless, it should be noted that research also suggests that general mental ability plays a role in judgment ability (Myszkowski et al., 2018). In other words, effects of judgment ability may be, in some part, one of the mechanisms of the relation between general mental ability and creativity, and therefore, the incremental predictive power of judgment ability over creativity, over and beyond general mental ability, remains open for discussion.

In sum, the typical cognitive profile of a creative individual is complicated to draw. It would certainly include many abilities that we would theoretically consider to be manifestations of general mental ability. If, however, general mental ability is defined by the content of the tests used to measure it, then there are certainly several abilities that are involved in the creative process but that are not present in general mental ability tests (Kaufman, 2015). Beyond mental abilities, for individuals to be thrown in at the deep end of creativity, they often need to acquire expertise in the domain. Doing such, they develop their ability to wander and handle ideas that are not just novel, useful and styled compared with their own previous productions, but that are also novel, useful and styled when compared with others' productions. Finally, aside

from intellectual performance and expertise, we advocate that other abilities than domain-specific knowledge and general mental ability may play domain-specific roles.

3 Personality Traits and Creativity

Numerous theoretical and empirical studies show that some personality traits support creativity. Most of the research related to this field is based on exploratory psychometric studies which often examine how main personality traits described in classical models of personality, such as the Big Five, as related to creativity (Feist, 1998). However, an important number of recent studies also show that some very specific personality dimensions, not fully apparent in standard personality models, have an explicit role in creativity and creations. This is mostly the case of emotion-related personality traits which tend to be usually covered, in a much reduced way, by the generic concept of neuroticism. Beyond these numerous empirical studies, we may note that only few theoretical models describe how personality traits or personality structure predict creativity. We will first present these models.

3.1 Personality and Creativity: Theoretical Expectations

Relationships between personality traits and creativity have been examined at the conceptual level over the past century. For example, Eysenck (1993) developed a theory unifying personality and creativity. According to his model, psychoticism is the principal personality trait favoring original thinking and creativity. He proposed first that creative achievement may depend on personality traits—such as internal motivation, confidence, nonconformity, and originality. Originality and nonconformity may be related to psychoticism, which is defined in Eysenck's model of personality as a dispositional trait, concerning one's reality orientation, underlying susceptibility to the development of psychotic symptoms. Psychotism favors creativity because it favors the ability to be original: Individuals with high levels of psychotism show less constrained top-down processes and thus reduced cognitive inhibition (Abraham et al., 2005). This theory is in part based on previous empirical findings, from Richards (1981) notably, who found elevated levels of psychopathology among eminent creators compared to the general population. Many following studies confirmed, in part, this model (e.g., Batey & Furnham, 2006; Feist, 2018).

In a less clinical perspective, Sternberg and Lubart (1995) proposed that six specific factors of personality should be theoretically involved in creativity: Tolerance of ambiguity, willingness to surmount obstacles, willingness to grow, intrinsic motivation, moderate risk taking, and desire for recognition.

Tolerance of ambiguity was first considered by Vernon (1970) as an individual characteristic fundamental for creative individuals. It can be a resource to move forward when individuals face an ambiguous situation, particularly when it can induce anxiety. Some studies tend to validate the positive impact of ambiguity tolerance on creativity. However these relationships appear to be sensitive to contextual conditions. For example, Zenasni et al. (2008) observed a positive relation between these dimensions, but only when the creative task is based on ambiguous stimuli. Similarly, Wang et al. (2011) observed that high tolerance of ambiguity is associated with employee creativity only when there is at least moderate role ambiguity. Willingness to surmount obstacles may also be related to perseverance. This trait should be related to creative achievement: facing rejection by colleagues or the public concerning a creative idea, a creative individual should persevere until they succeed in their project. This is also related to willingness to grow and intrinsic motivation which both are resources and impulses that give creators the energy and desire to pursue and achieve closure in a creative process. Risk taking is a resource of creativity because it leads creators to invest in ideas and processes that they are not necessarily supported by others. Finally, narcissism and the desire for recognition is also a potential characteristic for creative achievements because it motivates any potential creator to produce the most original production. This may be related to overconfidence and arrogance sometimes observed in empirical studies (as described in a later section of this chapter).

In the Emotional Resonance Model of creativity (ERM, Lubart & Getz, 1997), affective intensity and emotional idiosyncrasy appear as significant emotion-related personality traits for creativity. This model predicts that creativity may be the result of idiosyncratic emotional experiences; individualized emotions are attached to concepts or images in memory and describe how these emotional endocepts interact with each other and can provide the basis for creative associations. In other words, Lubart and Getz consider that when a concept or image is activated (through external stimuli or internal thought), its emotional profile—the attached endocept—is also activated. This endoceptual activation then propagates the emotional profile as a global "wave" throughout the memory system. In this perspective, affective intensity and emotional idiosyncrasy are potential boosters in this model. Affect intensity is defined as a tendency to experience emotional reactions that are strong or extreme in a given emotional situation (Larsen & Diener, 1987). Emotional idiosyncrasy is defined as the tendency of individuals to experience personalized emotions differently from those that others tend to experience in a given situation (Averill, 1999). According to the ERM model, these affective traits should favor creativity because individuals with a significant personal experience upon which they have dwelt and for which they acquired complex, intense, and idiosyncratic emotions, and who furthermore are highly attentive to their emotional processes will be the most effective in generating emotion-based associations for creativity. Botella et al. (2011) complete this model suggesting that alexithymia, defined as the difficulty to identify and verbalize emotions, may prevent individuals from being creative because people who show alexithymia will have relatively poor, undeveloped endocepts, leading to weak resonance.

In an integrative model, Fürst et al. (2016) proposed that three high-order personality factors predict two main process factors, which in turn predict intensity and achievement of creative activities. The personality factors are: Plasticity (high openness, extraversion, energy, and inspiration), Divergence (low agreeableness and conscientiousness, high non-conformity and impulsivity), and Convergence (high ambition, precision, persistence, and critical sense).

3.2 Personality of Creators: Evidence-Based Research

As pointed out by Batey and Furnham (2006), the study of the relationships between creativity and personality is mostly based on the study of modern theories of personality such as the Big Five or Eysenck's three-factor model of personality. These studies are in line with preceding exploratory studies which tend to identify creative individuals who present specific personality traits. Thus, in their early research on this topic Cattell and Drevdahl (Cattell & Drevdahl, 1955; Drevdahl & Cattell, 1958) examined the personality traits of creators in several domains such as art, literature, physical science, biology, human sciences etc. They observed that artists and writers, compared to individuals from the general population present higher ego-strength, are self-sufficient, more dominant, adventurous, unconventional, and radical (Drevdahl & Cattell, 1958). Scientists seem to present the same characteristics. These results are in line with works from the Institute of Personality Assessment and Research (IPAR). MacKinnon (1962) showed that renowned architects tend to be more independent, individualist, self-confident, unconventional and spontaneous. Gough (1979) in order to develop a scale of creative personality explored the personality traits of certified and/or mathematicians, scientists, and architects using the Adjective Check List. Among all the 300 adjectives tested, eighteen refer positively to creative personality (capable, clever, confident, egotistical, humorous, individualistic, informal, insightful, intelligent, interests wide, inventive, original, reflective, resourceful, self-confident, sexy, snobbish, and unconventional). If we consider all these initial studies, the personality of creators may be summarized by a combination of a strong ego and unconventional attitudes. At this point we may propose that strong self-confidence helps creators to express their non-conformist tendencies and ideas. As instructive as these original studies seem, we may limit their conclusions because they focused on distinguished creators, having succeeded in their activities. It is difficult to say whether these personality traits are factors of creativity or factors of success and notoriety in creative occupations.

Recent studies based on the Big Five model of personality extend this perspective showing significant relationships between specific personality traits and creativity evaluated by different methods capturing both normal and exceptional creativity. The Big Five model proposes that specific personality traits can be derived from five main factors which are Openness, Consciousness, Extraversion-Introversion, Agreeability and Neuroticism. Among these traits, Openness is the one which appears systematically, positively and significantly related to divergent thinking (McCrae,

Table 1 Characteristics associated with creativity

	Cognitive	Motivational	Social	Affective
Artist's traits	Imaginative	Impulsive	Aloof Cold Independent Non-conformist norm-doubting	Anxious Emotionally Sensitive
Scientist's traits	Flexible		Arrogant Autonomous Dominant Self-confident	
Common traits	wide interests	Ambitious Driven	Hostile Introverted Openness	

1987). For McCrae, openness interacts with the divergent thinking process to make possible creative production. The robust relationship observed between openness and creativity was confirmed in many distinct studies (e.g., Jauk et al., 2014; Silvia et al., 2009). Openness may in fact have two implications for creativity. First, it leads individuals to be exposed to many distinct objects and situations that are fruitful for creating and associating. Moreover, openness reflects a motivational component because open individuals desire new experiences and new knowledge.

The importance of openness is confirmed by Feist's (1998) meta-analysis. Feist identified the main personality traits related to scientific and artistic creativity, and concluded that a creative person tends to be more open to new experiences, more self-confident, more dominant, less conventional and less conscientious than other people. However, Feist pointed out differences in personality traits between artists and scientists, both considered as creative job groups. He summarized these differences considering the nature of personality traits which can be cognitive, motivational, social or affective. Table 1 presents the personality traits specific to artists and scientists.

From this meta-analysis, we may observe some common personality traits between artists and scientists. Several social-related personality traits seem to characterize both artists and scientists, but emotional traits seem to be specific to artists. Artists seem to be distant from others and norms whereas scientists show themselves as dominant and do not show a specific profile on emotionality. As noted by Feist himself, this meta-analysis must not be considered exhaustive because it refers mostly to artists and scientists and not all the potential domains of creation. It is also dependent on previous studies which focus on specific models of personality testing specific dimensions with specific methodologies. Ma (2009) pursued in part Feist's analysis, by conducting a meta-analysis with a systematic selection of variables relative to the creative person, the creative process, the creative product and the creative environment. Analyzing 2,013 effect sizes from 111 studies, Ma showed that openness to new experiences, mysticism (i.e. a tendency to interpret an unusual

experience as a general or religious mystery) and affective sensibility are personality variables related to creativity.

Moreover, we note that recent research has been conducted considering the HEXACO personality model (Ashton & Lee, 2007). Silvia et al. (2011) examined to which degree the HEXACO factors (i.e., Honesty-Humility, Emotionality, Extraversion, Agreeableness, Consciousness, Openness to experience) are related to creative achievement and activities. They observed that the higher is the level of Honesty and Humility, the lower levels of creative activities and creative achievement tend to be. As discussed by the authors, this is in line with Feist's work indicating that arrogance and hostility are positive factors of creativity. Research (Furnham et al., 2013) has also indicated relations between narcissism and self-reported creativity, in line with high self-esteem and pretentious vocabularies observed in Gough's research. The main interpretation is that arrogant, pretentious individuals may have sufficient self-esteem allowing them to achieve their potential and to take risks in spite of the constraints (Silvia et al., 2011).

4 Self and Creativity

As highlighted, creativity often involves a combination of a strong ego and unconventional attitudes. It is indeed understandable that creative work requires breaking with existing codes and standards and therefore may take a great deal of risk taking, courage and self-confidence. In recent years, there is a growing interest in ego- and self- related dimensions important for creativity. These dimensions have been categorized under the term "creative self-beliefs" (e.g., Karwowski & Barbot, 2016), which refer to people's convictions about their own creative potential, creative achievement, and creative identity, as well as their perception of what creativity is.

Historically, this literature is rooted in Maslow's (1958) and Rogers' (1954) work, who qualified creativity as a natural fulfillment of the self and a mechanism for achieving one's potential. Recent perspectives conceptualize creativity and the self quite differently, often suggesting a reciprocal dynamic between interests, domain-specific self-concepts, and creative achievement. For example, "investment" theories of self-concept suggest that self-concepts determine interests leading to activity, effort, and perseverance and in turn, to achievement (e.g., Ackerman & Heggestad, 1997). Conversely, the *expectancy-value theory* (Wigfield & Eccles, 2000) suggests reciprocal relations between domain-specific achievement, self-concept, and personal interests. Regardless of the issue of directionality, it is established that self-concept (particularly creative self concept), represents an aspect of creative potential that facilitates or inhibits the achievement of one's potential (e.g., Jaussi et al., 2007; Karwowski & Barbot, 2016).

A possible mechanism for this dynamic is the following: Creative self-concepts refer to representations structured by an individual's creative personal identity (importance given to creativity in the definition of the self) which is confirmed and reinforced by creative role identity (fulfillment of the "social role" of being

a creative person). Creative identity builds upon past experiences with creative endeavors. People who consider creativity as an important part of the definition of themselves (salient creative identity) seek opportunities to be creative in order to maintain and affirm this fundamental aspect of themselves. By fulfilling their social role as someone creative (thus, increasing creative productivity), they increase the odds of successful creative achievements (Helson & Pals, 2000). In turn, successful creative achievements will shape a person's creative self-efficacy, itself predictive of the quality of creative outputs (Beghetto, 2006) and, ultimately, will reinforce creative personal identity. Hence, creative self-efficacy can be viewed as a form of domain specific self-confidence which may help individuals persevere in their creative endeavors even when external support lags behind. This dynamic is illustrated through eminent examples often characterized by a high level of self-confidence for creative work (Feist, 2014).

However, empirical studies that have more directly investigated the relationship between creativity and self-related variables (in particular self-esteem) have usually reported low to moderate associations as well as limited external validity (Hoff, 2005). In recent work, we have suggested that these inconsistent results may be due to different developmental pathways (1) (different patterns of associations between creativity and aspects of the self may arise at different developmental stages) and (2), multidimensionality of both creativity and the self, leading to relationships of different magnitude depending on whether domains are congruent or incongruent (Barbot & Lubart, 2012; Karwowski & Barbot, 2016; Zenasni et al., 2016a, 2016b).

Finally, individuals differ in terms of specific metacognitive components of creative self-belief, which may impact creative outcomes. In particular, creative mindsets refer to a combination of creative self-knowledge and contextual knowledge (e.g., knowing when to be and when not to be creative; Kaufman & Beghetto, 2013). Fixed creativity mindset (i.e., belief that creativity is mainly an inherited feature and cannot change) may be related to a lack of "Resilience" in the face of negative feedback on creative performance outcomes, which could lead to creative mortification (Beghetto, 2014). In contrast, growth mindsets (i.e., beliefs that creativity is not a fixed property and can grow and change overtime) is a prerequisite for pursuing creative endeavors regardless of external pressures, negative feedback, and poor performance outcomes that could be discouraging along the way.

5 Conclusion

In this chapter, we have provided an overview of the traits and abilities that are generally found in creative individuals, thereby specifying a creative profile. We discussed first how cognitive abilities—general and specific—are acquired and how expertise plays an important role in creativity. We discussed under which conditions these abilities are involved. We then discussed conative aspects and what personality traits are typically found in creative individuals. Finally, we discussed how creative individuals are characterized by the way they view themselves.

Although there has been a lot of work to understand individual creativity, there still is much to be done to fully grasp it. It is important to note that what we presented here is only an overview, and does not account for the full complexity of individual skills, abilities, personality traits and self-concept. This is the case for several reasons. First, the structure of cognitive abilities, personality traits and creativity itself are far from completely understood yet. Second, the measures of many of the constructs discussed here—including individual creativity—are very partial, and we hope that improvements in measurement will facilitate the study of creativity. Third, the empirical results discussed here essentially rely on statistical effects that are of varying magnitude, being often small or moderate. In other words, and as an example, it would be incorrect to assume that because a statistical relation between creativity and risk-taking is often found (as we discussed earlier), then it is impossible for someone to be creative if the individual is not a risk taker. There are many individuals who could serve as counterexamples to the statistical relations we described (e.g., creative artists with low self-esteem), and one must consider that skills and personality traits are not always stable within individuals, notably across situations (i.e., one may avoid taking risks in some situations and domains, not in others). Finally, in spite of decades of work on the topic, there are certainly plenty of other traits and abilities that could bé mentionned in this chapter, but that are still insufficiently studied, not studied at all, or that we simply did not include for the sake of brevity. Therefore, the set of traits, skills and abilities used here to describe typical creative individuals is unavoidably partial, and should be considered a work in progress.

References

Abraham, A., Windmann, S., Daum, I., & Güntürkün, O. (2005). Conceptual expansion and creative imagery as a function of psychoticism. *Consciousness and Cognition, 14*(3), 520–534. https://doi.org/10.1016/j.concog.2004.12.003

Ackerman, P. L., & Heggestad, E. D. (1997). Intelligence, personality, and interests: Evidence for overlapping traits. *Psychological Bulletin, 121*(2), 219–245. https://doi.org/10.1037//0033-2909.121.2.219

Amabile, T. M. (1983). The social psychology of creativity: A componential conceptualization. *Journal of Personality and Social Psychology, 45*(2), 357–376. https://doi.org/10.1037/0022-3514.45.2.357

Ashton, M. C., & Lee, K. (2007). Empirical, theoretical, and practical advantages of the HEXACO model of personality structure. *Personality and Social Psychology Review, 11*(2), 150–166. https://doi.org/10.1177/1088868306294907

Averill, J. R. (1999). Individual differences in emotional creativity: structure and correlates. *Journal of Personality, 67*(2), 331–371. https://doi.org/10.1111/1467-6494.00058

Baer, J. (1998). The case for domain specificity of creativity. *Creativity Research Journal, 11*(2), 173–177. https://doi.org/10.1207/s15326934crj1102_7

Barbot, B., & Lubart, T. (2012). Creative thinking in music: Its nature and assessment through musical exploratory behaviors. *Psychology of Aesthetics, Creativity, and the Arts, 6*(3), 231–242. https://doi.org/10.1037/a0027307

Barron, F. (1961). Creative vision and expression in writing and painting. In D. W. MacKinnon (Ed.), *The creative person* (pp. 237–251). Berkeley, CA: Institute of Personality Assessment Research, University of California.

Batey, M., & Furnham, A. (2006). Creativity, intelligence, and personality: A critical review of the scattered literature. *Genetic, Social, and General Psychology Monographs, 132*(4), 355–429. https://doi.org/10.3200/MONO.132.4.355-430

Batey, M., & Furnham, A. (2008). The relationship between measures of creativity and schizotypy. *Personality and Individual Differences, 45*(8), 816–821. https://doi.org/10.1016/j.paid.2008.08.014

Beghetto, R. A. (2006). Creative self-efficacy: Correlates in middle and secondary students. *Creativity Research Journal, 18*(4), 447–457. https://doi.org/10.1207/s15326934crj1804_4

Beghetto, R. A. (2014). Creative mortification: An initial exploration. *Psychology of Aesthetics, Creativity, and the Arts, 8*(3), 266–276. https://doi.org/10.1037/a0036618

Benedek, M., Jauk, E., Sommer, M., Arendasy, M., & Neubauer, A. C. (2014). Intelligence, creativity, and cognitive control: The common and differential involvement of executive functions in intelligence and creativity. *Intelligence, 46*, 73–83. https://doi.org/10.1016/j.intell.2014.05.007

Besemer, S. P. (1998). Creative product analysis matrix: Testing the model structure and a comparison among products-three novel chairs. *Creativity Research Journal, 11*(4), 333–346. https://doi.org/10.1207/s15326934crj1104_7

Besemer, S. P., & O'Quin, K. (1999). Confirming the three-factor creative product analysis matrix model in an American sample. *Creativity Research Journal, 12*(4), 287–296. https://doi.org/10.1207/s15326934crj1204_6

Besemer, S. P., & Treffinger, D. J. (1981). Analysis of creative products: Review and synthesis. *The Journal of Creative Behavior, 15*(3), 158–178. https://doi.org/10.1002/j.2162-6057.1981.tb00287.x

Botella, M., Glaveanu, V., Zenasni, F., Storme, M., Myszkowski, N., Wolff, M., & Lubart, T. (2013). How artists create: Creative process and multivariate factors. *Learning and Individual Differences, 26*, 161–170. https://doi.org/10.1016/j.lindif.2013.02.008

Botella, M., Zenasni, F., & Lubart, T. (2011). Alexithymia and affect intensity of art students. *Psychology of Aesthetics, Creativity, and the Arts, 5*(3), 251–257. https://doi.org/10.1037/a0022311

Carlson, W. B., & Gorman, M. E. (1992). A cognitive framework to understand technological creativity: Bell, Edison, and the telephone. *Inventive Minds: Creativity in Technology*, 48–79.

Cattell, R. B., & Drevdahl, J. E. (1955). A Comparison of Personality profile (16 P.f.) of eminent researchers with that of eminent teachers and administrators, and of general population. *British Journal of Psychology*, *46*(4), 248–261. https://doi.org/10.1111/j.2044-8295.1955.tb00547.

Corazza, G. E., & Lubart, T. (2021). Intelligence and creativity: Mapping constructs on the space-time continuum. *Journal of Intelligence, 9*(1), 1.

Cropley, A. (2006). In praise of convergent thinking. *Creativity Research Journal, 18*(3), 391–404. https://doi.org/10.1207/s15326934crj1803_13

Drevdahl, J. E., & Cattell, R. B. (1958). Personality and creativity in artists and writers. *Journal of Clinical Psychology, 14*(2), 107–111. https://doi.org/10.1002/1097-4679(195804)14:2%3c107::AID-JCLP2270140202%3e3.0.CO;2-T

Eysenck, H. J. (1993). Creativity and personality: Suggestions for a theory. *Psychological Inquiry, 4*(3), 147–178. https://doi.org/10.1207/s15327965pli0403_1

Feist, G. J. (1998). A meta-analysis of personality in scientific and artistic creativity. *Personality and Social Psychology Review, 2*(4), 290–309. https://doi.org/10.1207/s15327957pspr0204_5

Feist, G. J. (2014). Psychometric studies of scientific talent and eminence. In *The Wiley handbook of genius* (pp. 62–86). Wiley Blackwell. https://doi.org/10.1002/9781118367377.ch4

Feist, G. J. (2018). In search of the creative personality. In R. J. Sternberg & J. C. Kaufman (Eds.), *The nature of human creativity* (pp. 63–76). Cambridge University Press. https://doi.org/10.1017/9781108185936.007

Finke, R. A., Ward, T. B., & Smith, S. M. (1996). *Creative Cognition: Theory, Research, and Applications*. A Bradford Book.

Furnham, A., Hughes, D. J., & Marshall, E. (2013). Creativity, OCD, narcissism and the big five. *Thinking Skills and Creativity, 10*, 91–98. https://doi.org/10.1016/j.tsc.2013.05.003

Fürst, G., Ghisletta, P., & Lubart, T. (2016). Toward an integrative model of creativity and personality: Theoretical suggestions and preliminary empirical testing. *The Journal of Creative Behavior, 50*(2), 87–108. https://doi.org/10.1002/jocb.71

Gajda, A., Karwowski, M., & Beghetto, R. A. (2017). Creativity and academic achievement: A meta-analysis. *Journal of Educational Psychology, 109*(2), 269–299. https://doi.org/10.1037/edu0000133

Gough, H. G. (1979). A creative personality scale for the Adjective Check List. *Journal of Personality and Social Psychology, 37*(8), 1398–1405. https://doi.org/10.1037/0022-3514.37.8.1398

Guilford, J. P. (1967). *The nature of human intelligence*. McGraw-Hill.

Hayes, J. R. (1989). Cognitive processes in creativity. In J. A. Glover, R. R. Ronning, and C. R. Reynolds (Eds.), *Handbook of Creativity* (pp. 135–145). Springer US. https://doi.org/10.1007/978-1-4757-5356-1_7

Helson, R., & Pals, J. L. (2000). Creative potential, creative achievement, and personal growth. *Journal of Personality, 68*(1), 1–27. https://doi.org/10.1111/1467-6494.00089

Hoff, E. V. (2005). Imaginary companions, creativity, and self-image in middle childhood. *Creativity Research Journal, 17*(2–3), 167–180. https://doi.org/10.1080/10400419.2005.9651477

Hunter, J. E., & Schmidt, F. L. (2004). *Methods of Meta-Analysis: Correcting Error and Bias in Research Findings*. SAGE.

Jauk, E., Benedek, M., Dunst, B., & Neubauer, A. C. (2013). The relationship between intelligence and creativity: New support for the threshold hypothesis by means of empirical breakpoint detection. *Intelligence, 41*(4), 212–221. https://doi.org/10.1016/j.intell.2013.03.003

Jauk, E., Benedek, M., & Neubauer, A. C. (2014). The road to creative achievement: A latent variable model of ability and personality predictors. *European Journal of Personality, 28*(1), 95–105. https://doi.org/10.1002/per.1941

Jaussi, K. S., Randel, A. E., & Dionne, S. D. (2007). I am, I think I can, and I do: The role of personal identity, self-efficacy, and cross-application of experiences in creativity at work. *Creativity Research Journal, 19*(2–3), 247–258. https://doi.org/10.1080/10400410701397339

Jung, R. E., Gasparovic, C., Chavez, R. S., Flores, R. A., Smith, S. M., Caprihan, A., & Yeo, R. A. (2009). Biochemical support for the "threshold" theory of creativity: A magnetic resonance spectroscopy study. *The Journal of Neuroscience, 29*(16), 5319–5325.

Karwowski, M., & Barbot, B. (2016). Creative self-beliefs: Their nature, development, and correlates. In J. C. Kaufman & J. Baer (Eds.), *Creativity and reason in cognitive development* (pp. 302–326). Cambridge University Press. https://doi.org/10.1017/CBO9781139941969.016

Karwowski, M., Dul, J., Gralewski, J., Jauk, E., Jankowska, D. M., Gajda, A., ... Benedek, M. (2016). Is creativity without intelligence possible? A necessary condition analysis. *Intelligence, 57*, 105–117.

Kaufman, J. C. (2006). Self-reported differences in creativity by ethnicity and gender. *Applied Cognitive Psychology, 20*(8), 1065–1082.

Kaufman, J. C. (2010). Using creativity to reduce ethnic bias in college admissions. *Review of General Psychology, 14*(3), 189.

Kaufman, J. C. (2015). Why creativity isn't in IQ tests, why it matters, and why it won't change anytime soon probably. *Journal of Intelligence, 3*(3), 59–72. https://doi.org/10.3390/jintelligence3030059

Kaufman, J. C., & Beghetto, R. A. (2009). Beyond big and little: The four c model of creativity. *Review of General Psychology, 13*(1), 1–12. https://doi.org/10.1037/a0013688

Kaufman, J. C., & Beghetto, R. A. (2013). In Praise of Clark Kent: Creative Metacognition and the Importance of teaching kids when (not) to be creative. *Roeper Review, 35*(3), 155–165. https://doi.org/10.1080/02783193.2013.799413

Kaufman, J. C., Plucker, J. A., & Russell, C. M. (2012). Identifying and assessing creativity as a component of giftedness. *Journal of Psychoeducational Assessment, 30*(1), 60–73. https://doi.org/10.1177/0734282911428196

Larsen, R. J., & Diener, E. (1987). Affect intensity as an individual difference characteristic: A review. *Journal of Research in Personality, 21*(1), 1–39. https://doi.org/10.1016/0092-6566(87)90023-7

Leon, I. (1971). IQ, creativity, and achievement: Interaction and threshold. *Multivariate Behavioral Research, 6*(1), 51–62.

Lubart, T. (1999). Componential models. In M. A. Runco & S. Pritzer (Eds.), *Encyclopedia of creativity* (Vol. 1, pp. 295–300). Academic Press.

Lubart, T. I., Besançon, M., & Barbot, B. (2011). *EPoC: Évaluation du potentiel créatif des enfants.* Editions Hogrefe France.

Lubart, T. I., & Getz, I. (1997). Emotion, metaphor, and the creative process. *Creativity Research Journal, 10*(4), 285–301. https://doi.org/10.1207/s15326934crj1004_1

Ma, H.-H. (2009). The effect size of variables associated with creativity: A meta-analysis. *Creativity Research Journal, 21*(1), 30–42. https://doi.org/10.1080/10400410802633400

Mackinnon, D. W. (1962). The nature and nurture of creative talent. *American Psychologist, 17*(7), 484–495. https://doi.org/10.1037/h0046541

Marsh, R. L., Ward, T. B., & Landau, J. D. (1999). The inadvertent use of prior knowledge in a generative cognitive task. *Memory & Cognition, 27*(1), 94–105. https://doi.org/10.3758/BF03201216

Maslow, A. H. (1958). Emotional blocks to creativity. *Journal of Individual Psychology, 14*(1), 51.

McCrae, R. R. (1987). Creativity, divergent thinking, and openness to experience. *Journal of Personality and Social Psychology, 52*(6), 1258–1265. https://doi.org/10.1037/0022-3514.52.6.1258

Miroshnik, K. G., & Shcherbakova, O. V. (2019). The proportion and creativity of "old" and "new" ideas: Are they related to fluid intelligence? *Intelligence*, *76*, 101384. https://doi.org/10.1016/j.intell.2019.101384

Myszkowski, N., Çelik, P., & Storme, M. (2018). A meta-analysis of the relationship between intelligence and visual "taste" measures. *Psychology of Aesthetics, Creativity, and the Arts, 12*(1), 24–33. https://doi.org/10.1037/aca0000099

Myszkowski, N., Storme, M., Davila, A., & Lubart, T. (2015). Managerial creative problem solving and the Big Five personality traits. *Journal of Management Development, 34*(6), 674–684. https://doi.org/10.1108/JMD-12-2013-0160

Myszkowski, N., Storme, M., Zenasni, F., & Lubart, T. (2014). Is visual aesthetic sensitivity independent from intelligence, personality and creativity? *Personality and Individual Differences, 59*, 16–20. https://doi.org/10.1016/j.paid.2013.10.021

Myszkowski, N., & Zenasni, F. (2016). Individual differences in aesthetic ability: The case for an Aesthetic Quotient. *Frontiers in Psychology*, *7*(750). https://doi.org/10.3389/fpsyg.2016.00750

Newell, A., and Simon, H. A. (1972). *Human problem solving* (Vol. 104). Prentice-Hall Englewood Cliffs, NJ. http://www.sci.brooklyn.cuny.edu/~kopec/cis718/fall_2005/2/Rafique_2_humanthinking.doc

Nusbaum, E. C., & Silvia, P. J. (2011). Are intelligence and creativity really so different? Fluid intelligence, executive processes, and strategy use in divergent thinking. *Intelligence, 39*(1), 36–45. https://doi.org/10.1016/j.intell.2010.11.002

Preckel, F., Holling, H., & Wiese, M. (2006). Relationship of intelligence and creativity in gifted and non-gifted students: An investigation of threshold theory. *Personality and Individual Differences, 40*(1), 159–170. https://doi.org/10.1016/j.paid.2005.06.022

Richards, R. L. (1981). Relationships between creativity and psychopathology: An evaluation and interpretation of the evidence. *Genetic Psychology Monographs, 103*(2), 261–324.

Rogers, C. R. (1954). Toward a theory of creativity. *ETC: A Review of General Semantics*, *11*(4), 249–260.

Runco, M. A., & Albert, R. S. (1986). The threshold theory regarding creativity and intelligence: An empirical test with gifted and nongifted children. *Creative Child and Adult Quarterly, 11*(4), 212–218.

Silvia, P. J., Kaufman, J. C., & Pretz, J. E. (2009). Is creativity domain-specific? Latent class models of creative accomplishments and creative self-descriptions. *Psychology of Aesthetics, Creativity, and the Arts, 3*(3), 139–148. https://doi.org/10.1037/a0014940

Silvia, P. J., Kaufman, J. C., Reiter-Palmon, R., & Wigert, B. (2011). Cantankerous creativity: Honesty-humility, agreeableness, and the HEXACO structure of creative achievement. *Personality and Individual Differences, 51*(5), 687–689. https://doi.org/10.1016/j.paid.2011.06.011

Smith, S. M., & Ward, T. B. (1995). *The creative cognition approach: Edited by Steven M. Smith, Thomas B. Ward, and Ronald A. Finke*. MIT Press.

Sternberg, R. J. (1998). Abilities are forms of developing expertise. *Educational Researcher, 27*(3), 11–20. https://doi.org/10.3102/0013189X027003011

Sternberg, R. J. (2001). What is the common thread of creativity? Its dialectical relation to intelligence and wisdom. *American Psychologist, 56*(4), 360.

Sternberg, R. J., Kaufman, J. C., & Pretz, J. E. (2002). *The creativity conundrum: A propulsion model of kinds of creative contributions*. Psychology Press.

Sternberg, R. J., & Lubart, T. I. (1993). Creative giftedness: A multivariate investment approach. *Gifted Child Quarterly, 37*(1), 7–15. https://doi.org/10.1177/001698629303700102

Sternberg, R. J., & Lubart, T. I. (1995). *Defying the crowd: Cultivating creativity in a culture of conformity* (Vol. ix). Free Press.

Storme, M., Myszkowski, N., Çelik, P., & Lubart, T. (2014). Learning to judge creativity: The underlying mechanisms in creativity training for non-expert judges. *Learning and Individual Differences, 32*, 19–25. https://doi.org/10.1016/j.lindif.2014.03.002

Torrance, E. P. (1966). *The torrance tests of creative thinking–Norms—Technical manual research edition—Verbal tests, forms A and B—Figural tests*. Personnel Press.

Torrance, E. P. (2008). *Torrance tests of creative thinking: Norms-technical manual, verbal forms A and B*. Scholastic Testing Service.

Vernon, P. E. (1970). *Creativity: Selected readings*. Penguin Books.

Wallach, M. A., & Kogan, N. (1965). A new look at the creativity-intelligence distinction. *Journal of Personality, 33*(3), 348–369. https://doi.org/10.1111/j.1467-6494.1965.tb01391.x

Wang, S., Zhang, X., & Martocchio, J. (2011). Thinking outside of the box when the box is missing: Role ambiguity and its linkage to creativity. *Creativity Research Journal, 23*(3), 211–221. https://doi.org/10.1080/10400419.2011.595661

Ward, T. B. (1994). Structured imagination: The role of category structure in exemplar generation. *Cognitive Psychology, 27*(1), 1–40. https://doi.org/10.1006/cogp.1994.1010

Ward, T. B. (2007). Creative cognition as a window on creativity. *Methods, 42*(1), 28–37. https://doi.org/10.1016/j.ymeth.2006.12.002

Ward, T. B., & Sifonis, C. M. (1997). Task demands and generative thinking: What changes and what remains the same? *Journal of Creative Behavior, 31*(4), 245–259.

Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology, 25*(1), 68–81. https://doi.org/10.1006/ceps.1999.1015

Wilkenfeld, M. J., & Ward, T. B. (2001). Similarity and emergence in conceptual combination. *Journal of Memory and Language, 45*(1), 21–38. https://doi.org/10.1006/jmla.2000.2772

Zenasni, F., Besançon, M., & Lubart, T. I. (2008). Creativity and tolerance of ambiguity: An empirical study. *The Journal of Creative Behavior, 42*(1), 61–73. https://doi.org/10.1002/j.2162-6057.2008.tb01080.x

Zenasni, F., Botella, M., & Barbot, B. (2016a). The socioemotional characteristics of creatively and artistically gifted children. In *The Social and Emotional Development of Gifted Children* (2nd ed.). Routledge.

Zenasni, F., Mourgues, C., Nelson, J., Muter, C., & Myszkowski, N. (2016b). How does creative giftedness differ from academic giftedness? A multidimensional conception. *Learning and Individual Differences, 52*, 216–223. https://doi.org/10.1016/j.lindif.2016.09.003

The DA VINCI Model for the Creative Thinking Process

Giovanni Emanuele Corazza and Sergio Agnoli

Keywords Creativity · Creative process · Inspiration · Divergent thinking · Convergent thinking · Openness · Leonardo da Vinci

1 Introduction: The Central Role of the Process in Creativity

There are several frameworks for creativity studies, such as the 4P's (Rhodes, 1961), the 5A's (Glăveanu, 2013), or the 7C's model (Lubart, 2017). All of these frameworks encompass at least three fundamental dimensions: the creative process, the creative actor enacting the process, and the creative product as the outcome of the process. It can be argued that the core of the creativity phenomenon is undoubtedly the creative process. Without a creative process, the actor could not be engaged in creativity, and therefore there would be no creative outcome nor its consumption. The same line of reasoning applies even more strongly to the other dimensions contemplated by the 4P's, 5A's, and 7C's frameworks: they all rely intrinsically on the existence of a creative process. The opposite does not hold: for example, it is perfectly normal to have a creative process without having reached any creative outcomes: this might even be useful, for example in case creativity is used as a therapeutic mechanism (Hannemann, 2006).

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As a direct consequence, when creativity is considered, we should look for a definition that focuses on the creative process, and not on the possible creative outcomes of this process. Strangely enough, the standard definition of creativity (Runco & Jaeger, 2012), by foreseeing that creativity requires both originality and effectiveness, is actually focused on the existence of an outcome and on its assessment by some entity, who should recognize its originality and effectiveness in some specific knowledge domain. As discussed in Corazza (2016), this definition is insufficient as it leads to a static theoretical framework, missing all the dynamics of the creative process, which include long periods of creative inconclusiveness (Corazza, 2016), along with more rare occasions of creative achievement. Recognizing the central role of the creative process, it is therefore mandatory to adopt a dynamic definition of creativity (Corazza, 2016), foreseeing that creativity requires *potential* originality and effectiveness. The addition of a single word, potential, has the power to transform the theoretical framework from static to dynamic, and to shift the focus from creative products to creative processes (Botella & Lubart, 2019; Corazza, 2016, 2020; Corazza & Glaveanu, 2020).

Under the light of the dynamic definition of creativity, we can also provide a definition for the creative process. Lubart (2001) defined it as: "The sequence of thoughts and actions that leads to a novel, adaptive production", and this definition is still a derivative of the standard definition of creativity, for it does not contemplate the case in which the production is not (yet) reached, or its value is debatable. Therefore, we must provide a dynamic definition of a creative process, as "*A sequence of thoughts and actions aimed at the generation of outcomes with a potential for originality and effectiveness*". A fundamental part of the creative process will therefore reside in the active extraction of value from generated ideas, that we identify as creativity *estimation* as opposed to creativity assessment or judgment (Corazza, 2016, 2020).

Modeling the creative process has been an important topic for about a century in creativity studies (see Lubart, 2001, 2018, and the references therein). Any model must be interpreted as a metaphor, without any claim to represent 'reality' in a faithful way, but with different levels of usefulness that need to be justified. For the DA VINCI model presented in this Chapter, there are three levels of usefulness: (a) theoretical; (b) empirical; and (c) practical. First, from a theoretical point of view, the DA VINCI model is an important part of the Dynamic Creativity Framework descending from the dynamic definition of creativity cited above; the DA VINCI model is compatible with other models proposed in the literature, as discussed below, but it adds the important elements of Inspiration and divergent Creativity estimation. Second, understanding the creative process through the DA VINCI model can be used as a guide in the design and realization of empirical experiments for the study of creative cognition, creative motivation, idea generation, creativity estimation, and so on, to provide additional scientific data to confirm the validity of the model itself. Finally, the DA VINCI model can also be used as an educational tool for creativity training, as well as an application tool to guide practical sessions of idea generation. In this practical sense, the DA VINCI model can be used both by an individual and by a team of actors.

2 The DA VINCI Model for the Creative Thinking Process

Our model was initially identified as 'DIMAI' (Corazza & Agnoli, 2018; Corazza et al., 2014, 2016), and was renamed 'DA VINCI' in 2019, to dedicate it to the great Leonardo Da Vinci (1452–1519) in the year of the 500-th anniversary of his death. This dedication is well justified by the fact that Leonardo represents a unique testimonial for creativity, being the only human in history who was able to produce high level creative work in about twenty different disciplines, pertaining to the arts, science, and technology. The DA VINCI model is intended to describe the occurrence of a *creativity episode*, the time-extension of which is a-priori undetermined, due to its manifold dynamic extensions (Corazza, 2019, 2020). It must be clearly stated that there is no claim that this model actually reflects the approach that Leonardo followed in his creativity episodes, although some of the components of this model have been inspired by the lessons that can be learned from the Da Vinci codex. It is worth noting that DA VINCI has been turned into an acronym to help indexing the five key mental states that constitute the backbone of the model: DAV (Drive—Attention & Volition), I (Information), N (Novelty generation), C (Creativity estimation), I (Implementation).

The reason why we identify these main constituents of the DA VINCI model as 'mental states', as opposed to the more classic term 'stages' (e.g., see Wallas, 1926), is that multiple mental states can coexist at the same time in the mind of the creative actor. Therefore, even though the description of the DA VINCI model follows a linear and sequential order, its activation can be much more complex and non-linear, depending on meta-cognitive executive control. As an example, the DAV state, which contains the fundamental motivational elements allowing the actor to take risks and sustain possible frustrations, must remain active throughout the creative thinking process, in parallel with other mental states.

The graphical representation of the DA VINCI model is reported in Fig. 1. As can be seen, the three central mental states (I, N, C) contain each two components, representing a duality of modalities that will be explained later, but that in general reflects convergent vs. divergent modalities. At the output of the DAV, I, N, and C mental states, different forms of preliminary outputs are represented, feeding and creating an exchange between different mental states. These are, respectively: Refined Focus Area (RFA), Platform-Incubation, Raw Ideas, and Conceptual Prototype. Whereas the communication link is clearly visible between adjacent states, it can also be effective between non-adjacent mental states. For example, the RFA that links DAV and I states, also links DAV and C states, because as we will explain later convergent Creativity estimation is aimed at extracting value from the creative ideas with reference to the initial RFA. Further, it should be noted that all of the elements of the DA VINCI model are interconnected by paths that have no arrows. This is intended to show graphically that there is no single predetermined way to activate mental states, their modalities, and the corresponding outputs, but multiple sequences of activation can be generated within the DA VINCI model, corresponding to different thinking

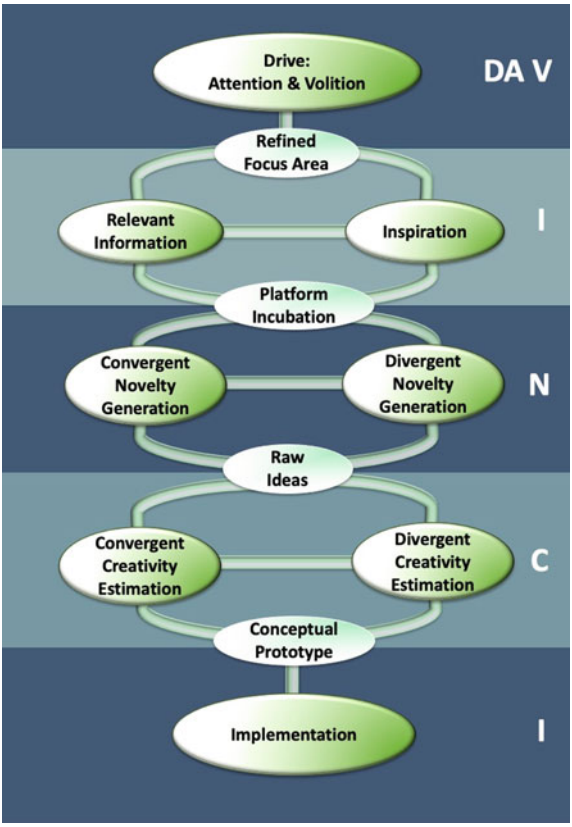

Fig. 1 The DA VINCI model for the creative thinking process

styles (to be discussed later) and/or different situations that may occur in the embedding environment. In fact, this process does not happen in isolation, but is influenced by all the interactions in which the creative actor engages.

As we will discuss later, the DA VINCI model is compatible with other models for the creative thinking process, but it also has two main peculiarities that make it well distinct: the component of Inspiration within the I (Information) mental state, and the component of divergent Creativity estimation within the C (Creativity estimation) state. Having given a general overview of the DA VINCI model, we now enter into the detailed description of the five mental states.

3 DAV: Drive—Attention & Volition

The basic behavior of a cognitive system supported by a non-pathological brain is guided by the minimization of energy expenditure. This is essentially the foundation of the *cognitive economy* assumption, which foresees as the main goal that

of conserving the finite available resources as much as possible (Rosch, 1978). In fact, the process of learning and reviewing produces a progressive reduction of energy expenditure in the brain, so that brilliant and fast responses to external or internal stimuli involve minimal energy consumption. This is a fundamental and adaptive neural and cognitive goal, that guarantees maximum survival time spans for a given level of nutrition. There are many mechanisms used by the neural and cognitive systems in order to achieve the goal of energy minimization, among which lowering thresholds of neurons, reduced activation of structures, habituation, attention focusing, and proactive prediction. All of these mechanisms work against the creative process, because they tend to lead rapidly towards the 'best', previously known, response.

As a consequence of the above fundamental observation, if a creativity episode is to begin at all, there is the necessity to invest an amount of energy and time which is far superior to the minimum necessary for mere survival. The Drive represents this mental state in which a willingness is (explicitly or implicitly) activated in the creative actor to actually make this investment of energy and time, taking the risk to engage in an activity without a-priori guarantees of the possible outcomes. Without this Drive, creativity remains stifled and unable to be expressed, as thinking always remains within the comfortable boundaries of previous knowledge.

In the DA VINCI model, it is explicitly recognized that the creative Drive stands on two pillars: cognitive (Attention) and motivational (Volition). The cognitive element involves the definition of an area of attentive focus (Focus Area) for the creativity episode, which might be an assigned creative task, a problem to be solved (in this case, the literature of interest speaks of Problem Discovery, Problem Definition and Re-definition, Problem finding; Guilford, 1967; Mumford et al., 1991), but also an area to be explored, without any evident problem to be solved. This third possibility promotes engagement in a much wider range of creativity episodes. The Drive in Attention involves spending energy and time to look at the Focus Ares from many different points of view, which is key to combat fixation and selectivity of attention. The ability to broaden the attentional focus while defining the creative focus emerged as an attribute of creative individuals, especially when associated with the Openness personality trait (Agnoli et al., 2015). In fact, flexible perspective taking is a fundamental ability to be trained in order to improve creative performance. In terms of problem solving, this is referred to as problem re-definition (Reiter-Palmon & Illies, 2004), which can be shown to be predictive of creative success.

On the other hand, the creative Drive is not only a matter of pure cognition. In fact, the motivational elements are as important, if not more. As we recently stated, motivation and emotions can be defined as the spinal cord of the overall creative thinking process, or as the necessary (but not sufficient) condition for the creative process to occur (Agnoli & Corazza, 2019). Volition, or the willingness to engage in the creativity episode, is actually the source of the excess energy in the Drive. Volition is known to have both intrinsic and extrinsic components (Amabile, 1993), depending on whether they come from within the creative actor or from the surrounding environment, such as for example a boss asking for creative ideas to solve a company's problem. The best condition corresponds to the case in which intrinsic and extrinsic

motivation resonate: imbalance is in general an inferior condition, either when the actor is motivated but the environment works as an obstacle, or when the environment is favorable but the actor does not show any interest. This interaction between intrinsic and extrinsic motivation emerged clearly in a recent exploration of creative achievement within the educational environment, where the highest achievement scores were obtained by individuals characterized by high openness and high levels of both motivational sources (Agnoli et al., 2018).

A neurological parallel to Volition can be found in the creative Drive model proposed by Flaherty (2005). This author offered an alternative neurological explanation to creativity as opposed to the lateralization model for creativity skills proposed by Martindale (1999). In particular, Flaherty suggested the term "creative drive" for explaining the result of the interaction between temporal and frontal lobes and the limbic system. She argued that most neurological models have focused on creative cognition skills, but the drive, as sustained by the limbic system, is neurally independent from these skills, and probably more important for explaining creative achievement. More recent models have been proposed for the neurological explanation of this state (see Khalil et al., 2019), all pointing at relatively independent neurophysiological patterns for the drive sustaining the creative process.

Further empirical evidence for the role of basic neural motivational systems in the creative thinking process comes from the study of the functions of the dopaminergic systems on the generation of new ideas (Boot et al., 2017; Nijstad et al., 2010; Zabelina et al., 2016), with recent data showing that higher activation of the striatal dopaminergic system is predictive of higher originality when supported by higher flexibility of thought (Agnoli et al., 2021).

Now, Attention and Volition interact in the selection of the output of the Drive mental state, that is the Refined Focus Area (RFA). In other words, as the actor is exercising his/her ability to see the area of focus under many different points of view, the visited alternatives produce an effect on the willingness to engage in the creativity episode. If the selected RFA corresponds to the focus definition that is felt (perhaps based on instinct) to have the highest potential for originality and effectiveness (Corazza, 2016), then interest for this focus area will grow (Agnoli & Corazza, 2019), motivation will be highest, and the Drive will be most effective. This ideal condition is not always achieved, as the level of Drive will vary on a continuum. Finally, it should be noted that a list of possible RFAs can also be formed, but the alternatives must be explored one at a time, unless the creative process involves parallel teams.

4 I: Information

The creative episode aimed at a specific RFA is fed by information that is deemed to be important and necessary in that RFA knowledge domain. In the DA VINCI model, we refer to this as Relevant Information, represented in Fig. 1 as the convergent modality of the Information mental state. Here, convergence is intended towards

the knowledge domain of the RFA. Relevant Information must always be available to feed the creative process; basically, it comes from the knowledge and culture previously possessed or purposely acquired by the actor regarding the RFA. Relevant Information shapes the way in which the actor sees or perceives the RFA. Different levels of expertise in an area correspond to the amount of Relevant Information the individual has at his/her disposal.

Expertise involves the acquisition, storage and use both of explicit knowledge of the domain (facts, ideas, principles, etc.) and of tacit knowledge of the field (Ericsson & Smith, 1991; Reilly, 2008; Sternberg, 1998). Expertise is a process of continual, life-long development (Reilly, 2008). Experts are characterized by specific thinking mechanisms, such as rapid performance of procedures, well organized, interconnected and easily accessible knowledge structures, as well as superior short and long term memory and rich repertoires of strategies for problem-solving (Ericsson & Smith, 1991; Glaser & Chi, 1988; Johnson, 1988). As proposed by Reilly (2008), experts tend to work forward from given information to implement strategies for finding unknowns.

However, past research demonstrated that exceptional creators are not merely extreme experts in their domains (Simonton, 1996, 2000). Even if experts are superior than novices in well-defined problems, it has been demonstrated that in domains of much uncertainty experts fail to do better than novices (Johnson, 1988). Indeed, it is a known fact that major creativity leaps often come from novel members or from the periphery of a field (Cattani & Ferriani, 2008). On the other hand, without any Relevant Information one would be missing the fundamental ingredients in the creative process, which would be stifled at its start. This is the reason why small children, who may be undoubtedly very creative, cannot however compose music (with a few famous exceptions of unique giftedness) or invent the next technological device.

Relevant Information in an RFA can include many categories of semantic entities: dominant ideas in a field, theories, best practices, constraints, requirements, assumptions, historical and current facts, archives, future trends, past errors to be avoided, information gathered by interviews, customer briefs, activities by competition, problems to be solved, desires to be satisfied, etcetera. Clearly, the RFA itself is a very important element of Relevant Information, and the way it is specified can lead towards certain areas of exploration and hide others. More generally, Relevant Information includes all those semantic entities that constitute the way in which the RFA is perceived and understood according to the cultural state-of-the-art. Sufficient time and energy should be spent in the creative process to gather, select, and structure Relevant Information, and several methods can be introduced in order to make this step more efficient, such as for example the use of persona (Johansson & Messeter, 2005) that represents an idealized version of a person/user with interest in the RFA, with the purpose of better visualizing its needs and desires. Gathering and structuring Relevant Information is a strictly domain-specific activity, because it will change considerably if the RFA is, for example, composing a piece of music or designing a new product.

However, Relevant Information is not the only ingredient of the creative process. One of the most peculiar characteristics of the DA VINCI model, perhaps its most important difference with respect to other models, is that it also contains a specific component aimed at the introduction of *Inspiration* in the creative process, represented as the divergent modality of the Information state in Fig. 1. Inspiration should be intended essentially as information that a-priori does not appear to be strictly relevant to the RFA, or even purely irrelevant, paradoxical, absurd, incorrect. Therefore, if one were to follow a strictly rational approach to the generation of ideas related to the RFA, irrelevant information would have to be discarded, because it would act as a distraction. On the other hand, the thinking style in a creative process will include non-linearity, unusual associations, surprising interpretations, unexpected insights, original alternatives. For these, the introduction of an Inspiration in the form of irrelevant information (Agnoli et al., 2015, 2019) turns out to be crucial, in conjunction with personality characteristics: in fact, in the presence of sufficient Openness (Agnoli et al., 2015: Corazza & Agnoli, 2020), these elements of Inspiration can be processed along with the RFA and Relevant Information in order to create a state of mind that the actor has never visited before. We identify this state of mind as the Platform (see Fig. 1), which is the starting condition for Novelty generation to follow. Previous literature has pointed out that creative achievement could be related to the tendency to focus on irrelevant or discrepant facts (see for example the use of analogy in Dunbar's explanation of scientific thinking; Dunbar, 1995). Alissa (1972) stated that individuals who use a wider range of information, even if sometimes apparently irrelevant, tend to produce more creative products. More recently, empirical results demonstrated that the ability to focus attention also on apparently irrelevant information, which is typical of open-minded individuals, leads to a higher creative performance and creative achievement (Agnoli et al., 2015).

In essence, the role of the Inspiration component is to increase the probability that the Platform will be out of the common knowledge domain, or out-of-the-box. This greatly increases the potential for originality and effectiveness of the creative process: in fact, if all of the process remains within the high walls of existing knowledge, the probability to generate original ideas is in general quite low. There are many practical ways for introducing Inspiration in the creative process, such as for example the inventive principles of the TRIZ methodology (Altshuller, 1984), the SCAMPER approach (Serrat, 2017), or the Generative Modifiers (or Divergent Modifiers) of the Marconi Institute for Creativity (Corazza et al., 2015). It should be noted that the Platform can remain active in the creative process for a long period of time, even below the level of awareness of the actor, particularly in the case that the RFA contains very difficult problems to be solved. We identify this period as Incubation (see Fig. 1), and it is known that Incubation can lead to insight in creative problem solving (Gilhooly, 2017), as famously noted by Henri Poincaré (Corazza & Lubart, 2019; Poincaré, 1914).

5 N: Novelty Generation

The first objective in the generation of ideas is to produce authentic novelty. This will only lead to originality if an element of surprise can be identified; in other words, novelty is a necessary but not sufficient condition to generate originality (Corazza, 2016). As discussed before, bringing the Platform out of the common knowledge domain is essential to increase the potential for originality in the Novelty generation state, by processing the a-priori irrelevant information brought in through Inspiration (Agnoli et al., 2015, 2019). As well known from the creativity studies literature, Novelty generation entails two fundamental and dual modalities: convergent vs. divergent.

Convergent Novelty generation, or convergent thinking, consists in taking all the available inputs (RFA, Relevant Information, Inspiration) and moving towards a creative synthesis, a single output achieved by integration (Lubart et al., 2013). In case the RFA contains a problem, convergent Novelty generation works to find a solution, possibly a creative solution. In case the RFA is an area to be explored, convergent Novelty generation works to find a combination of the available inputs which is difficult to predict a-priori, and therefore novel and surprising. Achieving originality typically entails a use of the available inputs which goes beyond simple juxtaposition, but rather involves the emergence of a new reality which is more than the sum of the inputs. Here, a clear parallel to the phenomenon of emergence in complex systems can be seen (Sawyer, 1999). From a graphical point of view, convergent Novelty generation can be seen as a cone that takes many inputs and produces a single output. From a metaphorical perspective, it can be seen as climbing a mountain peak, with many possible routes and only one ‘solution’.

Divergent Novelty generation, or divergent thinking, being dual to convergent thinking, is aimed at producing a large number of alternative outcomes starting from a common root, that we identify as the Platform (Guilford, 1967). Tasks designed to measure divergent thinking performance are one of the most frequent approaches in empirical creativity studies, sometimes leading to the mistake of confusing divergent thinking for the creative process. Three parameters are typically associated to divergent thinking performance: fluency, flexibility, and originality.

Fluency corresponds to quantity, that is the number of generated alternatives. It is a peculiarity of the creative thinking process that quantity might lead to quality: in fact, the level of originality is not uniform across the responses, because high originality is rare and remote. Therefore, large fluency is crucial to have high potential originality. Also, this implies that in the measurement of divergent thinking performance average originality scores are not really significant: we are looking for those few outliers that stem out for their originality.

Lack of flexibility refers to the fact that, even if one shows very large fluency, all the alternatives could belong to a narrow semantic field. For example, if one is looking at alternative uses for a brick (a classic question in the Alternative Uses Test, Guilford, 1967), one could think of it as a tool to break a window, a door, someone’s head, to crack a nut, a chestnut, etcetera. As can be seen from this simple example, all

these alternatives share strong similarity, as they belong to the same semantic category of 'breaking objects'. Flexibility is therefore the ability to visit many semantic categories in the course of divergent Novelty generation. High flexibility is desirable, as it also increases the potential for originality, which is the ultimate goal. The importance of flexibility has been confirmed by Acar and colleagues (Acar et al., 2019); on the other hand, flexibility requires a higher investment of mental energy, due to the increase of neural activity in several brain regions associated with the changes of semantic category (Mastria et al., 2021).

Response originality, which comprises novelty, surprise, and authenticity (Corazza, 2016), is perhaps the most important performance parameter in a divergent thinking test, and one that is not simple to measure (Reiter-Palmon et al., 2019). For this purpose, there exist both objective methods, based on statistical infrequency (Wallach & Kogan, 1965), and subjective methods, such as the consensual assessment technique (CAT, Amabile, 1982). Given the emphasis on fluency and large samples in empirical studies, the problem of assessing originality can become cumbersome; for this reason, recent efforts have been geared toward the automation of originality scoring (Beaty & Johnson, 2021).

Finally, it should be noted that divergent thinking is an iterative process, in which an already produced alternative must be inhibited in order for the next one to be generated. Therefore, in a creative process exploiting divergence, inhibition is as important as elicitation. The first response to be inhibited corresponds to the most common response, the one typically associated with being correct and 'intelligent'. This inhibitory behavior clearly emerged in a recent neurophysiological study on the temporal occurrence of originality in the brain activity (Agnoli et al., 2020), where the first most obvious response is recovered from the memory system (with an evident activity in the frontal brain regions), whereas starting from the second response memory is inhibited in order to elicit an imaginative and integrative activity (with an evident activity in the parietal and temporal regions). When Binet defined intelligence, he referred to it as 'the ability to inhibit the instinct response' (Goddard, 1946). Here we can say that the creativity component of divergent Novelty generation entails a second level of inhibition: not only the instinct, but also the intelligent response must be inhibited in order to generate divergent alternatives.

At the output of convergent and divergent Novelty generation activities, a certain number of Raw Ideas will be available (see Fig. 1). These will in general need refinement, essentially because the more an idea is original, the more difficult it is to see its value. This is the purpose of the next state of mind, Creativity estimation.

6 C: Creativity Estimation

In the dynamic creativity framework (DCF), based on the dynamic definition of creativity (Corazza, 2016, 2020; Corazza & Lubart, 2020), it is crucial to avoid the mistake of considering the assessment of ideas as static judgment, as categorization, or as a simple scoring procedure. Even though all these activities are possible, and

perhaps necessary when performing empirical experiments in creativity studies, they carry as a consequence the end of the creative thinking process. But this would be very far from optimal: the extraction of all the potential effectiveness from Raw Ideas is an active process, definitely non-obvious, which we identify as Creativity estimation. The word estimation (Corazza, 2016) was purposely introduced to hint at the fact that this mental state is affected by both objective and subjective elements, and therefore an absolute judge for creative ideas does not exist. Although this might be seen as a problem in empirical experiments, especially in view of the consensual assessment technique mentioned before, it is actually a source of richness in terms of the potential for originality and effectiveness of the creative process. Recent research indeed demonstrated that taking into account the subjective emotional state of the judges engaged in CAT scoring of an AUT task, it was possible to explain a source of variability in the scoring of alternative ideas (Mastria et al., 2019).

It can be argued that a good part of the art of the creative process resides in the subjective ability to see the value (artistic, scientific, practical) in ideas that everyone else consider to have no value. Creativity estimation includes clearly the simple assessment or scoring of ideas, but it can go well beyond that to lead to dynamic refinement of the Raw Ideas (Corazza, 2020, 2016). It is very interesting to note that also in this state, both convergent and divergent modalities are foreseen, but with quite a different meaning.

Convergent Creativity estimation corresponds to the action of trying to extract the maximum value from a Raw Idea while making reference to the selected RFA. In other words, the objective is to see how the idea under consideration can be formulated or evolved in order to enlarge its originality with respect to the state-of-the-art in the RFA, as well as its effectiveness in terms of providing a solution, satisfying a need, or in general providing aesthetic, scientific, or practical value within the boundaries of the RFA. It can be stated that convergent Creativity estimation is the classic state of mind one would expect at this stage, in particular for creative problem solving.

On the other hand, we also foresee the possibility of divergent Creativity estimation, another peculiarity of the DA VINCI model. This corresponds to the case in which the actor is allowed to extract the value from a Raw Idea above and beyond the initial RFA, by imagining different environments, different fields of application or of knowledge. The reason why this unconventional step holds very significant potential is that the actual value of an idea might not reside in the initial focus, but perhaps in a totally different and unforeseen area. In extreme cases, an outcome could be considered a total failure with respect to the initial RFA, and as such it should be discarded, but it might turn out to be an extremely successful creative disruption from a different perspective. An example is in order: as reported in (Glăveanu & Gillespie, 2014; Karapapa, 2019) the invention of the post-it notes came out from a failed design of a super-strong glue by Spencer Silver. The weak glue he generated by experimenting on a new family of polymers remained in a state of creative inconclusiveness for about ten years, also identified as ‘a solution looking for a problem’. Fortunately, instead of completely throwing away the idea, a form of divergent Creativity estimation was enacted by someone else, Arthur Fry, who devised a different use for this

adhesive to hold a bookmark in place, which led to one of the most successful products for meetings and teamwork (Karapapa, 2019). Whenever the creative process is pushed towards the search for high potential originality, it is not unusual to see that one has generated some ideas with properties that were not initially sought. In other words, divergent Creativity estimation is the home of serendipity (Ross & Vallée-Tourangeau, 2021).

When as an outcome of convergent and divergent Creativity estimation many refined ideas are extracted, it will be necessary to proceed to form a short-list and a selection. The top idea(s) might then be transformed into a prototype (see Fig. 1), in order to test actual effectiveness, perhaps by involving external actors. This is the purpose of the next state, Implementation.

7 I: Implementation

The final goal of the process for a given creativity episode is in general subject to discussion: in the DA VINCI model, we consider that the process cannot be successfully concluded unless some form of Implementation of at least one idea occurs, leading to a process of innovation. Otherwise, the process would be reduced to some form of mental exercise, which certainly has its own value, but with scarce practical bearing. Carrying at least one idea to actual Implementation is therefore a crucial part of the process, that can take on many forms. Implementation involves the highest interaction with the outside world.

The most basic form of Implementation, but a very important one nonetheless, is to prepare a presentation of the idea for an audience. Indeed, the higher the originality of a creative idea, the stronger the resistance that the outside world will generally offer against it. This is because the state-of-the-art exists for good reasons, and it tends to grow incrementally instead of leaping towards creative disruptions. As a consequence, if one wants to bring any creative idea to success, it is of fundamental importance to be able to persuade an audience of the potential benefits and advantages. For the same idea, a good vs. bad presentation to a critical audience might lead to success vs. failure.

Presuming that a successful presentation of an idea has taken place, the Implementation state foresees actual realization under constraints. In particular, Implementation is constrained by two different kinds of factors: 1. intrinsic constraints, i.e., factors that are strictly related to the idea characteristics (e.g., time to bring the idea to reality, money needed to realize the idea, knowledge to be acquired, etc.); and 2. extrinsic constraints, i.e., factors that highly influence idea realization, mostly related to the individual's social environment, such as cultural rules, dominant ideas, experts opinions, etcetera. Moreover, a third factor plays a central role during the implementation state, determining the success of idea Implementation: individual personality. Creative self-beliefs, self-identity, grit and persistence all play a fundamental role in the process of bringing a creative idea to a successful realization (Karwowski & Kaufman, 2017).

The ability to resist the frustration caused by critical remarks or rejection of one's idea coming from an external audience is a fundamental characteristic of a creative actor, largely influencing the potential for a successful Implementation and therefore for creative achievement. Trait emotional intelligence, including the attitude to successfully manage negative emotions emerging from frustration, has been demonstrated to be essential in order to persist in the creative process, possibly refining previous ideas to implement more original solutions (Agnoli et al., 2018).

8 Comparisons Between DA VINCI and Other Models

First, let's compare the DA VINCI model with its five mental states to the general three-stages model discussed in Corazza and Agnoli (2015), which foresaw: (a) gathering and structuring of information elements; (b) ideation; and (c) verification of the effects. The mapping appears to be quite simple: in the DA VINCI model, stage (a) is represented by the Information state; stage (b) is represented by the Novelty generation state; stage (c) is represented by a combination of the Creativity estimation and Implementation states. Clearly, the DA VINCI model adds very important elements, such as the DAV state and much more detailed descriptions of the relevant components at the different stages, with the specificities of the Inspiration and divergent Creativity estimation components.

Undoubtedly, one of the most famous models of the creative thinking process is the one by Wallas (1926), which was actually inspired by the writings of Henri Poincaré (1914, Corazza & Lubart, 2019). Wallas' model foresees four stages: Preparation, Incubation, Illumination, and Verification. Whereas the difference between 'stages' and 'mental states' should be underlined, it is at any rate possible to map these four stages onto the states of the DA VINCI model. Preparation maps onto both DAV and I states; Incubation occurs at the border between the I and N states (see Fig. 1); Illumination is a subset of the N state (because not all ideas are generated by insight); finally, the Verification stage is a part of the Implementation state. Clearly the DA VINCI model emerges as an advancement with respect to Wallas' by introducing subprocesses and components of the creative process, as suggested by Lubart (2001), the concept of mental states as opposed to stages, the distinction between convergent and divergent modalities, and the multifold creative styles that will be discussed in the next section.

Mumford et al. (1991) introduced an eight stage model: (i) problem construction, (ii) information encoding, (iii) category search, (iv) specification of best fitting categories, (v) combination and reorganization of category information to find new solutions, (vi) idea evaluation, (vii) implementation of ideas, and (viii) monitoring. In terms of the DA VINCI model, stage (i) is mapped onto DAV, stages (ii, iii, iv) all refer to the I state, in its Relevant Information component (Inspiration was not foreseen in Mumford et al., 1991), stage (v) corresponds to the N state, stage (vi) to the C state, and finally stages (vii, viii) are mapped onto the Implementation state. The DA VINCI model extends the reach of Mumford's model by allowing the RFA

to represent not a problem but an area to be explored, by introducing irrelevant information as a key form of Inspiration, by introducing mental states in place of stages, and by allowing divergent Creativity estimation to include serendipitous findings.

Finally, we consider the Geneplore model (Finke et al., 1992), which includes two fundamental stages that are visited in an iterative fashion: Generation of pre-inventive structures and Exploration of their effectiveness. The iteration is controlled by the intrinsic or extrinsic Constraints of the problem or the area. This model can also be mapped onto the DA VINCI model: Generation corresponds to the N state, and Exploration is mapped onto the C state, between which it is possible to iterate indefinitely. The Constraints in the Geneplore model can be mapped onto the boundaries produced by the RFA as well as the Relevant Information of the DA VINCI model. It is evident that the DA VINCI model represents a much more complete vision of the creative process, with respect to what Geneplore can offer.

Other models for the creative thinking process (Lubart, 2001) could be considered and mapped onto DA VINCI in a similar fashion. As a consequence, we argue that the DA VINCI model is able to cover all of the previously introduced models for the creative thinking process, but it also adds important elements that could not be found in preceding proposals, at least explicitly: the Inspiration component inside the Information state, and the divergent component in the Creativity estimation state. Notably, these two additional elements are both characteristic and critical in the creative thinking process.

9 Creative Styles in the DA VINCI Model

As noted by Botella and Lubart (2019), when the creative process is enacted in domains as different as the arts, design, or science by different individuals, many variations on the theme should be expected, and the possible sequence of thoughts and actions that are followed can appear to be quite diversified and complex. In short, many different creative styles are possible, and it might seem to be difficult for a single creative process model to be representative of all possible styles. However, it is possible to show that the DA VINCI model, with its structure, absence of arrows, possibility to iterate, and use of dual components, contains a very large number of different trajectories, corresponding to many different creative styles.

The two fundamental styles contained in the DA VINCI model correspond to a sequential visit to the five mental states of DAV, I, N, C, I maintaining either a convergent (left side) or a divergent (right side) style of thinking. We identify these respectively as the ‘problem solver style’, and the ‘free explorer style’. If an actor adopts a problem solver style (left side of the DA VINCI model): the RFA will correspond to the problem to be solved, possibly ill-defined; in the I state, only Relevant Information will be collected; in the N state, convergent Novelty generation will be pursued to find possible solutions to the problem at hand; in the C state, convergent Creativity estimation will be adopted to verify whether the solution is

potentially original and effective; finally, in the Implementation state the solution will be brought to reality to instantiate innovation.

In contrast, if an actor adopts a free explorer style: the RFA will be a loosely defined area to be explored, perhaps one that only a few others are considering; in the I state, irrelevant information will be allowed to enter as a form of Inspiration (along with the always present Relevant Information), leading to Platforms that might be very far out from the common knowledge domain; in the N state, divergent Novelty generation will be enacted to give multiple alternative interpretations of the Platform; in the C state, divergent Creativity estimation will be allowed to see all the possible implications of the alternative interpretations produced in the N states, within the RFA but also beyond it, out of which one (or more) will be selected for actual Implementation. It should be clear that the free explorer style is much more time- and energy-consuming than the problem solver style, but its potential for originality and effectiveness is also higher.

The richness of the DA VINCI model comes from the fact that it allows all possible intermediate styles that can exist between the extremes of the problem solver and free explorer styles. In fact, the creative actor can move from the left side to the right side of the DA VINCI model, and vice versa, at any moment he or she wishes to do so. Including the domain specificity of Relevant Information and the possibility for multiple iterations, that can occur also between non-adjacent mental states (for example, between the C state and the DAV state: as the actor is extracting value, the RFA gets modified and Volition might be enhanced or depressed), it should be evident that the variations on the theme within the DA VINCI model are abundant.

10 Conclusion

In this chapter, we have presented the DA VINCI model for the creative process, as composed of five fundamental mental states: DAV (Drive: Attention and Volition), I (Information), N (Novelty generation), C (creativity estimation), and I (Implementation). One of the most interesting questions raised by Lubart (2001) in his analysis of the past, present, and future of models for the creative process was the following: What makes a creative process *creative*? In other words, what are the distinctive elements of a creative process with respect to any other form of cognitive process that does not lead to outcomes that are potentially original and effective?

This question is relevant not only from the point of view of understanding the creativity construct per se, but also for putting it in perspective with respect to the intelligence construct, as proposed in Corazza and Lubart (2020, 2021) and Corazza et al. (2021a, 2021b) by introducing the concept of the space–time continuum. Finding a balance between intelligence and creativity is a crucial objective in all human endeavors. We believe that the DA VINCI model can provide several useful indications in trying to provide answers to the fundamental question raised by Lubart (2001).

First, the creative process is characterized by a Drive, i.e., excess expenditure of energy and time with respect to the minimum that would be necessary to provide a correct (intelligent) response. Second, the creative process allows the entrance of inspiration, in the form of irrelevant information that would normally be discarded in an intelligent thinking process, the purpose of which is to create mental states that are rare and far from the state-of-the-art. The idea generation state is then launched from this platform. Third, the creative process is characterized by convergent and divergent novelty generation approaches, the purpose of which is to let ideas *emerge* in an a-priori unpredictable way, instead of being the result of a rational progress of thought. Fourth and final, the creative process is characterized by both convergent and divergent creativity estimation styles, that allow not only to be coherent with one's initial purposes, but also to discover and welcome serendipitous findings.

Several empirical results have been presented in this manuscript to support the introduction of different elements of the DA VINCI model, but there are clearly many open avenues for other empirical studies to confirm various elements of this model of the creative process, which represents one of the most complex constructs of the human mind. We hope that these avenues will be the subject of future research endeavors in the creativity studies community.

References

Acar, S., Alabbasi, A. M. A., Runco, M. A., & Beketayev, K. (2019). Latency as a predictor of originality in divergent thinking. *Thinking Skills and Creativity, 33*, 100574.

Agnoli, S., & Corazza, G. E. (2019). Emotions: The spinal cord of the creative thinking process. In R. Beghetto & G. E. Corazza (Eds.), *Dynamic Perspectives on Creativity* (pp. 47–65). Springer.

Agnoli, S., Franchin, L., Rubaltelli, E., & Corazza, G. E. (2015). An eye-tracking analysis of irrelevance processing as moderator of openness and creative performance. *Creativity Research Journal, 27*(2), 125–132.

Agnoli, S., Franchin, L., Rubaltelli, E., & Corazza, G. E. (2019). The emotionally intelligent use of attention and affective arousal under creative frustration and creative success. *Personality and Individual Differences, 142*, 242–248.

Agnoli, S., Mastria, S., Zanon, M., & Corazza, G. E. (2021, April 13). Dopamine supports idea originality: The role of spontaneous eye blink rate on divergent thinking. *PsyArXiv*. April 13. https://doi.org/10.31234/osf.io/rfgu4

Agnoli, S., Runco, M. A., Kirsch, C., & Corazza, G. E. (2018). The role of motivation in the prediction of creative achievement inside and outside of school environment. *Thinking Skills and Creativity, 28*, 167–176.

Agnoli, S., Zanon, M., Mastria, S., Avenanti, A., & Corazza, G. E. (2020). Predicting response originality through brain activity: An analysis of changes in EEG alpha power during the generation of alternative ideas. *NeuroImage, 207*, 116385.

Alissa, I. (1972). Stimulus generalization and over-inclusion in normal and schizophrenic subjects. *Journal of Clinical Psychology, 34*, 182–186.

Altshuller, G. (1984). *Creativity as an exact science*. Gordon and Breach.

Amabile, T. M. (1982). Social psychology of creativity: A consensual assessment technique. *Journal of Personality and Social Psychology, 43*, 997–1013.

Amabile, T. M. (1993). Motivational synergy: Toward new conceptualizations of intrinsic and extrinsic motivation in the workplace. *Human Resource Management Review, 3*(3), 185–201.

Beaty, R. E., & Johnson, D. R. (2021). Automating creativity assessment with SemDis: An open platform for computing semantic distance. *Behavior Research Methods, 53*(2), 757–780.

Boot, N., Baas, M., van Gaal, S., Cools, R., & De Dreu, C. K. (2017). Creative cognition anddopaminergic modulation of fronto-striatal networks: Integrative review and researchagenda. *Neuroscience & Biobehavioral Reviews, 78*, 13–23.

Botella, M., & Lubart, T. (2019). From dynamic processes to a dynamic creative process. In R. A. Beghetto & G. E. Corazza (Eds.), *Dynamic Perspectives on Creativity* (pp. 261–278). Springer.

Cattani, G., & Ferriani, S. (2008). A core/periphery perspective on individual creative performance: Social networks and cinematic achievements in the Hollywood film industry. *Organization Science, 19*(6), 824–844.

Corazza, G. E. (2016). Potential originality and effectiveness: The dynamic definition of creativity. *Creativity Research Journal, 28*(3), 258–267.

Corazza, G. E. (2019). The dynamic universal creativity process. In R. A. Beghetto & G. E. Corazza (Eds.), *Dynamic perspectives on* (pp. 297–319). Springer.

Corazza, G. E. (2020). Dynamic creative process. In M. Runco & S. Pritzker (Eds.), *Encyclopedia of creativity* (3rd ed., Vol. 1, pp. 400–405). Elsevier.

Corazza, G. E., & Agnoli, S. (Eds.). (2015). *Multidisciplinary contributions to the science of creative thinking.* Springer.

Corazza, G. E., & Agnoli, S. (2018). The creative process in science and engineering. In T. Lubart et al. (Eds.), *The creative process: Perspectives from multiple domains* (pp. 155–180). Palgrave Macmillan. https://doi.org/10.1057/978-1-137-50563-7_6

Corazza G. E., & Agnoli (2020). Personality: Openness. In Runco, M. A., & Pritzker, S. R. (Eds.), *Encyclopedia of creativity* (3rd ed., Vol. 2, pp. 338–344). Elsevier, Academic Press.

Corazza, G. E., Agnoli, S., & Martello, S. (2014). Counterpoint as a principle of creativity: Extracting divergent modifiers from The Art of Fugue by Johann Sebastian Bach. *Musica Docta, 4*, 93–105.

Corazza, G.E., Agnoli S., & Martello S. (2016). Introducing irrelevant information in the creative process: The DIMAI model for fashion design. In *Cultures, Fashion, and Society Notebooks 2015* (1–15). Pearson – Bruno Mondadori.

Corazza, G. E., Darbellay F., Lubart T., & Panciroli C. (2021a) Developing intelligence and creativity in education: Insights from the space–time continuum. In S. Lemmetty, K. Collin, V. P. Glăveanu, P. Forsman (Eds.), *Creativity and Learning*. Palgrave Studies in Creativity and Culture. Palgrave Macmillan. https://doi.org/10.1007/978-3-030-77066-2_4

Corazza, G.E., & Glăveanu, V. P. (2020). Potential in creativity: Individual, social, material perspectives, and a dynamic integrative framework. *Creativity Research Journal*, *32*(1), 81–91.

Corazza, G. E., & Lubart, T. (2019). Science and method: Henri Poincaré. In V. P. Glaveanu (Ed.), *The creativity reader* (pp. 33–47). Oxford University Press.

Corazza, G. E., & Lubart, T. (2020). The Big Bang of originality and effectiveness: A dynamic creativity framework and its application to scientific missions. *Frontiers in Psychology, 11*, 2472.

Corazza, G. E., & Lubart, T. (2021). Intelligence and creativity: Mapping constructs on the space-time continuum. *Journal of Intelligence, 9*(1), 1.

Corazza, G. E., Reiter-Palmon, R., Beghetto, R., & Lubart, T. (2021b). Intelligence and creativity in the space–time continuum for education, business, and development. *Journal of Creativity*, *31*, 100003.

Dunbar, K. (1995). How scientists really reason: Scientific reasoning in real-world laboratories. In R. Sternberg & J. Davidson (Eds.), *Mechanisms of insight* (pp. 365–395). MIT Press.

Ericsson, K., & Smith, J. (1991). Prospects and limits of the empirical study of expertise: An introduction. In K. Ericsson & J. Smith (Eds.), *Toward a general theory of expertise: Prospects and limits* (pp. 1–38). Cambridge University Press.

Finke, R. A., Ward, T. B., & Smith, S. M. (1992). *Creative cognition: Theory, research, and applications.* MIT Press.

Flaherty, A. W. (2005). Frontotemporal and dopaminergic control of idea generation and creative drive. *Journal of Comparative Neurology, 493*, 147–153.

Gilhooly, K. J. (2017). Incubation, problem solving and creativity. In L. J. Ball & V. A. Thompson (Eds.), *The Routledge International Handbook of Thinking and Reasoning* (pp. 204–217). Routledge.

Glaser, R., & Chi, M. (1988). Overview. In M. Chi, R. Glaser, & M. Farr (Eds.), *The nature of expertise* (pp. 15–28). Erlbaum.

Glăveanu, V. P. (2013). Rewriting the language of creativity: The Five A's framework. *Review of General Psychology, 17*(1), 69.

Glăveanu, V. P., & Gillespie, A. (2014). Creativity out of difference: Theorising the semiotic, social and temporal origin of creative acts. In V. P. Glăveanu, A. Gillespie, & J. Valsiner, (Eds.), *Rethinking Creativity* (pp. 25–39). Routledge.

Goddard, H. H. (1946). What is intelligence? *The Journal of Social Psychology, 24*(1), 51–69.

Guilford, J. (1967). Creativity: Yesterday, today, and tomorrow. *Journal of Creative Behavior, 1*, 3–14.

Hannemann, B. T. (2006). Creativity with dementia patients. *Gerontology, 52*(1), 59–65.

Johansson, M., & Messeter, J. (2005). Presenting the user: Constructing the persona. *Digital Creativity, 16*(04), 231–243.

Johnson, E. (1988). Expertise and decision under uncertainty: Performance and process. In M. Chi, R. Glaser, & M. Farr (Eds.), *The nature of expertise* (pp. 209–228). Erlbaum.

Karapapa, S. (2019) Post-it note. In: C. Op den Camp, and D. Hunter, D. (Eds.), *A History of Intellectual Property in 50 Objects* (pp. 329–335). Cambridge University Press.

Karwowski, M., & Kaufman, J. C. (Eds.). (2017). *The creative self: Effect of beliefs, self-efficacy, mindset, and identity*. Academic Press.

Khalil, R., Godde, B., & Karim, A. A. (2019). The link between creativity, cognition, and creative drives and underlying neural mechanisms. *Frontiers in Neural Circuits, 13*, 18.

Lubart, T. I. (2001). Models of the creative process: Past, present and future. *Creativity Research Journal, 13*(3–4), 295–308.

Lubart, T. I. (2017). The 7 C's of creativity. *The Journal of Creative Behavior, 51*(4), 293–296.

Lubart, T. I. (Ed.). (2018). *The creative process: Perspectives from multiple domains*. Springer.

Lubart, T., Zenasni, F., & Barbot, B. (2013). Creative potential and its measurement. International *Journal for Talent Development and Creativity, 1*(2), 41–50.

Martindale, C. (1999). Biological bases of creativity. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 137–152). Cambridge University Press.

Mastria, S., Agnoli, S., & Corazza, G. E. (2019). How does emotion influence the evaluation of creative ideas? *Plos One, 14*(7), e0219298.

Mastria, S., Agnoli, S., Zanon, M., Acar, S., Runco, M., & Corazza, G. E. (2021). Clustering and switching in divergent thinking: Neurophysiological correlates underlying flexibility during idea generation. *Neuropsychologia, 158*, 107890.

Mumford, M. D., Mobley, M. I., Reiter-Palmon, R., Uhlman, C. E., & Doares, L. M. (1991). Process analytic models of creative capacities. *Creativity Research Journal, 4*, 91–122.

Nijstad, B. A., De Dreu, C. K., Rietzschel, E. F., & Baas, M. (2010). The dual pathway to creativity model: Creative ideation as a function of flexibility and persistence. *European Review of Social Psychology, 21*(1), 34–77.

Poincaré, H. (1914). *Science and method*. Original archived at Cornell University Library.

Reilly, R. C. (2008). Is expertise a necessary precondition for creativity? A case of four novice learning group facilitators. *Thinking Skills and Creativity*, *3*(1), 59–76.

Reiter-Palmon, R., Forthmann, B., & Barbot, B. (2019). Scoring divergent thinking tests: A review and systematic framework. *Psychology of Aesthetics, Creativity, and the Arts, 13*(2), 144.

Reiter-Palmon, R., & Illies, J. J. (2004). Leadership and creativity: Understanding leadership from a creative problem-solving perspective. *The Leadership Quarterly, 15*(1), 55–77.

Rhodes, M. (1961). An analysis of creativity. *Phi Delta Kappan, 42*, 305–310.

Rosch, E. (1978). Principles of categorization. In E. Rosch & B. B. Lloyd (Eds.), *Cognition and categorization* (pp. 27–48). Lawrence Erlbaum.

Ross, W., & Vallée-Tourangeau, F. (2021). Microserendipity in the creative process. *The Journal of Creative Behavior, 55*(3), 661–672.

Runco, M. A., & Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal., 24*, 92–96.

Sawyer, R. K. (1999). The emergence of creativity. *Philosophical Psychology, 12*(4), 447–469.

Serrat, O. (2017). The SCAMPER technique. In O. Serrat (Ed.), *Knowledge Solutions* (pp. 311–314). Springer.

Simonton, D. K. (1996). Creative expertise: A life-span developmental perspective. In K. A. Ericsson (Ed.), *The road to expert performance: Empirical evidence from the arts and sciences, sports, and games* (pp. 227–253). Erlbaum.

Simonton, D. K. (2000). Creative development as acquired expertise: Theoretical issues and an empirical test. *Developmental Review, 20*, 283–318.

Sternberg, R. (1998). Abilities are forms of developing expertise. *Educational Researcher, 27*, 11–20.

Wallach, M. A., & Kogan, N. (1965). *Modes of thinking in young children: A study of the creativity–intelligence distinction.* Holt, Rinehart, and Winston.

Wallas, G. (1926). *The art of thought*. Harcourt Brace.

Zabelina, D. L., Colzato, L., Beeman, M., & Hommel, B. (2016). Dopamine and the creative mind: Individual differences in creativity are predicted by interactions between dopamine genesDAT and COMT. *PloS One, 11*(1), e0146768.

Creative Processes in Five Domains: Art, Design, Scriptwriting, Music and Engineering

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Keywords Creative process · Art · Design · Scriptwriting · Music · Engineering

In this chapter, we will compare five domains of creativity: art, design, scriptwriting, music, and engineering. For each domain, we will describe a current model of the process and then present the results of observations of a class of students doing a project in a training context. Finally, we will discuss how these fields are similar or different. Before starting, we will first review the specificities and generalities of creativity.

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1 Specificity–Domain Generality of Creativity

Creativity may be involved in several domains such as art, literature, science, music or everyday life. Baer (2010) argues that the skills that are necessary in one creative domain may not be the same as those that are necessary in another. He talks about "task specificity" (Baer, 1998). Some differences could even exist within one specific domain: for example, the skills necessary for making a sculpture might not be the same as those for making a painting. According to Baer, an individual might be very creative in one domain, but not necessarily in another. Following this view, the results obtained in research on general creativity might be partly wrong, or at least might not be valid in some domains.

Analysis of tasks is essential in order to identify the specific set of abilities, knowledge and traits involved in a particular activity, and the relative weights of these different factors. For example, in a creative writing task, processes such as divergent thinking, metaphor generation, accessing knowledge about story prototypes (scripts), evaluation and convergent thinking tend to be involved. The case of knowledge is especially clear: knowledge that may be useful in a particular task, such as creating a novel car design, may differ from the knowledge required in another task, such as finding new ways to increase productivity in a car assembly line. A person may have more knowledge in one domain than in another, which contributes to intra-individual differences in creativity across domains.

Creativity, and divergent thinking in particular, is relatively specific to one cognitive domain and one type of content (Baer, 1993, 1998, 1999, 2010). For example, Baer (1993, 1994) had children take part in creativity trials corresponding to different aspects: writing a poem, writing a story, making an oral presentation about a story, solving a mathematical puzzle, and making a collage. Results indicate very low correlations between dimensions ($r^2 < 5\%$). However, within a single individual, there exists some stability in performance when the trials are performed twice with a one-year interval. From the sum of his research, Baer (1998, 1999) concludes that the mechanisms underlying creativity and divergent thinking are task-specific.

Research on the domain specificity–domain generality of creativity shows that there are weak positive correlations across tasks. In studies in which people complete several creative thinking tasks from diverse domains, such as making a drawing, writing a story, proposing an idea for an advertisement and proposing solutions for societal problems, the correlations vary in general from 0.20 to 0.60, with a median value near 0.30 (Lubart & Guignard, 2004). Thus, there tends to be between 4 and 36% shared variance in creative performance across tasks, with about 10% on average. If two tasks from close domains, such as making a drawing and making a collage, are used the correlations tend to be in the 0.40 to 0.60 range. When nearly identical tasks are used, such as two story composition tasks that vary on the specified title for each of the stories, the correlations are stronger, tending toward 0.70 or 0.80 (50–60% shared variance) (Lubart & Sternberg, 1995). In an important study, Gray (1966) examined 2,400 historically eminent creative people and found that extremely few (2%) showed creative accomplishments in diverse domains, such

as art and literature, and only 17% of the sample showed creative work in related domains, such as painting and sculpture.

These observations argue in favor of creativity being partially domain and task specific. There is a gradient from general creativity which may be present to a small extent in every task that involves creativity, to a second, domain level of creative ability (such as visual arts creativity, design creativity, literary creativity, scientific creativity, business creativity, etc.) to a third more detailed level within such domains (such as sub-types of artistic creativity, e.g., drawing vs painting), to a fourth final level in which the task is defined completely, and the most specific components of creativity exist. Thus, it is essential to understand the combination of sub-processes involved in each particular task in order to predict and train creativity.

At this point, we can ask what is the nature of these specificities. It will be difficult to explain which is the cause but some keys can be identified: the cognitive and conative resources solicited vary according to the creative domain, as well the material used (figurative or verbal), the domain of application (art versus science, or more specifically biology versus physical science), and the creative process.

As we have already noted, analysis of tasks is essential in order to identify the specific set of abilities, knowledge and traits involved in a particular activity, and the relative weights of these different factors. First, to simplify, one can imagine classifying a priori the various categories of jobs on a continuum, starting with those requiring a low involvement of creativity (for example, security jobs) to those requiring a high level (for example, commercial artists, designers, R & D workers), passing through job categories for which creativity would be more or less implied in professional performance (for example, manufacturing and finding improvements with assembly line workers). However, this level of description is not satisfactory, and only a specific analysis of activity will lead to the form of creativity required for each kind of work, but also to the specific combination of aptitudes, knowledge and personality traits required for training purposes.

Several authors have taken an interest in comparing the personality of creative individuals depending on the domain of application. Baer (2012) underlines the link between some specific-domain as the arts and literature tend to show correlations between creativity in mental illness whereas no link was found in sciences Thus, according to Gardner (1971), problems encountered in science and in the arts are not identical from this point of view. For example, in the case of scientists, the scientist starts by formulating a hypothesis and then by verifying it; in the case of artists, on the other hand, the stage of conceptualizing a problem is completely meshed together with the stage of solving it. Piechowski (1999) points out the fact that scientists and artists work on different materials. Scientific creativity takes place “outside” of the individual in term of physical phenomena studied by science and also in terms of interactions between researchers and the outside environment (Latour & Woolgar, 1979); hence it is easy to analyse, identify and observe scientific phenomena. Yet, this effect is due more to the very nature of science than to that of the creative process of scientists. Artistic creativity, on the other hand, is related to the subjectivity of the creator. According to Piechowski, artists work with emotions and with human complexity.

Feist (1998) has also noted some differences between artists and scientists: artists tend to be more affect-driven, unstable in emotional terms, and antisocial, whereas scientists tend to be more conscientious. Domain-based analyses are therefore essential to identifying the set of skills, knowledge, and specific traits involved in a specific kind of creativity, and the relative weight of these various factors. For example, knowledge that might be useful in a particular task, such as designing a new car, might differ from the knowledge needed for another task, such as finding new ways to increase productivity in an automobile manufacturing line. A person might have more knowledge in one domain than in another, leading to within-subject differences in creativity across domains.

During many years, artists were considered as more divergent and scientists as more convergent (Berry, 2000; Gould, 2003; Wilson, 1998). However, recent researchers considered that the debate between art and science is over because, now, they have more in common than in the past. Williamson (2011) did not observe any significant differences on the cognitive skills of 51 art and 65 science students. Furnham et al. (2011) tested this hypothesis comparing 65 science students and 42 arts students. When age, gender, Extraversion and Openness were controlled, no difference was observed for divergent thinking fluency in a task of listing the maximum of consequences to unfamiliar events. When divergent thinking was evaluated by listing the maximum uses of objects, Furnham and collaborators did not find differences between 30 students form Natural Sciences (Chemistry, Biology, Physics, Medical Sciences and Mathematics), 30 students from Social Sciences (Psychology and Economics), and 30 students from Arts (Fashion, Fine Art and Design).

Finally, creativity might be organized following multiple levels (Fig. 1). We have presented a few examples for each level, without aiming for comprehensive coverage.

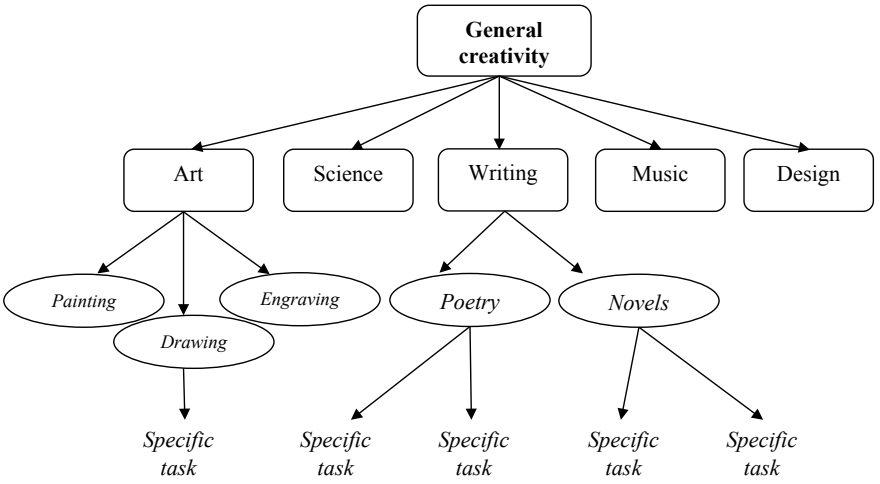

Fig. 1 Some examples of supposed "levels" of creativity

2 Specificity–Domain Generality of the Creative Process

In this section, some models of the creative process in art, design, scriptwriting, music and engineering will be presented with an example of observation in each domain. Based on the work of Glăveanu et al. (2013), who interviewed different experts in these five domains, a Creative process Report Diary (CRD, Botella et al., 2017) was constructed allowing self-observation of the creative process (Botella & Lubart, 2015). This CRD consisted of a structured self-report focused on stages of the creative process in which participants indicated their weekly progress. Thirteen stages of the creative process were considered in the CRD: definition of the problem, reflection, documentation, consideration of constraints, insight, associative thinking, divergent thinking, convergent thinking, the benefit from chance, implementation, finalization, judgment, and taking a break. All these stages were presented with a short definition (see Table 1) based on the interviews by Glăveanu et al. (2013). At each evaluation episode, students checked whether they had engaged in each stage during their project work. Each group of students completed the CRD at the end of each week while creating a production for one of their university or school classes.

Table 1 Description of the thirteen stages of the creative process used in the booklet material based on Glăveanu et al. (2013)

Stages	Description
Definition of the problem	To focus, to explore the theme, the aims, need to create, need to express, challenge
Reflection	To ask, to interact with the work, understand
Documentation	To capture and search for information, to be attentive, to always have the project in mind, to store information, to accumulate, to be impregnated, receptive, available, to observe, to show sensitivity and awareness
Consideration of constraints	To define constraints, to identify a customer's request, to set constraints for oneself and define one's rules and freedom
Insight	To have an idea, to experience the emergence, the sudden appearance of an idea
Associative thinking	Resonance, to play with forms, materials and significations, imagination, daydream, analogy
Divergent thinking	To try, modify, manipulate, and test
Convergent thinking	To crystallize, to make a prototype, to visualize and structure, to establish order, sequence, to control and organize
The benefit of chance	The luck of the environment, aleatory processes, to be open to chance, to take a walk, to accept accidents and chaos
Implementation	To transpose, make, illustrate, produce, compose, give shape, apply
Finalization	To edit, develop, complete, justify, explain one's work, exhibit
Judgement	To be self-critical, to stand back, to analyze, check the quality of a result
Taking a break	To rest, to digest an idea, to let time pass, to do something else

2.1 Art

The works of great artists such as Michelangelo, Leornardo Da Vinci, and Picasso have long been the subject of study in terms of psychological processes (Piirto, 1992). The artist must not simply aim to produce work that is more imaginative or inventive than that of others, but must create an active object that interacts with the viewer at the psychological level. In line with the multivariate approach to creativity (Lubart, 1999), research has identified certain factors that play a role in artistic creativity, such as personality traits of openness, individualism, and non-conformity (Feist, 1998). Other authors such as Silvia (2005) or Newton (2013) have highlighted the importance of emotional information processing in creative artistic work.

In terms of research on the creative process in art, Patrick (1937) conducted an early observational study on artistic phases of work. Mace and Ward (2002) proposed a specific model of the creative process of art making; based on interviews of professional artists, involving: (1) *conception* in which the artist identifies an idea or a feeling; (2) *idea development* in which the artist works to structure and restructure the idea, (3) *making* the work and idea development in which the artist transforms the idea into a "physical entity"; and (4) *finishing* the work, in which the artist evaluates the production. In addition, this model proposes several sub-stages. For instance, the second stage included structuring, enriching, restructuring and evaluating of ideas which are managed by another sub-stage called decision making. Mace and Ward proposed a cyclical model in which the end of the creative process could contribute to a new creative process; Finishing one work could generate new ideas for another, and consequently, a new creative process is engaged to explore these news possibilities. Getzels and Csikszentmihalyi (1976) found that artistic creativity is related to time spent in an exploratory phase before starting to draw. In a field study of ink painters, Yokochi and Okada (2005) observed that the painter formed a global picture with each successive element. The painter had a partial image in his head and each line drawn constrains other lines. In this way the ink paint seemed to be a set of many successive pictures where each picture needed its own art process.

To illustrate the creative process in this domain, 27 undergraduate art students in their third year at a French art university (21 females, 6 males, $m = 22.75$ years, $sd = 1.16$ years, age range: 21–25 years) had one semester—12 weeks—to create freely a work of art. This task was given by the art university and not by the research team. At the end of each week, students had to complete a page of the CRD on the stage(s) of the creative process they engaged in during that session. Most students completed the CRD in class but some of them preferred to complete it at home. The graphical representation of their creative process is presented in Fig. 2. The artistic creative process appears dynamic, as already shown in a previous study (Botella et al., 2011), with non-linear transitions between the stages, possible feedback between the stages and the option to skip a specific stage.

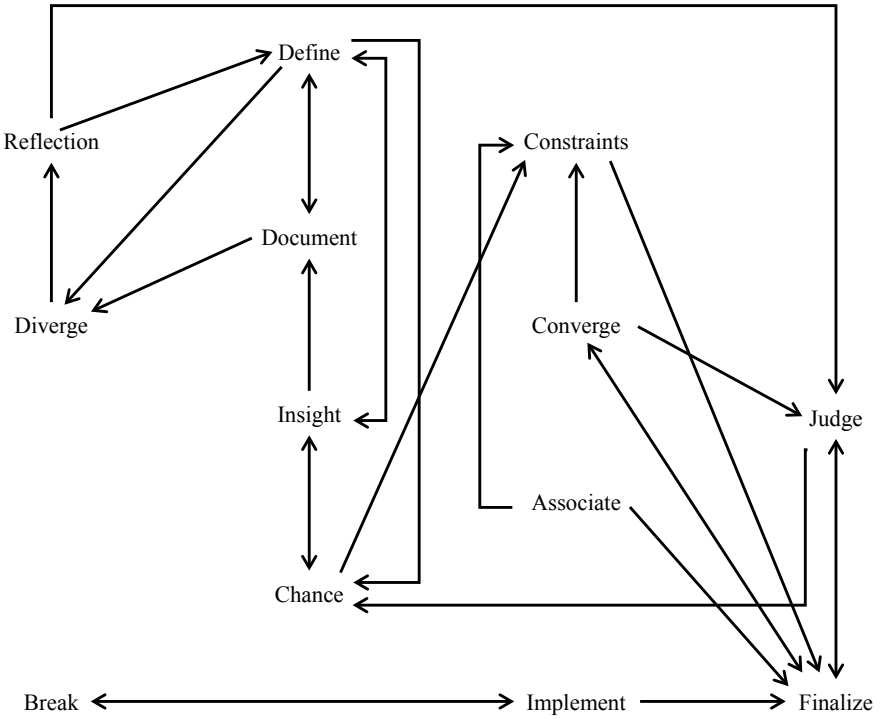

Fig. 2 A representation of the creative process in art

2.2 Design

Design, the creation of new artefacts that meet certain requirements or constraints, has been examined in several studies (Bonnardel, 2006). Design covers a range of activities such as creating household objects (e.g., kitchenware, furniture) and architectural constructions (e.g., interior design). A main characteristic of creative design tasks is that the initial state is "ill structured" (Simon, 1973, 1995). Thus, the designer's mental representation is, initially, incomplete and imprecise. The designer's mental representation evolves as problem solving progresses and the search space of potential solutions is progressively restricted until the designer reaches a design solution that is considered as satisfying with regard to certain criteria. Thus, a co-evolution of problem and solution spaces can be observed (Dorst & Cross, 2001). This specificity of design problems has also been described as based on an iterative dialectic between problem-framing and problem-solving (Rittel & Webber, 1984; Simon, 1995). The seminal study of Hayes-Roth and Hayes-Roth (1979) and later research (see Bonnardel et al., 2003; Visser, 1990) provided arguments in favour of an opportunistic organization of design activities, though they possibly include hierarchical

episodes. For instance, opportunistic decisions lead to reconsidering previous decisions or postponing certain decisions. All these characteristics are also explained by a "reflective conversation" between the designer and the external representations of the artefact, consisting, for instance, in sketches or drawings (see Schön & Wiggings, 1992). Sketches allow designers to express or "externalize" their ideas and they also support visual reasoning. According to Tversky (1999), this last cognitive process establishes relationships between knowledge in long-term memory and knowledge based on perception. In addition, Goldschmidt (1991, 1994) describes two functions of sketches: they allow designers to see visual and graphical properties of their sketches ("to see that") as well as to develop interpretative processes in order to see more than what is strictly represented ("to see as").

Concerning, more precisely, the emergence of creativity in design, observations of real-world creative design situations suggest that new ideas are inspired by old situations pertaining or not to the same conceptual domain as the current creative context (see, for instance, Bonnardel, 2000). In line with such observations, the A-CM—Analogy and Constraint Management—model (Bonnardel, 2000, 2006) points out the role of two main cognitive processes that continuously interact during the design activity and can have opposite effects: (a) *analogy-making*, which may lead designers to extend or "open up" their "space of research" of new ideas; and (b) the *management of constraints*, which orients design problem solving and allows designers to progressively set boundaries to their research space until they find a design solution that is both new and adapted to various constraints. In line with this view, design creativity has been described as based on the activation and recombination in a new way of previous knowledge elements in order to generate new properties based on the previous ones (Ward & Sifonis, 1997; Ward et al., 1997). One of the current gaps in the literature on design is to situate the psychological mechanisms involved in design creativity with respect to those involved in artistic creativity and scientific creativity, as design appears to exist at the interface of these kinds of activities.

Twenty seven design students in their second year at a design school (18 females, 9 males, $m = 23.18$ years, $sd = 4.79$ years, age range: 20–25 years) had 7 weeks to create individually a graphic poster on a given topic: answering a brief about an event called "Green-Box", promoting an ecological approach to packaging. They completed the CRD at least 10 times. They used the CRD typically at the design school, during classes, but had also the option of completing it at home. The graphical representation of their creative process is presented in Fig. 3. The stages are placed in the same order than the graphical representation of art students but the transitions between the stages are quite different. For example, the consideration of constraints stage came after the chance, association and convergence stages for art students, whereas for design students, this consideration of constraints stage comes after an insight or pause.

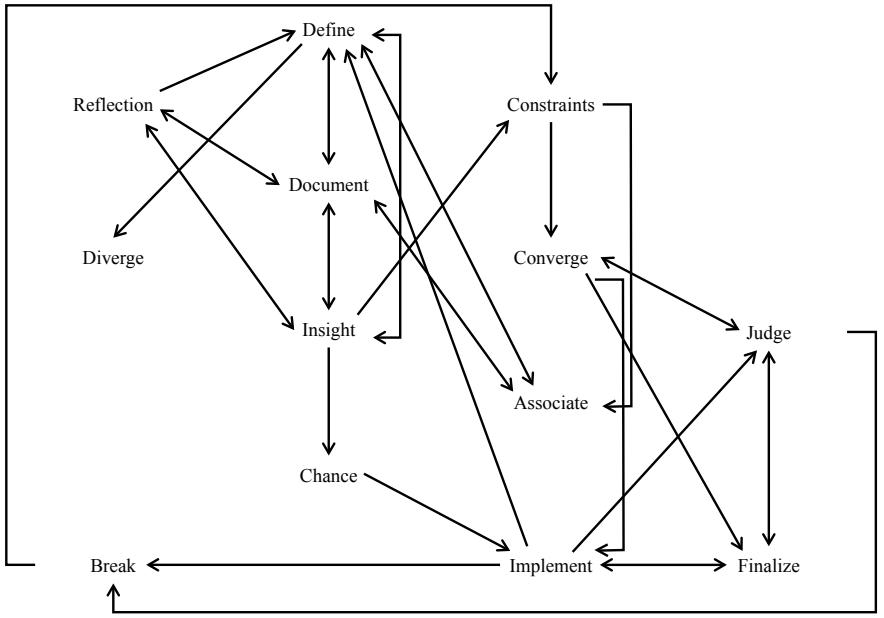

Fig. 3 A representation of the creative process in design

2.3 Literary Creation/Scriptwriting

Case studies of writers have been an important source of information in the field of text-based analyses, in particular since authors in the late nineteenth century (ex. G. Flaubert, V. Hugo) saved their working drafts. In the 1970s, *genetic criticism* developed in the literary field to explore the writing process, the generation of texts rather than the characteristics of the final document. This text-based methodology examines the author's search for relevant information on a topic, preparatory writing, the generation of the text, editing and revising. Two main strategies for literary creation have been found: (a) planned composition, in which scenario generation, notes, documentary research are essential steps and text generation is oriented; and (b) free writing, in which the text is constructed as one writes, without an explicit plan. These modes of writing can be mixed and are analyzed in terms of pre-writing, composition, pre-editing, and editing phases.

This methodology, developed and used to examine eminent authors' literary creations, has remained relatively distinct from work in psychology with novice or professional writers, Empirical studies have begun to identify the cognitive and personality characteristics associated with literary creation in "everyday" populations (see Lubart, 2009). For example, in one study the role of author's evaluations during the task of composing a short story was monitored. A relatively high level of creativity was associated with critical, evaluative thinking very early in the compositional work.

Baer (1996) has tested the impact of training for a divergent thinking task in literature. The task consists of providing as many words as possible that are related to a target word. An experimental group of 79 children took part in a specific training program, where it is suggested, for example, to think about words that rhyme with the target word. All participants, whether they took part in this training program or not (control group), were then invited to write a poem and a story. Results showed that this training exerted a great impact on writing a poem.

Research on literary creativity may extend to the task of scenario-writing. Interviews with scriptwriters have underlined the complexity of this creative process by the identification of distinct but interrelated stages starting with a stage of impregnation, followed by a formal stage of structuring and finishing with an intense period of writing and rewriting the script (Bourgeois-Bougrine et al., 2014). To illustrate this process, 6 students[1] of scriptwriting and filmmaking studies in Paris (4 females, 2 males, age range: 23 and 28 years) had 8 weeks to create a script starting from a common theme: "A 19 years old woman was found dead, murdered by eight knife stabs, in the nave of Notre Dame". The first four weeks were dedicated to collective work and run by a professional scriptwriter to help students produce several alternatives and sketch out a general plan or outline. The last 4 weeks were devoted to the individual writing of the script. The graphical representation of their creative process is presented in Fig. 4. For example, the consideration of constraints stage comes after the definition of the problem, the reflection about the project and the documentation whereas for art students, this stage comes after chance, association and convergence stages, and for design students, this stage comes after an insight or pause.

2.4 Musical Composition

The lives of eminent creative musicians such as Bach, Mozart, Beethoven have received attention for centuries, however the empirical study of creative thinking in music started only to develop during the last four decades. Most of the literature on this topic is in the field of musical education (Webster, 1990), improving assessment and theory on musical creative thinking (Barbot & Lubart, 2012). Consistent with the multivariate approach to creativity (Lubart, 1999), results on musical creativity suggest the importance of distinct but interrelated resources: notably cognitive abilities, psychological traits, and features of the environment. Among the individual factors contributing to musical creativity, musical divergent thinking plays a leading role. Intrinsic motivational orientation is related significantly to relatively high musical creativity scores (Eisenberg & Thompson, 2003), whereas extrinsic motivational orientation is related to relatively low creative performance in music composition. Among the personality traits studied by Swanner (1985), excitability, aggressiveness, independence, anxiety, self-confidence, and curiosity

[1] The small size of the sample is linked to the limited number of students enrolled. Six is in an entire cohort.

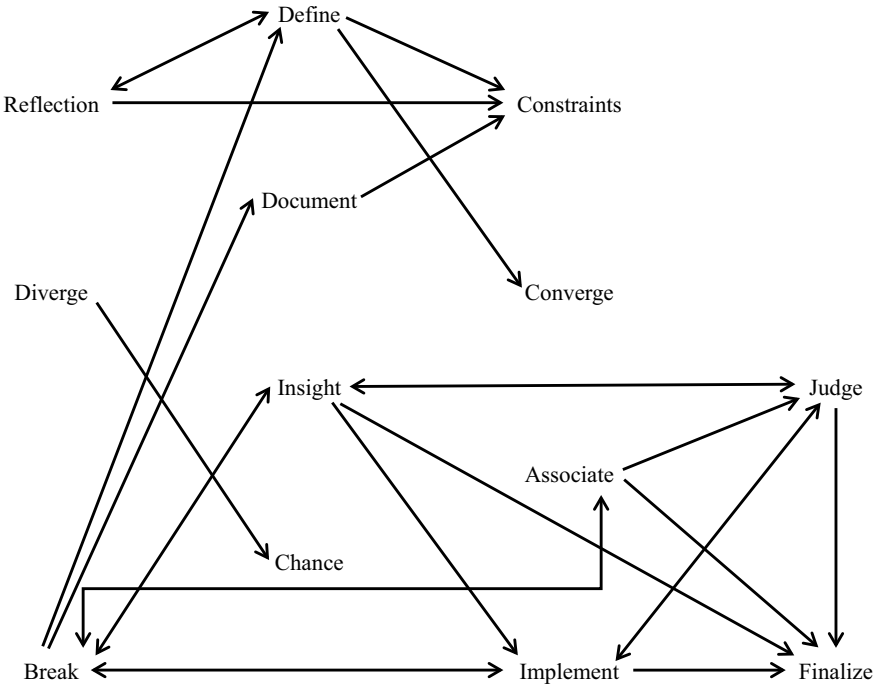

Fig. 4 A representation of the creative process in scriptwriting

were significantly related to musical creativity. From an intercultural point of view, Campbell and Teicher (1997) examined the characteristics of musical creativity in non-western countries and found that improvisation dominates the creative process and product, suggesting a potential important role of the cultural environment. Family environment also proved to be an important environmental factor for musical achievement (Zdzinski, 1992) and creativity.

The creative process in musical composition has also received attention (e.g. Carlin, 1997; Gromko, 1996; Van Ernst, 1993), especially concerning creative composition processes. Significant relations were found between problem-finding behaviors (such as exploring instrument capabilities) and the creative nature of the productions in music (see Barbot & Lubart, 2012). Traditionally, the analysis of the creative process in musical composition is based on Wallas' (1926) model which applies to all creative fields. Graf (1947) applied this model to composing music—productive mood (preparation), musical conception (incubation), sketching (illumination), and composition (verification). Kratus (1989) proposed the processes of exploration (sound experimentation with the instruments presented), development (referring to musical variations), repetition (in which the individual replays exactly the same musical segment during a process of exploration) and silence (which could relate to incubation).

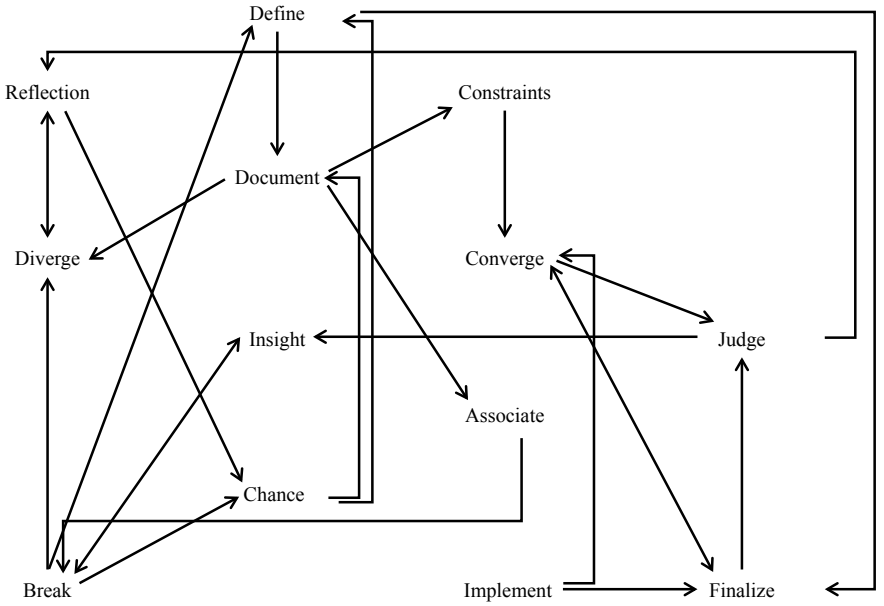

Fig. 5 A representation of the creative process in musical composition

To illustrate the creative process in this domain, 5 music students (1 female, 4 males, $m = 21.06$ years, $sd = 0.55$ years, age range: 21–22 years) had 6 weeks to create a piece of acoustic music. The graphical representation of their creative process is presented in Fig. 5. Here, the consideration of constraints stage appears after the documentation as in the literacy process but the transitions compared to other domains are different.

2.5 Engineering

Scientific creativity concerns a large number of fields, ranging from the hard sciences (physics, chemistry), to life sciences (biology, medicine) to human and social sciences (psychology, sociology). The term "scientific creativity" encompasses engineering sciences and the inventive process as well. The most in-depth work has been case studies of the notebooks of famous scientists and inventors, such as extensive studies of Charles Darwin, Thomas Edison, Albert Einstein and others. These case studies have suggested specific kinds of thinking that seem to favour the emergence of creative theories, inventions, and discoveries. Charles Darwin, for example, used a chain of analogies to lead him to the theory of evolution of species. Some of these creativity heuristic mechanisms were modelled in artificial intelligence computational systems that were able to "re-discover" basic scientific laws such as Kepler's

and Bacon's fundamental discoveries. In terms of empirical laboratory observations, Ward et al. (1999) in a series of studies examined the cognitive processes involved in tasks requiring people to invent new machines from a given set of mechanical parts. This work was conducted within the creative cognition approach, described earlier, and showed how exploratory pre-inventive thought processes and generative processes for idea specification were both involved in the technical inventive process. This seminal work was conducted, however, with participants who were novices in the scientific-technical field. The tasks involved relatively simple technical constructions. The main gap in the literature on scientific-inventive creativity concerns the vast intermediate population of scientists and future scientists, spanning students in scientific-engineering schools to active scientists who have not (yet) achieved as eminent a status as Charles Darwin.

Based on research with science-engineering students and engineers, Shaw (1989, 1994) proposed a cyclical and dynamic model in five stages. In this first phase, called *immersion,* the problem is posed. Then *incubation* follows with unconscious associations of ideas in which solutions begin to form. Shaw considers that these two phases are not independent but mixed. Next, *illumination* occurs and ideas become conscious and accessible. The engineers *explain* their idea and realize a *creative synthesis* by producing it. These two stages are also mixed.

The model proposed here is dynamic; at each stage, it is possible to return to the previous stage. Furthermore, this model is circular. The *validation* of the production leads to a new creative process. According to Shaw, there are two kinds of validation: personal validation and collective validation. Personal validation consists of estimating the work and using the experience acquired during the process to generate a new creative process whereas collective validation concerns the evaluation of the production by peers, public or critics. This validation can lead to a new process only if the creator accepts the evaluation; the comments of the public must be recognized to engage a new creative process.

To illustrate the creative process in this domain, 27 engineering science students in their fifth year at an engineering school (4 females, 23 males) had 10 sessions distributed over 8 weeks. They were asked to propose six different layouts for a functional kitchen located in a campervan. From these, two were short-term implementation projects (<1 year), two were medium-term and two were long-term projects (>10 years). The layouts had to respect a set of technical constraints, defined in advance. Students completed the CRD after each session. The graphical representation of their creative process is presented in Fig. 6. Exactly as in literacy/scriptwriting field, in engineering, the consideration of constraints stage comes after the definition of the problem, the reflection about the project and the documentation (as in musical field too for this last stage), whereas this stage comes after other stages in art (chance, association and convergence) and design fields (insight or pause).

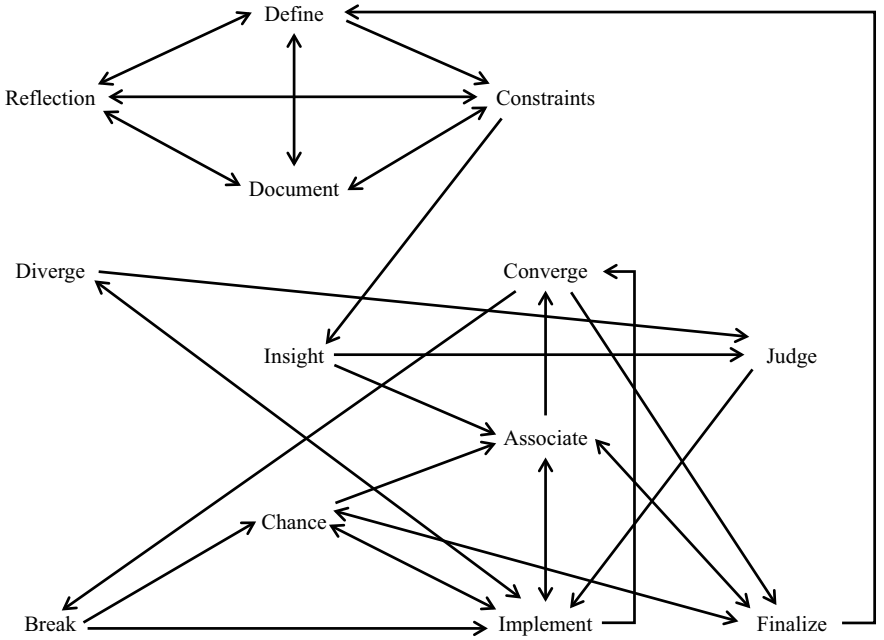

Fig. 6 A representation of the creative process in engineering

3 Comparison of All Five Domains and Conclusion

These models, and more specifically the graphical representations illustrating each creative domain, have highlighted the existence both of transitions that are common to all domains, and of transitions that are specific to each domain (see Table 2). Hence, the stages of reflection and documentation lead frequently to definition in almost all domains, and the definition stage interacts with the documentation stage. Similarly, associative thinking, convergent thinking, implementation and judgment lead mainly to a finalization stage. However, some of the stages interact with each other, such as convergent thinking that leads to judgment. Moreover, the stage of finalization interacts with judgment, such as implementation and breaks that are both linked to it by a double arrow.

Beyond these shared features, it is interesting to note the specific features of each creative domain. Whereas the definition stage leads to insight in art students and design students, it leads to reflection and consideration of the constraints in engineering and scriptwriting students. Again, in art and design students, insight leads to documentation and chance whereas it leads to judgment for engineering and scriptwriting students.

It is interesting to note that the diversity of the models described in this chapter could be due to the domain-specificity and also to the specificity of the participants. Some models were built on experts and others on students. At this point of the

Table 2 Frequency of the stages and resume of the transitions between stages of the creative processes for art, design, scriptwriting, music and engineering

	Art	Design	Scriptwriting	Music	Engineering
Definition of the problem	**Documentation**, *insight*, chance	**Documentation**, *insight*, associative and divergent thinking	*Reflection*, *constraints*, convergent thinking	**Documentation**, finalization	*Reflection*, **documentation**, *constraints*
Reflection	**Definition**, judgement	**Definition**, *documentation*, insight	**Definition**, *constraints*	Divergent thinking, chance	**Definition**, *documentation*, *constraints*
Documentation	**Definition**, *divergent thinking*	**Definition**, *reflection*, insight, *associative thinking*	**Definition**, *constraints*	*Associative* and *divergent thinking*	**Definition**, *reflection*, *constraints*
Consideration of constraints	Finalization	Associative and *convergent thinking*		*Convergent thinking*	Reflection, documentation, insight
Insight	Definition, *documentation*, *chance*	Reflection, *documentation*, constraints, *chance*	Implementation, finalization, *judgement*, *breaks*	*Breaks*	Associative thinking, *judgement*
Associative thinking	Constraints, **finalization**	Definition, Documentation	**Finalization**, judgement, breaks	Insight	Convergent thinking, implementation, **finalization**
Divergent thinking	*Reflection*		Chance	*Reflection*, constraints	Implementation, judgement,
Convergent thinking	Constraints, **finalization**, **judgement**	Implementation, **finalization**, **judgement**		**Finalization**, **judgement**	**Finalization**, break
Benefit from chance	Constraints, insight	*Implementation*		Definition, documentation	Associative thinking, *implementation*, finalization
Implementation	**Finalization, break**	Definition, **finalization**, *judgement*, **break**	**Finalization**, *judgement*, **breaks**	*Convergent thinking*, **finalization**	Associative, divergent and *convergent thinking*, chance
Finalization	**Judgement**, *convergent thinking*	Implementation, **judgement**		*Convergent thinking*, **judgement**	Definition, associative thinking, chance
Judgement	Chance, **Finalization**	Convergent thinking, **finalization**, break	*Insight*, *implementation*, **finalization**	Documentation, *insight*	*Implementation*
Taking breaks	**Implementation**	Constraints	*Definition*, documentation, *insight*, associative thinking, **implementation**	*Definition*, *insight*, divergent thinking, *chance*	*Chance*, **implementation**,

Note In bold, transitions similar in at least three domains; in italics, transitions similar in two domains; in normal text, transitions specific to each domain

research, it is too early to determine if the creative process will be different according to the expertise level. Finally, the educability of creativity based on these models needs to be test in future research. Is it possible to improve the artistic creative process of participants by inviting them to follow these transitions?

References

Baer, J. (1993). *Creativity and divergent thinking: A task-specific approach*. Lawrence Erlbaum Associates Inc.

Baer, J. (1994). Divergent thinking is not a general trait: A multidomain training experiment. *Creativity Research Journal, 7*, 35–46. https://doi.org/10.1080/10400419409534507

Baer, J. (1996). The effects of task-specific divergent-thinking training. *Journal of Creative Behavior*, *30*(3), 183–187. https://doi.org/10.1002/j.2162-6057.1996.tb00767.x

Baer, J. (1998). The case for domain specificity of creativity. *Creativity Research Journal, 11*(2), 173–177. https://doi.org/10.1207/s15326934crj1102_7

Baer, J. (1999). Domains of creativity. In M. A. Runco & S. R. Pritzker (Eds.), *Encyclopedia of creativity* (Vol. 1, pp. 591–596). Academic Press.

Baer, J. (2010). Is creativity domain specific? In J. C. Kaufman, and R. J. Sternberg (Eds.), *The Cambridge handbook of creativity* (pp. 321–341). Cambridge University Press. https://doi.org/10.1017/CBO9780511763205.021

Baer, J. (2012). Domain specificity of creativity: Implications for early childhood education. In O. N. Saracho (Ed.), *Contemporary perspectives on research in creativity and early childhood education* (pp. 45–62). IAP-Information Age Publishing.

Barbot, B., & Lubart, T. (2012). Creative thinking in music: Its nature and assessment through musical exploratory behaviors. *Psychology of Aesthetics, Creativity, and the Arts, 6*(3), 231. https://doi.org/10.1037/a0027307

Berry, W. (2000). Life is a miracle. *Communio-Spokane then Washington, 27*(1), 83–97.

Bonnardel, N. (2000). Towards understanding and supporting creativity in design: Analogies in a constrained cognitive environment. *Knowledge-Based Systems, 13*, 505–513. https://doi.org/10.1016/S0950-7051(00)00067-8

Bonnardel, N. (2006). *Créativité et conception. Approches cognitives et ergonomiques*. Solal Editions.

Bonnardel, N., Lanzone, L., & Sumner, S. (2003). Designing web sites: Opportunistic actions and cognitive effort of lay-designers. *Cognitive Science Quarterly, 3*, 25–56.

Botella, M., & Lubart, T. (2015). Creative processes: Art, design and science. In S. Agnoli & G. E. Corazza (Eds.), *Multidisciplinary contributions to the science of creative thinking* (pp. 53–65). Springer.

Botella, M., Nelson, J., & Zenasni, F. (2017). It is time to observe the creative process: How to use a Creative process Report Diary (CRD). *Journal of Creative Behavior*. https://doi.org/10.1002/jocb.172

Botella, M., Zenasni, F., & Lubart, T. I. (2011). A dynamic and ecological approach to the artistic creative process in arts students: An empirical contribution. *Empirical Studies of the Arts, 29*(1), 17–38. https://doi.org/10.2190/EM.29.1.b

Bourgeois-Bougrine, S., Glăveanu, V., Botella, M., & Lubart, T. (2014). The creativity maze: Exploring creativity in screenplay writing. *Psychology of Aesthetics, Creativity, and the Arts, 8*(4), 384–399. https://doi.org/10.1037/a0037839

Campbell, P. S., & Teicher, J. (1997). Themes and variations on the creative process: Tales of three cultures. *Research Studies in Music Education, 8*, 29–41. https://doi.org/10.1177/1321103X9700800104

Carlin, J. (1997). Music preferences for compositions by selected students aged 9–15 years. *Bulletin of the Council for Research in Music Education, 133*, 9–13.
Dorst, K., & Cross, N. (2001). Creativity in the design process: Co-evolution of problem-solution. *Design Studies, 22*, 425–437. https://doi.org/10.1016/S0142-694X(01)00009-6
Eisenberg, J., & Thompson, W. F. (2003). A matter of taste: Evaluating improvised music. *Creativity Research Journal, 15*(2), 237–296. https://doi.org/10.1080/10400419.2003.9651421
Feist, G. J. (1998). A meta-analysis of personality in scientific and artistic creativity. *Personality and Social Psychology Review, 2*(4), 290–309. https://doi.org/10.1207/s15327957pspr0204_5
Furnham, A., Batey, M., Booth, T. W., Patel, V., & Lozinskaya, D. (2011). Individual difference predictors of creativity in Art and Science students. *Thinking Skills and Creativity, 6*, 114–121. https://doi.org/10.1016/j.tsc.2011.01.006
Gardner, H. (1971). Problem-solving in the arts and sciences. *Journal of Aesthetic Education, 5*(1), 93–113. https://doi.org/10.2307/3331579
Getzels, J. W., & Csikszentmihalyi, M. (1976). *The creative vision: A longitudinal study of problem finding in art*. Wiley.
Glăveanu, V., Lubart, T., Bonnardel, N., Botella, M., de Biaisi, M.-P., Desainte-Catherine, M., Georgsdottir, A., Guillou, K., Kurtag, G., Mouchiroud, C., Storme, M., Wojtczuk, A., & Zenasni, F. (2013). Creativity as action: Findings from five creative domains. *Frontiers in Psychology, 4*. https://doi.org/10.3389/fpsyg.2013.00176
Goldschmidt, G. (1991). The dialectics of sketching. *Creativity Research Journal, 4*, 123–143. https://doi.org/10.1080/10400419109534381
Goldschmidt, G. (1994). On visual design thinking: The vis kids of architecture. *Design Studies, 19*, 389–430. https://doi.org/10.1016/0142-694X(94)90022-1
Gould, S. J. (2003). *The hedgehog, the fox, and the magister's pox*. Vintage.
Graf, M. (1947). *From Beethoven to Shostakovich: The psychology of the composing process*. Philosophical Library.
Gray, C. E. (1966). A measurement of creativity in Western civilization. *American Anthropologist, 68*, 1384–1417. https://doi.org/10.1525/aa.1966.68.6.02a00030
Gromko, J. E. (1996). In a child's voice: An interpretive interaction with young composers. *Bulletin of the Council for Research in Music Education, 128*, 37–51.
Hayes-Roth, B., & Hayes-Roth, F. (1979). A cognitive model of planning. *Cognitive Science, 3*(4), 275–310. https://doi.org/10.1016/S0364-0213(79)80010-5
Kratus, J. (1989). A time analysis of the compositional processes used by children aged 7 to 11. *Journal of Research in Music Education, 37*(1), 5–20. https://doi.org/10.2307/3344949
Latour, B., & Woolgar, S. (1979). *Laboratory life: The social construction of scientific facts*. Sage.
Lubart, T. I. (1999). Componential models. In M. A. Runco, and S. R. Pritzker (Eds.), *Encyclopedia of creativity* (Vol. 1, pp. 295–300). Academic Press.
Lubart, T. I. (2009). In search of the writer's creative process. In S. B. Kaufman & J. C. Kaufman (Eds.), *The psychology of creative writing* (pp. 149–165). Cambridge University Press.
Lubart, T., & Guignard, J. (2004). The generality-specificity of creativity: A multivariate approach. In R. J. Stemberg, E. L. Grigorenko, & J. L. Singer (Eds.), *Creativity: Front potential to realization* (pp. 43–56). American Psychological Association.
Lubart, T. I., & Sternberg, R. J. (1995). An investment approach to creativity: Theory and data. In S. M. Smith, T. B. Ward, and R. A. Finke (Eds.), *The creative cognition approach* (pp. 271–302). MIT Press.
Mace, M.-A., & Ward, T. (2002). Modeling the creative process: A grounded theory analysis of creativity in the domain of art making. *Creativity Research Journal, 14*(2), 179–192. https://doi.org/10.1207/S15326934CRJ1402_5
Newton, D. P. (2013). Moods, emotions and creative thinking: A framework for teaching. *Thinking Skills and Creativity, 8*, 34–44. https://doi.org/10.1016/j.tsc.2012.05.006
Patrick, C. (1937). Creative thought in artists. *Journal of Psychology, 4*, 35–73. https://doi.org/10.1080/00223980.1937.9917525

Piechowski, M. M. (1999). Overexcitabilities. In M. A. Runco & S. R. Pritzker (Eds.), *Encyclopedia of creativity* (Vol. 2, pp. 325–334). Academic Press.
Piirto, J. (1992). *Understanding those who create*. Ohio University Press.
Rittel, H., & Webber, M. M. (1984). Planning problems are wicked problems. In N. Cross (Ed.), *Developments in design methodology* (pp. 135–144). John Wiley & Sons Inc.
Schön, D. A., & Wiggings, G. (1992). Kind of seeing and their functions in designing. *Design Studies, 13*(2), 135–156. https://doi.org/10.1016/0142-694X(92)90268-F
Shaw, M. P. (1989). The eureka process: A structure for the creative experience in science and engineering. *Creativity Research Journal, 2*(4), 286–298. https://doi.org/10.1080/10400418909534325
Shaw, M. P. (1994). Affective components of scientific creativity. In M. P. Shaw & M. A. Runco (Eds.), *Creativity and affect* (pp. 3–43). Ablex Publishing.
Silvia, P. J. (2005). Emotional responses to art: From collation and arousal to cognition and emotion. *Review of General Psychology, 9*(4), 342–357. https://doi.org/10.1037/1089-2680.9.4.342
Simon, H. A. (1973). The structure of ill structured problems. *Artificial Intelligence, 4*(3–4), 181–201. https://doi.org/10.1016/0004-3702(73)90011-8
Simon, H. A. (1995). Problem forming, problem finding and problem solving in design. In A. Collen & W. Gasparski (Eds.), *Design & systems* (pp. 245–257). Transaction Publishers.
Swanner, D. L. (1985). Relationships between musical creativity and selected factors, including personality, motivation, musical aptitude, and cognitive intelligence as measured in third grade children. *Dissertation Abstracts International, 46*(12), 3546A.
Tversky, B. (1999). What does drawing reveal about thinking? In J. S. Gero, and B. Tversky (Eds.), *Visual and spatial reasoning in design* (pp. 93–101). Key Center of Design Computing and Cognition.
Van Ernst, B. (1993). A study of the learning and teaching processes of non-naive music students engaged in composition. *Research Studies in Music Education, 1*(1), 22–39. https://doi.org/10.1177/1321103X9300100104
Visser, W. (1990). More or less following a plan during design: Opportunistic deviations in specification. *International Journal of Man-Machine Studies, 33*(3), 247–278. https://doi.org/10.1016/S0020-7373(05)80119-1
Wallas, G. (1926). *The art of thought*. Harcourt, Brace and Company.
Ward, T. B., & Sifonis, C. (1997). Task demands and generative thinking: What changes and what remains the same? *Journal of Creative Behavior, 31*(4), 245–259. https://doi.org/10.1002/j.2162-6057.1997.tb00797.x
Ward, T. B., Smith, S. M., & Vaid, J. (1997). Conceptual structures and processes in creative thought. In T. B. Ward, S. M. Smith, & J. Vaid (Eds.), *Creative thought: An investigation of conceptual structures and processes* (pp. 1–27). American Psychological Association.
Ward, T. B., Smith, S. M., & Finke, R. A. (1999). Creative cognition. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 189–212). Cambridge University Press.
Webster, P. (1990). Creativity as creative thinking. *Music Educators Journal, 76*(9), 22–28. https://doi.org/10.2307/3401073
Williamson, P. (2011). The creative problem solving skills of arts and science students. The two cultures debate revisited. *Thinking Skills and Creativity, 6*(1), 31–43. https://doi.org/10.1016/j.tsc.2010.08.001
Wilson, E. O. (1998). *Consilience*. Little, Brown and Company.
Yokochi, S., & Okada, T. (2005). Creative cognitive process of art making: A field study of a traditional Chinese ink painter. *Creative Research Journal, 17*(2&3), 241–255. https://doi.org/10.1080/10400419.2005.9651482
Zdzinski, S. F. (1992). Relationships among parental involvement, music aptitude, and musical achievement of instrumental music students. *Journal of Research in Music Education, 40*(2), 114–125. https://doi.org/10.1080/10400419.2005.9651482

Creative Collaboration in Groups

Julien Nelson and Jérôme Guegan

Keywords Creativity · Small groups · Social identity brainstorming · Production loss · Electronic brainstorming · Virtual environments

1 Introduction

Before undertaking a survey of such a broad topic as creative cooperation in small groups, one should probably begin by clarifying the terminology used. *Creativity* is often defined as the ability to produce work that is both novel and adapted to task constraints (Amabile, 1996; Sternberg & Lubart, 1999). Groups, in turn, are defined as "*a collective of persons whose history of shared fate, common purpose and interaction has led to the perception, by participants and outsiders alike, that this collective is a social unit*" (Kerr et al., 2000, p. 160). *Collaboration* refers to a specific type of work organization where group members are mutually dependent on each other to complete creative tasks—not just because they share the same pool of limited resources, but also because they manipulate mutually interdependent objects (Schmidt, 1994), or because they may share the same social identity and are sometimes involved in complex intergroup relations (Tajfel & Turner, 1979). Furthermore, technology has allowed the emergence of new forms of work organization, such as distributed teams for collaborative work. Such evolutions question the effects of technology on collaborative creative work.

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In line with Guilford's pioneering work, much of early research on creativity has tended to focus on divergent thinking, i.e. the ability to "think in different directions" (Guilford, 1956). This led in turn to the idea that creative potential could be assessed by studying participant responses to divergent thinking tasks (Torrance, 1966). Thus, these studies focus on the *ideas* produced in response to problems, whether these are part of an experimental task or encountered in professional settings. Divergent thinking is not a self-contained process: the ideas produced in response to a creative problem must then be evaluated, selected, and refined iteratively before they can be said to constitute a real solution to the problem (Rietzschel et al., 2019). Creativity, therefore, implies a mix of "*blind variation and selective retention*" (Campbell, 1960; Simonton, 1999), leading creativity researchers to focus on idea generation—also termed *ideation*—and, to a lesser degree, on idea selection. The goal of this chapter is to examine how work collectives can support or hinder idea generation and idea selection in creative tasks. We begin by reviewing a familiar paradigm for idea generation in groups—*brainstorming*—and some of the processes that have been shown to contribute to a productivity loss in brainstorming groups. We go on to argue that participants interacting in the context of a typical experimental brainstorming study can seldom be said to constitute a true group and introduce a new perspective on brainstorming groups based on Social Identity Theory. We then present some of the consequences of the research on production loss for improving group performance in idea generation tasks based on technology use, beginning with Electronic Brainstorming and moving on to a new perspective which we term *cybercreativity*—the use of virtual environments to support collaborative creative work. We describe the main research findings in this field to date, and discuss some prospects for designing virtual environments for creative work and for future research.

2 Idea Generation in Small Groups

2.1 Brainstorming as a Foundational Model of Ideation in Small Groups

One of the earliest models of idea generation in groups was proposed by Osborn (1957) as part of the Creative Problem-Solving (CPS) process. According to Osborn, the creativity of individuals was responsible for much of human progress and innovation, but it often developed in an unforgiving climate of self-doubt and discouragement by friends, colleagues, and organizations. The brainstorming framework was proposed as a means to make better use of the creative potential of groups and organizations. In the original formulation, brainstorming relied on the following basic rules: (1) judicial judgment is ruled out. Criticism of ideas must be withheld until later; (2) "Free-wheeling" is welcomed. The wilder the idea, the better; (3) Quantity is wanted. The greater the number of ideas, the more the likelihood of winners; and (4) Combination and improvement are sought.

To this day, brainstorming is commonly used in organizations. Indeed, people do *believe* that they are more able to access their creative potential when working in groups (Paulus et al., 1993; Stroebe et al., 1992). Yet, experimental studies of creative performance in brainstorming groups have shown that individuals working alone whose ideas are subsequently pooled together—known as *nominal* brainstorming groups—consistently outperform individuals allowed to interact in a group—a phenomenon known as *productivity loss* (Diehl & Stroebe, 1987; Mullen et al., 1991). Performance is judged through measures typically used in research on divergent thinking—most often, creative fluency (i.e., the number of nonredundant ideas produced) and originality, measured either subjectively by domain experts or through some index of statistical infrequency (Kaufman et al., 2008).

2.2 Causes for Production Loss in Brainstorming Groups

Early attempts to explain the causes of production loss have led to a large body of research weighing various possible explanations against one another. The three main explanations, outlined below, are (a) social loafing, (b) evaluation apprehension, and (c) production blocking (for a review, see Stroebe et al., 2010).

2.2.1 Social Loafing

Social loafing refers to a decrease in individual effort when performing in groups as compared to when peopler perform alone (Latané et al., 1979). These authors considered tasks such as clapping one's hands and shouting. According to them, such tasks exhibit three key features. First, they are maximizing: success depends on how much effort is expended by participants. Second, they are unitary, i.e., the task cannot be divided into separate subtasks. Third, it is additive: group performance depends on the sum of individual efforts. Although early work on social loafing tended to focus on physical tasks (Ingham et al., 1974; Latané et al., 1979), other authors have provided evidence of social loafing occurring in tasks with more "cognitive" elements, such as editing a poem (Petty et al., 1977).

Following the initial work aiming to prove the existence of social loafing, several authors have sought to identify the factors that foster or hinder the occurrence of this phenomenon. Factors examined in this way include task difficulty, identifiability of authorship of individual production, the existence of a feedback on individual performance, and group size.

Regarding task difficulty, Harkins and Petty (1982) demonstrated that individuals involved in a brainstorming task generated less ideas when confronted with a difficult topic than when confronted with a simple one. However, later research showed that when working on difficult tasks, people performed better when they were led to believe they were working as groups than when they were told they would be working alone (Jackson & Williams, 1985).

A second topic concerns the traceability of authorship of individual idea production. Williams et al. (1981) performed a shouting experiment based on an earlier study (Latané et al., 1979), in which they manipulated the perceived identifiability of individual contributions. They showed that participants expended greater levels of effort when their contributions were identifiable, than when they were not. However, identifiability is not enough to improve individual performance. Harkins and Jackson (1985), studying a collective divergent thinking task, manipulated separately the identifiability of idea authorship and the belief that they were working on the same task as the other group members—and consequently, that their production could be compared with that of other group members. They observed an improvement in performance only when those two conditions—identifiability and comparability—were met. In related work, Szymanski and Harkins (1987) studied group performance in a collective divergent thinking task and manipulated the belief that (a) individual performance could be evaluated by the experimenter and (b) participants could evaluate their own performance at the end of the session. They observed that both perceived evaluation by the experimenter and self-evaluation improved performance. In a later experiment (Harkins & Szymanski, 1989), they manipulated participants' belief that their creative performance would be judged according to a standard (for individuals or for the group) at the end of the brainstorming task. They found that individual performance improved when the experimenter suggested that participant performance could be known at the end of the task, but also compared at the individual or group level.

Taken together, these results suggest that social loafing may be alleviated by fostering social comparison processes. It is not enough to provide feedback over performance: it is also necessary to provide a clear standard by which people judge their own performance.

Diehl and Stroebe (1987, Study 1) sought to examine the role of social loafing in production loss by manipulating (a) the type of brainstorming group (nominal or interacting) and (b) expectations related to performance assessment (personal or collective). Their results show a main effect of both these factors: participants involved in nominal brainstorming groups outperformed those in interacting groups in terms of ideational fluency, as did participants working under personal rather than collective assessment expectations. However, they also found that the impact of the type of brainstorming group on ideational fluency was much larger than the assessment instructions. This led them to conclude that social loafing exerted a relatively minor influence in production loss.

Social loafing does not only lead to decreased performance in loafers. It may also lead to loss of motivation and under-performing in members of the group who are otherwise capable, a phenomenon known as the "sucker effect" (Kerr, 1983): high performers match their performance to the rest of the group in order not to be "taken for a sucker". In some cases, this may result in high performers leaving the group altogether (Yamagishi, 1988). In other words, in the context of a brainstorming group, social loafing may lead to decreased creative performance through processes of downward comparison (Paulus & Dzindolet, 1993). Hence, the effects of social loafing may

be alleviated in two ways: (a) by minimizing downward matching effects, and (b) by encouraging upward matching (Paulus et al., 2002). For example, providing members of a brainstorming group with continuous feedback on group performance enhances their performance (Paulus et al., 1996). Furthermore, providing feedback regarding the performance of individual group members also improves creative performance (Schmitt et al., 2012).

2.2.2 Evaluation Apprehension

Another possible explanation to the production loss phenomenon is evaluation apprehension: in spite of Osborn's rules precluding the criticism of ideas, the fear of negative evaluation of one's ideas by other group members may have an adverse impact on group performance. Two early studies on this topic, often cited in the literature, are those by Collaros and Anderson (1969) and Maginn and Harris (1980).

The first study manipulated the perceived expertise of other group members. Participants were informed, prior to the beginning of the brainstorming task, that all group members had previous experience in brainstorming (all-experts condition), that one group member had such experience (one-expert condition), or that none of them did (control condition). Results showed that participants experienced more inhibition in the all-experts and one-expert condition than in the control condition, and produced fewer ideas in these conditions compared with the control condition.

Maginn and Harris (1980), on the other hand, manipulated the anticipation of idea evaluation by fellow group members to be either immediate or delayed, but failed to identify significant effects of this factor on ideational fluency in a brainstorming task. Diehl and Stroebe (1987, Study 2) sought to assess the effects of evaluation apprehension on production loss by replicating Maginn and Harris' study—i.e., inducing evaluation apprehension in participants by suggesting that their performance would subsequently be evaluated by judges or by their peers—but also by manipulating the controversial character of the brainstorming topic. Unlike Maginn and Harris' findings, Diehl and Stroebe's results suggested a main effect of the anticipation of evaluation on ideational fluency, as well as of the nature of the topic. Participants produced fewer ideas when they expected they would be evaluated, and when working on a controversial brainstorming topic. Diehl and Stroebe (1987, Study 3) extended this study by manipulating evaluation apprehension (through the procedure outlined above), the type of assessment (individual or collective) and the type of brainstorming group (nominal or interacting). As was the case with the studies on social loafing (see above), they found main effects of group type and evaluation apprehension, but no significant interaction between these two factors. In addition, as was the case for social loafing, the type of session still accounted for a very large proportion of observed effects on ideational fluency, leading to the conclusion that evaluation apprehension was not a major determinant of production loss.

2.2.3 Production Blocking

A third possible explanation for production loss, termed «production blocking», refers to the fact that "*in a normal discussion setting, the implicit rule is that only one person should talk at a time*" (Lamm & Trommsdorff, 1973, p. 366). Diehl and Stroebe (1987, Study 4) used a system of acoustic sensors, lights, microphones and headphones to control (a) when participants in a brainstorming task were able to share ideas with other group members, and (b) whether participants had access to the creative production of other group members. In addition, two further conditions were included: nominal and interactive brainstorming groups involving no such apparatus. Consistent with expectations, production blocking led to a decrease in ideational fluency such that participant performance was similar to that of interactive groups. In comparison, the performance of participants who did not have access to other group members' ideas but were instructed to talk whenever they wished, mirrored that of nominal groups. Hence, the authors argued that production blocking was a key mechanism in production loss.

Because production blocking is essentially due to a social norm affecting *oral* communication in groups, many authors have imagined adaptations in Osborn's classical brainstorming procedure that relied on written communication, which is not subjected to such a norm. "Brainwriting" refers to a situation where participants involved in a brainstorming task communicate silently with other group members, using handwritten communication. Paulus and Yang (2000) studied the ideational fluency of participants in brainwriting and found that it exceeded that of participants in nominal brainstorming groups. Interestingly, several aspects of their experiment might explain this finding. First, although exposure to other people's ideas can be a key source of cognitive stimulation in brainstorming, oral communication may not make it possible to retain past ideational production very efficiently, or for these ideas to stimulate the generation of new ideas (Nijstad et al., 2002). Second, in Paulus and Yang's (2000) study, participants used different-colored inks to write down their ideas, possibly leading to increased identifiability of authorship and decreased social loafing, as suggested by Heslin (2009). Hence, as this author points out, the effectiveness of brainwriting relative to the classical brainstorming procedure may stem from both cognitive *and* social factors.

In summary, the literature on brainstorming groups has explored several potential social and cognitive mechanisms that might play a part in production loss. However, in this literature, little emphasis is placed on what actually constitutes a group. Typically, in the context of these experimental studies, a brainstorming group can be defined as a transient collective of individuals that will only exist for the time of the study. As we will see below, this view presents several limitations.

2.3 A Social Identity Perspective on Brainstorming

Social Identity Theory (Tajfel & Turner, 1979) posits that identity varies along a continuum, the extremities of which refer to interpersonal behavior on one side ("me" vs. "you"; personal identity) and intergroup behavior on the other ("us" vs. "them"; social identity). In addition, Self-Categorization Theory (SCT; Turner et al., 1987) postulates that, depending on the situation, the individual may feel more or less part of a given social category. Social categories are organized in a hierarchical system of inclusion levels. SCT therefore views the self as a variable, multifaceted cognitive structure (i.e., different social groups at different levels of inclusion). Thus, social categories are internalized to define the self (Turner, 1981), by combining individual components with elements of a salient category in a given context. Through the concept of depersonalization (Turner, 1984; Turner et al., 1987), SCT highlights context-dependent changes of identity in terms of subjective association between the individual and the prototype of the salient category. In this case, individuals adopt the group's assessment of the social situation.

According to these theoretical propositions, the characteristics of an individual hinge on personal identity (and its associated idiosyncratic attributes) and the multiple social identities associated with the multiple groups to which the individual may claim membership. This plurality of self allows one to adapt by identifying with various levels of categorical inclusion depending on the social situation. Indeed, various factors in the environment will determine the salience of a particular social category (Haslam & Turner, 1992; Turner et al., 1987, 1994).

The Social Identity Perspective makes it possible to reinterpret some of the processes related to collaborative creativity in groups. Indeed, the existing literature does not take sufficiently into account the meaning of the group—and of group membership—to its individual members, and / or the potential intergroup relations where the creative work might take its place. Contextual cues present in the workplace may render specific social categories more or less salient and modulate the strength of the resulting effects on individual and collective performance in creative tasks.

Indeed, as noted above, the key mechanism involved in production loss—*i.e.*, production blocking—has a social component which relates to some widely accepted rules of oral communication. The other phenomena we have noted above, social loafing and evaluation apprehension, also have a social component, which in those cases is more related to the individual comparing his/her own performance (or that of his/her group) with that of other individuals within the group (or with other groups). Depending on the nature and the results of this comparison, performance can be impacted adversely, but also, potentially, positively. Indeed, whereas social loafing refers to individuals "freeriding" on the contributions of others, *social compensation* refers to the fact that individual members may *work harder* to compensate for the low performance of other group members in a meaningful task (Williams & Karau, 1991). Hence, one approach to improving group performance in a brainstorming task would be to prevent social comparisons that have adverse effects on individual performance,

and to foster comparisons that have positive effects. However, a different approach would be to value group membership to ensure that each individual group member will engage in a collective effort (Karau & Williams, 1993).

As a corollary, it is not enough to merely "bring individuals together" to form a group. The group emerges when individuals perceive themselves as group members (Turner, 1981). Indeed, since the group exists as a cognitive representation within individuals (e.g., Rogers & Lea, 2005), it is its interiorization within individual cognition which allows it to exist. Following this view, one might even argue that individuals involved in a nominal brainstorming task in conditions that are conducive to the activation of social identity (i.e. depersonalization) might consider themselves as "more of a group" than individuals involved in an interactive brainstorming task in laboratory settings, where the group has little meaning to them (Ellemers et al., 2004). In particular, increasing the salience of social identity would likely support the reduction of social loafing effects, because the individual perceives him or herself more as a member of the group (e.g., Williams et al., 1993). If individuals share the same salient social identity, they may no longer perform for their own sake (personal identity) but may do so on behalf of the group (social identity) instead. This depersonalization may even lead to the emergence of *social laboring phenomena* (van Dick et al., 2009; Worchel et al., 1998), seen here as the opposite phenomenon to social loafing: individuals working as groups and for the group exhibit increased, rather than decreased performance. This view strongly echoes Osborn's (1957) initial work advocating the brainstorming method. Based on this reasoning, one can understand one reason why social loafing effects have mostly been identified in laboratory-based groups, and less in everyday work situations, where people can be truly said to exhibit a genuine group identity (*e.g.*, Erez & Somech, 1996).

In short, this perspective differs greatly from the classical view that the social comparison effects that impact the performance of brainstorming groups are related only to comparisons between group members (e.g., Dugosh & Paulus, 2005; Michinov & Primois, 2005). Instead, the focus should be on creating social comparison *between groups*. This makes it possible to imagine improvements in creative performance that truly stem from group processes, and not on interpersonal competition. In the words of Worchel et al., (1998, p. 395), "loafing can be reduced or eliminated *without increasing personal identifiability*, without increasing the enjoyment of the task, and without increasing arousal or concern with the productivity of others" (our emphasis). Indeed, much of the existing literature concerning the creative performance of brainstorming groups focuses on comparing performance within the group, without addressing the issue of whether participants perceive themselves to be members of a group or not. From this point of view, the "group" may in fact exert detrimental effects on creative performance. Yet, we argue, this view of group membership is overly simplistic and functionalist. Encouraging people to think of themselves as members of a group—possibly competing against another group—is another potential means for these people to achieve increased creative performance. In addition to influencing overall performance, it is possible that these intergroup

processes might influence the orientations of idea generation by leading participants identifying with a given group to selectively "rebound" on ideas produced by members of the ingroup rather than the outgroup.

3 Instrumenting Group Creativity with Computers

Having described some of the social and cognitive processes that influence performance in idea generation in groups, we now turn to how technology may be used to better leverage creativity therein. Indeed, it has been argued on many occasions that technology may offer interesting means to counter production loss as described above. As we will see, the literature uses a dominant paradigm, Electronic Brainstorming, and follows the functionalist view of the group we have mentioned above. However, by extending this view to one that includes a social identity perspective, it is possible to raise new possibilities to improve collective creative performance.

3.1 Electronic Brainstorming: An Anonymous Medium

Electronic BrainStorming (EBS) refers to a situation where participants in a brainstorming group share their ideas in written form, via networked computers (Nunamaker et al., 1991). Because it also relies on written, not oral communication, EBS makes it possible to circumvent production blocking (Gallupe et al., 1991). However, it also makes it possible to influence parameters of situations of collaborative creative work in ways that would not be possible in normal brainstorming or brainwriting situations. This includes, for example, brainstorming between large numbers of people, which makes it possible to further improve ideational fluency. Indeed, as group size increases, group members are exposed to more ideas (Dennis & Williams, 2007; Dennis et al., 1990; DeRosa et al., 2007; Gallupe et al., 1992; Paulus et al., 2013), potentially leading to further cognitive stimulation (Nijstad & Stroebe, 2006). Furthermore, as noted by Michinov (2012), EBS reduces the level of effort required to access other group members' creative productions, leading to increased performance and greater satisfaction with the process.

Another phenomenon that may explain the positive effects of EBS systems on individual and group performance in brainstorming tasks relates to the fact that the anonymity afforded by EBS interfaces may reduce personal identification—and other effects related to the perception of differences in status within the group—thus leading to diminished evaluation apprehension and improved creative performance (Cooper et al., 1998). However, the literature on EBS to date is firmly based on a view of the group as a collection of cognitive resources present in individuals.

Following a social identity perspective, some specific features of Computer-Mediated Communication (CMC)—namely, physical isolation and anonymity—may strengthen group processes related to group membership and performance. Indeed,

the Social Identity Model of Deindividuation Effects (SIDE; Reicher et al., 1995; Spears & Lea, 1994) posits that in situations of anonymity, interlocutors cease to pay attention to individual differences or personal characteristics. Furthermore, when the scarcity of individuating information is combined with the presence of cues pertaining to the individuals' group affiliations (e.g., the name of a group, association with a particular color, etc.), this is thought to accentuate the depersonalization process (Turner et al., 1987). By masking the idiosyncratic features of individual members, anonymity ensures that groups are presented in a homogeneous and standardized fashion (Lee, 2004). Therefore, individuals who do not have access to the specificities of each member of the group tend to reason based on social categories. Thus, as Postmes et al. (2002) indicate, "*depersonalized interactions over the Internet could stimulate our natural tendency for differentiation between social categories*" (p. 4). This can have a major impact on the way in which members of groups are perceived, in particular, by increasing the influence of stereotypes in anonymous online communication. This has been confirmed in several studies (Postmes et al., 1998; Spears & Lea, 1994; Spears et al., 2007). For instance, in a series of experiments, Postmes and Spears (2002) found that the activation of gender stereotypes in the context of anonymous interaction increased the display of male or female prototypical behaviors (e.g., a tendency for women to ask more questions and to be less dominant than men during CMC).

Hence, CMC may be used to support depersonalization and social laboring in the context of creative work. By considering themselves as members of a group rather than people who have been "lumped together", individuals may more easily implement strategies improving group performance. Instead of being thought of as a source of criticism and a cause for apprehension, others might genuinely be viewed as peers and a source of support. Perhaps this could lead, in turn, to a willingness to share ideas with the group, rather than to withhold them in order to shield oneself from negative evaluation as suggested by classical accounts of evaluation apprehension. Moreover, just as the perception of self and of others may change with the salience of social identity, so can the perception of their own ideas and of their value for inspiration. In this way, one might truly achieve optimal levels of cognitive stimulation through exposure to other people's ideas.

3.2 Towards Cybercreativity

In the following, *cybercreativity* refers to the use of online virtual environments to support creative work. In comparison to EBS interfaces, cybercreativity deals in particular with virtual environments, defined as "*electronic environments that visually mimic complex physical spaces, where people can interact with each other and with virtual objects, and where people are represented by animated characters*" (Bainbridge, 2007, p. 472). These characteristics, as we argue below, make virtual worlds an ideal medium to support creative collaboration.

3.2.1 Manipulating the Appearance of User Avatars

First, virtual worlds make it possible to customize the appearance of avatars representing users. Indeed, in a situation of online anonymity, avatars constitute a major source of cues concerning a user's identity—a digital representation of self. As a result, the visual characteristics of avatars have been found to modulate user behaviors. This *Proteus effect* (Yee & Bailenson, 2007; Yee et al., 2009) has been shown to affect performance in creative tasks (Guegan et al., 2016). In an experiment involving engineering students, the authors designed avatars corresponding to characteristically creative individuals in that population (i.e., inventors) and found that participants carrying out a brainstorming task in a virtual environment exhibited improved creative performance when embodying inventor avatars than when embodying non-inventor avatars.

Closer to our present argument, avatars can serve as a means of introducing visually perceptible social cues, thereby increasing the motivation of participants to work together and combine their efforts. In one example, Lee (2004) manipulated the appearance of avatars representing members of a group to be identical or different, as well as the salience of group membership (intergroup interaction or interpersonal interaction) in a task involving solving social dilemmas. She found that when participants were interacting with confederates represented by avatars of the same appearance, they perceived them as more similar to themselves and exhibited greater conformity when the group identity was made salient. In a later study, Kim (2011) demonstrated that people experienced stronger feelings of group identity when sharing the same avatar, even if the avatar differed from their virtual self in terms of gender or ethnicity.

In the studies described above, and in line with the SIDE model, CMC affords anonymity through physical isolation and visual anonymity on the one hand, and perceived similarity within the ingroup on the other. Concerning this second point, however, similarity is operationalized through the use of identical 2D characters. Although these may correspond to the classical definition of avatars as digital representations of the self, virtual environments most often use 3D characters that are more visually detailed, making it possible to include social identity cues (SICs) while minimizing the threat to uniqueness. Guegan et al. (2017a, 2017b) carried out a study in a school of engineering in which participants carried out a brainstorming task. They manipulated separately the setting in which the task was carried out—i.e., in a virtual environment while represented by avatars vs. in face-to-face interaction—and the presence or absence of SICs. Concerning this second factor, students in the school share a strong, positive, social identity symbolized by the use of traditional clothing, a coat named a *biaude*. Results showed that the presence of SICs exerted a positive effect on idea generation performance measured through idea fluency and uniqueness. However, the setting exerted no effect, and no significant interaction effect was observed. Furthermore, the effect of the presence of SICs on social identification with the group was greater in the virtual environment setting than in the face-to-face

setting, suggesting that "using an existing and powerful SIC (…) induced high standards for performance in our experimental population, *both in face-to-face and in the virtual environment*" (Guegan et al., 2017a; 2017b, pp. 144–145, our emphasis).

3.2.2 Manipulating the Appearance of the Environment

There has been an increasing interest in recent years concerning the impact of the work environment on performance in creative tasks (for a review, see Dul, 2019). Although numerous studies have focused on assessing the effects of the presence of a specific object, e.g., a window or an indoor plant—on performance with an eye for workstation design, very few studies to date have focused on the effects of the contents of a *virtual environment*. Yet, such environments offer not only the means to customize the contents of the work environment and possibly to expose users to experiences that would be unattainable in "real world" settings. Studies in this field have mostly focused on how the situational context can automatically direct behavior through priming (Bargh et al., 1996). Although priming effects have been identified with many different kinds of cues—including the appearance of avatars in virtual settings (Peña et al., 2009)—the kind of effects that interests us particularly is that which takes place when exposure to an *environment* may activate a specific situational norm in this way. For example, it has been shown that priming the concept of a library can lead participants to talk more quietly in a word pronunciation task, but only if they are told they will be visiting the library later (Aarts & Dijksterhuis, 2003). Such behavioral priming effects have also been found in exposure to virtual environments (Peña & Blackburn, 2013).

Behavioral priming has been found to affect performance in creative tasks. Fitzsimons et al., (2008, Study 1) examined the effects of exposure to the logos of two brands on performance in a divergent thinking task: Apple, a brand which has strong associations with creativity, and IBM, which does not. They found that participants primed with Apple logos performed better than those primed with IBM logos. Guegan et al. (2017a) examined whether priming effects could exert a positive effect on creative performance in an (individual) divergent thinking task in a virtual environment. They conducted first a survey with students from the chosen population concerning what objects they associated with an environment conducive to creativity and designed an environment that featured the objects most frequently cited. As a control environment, they chose a standard, existing meeting room. To discount the possibility that effects on performance might be due to the technological medium, they designed a virtual replica of that meeting room. Participants thus carried out the task in one of three environments: the creativity conducive environment, the real-world control environment, and the virtual control environment (Fig. 1). Their results show that participants generated more original ideas and explored idea categories in greater depth in the creativity conducive environment than in either of the two control conditions, in a manner consistent with the involvement of priming effects.

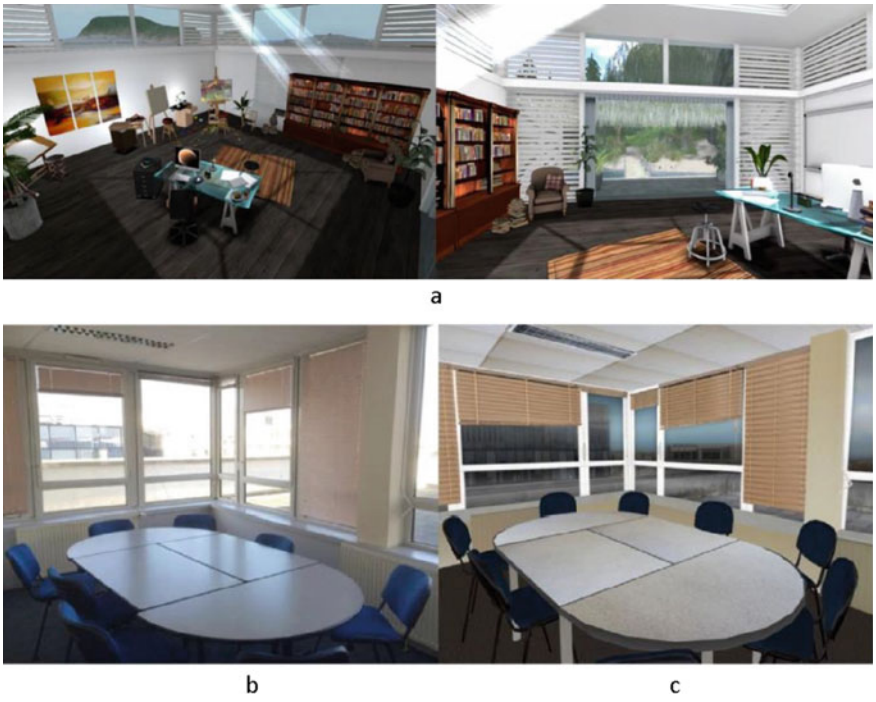

Fig. 1 The three environments used in the study by Guegan et al. (2017a): (a) creativity conducive environment; (b) real control environment; and (c) virtual control environment

4 Conclusions

In this chapter, we have presented a review of existing literature on creative collaboration in groups. Like much of this literature, it focuses on idea generation processes in small groups. Studies on brainstorming groups have led to the identification of processes that hinder group performance in such tasks. However, one surprising finding is that experimental studies of this kind often rely on temporary, ad hoc gatherings of individuals who may not even know each other, in situations where group-level effects are unlikely to be observed. For this reason, we found it necessary to adopt a social identity perspective in our treatment of this topic.

Our review shows that technology may be profitably used to leverage the creative potential of groups, but it has come a long way since the early days of Electronic Brainstorming. Virtual environments, in particular, currently offer the most flexibility in the design of work environments for creative collaboration, notably through the customization of the appearance of the avatar which the user embodies during an idea generation task and of the contextual cues present in the task environment. The first point can be further broken down, as the visual cues that define avatar appearance can not only influence the creator's personal identity but also convey

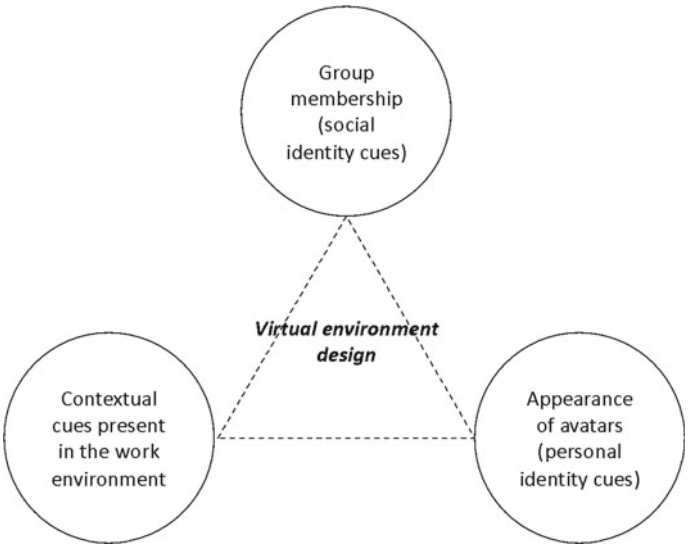

Fig. 2 Pathways for improving group performance through the design of virtual work environments suggested in this chapter

cues of social identity (Fig. 2). In the context of Computer-Mediated Communication (CMC), such cues may render a specific social category salient, fostering a sense of group membership, potentially improving performance as individuals work on behalf of the group rather than for their own sake.

Our focus on social identity cues has led us, in line with the existing research, to envision avatar appearance as the primary vehicle for conveying such cues. However, an interesting avenue for future research is to examine the role that the work environment might have at this level. Indeed, although many groups are characterized by a shared appearance (e.g., through the use of uniforms), they might also ascribe shared meanings to specific locations, for example a place that is historically significant to a company, or that includes items that are of particular social significance in a visually salient manner.

Finally, although the focus of this chapter is on idea generation processes, one should not discount the importance of the processes that occur subsequently—that is, idea evaluation and selection processes. Indeed, after a creative idea has been produced, it needs to be recognized as such to undergo further development, and there are many anecdotal examples in which truly creative ideas have been overlooked in an organization. Although idea evaluation and selection processes may occur at the individual level, they take place most often in group settings. Hence, just as virtual work environments can support the generation of creative ideas, they might also support more effective idea evaluation and selection, raising a major bottleneck to innovation.

References

Aarts, H., & Dijksterhuis, A. (2003). The silence of the library: Environment, situational norm, and social behavior. *Journal of Personality and Social Psychology, 84*(1), 18–28. https://doi.org/10.1037/0022-3514.84.1.18

Amabile, T. M. (1996). *Creativity in context*. Westview Press.

Bainbridge, W. S. (2007). The scientific research potential of virtual worlds. *Science, 317*(5837), 472–476. https://doi.org/10.1126/science.1146930

Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype-activation on action. *Journal of Personality and Social Psychology, 71*(2), 230–244. https://doi.org/10.1037/0022-3514.71.2.230

Campbell, D. T. (1960). Blind variation and selective retentions in creative thought as in other knowledge processes. *Psychological Review, 67*(6), 380–400. https://doi.org/10.1037/h0040373

Collaros, P. A., & Anderson, L. R. (1969). Effect of perceived expertness upon creativity of members of brainstorming groups. *Journal of Applied Psychology*, *53*(2, Pt.1), 159–163. https://doi.org/10.1037/h0027034

Cooper, W. H., Gallupe, R. B., Pollard, S., & Cadsby, J. (1998). Some liberating effects of anonymous electronic brainstorming. *Small Group Research, 29*(2), 147–178. https://doi.org/10.1177/1046496498292001

Dennis, A. R., Valacich, J. S., & Nunamaker, J. F. (1990). An experimental investigation of the effects of group size in an electronic meeting environment. *IEEE Transactions on Systems, Man, and Cybernetics, 20*(5), 1049–1057. https://doi.org/10.1109/21.59968

Dennis, A. R., & Williams, M. L. (2007). A meta-analysis of group size effects in electronic brainstorming: more heads are better than one. In N. Kock (Ed.), *Emerging E-collaboration concepts and applications* (pp. 250–269). Cybertech.

DeRosa, D. M., Smith, C. L., & Hantula, D. A. (2007). The medium matters: Mining the long-promised merit of group interaction in creative idea generation tasks in a meta-analysis of the electronic group brainstorming literature. *Computers in Human Behavior, 23*(3), 1549–1581. https://doi.org/10.1016/j.chb.2005.07.003

Diehl, M., & Stroebe, W. (1987). Productivity loss in brainstorming groups: Toward the solution of a riddle. *Journal of Personality and Social Psychology, 53*(3), 497–509. https://doi.org/10.1037/0022-3514.53.3.497

Dugosh, K. L., & Paulus, P. B. (2005). Cognitive and social comparison processes in brainstorming. *Journal of Experimental Social Psychology, 41*(3), 313–320. https://doi.org/10.1016/j.jesp.2004.05.009

Dul, J. (2019). The physical environment and creativity: a theoretical framework. In J. C. Kaufman, and R. J. Sternberg (Eds.), *Cambridge Handbook of Creativity* (2nd ed., pp. 481–510). Cambridge University Press.

Ellemers, N., De Gilder, D., & Haslam, S. A. (2004). Motivating individuals and groups at work: A social identity perspective on leadership and group performance. *Academy of Management Review, 29*(3), 459–478. https://doi.org/10.5465/AMR.2004.13670967

Erez, M., & Somech, A. (1996). Is group productivity loss the rule or the exception? Effects of culture and group-based motivation. *Academy of Management Journal, 39*, 1513–1537. https://doi.org/10.2307/257067

Fitzsimons, G. M., Chartrand, T. L., & Fitzsimons, G. J. (2008). Automatic effects of brand exposure on motivated behavior: How Apple makes you "think different." *Journal of Consumer Research, 35*(1), 21–35. https://doi.org/10.1086/527269

Gallupe, R. B., Bastianutti, L. M., & Cooper, W. H. (1991). Unblocking brainstorms. *Journal of Applied Psychology, 76*(1), 137–142. https://doi.org/10.1037/0021-9010.76.1.137

Gallupe, R. B., Dennis, A. R., Cooper, W. H., Valacich, J. S., Bastianutti, L. M., & Nunamaker, J. F. (1992). Electronic brainstorming and group size. *Academy of Management Journal, 35*(2), 350–369. https://doi.org/10.2307/256377

Guegan, J., Buisine, S., Mantelet, F., Maranzana, N., & Segonds, F. (2016). Avatar-mediated creativity: When embodying inventors makes engineers more creative. *Computers in Human Behavior, 61*, 165–175. https://doi.org/10.1016/j.chb.2016.03.024

Guegan, J., Nelson, J., & Lubart, T. (2017a). The relation between contextual cues in virtual environments and creative processes. *Cyberpsychology, Behavior and Social Networking, 20*(3), 202–206. https://doi.org/10.1089/cyber.2016.0503

Guegan, J., Segonds, F., Barré, J., Maranzana, N., Mantelet, F., & Buisine, S. (2017b). Social identity cues to improve creativity and identification in face-to-face and virtual groups. *Computers in Human Behavior, 77*, 140–147. https://doi.org/10.1016/j.chb.2017.08.043

Guilford, J. P. (1956). The structure of intellect. *Psychological Bulletin, 53*(4), 267–293. https://doi.org/10.1037/h0040755

Harkins, S. G., & Jackson, J. M. (1985). The role of evaluation in eliminating social loafing. *Personality and Social Psychology Bulletin, 11*, 457–465. https://doi.org/10.1177/0146167285114011

Harkins, S. G., & Petty, R. E. (1982). Effects of task difficulty and task uniqueness on social loafing. *Journal of Personality and Social Psychology, 43*(6), 1214–1229. https://doi.org/10.1037/0022-3514.43.6.1214

Harkins, S. G., & Szymanski, K. (1989). Social loafing and group evaluation. *Journal of Personality and Social Psychology, 56*(6), 934–941. https://doi.org/10.1037/0022-3514.56.6.934

Haslam, S. A., & Turner, J. C. (1992). Context-dependent variation in social stereotyping 2: The relationship between frame of reference, self-categorization and accentuation. *European Journal of Social Psychology, 22*(3), 251–277. https://doi.org/10.1002/ejsp.2420220305

Heslin, P. A. (2009). Better than brainstorming? Potential contextual boundary conditions to brainwriting for idea generation in organizations. *Journal of Occupational and Organizational Psychology, 82*(1), 129–145. https://doi.org/10.1348/096317908X285642

Ingham, A. G., Levinger, G., Graves, J., & Peckham, V. (1974). The Ringelmann effect: Studies of group size and group performance. *Journal of Experimental Social Psychology, 10*(4), 371–384. https://doi.org/10.1016/0022-1031(74)90033-X

Jackson, J. M., & Williams, K. D. (1985). Social loafing on difficult tasks: Working collectively can improve performance. *Journal of Personality and Social Psychology, 49*(4), 937–942. https://doi.org/10.1037/0022-3514.49.4.937

Karau, S. J., & Williams, K. D. (1993). Social loafing: A meta-analytic review and theoretical integration. *Journal of Personality and Social Psychology, 65*, 681–706. https://doi.org/10.1037/0022-3514.65.4.681

Kaufman, J. C., Plucker, J. A., & Baer, J. (2008). *Essentials of creativity assessment*. John Wiley & Sons.

Kerr, N. L. (1983). Motivation losses in small groups: A social dilemma analysis. *Journal of Personality and Social Psychology, 45*, 819–828. https://doi.org/10.1037/0022-3514.45.4.819

Kerr, N. L., Aronoff, J., & Messé, L. (2000). Methods of small group research. In H. T. Reis & C. M. Judd (Eds.), *Handbook of research methods in social and personality psychology* (pp. 160–189). Cambridge University Press.

Kim, J. (2011). Two routes leading to conformity intention in computer-mediated groups: Matching versus mismatching virtual representations. *Journal of Computer-Mediated Communication, 16*, 271–287. https://doi.org/10.1111/j.1083-6101.2011.01539.x

Lamm, H., & Trommsdorff, G. (1973). Group versus individual performance on tasks requiring ideational proficiency (brainstorming): A review. *European Journal of Social Psychology, 3*, 361–388. https://doi.org/10.1002/ejsp.2420030402

Latané, B., Williams, K., & Harkins, S. (1979). Many hands make light the work: The causes and consequences of social loafing. *Journal of Personality and Social Psychology, 37*(6), 822–832.

Lee, E. J. (2004). Effects of visual representation on social influence in Computer-Mediated Communication. *Human Communication Research*, *30*, 234–259. https://doi.org/10.1111/j.1468-2958.2004.tb00732.x

Maginn, B. K., & Harris, R. J. (1980). Effects of anticipated evaluation on individual brainstorming performance. *Journal of Applied Psychology, 65*(2), 219–225. https://doi.org/10.1037/0021-9010.65.2.219

Michinov, N. (2012). Is electronic brainstorming or brainwriting the best way to improve creative performance in groups? An overlooked comparison of two idea-generation techniques. *Journal of Applied Social Psychology, 42*(S1), E222–E243. https://doi.org/10.1111/j.1559-1816.2012.01024.x

Michinov, N., & Primois, C. (2005). Improving productivity and creativity in online groups through social comparison process: New evidence for asynchronous electronic brainstorming. *Computers in Human Behavior, 21*, 11–28. https://doi.org/10.1016/j.chb.2004.02.004

Mullen, B., Johnson, C., & Salas, E. (1991). Productivity loss in brainstorming groups: A meta-analytic integration. *Basic and Applied Social Psychology, 12*(1), 3–23. https://doi.org/10.1207/s15324834basp1201_1

Nijstad, B. A., & Stroebe, W. (2006). How the group affects the mind: A cognitive model of idea generation in groups. *Personality and Social Psychology Review, 10*(3), 186–213. https://doi.org/10.1207/s15327957pspr1003_1

Nijstad, B. A., Stroebe, W., & Lodewijkx, H. F. (2002). Cognitive stimulation and interference in groups: Exposure effects in an idea generation task. *Journal of Experimental Social Psychology, 38*(6), 535–544. https://doi.org/10.1016/S0022-1031(02)00500-0

Nunamaker, J. F., Dennis, A. R., Valacich, J. S., Vogel, D., & George, J. F. (1991). Electronic meeting systems. *Communications of the ACM, 34*(7), 40–61. https://doi.org/10.1145/105783.105793

Osborn, A. F. (1957). *Applied imagination* (3rd ed.). Scribner's.

Paulus, P. B., & Dzindolet, M. T. (1993). Social influence processes in group brainstorming. *Journal of Personality and Social Psychology, 64*, 575–586. https://doi.org/10.1037/0022-3514.64.4.575

Paulus, P. B., Dzindolet, M. T., Poletes, G., & Camacho, L. M. (1993). Perception of performance in group brainstorming: The illusion of group productivity. *Personality and Social Psychology Bulletin, 19*(1), 78–89. https://doi.org/10.1177/0146167293191009

Paulus, P. B., Larey, T. S., Putman, V. L., Leggett, K. L., & Roland, E. J. (1996). Social influence processing in computer brainstorming. *Basic and Applied Social Psychology, 18*(1), 3–14. https://doi.org/10.1207/s15324834basp1801_2

Paulus, P. B., Kohn, N. W., Arditti, L. E., & Korde, R. M. (2013). Understanding the group size effect in Electronic Brainstorming. *Small Group Research, 44*(3), 332–352. https://doi.org/10.1177/1046496413479674

Paulus, P. B., Putman, V. L., Dugosh, K. L., Dzindolet, M. T., & Coskun, H. (2002). Social and cognitive influences in group brainstorming: Predicting production gains and losses. *European Review of Social Psychology, 12*(1), 299–325. https://doi.org/10.1080/14792772143000094

Paulus, P. B., & Yang, H. C. (2000). Idea generation in groups: A basis for creativity in organizations. *Organizational Behavior and Human Decision Processes, 82*(1), 76–87. https://doi.org/10.1006/obhd.2000.2888

Peña, J., & Blackburn, K. (2013). The priming effects of virtual environments on interpersonal perceptions and behaviors. *Journal of Communication, 63*(4), 703–720. https://doi.org/10.1111/jcom.12043

Peña, J., Hancock, J. T., & Merola, N. A. (2009). The priming effects of avatars in virtual settings. *Communication Research, 36*(6), 838–856. https://doi.org/10.1177/0093650209346802

Petty, R. E., Harkins, S. G., Williams, K. D., & Latané, B. (1977). The effects of group size on cognitive effort and evaluation. *Personality and Social Psychology Bulletin, 3*(4), 579–582. https://doi.org/10.1177/014616727700300406

Postmes, T., Spears, R., & Lea, M. (1998). Breaching or building social boundaries? SIDE-effects of Computer-Mediated Communication. *Communication Research*, *25*(6), 689–715. https://doi.org/10.1177/009365098025006006

Postmes, T., Spears, R., & Lea, M. (2002). Intergroup differentiation in computer-mediated communication: Effects of depersonalization. *Group Dynamics: Theory, Research, and Practice, 6*(1), 3–16. https://doi.org/10.1037/1089-2699.6.1.3

Reicher, S. D., Spears, R., & Postmes, T. (1995). A social identity model of deindividuation phenomena. *European Review of Social Psychology, 6*(1), 161–198. https://doi.org/10.1080/14792779443000049

Rietzschel, E. F., Nijstad, B. A., & Stroebe, W. (2019). Why great ideas are often overlooked: A review and theoretical analysis of research on idea evaluation and selection. In P. B. Paulus & B. A. Nijstad (Eds.), *The Oxford Handbook of Group Creativity and Innovation* (pp. 179–198). Oxford University Press.

Rogers, P., & Lea, M. (2005). Social presence in distributed group environments: The role of social identity. *Behaviour & Information Technology, 24*(2), 151–158. https://doi.org/10.1080/01449290410001723472

Schmidt, K. (1994). Cooperative work and its articulation: Requirements for computer support. *Le Travail Humain, 57*(4), 345–366.

Schmitt, L., Buisine, S., Chaboissier, J., Aoussat, A., & Vernier, F. (2012). Dynamic tabletop interfaces for increasing creativity. *Computers in Human Behavior, 28*(5), 1892–1901. https://doi.org/10.1016/j.chb.2012.05.007

Simonton, D. K. (1999). Creativity as blind variation and selective retention: Is the creative process Darwinian? *Psychological Inquiry, 10*(4), 309–328. https://doi.org/10.1207/S15327965PLI1004_4

Spears, R., & Lea, M. (1994). Panacea or panopticon? The hidden power in Computer-Mediated Communication. *Communication Research, 21*, 427–459. https://doi.org/10.1177/009365094021004001

Spears, R., Lea, M., & Postmes, T. (2007). Computer mediated-communication and social identity. In A. N. Joinson, K. Y. A. McKenna, T. Postmes, and U. D. Reips (Eds.), *The Oxford Handbook of Internet Psychology*. Oxford University Press.

Sternberg, R. J., & Lubart, T. I. (1999). The concept of creativity: Prospects and paradigms. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 3–15). Cambridge University Press.

Stroebe, W., Diehl, M., & Abakoumkin, G. (1992). The illusion of group effectivity. *Personality and Social Psychology Bulletin, 18*(5), 643–650. https://doi.org/10.1177/0146167292185015

Stroebe, W., Nijstad, B. A., & Rietzschel, E. F. (2010). Beyond productivity loss in brainstorming groups: The evolution of a question. *Advances in Experimental Social Psychology, 43*(10), 157–203. https://doi.org/10.1016/S0065-2601(10)43004-X

Szymanski, K., & Harkins, S. G. (1987). Social loafing and self-evaluation with a social standard. *Journal of Personality and Social Psychology, 53*(5), 891–897. https://doi.org/10.1037/0022-3514.53.5.891

Tajfel, H., & Turner, J. C. (1979). An integrative theory of intergroup conflict. In W. G. Austin & S. Worchel (Eds.), *The social psychology of intergroup relations* (pp. 33–47). Brooks / Cole.

Torrance, E. P. (1966). *The Torrance tests of creative thinking: Norms – Technical manual*. Personnel Press.

Turner, J. C. (1981). Toward a cognitive redefinition of the social group. *Cahiers De Psychologie Cognitive, 1*, 93–118.

Turner, J. C. (1984). Social identification and psychological group formation. In H. Tajfel (Ed.), *The social dimension: European developments in social psychology* (Vol. 2, pp. 518–538). Cambridge University Press.

Turner, J. C., Hogg, M. A., Oakes, P. J., Reicher, S. D., & Wetherell, M. S. (1987). *Rediscovering the social group: A self-categorization theory*. Blackwell.

Turner, J. C., Oakes, P. J., Haslam, S. A., & McGarty, C. (1994). Self and collective: Cognition and social context. *Personality and Social Psychology Bulletin, 20*(5), 454–463. https://doi.org/10.1177/0146167294205002

van Dick, R., Tissington, P. A., & Hertel, G. (2009). Do many hands make light work? How to overcome social loafing and gain motivation in work teams. *European Business Review, 21*(3), 233–245. https://doi.org/10.1108/09555340910956621

Williams, K. D., Harkins, S. G., & Latané, B. (1981). Identifiability as a deterrant to social loafing: Two cheering experiments. *Journal of Personality and Social Psychology, 40*(2), 303–311. https://doi.org/10.1037/0022-3514.40.2.303

Williams, K. D., & Karau, S. J. (1991). Social loafing and social compensation: The effects of expectations of co-worker performance. *Journal of Personality and Social Psychology, 61*, 570–581. https://doi.org/10.1037/0022-3514.61.4.570

Williams, K. D., Karau, S. J., & Bourgeois, M. J. (1993). Working on collective tasks: Social loafing and social compensation. In M. A. Hogg & D. Abrams (Eds.), *Group motivation: Social psychological perspectives* (pp. 130–148). Harvester Wheatsheaf.

Worchel, S., Rothgerber, H., Day, E. A., Hart, D., & Butemeyer, J. (1998). Social identity and individual productivity within groups. *British Journal of Social Psychology, 37*(4), 389–413.

Yamagishi, T. (1988). Exit from the group as an individualistic solution to the free rider problem in the United States and Japan. *Journal of Experimental Social Psychology, 24*, 530–542. https://doi.org/10.1016/0022-1031(88)90051-0

Yee, N., & Bailenson, J. (2007). The Proteus effect: The effect of transformed self-representation on behavior. *Human Communication Research, 33*(3), 271–290. https://doi.org/10.1111/j.1468-2958.2007.00299.x

Yee, N., Bailenson, J. N., & Ducheneaut, N. (2009). The proteus effect: Implications of transformed digital self-representation on online and offline behavior. *Communication Research, 36*(2), 285–312. https://doi.org/10.1177/0093650208330254

Creativity and Culture: Four (Mis)Understandings

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When in the early 60s Mel Rhodes systematized the four P's of creativity in the form of the creative person, product, process, and press, he gave the field more than a simple typology but a guiding framework, equally descriptive and prescriptive. While his ambition was to take stock of what had been published in this emerging area of research during his time, the basic classification he proposed ended up being more than the outcome of a review of definitions: it became the model against which research is located and to which it contributes. There are numerous examples of recent publications that refer to this framework as a conceptual organizer (e.g., Couger et al., 1993; Isaksen et al., 2011; Glăveanu, 2011a; Lin et al., 2006; Murdock & Puccio, 1993; Smith & Smith, 2010). The present volume continues this tradition and develops it in a systematic manner, unpacking the features and processes specific for each one of the four P's previously established. In doing so, one cannot help but wonder regarding what falls under the category '*press*', perhaps the least transparent and discussed of the four.

Traditionally, creativity researchers tend to think about 'press' as the (pressing) influence of the environment over the creative person and process and the way its characteristics are reflected by creative products. But it is not any aspect of the environment that matters here. Indeed, what usually comes to the fore is the *social* element, the role of other people in creative work, either individuals or groups. This restrictive understanding not only excludes at least one other crucial dimension of any environment, the material one, but it also largely neglects the cultural constitution

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of any creative environment. While most studies falling under the 'press' category focus on the relation between creator and peers or evaluators (see this tradition exemplified by Amabile's social psychology of creativity; Amabile, 1996), the connection between creativity and culture did not emerge for a long time as a key research topic (for a recent illustration see Glăveanu, 2020; Glăveanu et al., 2015). This chapter corrects this oversight by focusing precisely on the multiple intersections between creativity and culture and on how both terms have been conceptualized until now. It will be argued that our understanding of what creativity is cannot be separated from an understanding of society and culture and, in fact, our present day conception of creativity talks as much about this phenomenon as it does about the creator's relation to his or her cultural environment. It will also describe the creative process as a fundamental collaborative act that engages human and non-human actors alongside various spaces, places, and institutions. In the end, a sociocultural perspective of distributed creativity will be advanced, blurring the lines between person and context in ways that problematise Rhodes's famous typology.

1 When Creativity Meets Culture: Notes About Theory, Research, and Practice

For decades after its emergence as a discipline (associated by many with Guilford's APA address encouraging fellow researchers to study and foster creativity; Guilford, 1950), the psychology of creativity suffered from an obvious *individualism*, on a theoretical level, and *reductionism*, on a methodological one. By locating the creative process inside the mind of the person and adopting a largely positivistic way of studying creativity as an objective quality of people or products, psychologists missed the opportunity to both understand and make a lasting impact with their research in concrete settings such as education and business. This is because any real-life study of creativity, outside of the laboratory or the testing situation, necessarily has to engage with people, objects and institutions beyond the person of the creator. Using Rhodes's terms, the 'press' factor is obvious for any practitioner, although researchers did not invest much in its study initially (Hennessey, 2003). Nonetheless, after the 1980s, more and more systemic ways of thinking about creativity emerged (Csikszentmihalyi, 1988; Gardner, 1982), and both society and culture appeared on the radar of creativity scholars. Interestingly though, this doesn't mean that prior to this period creativity theory developed in a 'cultural vacuum'. On the contrary, powerful ideas about what culture is stand at the very root of how we think about creativity, creative people and creative collaborations today, something that will become transparent as follows, with the analysis of four key (mis)conceptions.

1.1 The Creative Mind: Culture Exists 'Outside' the Person, Creativity Starts from 'Inside'

One of the most pervasive images of creativity coming out of psychology is that of the creative mind (taken by some to the extreme of talking about the creative brain; Herrmann, 1989), an understanding of creative processes as located mainly inside the head and being represented by special thinking operations. Among them one finds, besides divergent thinking, processes of creative association, analogy and metaphor, selective comparison, combination and recombination of elements, etc. (for more details see Lubart, 2003). Despite some diversity, what models of the creative mind have in common is an implicit dichotomy between person and context, between mind and its (cultural) environment. The old Cartesian split (Jovchelovitch, 2007) is foundational for modern psychology which took as its privileged domain of investigation the human mind and its behavioral expression. What exists outside this mind? Other people, objects, institutions, and everything else, social and material, that makes up what we commonly call human 'culture'. One talks of the creative mind precisely because it can be distinguished from the outside world with which it may be in contact and have a series of exchanges, none of which affect its status as a separate and self-contained entity in its own right. On the other hand, culture exists as such because individual minds constantly create material and symbolic forms that constitute the public domain. Through language and communication, cultural representations are made personal and private representations become public (for a discussion see Sperber's, 1994, epidemiological perspective).

The study of culture as a set of variables existing *independent* of the person and outside of him or her is best represented in psychology by the rise of cross-cultural psychology (for a critique see Cole, 1996; Shweder, 1990; Valsiner, 2013). In sharp contrast to this approach, cultural psychology starts from the premise that mind and culture are *mutually dependent and co-constitutive.* This fundamentally means that culture is not an environment external to the person but the very substance of individual minds. Instead of conceptualizing culture mainly as a national-level phenomenon open to cross-cultural comparisons, sociocultural theory advances the notion of personal cultures (Valsiner, 2000) or the (creative) integration and transformation of cultural signs and tools in the making of the self and the shaping of a life-trajectory. Instead of a fixed set of elements with pre-determined properties, cultural artefacts are constantly appropriated by individuals in their everyday actions and interactions, thus gaining personal value as symbolic resources (for a detailed discussion, see Zittoun et al., 2003).

1.1.1 Methodological Implications

To study the relation between creativity and culture within the cross-cultural research paradigm means to inquire into the *influence, impact or role* of culture on creativity. The former is typically operationalised in terms of values, norms or beliefs, while the

latter is captured either as a potential for creative expression (i.e., in the form of divergent thinking measures) or actual achievement (in case a concrete creative product is generated). This type of research is typically correlational because it is hard if not impossible to capture one cultural element, separate it from others, and manipulate it under standardized conditions. As such, the relation between culture and creativity assumes a certain direction of causality but fails to fully prove it empirically, at least with the means of classic quantitative measures. This is one of the reasons why culture itself has rarely been a concern for creativity researchers who most often operationalised 'press' factors in a more micro and contained manner. The series of experiments initiated by Teresa Amabile and collaborators (see Amabile, 1996) on the role of surveillance or rewards on creative production illustrate such attempts. However, for as informative as findings about the impact of rewards on intrinsic motivation and performance might be, they are hardly sufficient to reconstruct a whole cultural system in which creative work is rewarded in different ways, by different people, and rewards themselves carry various meanings. The great methodological challenge of culture outside/creativity inside perspectives is precisely their inability to explain in a dynamic and developmental manner the exchanges between person and context, creator, and his or her environment.

1.1.2 Practical Implications

This state of affairs has deep implications for practitioners. If we start from the premise that creativity exists inside the mind, then our primary focus will be to stimulate idea generation processes, leaving implementation to the side. Equally, if culture resides outside the individual but has an impact on 'internal' processes such as idea generation, then our concern should be on how to *design* better environments for creativity and shape social interactions around the creator. This is, in fact, the typical premise for many training programmes or strategies for creativity enhancement (see de Bono, 2007). The downside in this case lies precisely in the necessarily narrow conception of both creativity and culture such programmes tend to adopt. The material aspects of creative work, existing outside the mind, as well as the normative and historical dimensions of culture normally escape researchers working within this tradition. Moreover, the emphasis often falls on originality as a marker of creativity, the core of yet another dichotomy between creativity and culture to be discussed next.

1.2 The Original Creator: Culture as 'Sameness', Creativity as 'Difference'

Adding to the creative mind view, this opposition between sameness and differences is crucial for, once more, separating creativity and culture. For many scholars culture is necessarily represented by all those elements that are *common* to a group of people

(often a nation, as we saw in cross-cultural psychology) and set them apart from other groups. Moreover, within culture, there are elements that seem to be characteristic for all societies, thus gaining a universal status and emphasizing once more sameness over difference at a phylogenetic level (Cole, 1996). On the other hand, creativity seems to be deliberately going in the opposite direction. Creators are typically considered people who stand apart because of a unique personality profile or cognitive abilities (Barron & Harrington, 1981). Creative works are defined not only by novelty but also originality or the distance between what existed before and what is being produced. Finally, the creative process is supposed to express something unique about the self of the creator, a view that is specific for the artistic field where the value of a given output is measured against notions of authenticity and personal cost. The greater the difference in expression and the personal cost attached to it, the more notable the creative person or product.

Under these circumstances, it is easy to fall prey to a conception of culture as unitary and creativity as the personal quality making a difference and, as we shall see in the next section, changing culture. But are cultures homogenous and static entities? When considering cultural elements to be 'shared' what exactly does this imply? In order to answer these questions, we can explore sociocultural approaches to culture such as the theory of social representations (Duveen, 2007; Jovchelovitch, 2007), which explicitly theorize social knowledge on the basis of it being possessed by more than one single individual. Following a mediational structure specific for cultural psychology, this theory relates the emergence of representations about different aspects of reality (and, thus, the emergence of culture) to acts of communication between people and groups. In this sense, the actual focus of social representation studies is not or should not be the content of a representation, or what is being shared, but the process of *representing* or the act of *sharing*. Adopting this dynamic and developmental perspective, one becomes sensitive to the fact that constructing a common culture through dialogue and debate does not exclude conflict, difference of opinion or creativity. On the contrary, it places them at the center of cultural processes for which sameness is only a partial achievement and never a given.

1.2.1 Methodological Implications

To build a theory of creativity on the idea that creative work is original by comparison to the more conventional cultural background means to look for difference at the expense of understanding the *value* of sameness. In order to create a significant difference, a minimum level of sharedness is required between creators and between them and their audiences (otherwise there is no possibility of communication). Creative acts use and recombine existing cultural elements and are based on our capacity to appreciate these elements in making sense of novelty and its value (Glăveanu, 2011b). And yet, achieving a common understanding of what is novel is never as straightforward as it seems. This difficulty is well reflected by basic psychometric procedures used in creativity research (Plucker, & Renzulli, 1999). When scoring creativity tests, for instance, psychologists are interested not only in the number of

answers offered (an indicator of fluency) but also how original these answers are and how many different categories they represent (indicators of originality and flexibility). A comparison is thus made between new answers and what a large sample of individuals from within the same population (often seen as a unitary culture) responded for the same items. Considering the typically short length of the answers in testing situations, it is however problematic to assume that any two people taking the test and offering almost identical replies imagine *exactly* the same solution and invest it with the same *meaning*. Once again, language as a cultural tool allows us to share ideas but never in a completely linear, isomorphic fashion.

1.2.2 Practical Implications

Since creativity is considered to be the process that helps us make a difference within our cultural system, its personal and societal value is augmented. Conversely, thinking about culture as sameness can increase the feeling of togetherness but it also makes creators feel sometimes claustrophobic within their social environment. For many, the 'press' factor is precisely one leading towards more sameness and, ultimately, conformity. On the other hand, the pressure towards creativity understood solely as *difference* risks blurring the line between the creative and the simply bizarre. Culture and its system of shared values are not only about making people similar, but giving them a general set of criteria for how to interpret and react to change and novelty. This set of criteria is nonetheless flexible since, without this 'quality', cultures never have the chance to develop and transform as a result of integrating novelty. The alternative view is hard to imagine, and yet, it has often been incorporated in creativity theory, as we will see next.

1.3 The Rebel: Culture as Tradition, Creativity as Progress

From a view of culture as external to the person and essentially homogeneous there is but a small step to considering it a *static* entity, oriented mainly towards the *past*. Indeed, it is not uncommon to think about institutions, a central form of cultural organization, as driven by the need to establish clear routines, preserve them and look for stability rather than change (Douglas, 1986). This image of cultures resisting change is of course clashing with understandings of creativity as the very process of generating and implementing the 'new'. The status of creator is often awarded to those who visibly *revolutionize* a domain and are capable of leaving their mark on culture (Simonton, 1988, 1999). Creativity is therefore future oriented and capable of leading social progress. The question to ask here though is whether cultural forms are as static as we tend to imagine then and also whether creativity is always about producing change or can it also be involved in creating continuity.

To answer this, we need to unpack the notion of *tradition*, a concept that is central to understanding culture and, I will argue, creativity as well. Traditions are often

considered, both by scientific inquiry and common sense, as a set of old and stable beliefs and practices specific for certain groups or communities. As the very substance of culture, tradition is 'backward looking' and 'conservative' and, within an ever-changing and globalized world, there is struggle to keep traditions alive in the sense of keeping them unchanged. However, this conception ignores the fact that the mere survival of a traditional practice rests in its capacity to renew itself and adapt to dynamic environments (Negus & Pickering, 2004). Conversely, creative work always builds upon existing traditions and, when successful, is integrated by tradition (think here about the history of art and its changing canon). As such, the distinctive mark of authentic creativity is not the rupture it creates with the past, but its capacity to transform what exists in ways that help it *continue* in a better and novel way. There are ample examples of this dynamic coming from various creative domains, not least the traditional practice of craft (for a detailed study of creativity in folk art, see Glăveanu, 2013a). What they show is the fact that creativity depends on cultural traditions not only for its resources and standards but also for a background of meanings that renders creative acts intelligible.

1.3.1 Methodological Implications

If the capacity to change culture resides within people and if culture itself is resistant to change, than creators need to have quite a unique personality profile in order to perform their activity. In particular, they need to be able to take *risks* and *not conform* to cultural pressures, in other words, to display a rebellious nature that prevents them from adopting easy solutions and relying on traditional ways of doing things. Indeed, personality research into creativity often stresses risk taking and openness to new experiences (for more details see Feist, 1999) as central requirements for creative achievement in a wide range of areas. What this type of research is silent about, however, is the ontogenesis of such personal qualities, the way they play out within interpersonal contacts and how they are integrated by creators at an identity level. Being rebellious might be the conventional (indeed 'traditional') way of being creative within a Western cultural context, but this doesn't mean that there are no other competing conceptions of what defines a creative person (Lubart, 1999). In order to capture these alternatives methodologically, however, we would need to more consistently inquire about the cultural foundations of our concepts and theories and the biases we might have towards 'romantic' readings of creativity as a special, even dangerous quality.

1.3.2 Practical Implications

A paradoxical relationship is established between creators and culture when adopting the (mis)understanding described here: on the one hand, creative people need to rely on cultural resources, on the other, they are pushed to believe they have to create things '*out of thin air*' because today's culture represents the past while their work

concerns the future. This dilemma is surely experienced as a tension by many and we only need to consider the contemporary art scene to realize this. In fact, though, any additions to the cultural heritage of a group or society should optimally alter this heritage in ways that create not simply novelty, but meaningful novelty. This is what systemic models of creativity also argue for (see Csikszentmihalyi, 1988) when proposing that creators are always in dialogue with a social field and a cultural domain. The question is how do we appreciate what a cultural domain is? Answering this leads us towards the fourth and last dichotomy discussed in this chapter.

1.4 The Hero: High Culture and Everyday Creativity

The idea of culture opposing creativity for being external, homogenous, and static, is mobilized more or less implicitly by creativity scholars in order to promote a certain view of creativity as an individual act, at the same time original and rebellious. But when trying to engage more deeply with the issue of culture, compelled by the fact that great creators are known to shape the cultural environment of particular societies, if not humanity as a whole, it is not this broad and 'democratic' understandings that comes to the fore. On the contrary, creativity theory has traditionally engaged solely with what can be called '*high culture*' or those cultural institutions, artefacts and practices held in high esteem and considered the top achievements of our species. High culture includes the arts and sciences without being limited to them. What it excludes, nonetheless, is the 'vulgar' or the 'mundane', precisely the widely shared elements of culture that were considered in previous sections essential for creative production. Indeed, while more and more creativity research is recently focusing on little or mini-c creative expression (Kaufman & Beghetto, 2009), or the potential to create something of (personal) value, these creations become irrelevant for theories of culture that consider only its most visible outcomes.

This reversal, from 'everyday' to 'high' culture, does not however change many of the attributes I discussed previously. High culture is still (and even more obviously) outside any particular person, it achieves a level of universality, and resists radical change because of its institutionalized nature. The creativity that addresses this cultural level is no longer that of ordinary people but of *geniuses* and there is a long-lasting interest for and fascination with the person of the genius, at least in the Western world, from Antiquity onwards (Glăveanu, 2010). This tradition accentuates the 'qualities' of creators mentioned in previous sections: the eminent expression of individual minds, the uniqueness of their contributions, the progressive and radical aspects of their productivity. Great creators tend to stand alone, they face few of their peers (since they are so different from them), and engage only with previous achievements inscribed into the specialized culture of their domain. This mythology of the genius has gradually been deconstructed not only by psychologists, but by sociologists who rightfully refer to creators in this case as '*culture heroes*' (Schaffer, 1994), mistakenly considered to shape culture in an almost single handed manner. On the contrary, both sociological and sociocultural investigations reveal an intricate picture

of creative collaborations, far more extensive than initially thought (for details see Becker, 2008; John-Steiner, 1992). In this account, the 'culture hero' becomes not a person but designates a privileged 'position' located within and connecting various collaborative networks.

1.4.1 Methodological Implications

A focus on the structure and evolution of high culture has direct consequences for the study of creativity. If everyday life creations remain important for developmental research, studies of historical or Big-C creativity gain prominence in the field for dealing with 'pure' creativity, that is, creativity that transforms society and culture. There is a long tradition of engaging in research focused on *eminent or celebrated creators*, from Galton's (1874) well-known study of hereditary genius and up to much more nuanced and contextual descriptions of exemplary creators in a variety of domains (Gardner, 1993). In contrast to the latter, where detailed case studies are presented to the reader, introducing the life and work of an eminent creator, another vigorous line of research based on *historiometric* investigations adopts a radically nomothetic approach to the study of geniuses and culture (for details see Simonton, 1999). Regardless of the quantitative or qualitative nature of the research mentioned above, a focus on high-level creativity tends to obscure everyday creative acts made by people who don't contribute to 'high' culture but to their more immediate cultural environments, from homes to public spaces, from educational to organizational settings. To disregard this kind of creative expression means, in the end, to exclude a wide range of creative contributions, if not most of them, including the creativity of children who are not typically expected to contribute to culture in a significant way (Csikszentmihalyi in Sawyer et al., 2003).

1.4.2 Practical Implications

A strict division between high and popular culture might be intuitively valid but is has a series of important negative consequences. While we might agree that some creative forms of expression are more visible than others and generate useful novelty for more than an individual or small group, there is no reason to take them as an absolute *measure* for all we call creativity. First of all, operating with this dichotomy hides the fact that most human action is neither 'little' or 'Big' when it comes to its creative value but somewhere 'in between' (see also the notion of community creativity in Glăveanu, 2010). If we add to this a temporal dimension, we will be able to notice as well that what might seem culturally minor at one point can prove to be extremely significant at another (the classic example being that of Van Gogh) or, more often, what was celebrated as new once gradually becomes the usual, no longer noticed by anyone (think about architectural styles or technological inventions). What does this mean for creators themselves? One direct consequence is that creators might very well feel pressured to achieve *social recognition* for their work and eager to embody

the cultural model of the creative hero in their chosen domain. An even greater risk is not to be motivated to act creatively at all when falling short of achieving a significant contribution to culture.

2 Culture and Creativity, Beyond the 'Press' Factor

I have reviewed in this chapter four key (mis)conceptions concerning the nature of creativity and culture and their relationship. Each perspective was structured as a *dichotomy* since very often our understanding of what creativity is takes shape in contrast or in response to a certain view of culture. And this is valid even when we are not fully aware of using such antinomies. In theory, research and in practice, creativity is endowed with certain characteristics precisely because society and culture have the opposite features. Inside—outside, sameness—difference, static—dynamic, extraordinary—ordinary don't only separate culture and creativity, they end up turning culture into the *opposite* of creativity. This is the main reason why creativity theory did not fully engage with this notion until relatively recently, in the last three decades, and also why, when it did, it created a clear separation between the creative person and his or her cultural environment. The classic way of conceptualizing culture is to consider it as 'press', a constraining or enabling factor that can moderate the importance of cognitive or conative variables in creative work (see Amabile's, 1996, componential model of creativity, or Lubart's, 2003, multivariate approach). This certainly is a step forward in terms of acknowledging the role of environmental elements in creative work, but it rarely considers the *mutual dependency* between intra- and inter-psychological factors. This blind spot is reflected in and also endorsed by mainstream methodologies for the study of creativity, such as the wide use of experimental and psychometric tools. In striving for a more 'scientific' or 'objective' study of creativity, these methods start from the premise of the separation between person and context and thus reflect what Montuori and Purser (1997) called 'methodological reductionism'. A science of creativity that can deal with the complexities of systemic, collaborative, and emergent phenomena is still to be born.

What would be an alternative that can help us overcome harmful dichotomies within creativity theory and pave the way for new methodological developments? A proposal to rethink our current models of creativity comes from *cultural psychology*, an emerging inter-disciplinary field drawing not only on social and developmental psychological literature, but also on scholarship from other social sciences (like sociology and anthropology), the humanities (e.g., literary studies and history), and the natural sciences (drawing inspiration from biology, physics and, more recently, chemistry). A cultural or sociocultural model of creativity starts from the premise of the interdependence between creator and culture, both represented as dynamic, open systems (Glăveanu, 2010, 2011b; John-Steiner, 1992). From this perspective, the social and cultural environment is not an outside element imposing its own 'press' on the individual but a constitutive part of both mind and action. Creativity reflects

this very well when theorised as a *distributed and collaborative phenomenon* (see Glăveanu, 2014), as action distributed along social, material and temporal lines. Extending creativity into the cultural world by emphasising processes of exchange, interaction, communication, resistance, and so on, gives our theories a new ground above and beyond what is traditionally a study of internal thinking processes. At the same time, culture gains a new meaning beyond the institutional and macro-level approaches mainly adopted by cross-cultural research and sociological studies of 'high' culture.

Starting to think relationally and culturally about creativity has important conceptual and practical implications, including making us challenge the established schema of the four P's. While useful to systematise and locate one's research, the four P's model endorses the distinction between person and context ('press') and, despite Rhodes's (1961) initial aims, offers a static and disjointed view of creative work by separating person, process, and product. Elsewhere I tried to reformulate this framework from a cultural perspective and proposed a focus on the interrelation or collaboration, in creative expression, between *actors, audiences, actions, artefacts, and affordances* (the five A's model, see Glăveanu, 2013b). In this framework, culture is not outside of but intrinsic to actor—audience relations, to the use and generation of artefacts, and to creative actions aimed at exploiting and expanding existing affordances. Moreover, the 'press' factor acknowledges more than social relations and engages as well with the materiality of a creator's environment. In the end, however, both the four P's and five A's models are descriptive rather than predictive or explanatory. In this sense, they don't specify in advance the relation between their elements and invite researchers to discover them through research. Besides, they seem to cover more or less the same aspects but using a different terminology so the question arises in the end of *why* we should exchange one way of thinking for another.

The answer for me lies in the fact that, while similar on the surface, these two conceptions are radically different on an *epistemological and pragmatic level*. Dichotomising culture and creativity is not prevented (but rather encouraged) by the four P's approach, while unconceivable within a sociocultural framework like the five A's. Questions about correlation and causality formulated within one paradigm are also very different from the explanatory and interpretative focus of the other. But, most importantly, the ways in which creativity is fostered differ greatly. The four P's model invites researchers and practitioners to think about how they can 'design' the environment to have an 'impact' on the creative person according to a simple (and simplistic) causal logic. The cultural approach advocated for here starts by focusing not on separate elements but on the *relations* between person and context and their co-development, on the bonds of collaboration that unite creators with other people and with their wider world. It also understands that there is no 'either/or' between creative and cultural acts and, as such, a concern for culture is not optional but essential for building comprehensive and viable models of creative phenomena.

References

Amabile, T. M. (1996). *Creativity in context*. Westview Press.

Barron, F., & Harrington, D. (1981). Creativity, intelligence, and personality. *Annual Review of Psychology, 32*, 439–476.

Becker, H. S. (2008). *Art worlds: Updated and expended*. University of California Press.

Cole, M. (1996). *Cultural psychology: A once and future discipline*. Belknap Press.

Couger, J. D., Higgins, L. F., & McIntyre, S. C. (1993). (Un)structured creativity in information systems organizations. *MIS Quarterly, 17*, 375–397.

Csikszentmihalyi, M. (1988). Society, culture, and person: A systems view of creativity. In R. Sternberg (Ed.), *The nature of creativity: Contemporary psychological perspectives* (pp. 325–339). Cambridge University Press.

de Bono, E. (2007). *How to have creative ideas: 62 exercises to develop the mind*. Vermillion.

Douglas, M. (1986). *How institutions think*. Syracuse University Press.

Duveen, G. (2007). Culture and social representations. In J. Valsiner & A. Rosa (Eds.), *The Cambridge handbook of sociocultural psychology* (pp. 543–559). Cambridge University Press.

Feist, G. (1999). The influence of personality on artistic and scientific creativity. In R. Sternberg (Ed.), *Handbook of creativity* (pp. 273–296). Cambridge University Press.

Galton, F. (1874). *English men of science: Their nature and nurture*. MacMillan & Co.

Gardner, H. (1982). *Art, mind, and brain: A cognitive approach to creativity*. Basic Books.

Gardner, H. (1993). *Creating minds: An anatomy of creativity seen through the lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Ghani*. Basic Books.

Glăveanu, V. P. (2010). Principles for a cultural psychology of creativity. *Culture & Psychology, 16*(2), 147–163.

Glăveanu, V. P. (2011a). Children and creativity: A most (un)likely pair? *Thinking Skills and Creativity, 6*, 122–131.

Glăveanu, V. P. (2011b). Creativity as cultural participation. *Journal for the Theory of Social Behaviour, 41*(1), 48–67.

Glăveanu, V. P. (2013a). Creativity and folk art: A study of creative action in traditional craft. *Psychology of Aesthetics, Creativity, and the Arts, 7*(2), 140–154.

Glăveanu, V. P. (2013b). Rewriting the language of creativity: The five A's framework. *Review of General Psychology, 17*(1), 69–81.

Glăveanu, V. P. (2014). *Distributed creativity: Thinking outside the box of the creative individual*. Springer.

Glăveanu, V. P. (2020). A sociocultural theory of creativity: Bridging the social, the material, and the psychological. *Review of General Psychology, 24*(4), 335–354.

Glăveanu, V. P., Gillespie, A., & Valsiner, J. (2015). *Rethinking creativity: Contributions from cultural psychology*. Routledge.

Guilford, J. P. (1950). Creativity. *American Psychologist, 5*, 444–454.

Hennessey, B. (2003). Is the social psychology of creativity really social? Moving beyond a focus on the individual. In P. Paulus & B. Nijstad (Eds.), *Group creativity: Innovation through collaboration* (pp. 181–201). Oxford University Press.

Herrmann, N. (1989). *The creative brain*. Brain Books.

Isaksen, S. G., Dorval, K. B., & Treffinger, D. J. (2011). *Creative approaches to problem solving: A framework for innovation and change* (3rd ed.). Sage.

John-Steiner, V. (1992). Creative lives, creative tensions. *Creativity Research Journal, 5*(1), 99–108.

Jovchelovitch, S. (2007). *Knowledge in context: Representations, community and culture*. Routledge.

Kaufman, J. C., & Beghetto, R. A. (2009). Beyond Big and little: The four C model of creativity. *Review of General Psychology, 13*(1), 1–12.

Lin, C. L., Hong, J. C., Hwang, M. Y., & Ling, Y. L. (2006, June). *A study of the applicability of idea generation techniques*. Paper presented at the XVII International Society of Professional Innovation conference, Athens, Greece.

Lubart, T. (1999). Creativity across cultures. In R. Sternberg (Ed.), *Handbook of creativity* (pp. 339–350). Cambridge University Press.
Lubart, T. (2003). *Psychologie de la créativité*. Armand Colin.
Montuori, A., & Purser, R. (1997). Social creativity: The challenge of complexity. Translation of Le dimensioni sociali della creatività. *Pluriverso*, *1*(2), 78–88.
Murdock, M. C., & Puccio, G. J. (1993). A contextual organizer for conducting creativity research. In S. G. Isaksen, M. C. Murdock, R. L. Firestien, & D. J. Treffinger (Eds.), *Understanding and recognizing creativity: The emergence of a discipline* (pp. 249–280). Ablex.
Negus, K., & Pickering, M. (2004). *Creativity, communication and cultural value*. Sage.
Plucker, J., & Renzulli, J. (1999). Psychometric approaches to the study of human creativity. In R. Sternberg (Ed.), *Handbook of creativity* (pp. 35–61). Cambridge University Press.
Rhodes, M. (1961). An analysis of creativity. *Phi Delta Kappan, 42*, 305–311.
Sawyer, R. K., et al. (2003). Key issues in creativity and development. Prepared by all authors. In R. K. Sawyer et al. (Eds.), *Creativity and development* (pp. 217–242). Oxford: Oxford University Press.
Schaffer, S. (1994). Making up discovery. In M. Boden (Ed.), *Dimensions of creativity* (pp. 13–51). MIT Press/Badford Books.
Shweder, R. (1990). Cultural psychology—What is it? In J. Stigler, R. Shweder, & G. Herdt (Eds.), *Cultural psychology: Essays on comparative human development* (pp. 1–43). Cambridge University Press.
Simonton, D. K. (1988). *Scientific genius: A psychology of science*. Cambridge University Press.
Simonton, D. K. (1999). Historiometry. In M. Runco & S. Pritzker (Eds.), *Encyclopedia of creativity* (Vol. 1, pp. 815–822). Academic Press.
Smith, J. K., & Smith, L. F. (2010). Educational creativity. In J. C. Kaufman & R. J. Sternberg (Eds.), *The Cambridge handbook of creativity* (pp. 250–264). Cambridge University Press.
Sperber, D. (1994). The modularity of thought and the epidemiology of representations. In L. A. Hirschfeld & S. A. Gelman (Eds.), *Mapping the mind: Domain specificity in cognition and culture* (pp. 39–67). Cambridge University Press.
Valsiner, J. (2000). *Culture and human development: An introduction*. Sage.
Valsiner, J. (2013). *An invitation to cultural psychology*. Sage.
Zittoun, T., Duveen, G., Gillespie, A., Ivinson, G., & Psaltis, C. (2003). The use of symbolic resources in developmental transitions. *Culture & Psychology, 9*(4), 415–448.

The Social Environment of Creativity

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1 Introduction

We can consider the relationship between creativity and the environment in several ways. First, creative ideas never stem from the void. Some kind of input, at some given time, is necessary for the creative process to unfold, such as an outside problem to be solved creatively, or pieces of knowledge originally combined. Next, we must also acknowledge the role of the environment in the development of the cognitive and emotional resources the individual will use during the creative act. Among other things, our present mental and emotional abilities have been shaped by the social and physical environment of our developmental years of life.

Last, but not least, the environment is determinant in the "production" or final phase of the creative process, as the product or idea must be accepted by specific social groups (such as gatekeepers in Csikszentmihalyi's model of creativity, 1988) to gain the social label "creative". In fact, one way to operationalize creativity is based on this idea of creativity as a social judgment (Amabile, 1996). This facet

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of the relationship between environment and (the acceptance of) creativity will be addressed in the chapter on assessment.

In spite of the relevance of studying the environment of creativity (the "Press" factor, within the four P categorization), data on research in creativity journals give a quite different picture. As we pooled indexed articles from the major creativity research peer-reviewed journals, results showed that the environmental or contextual perspective is not such a priority: less than 5% of articles were recorded with "environment" as a keyword, less than 1% on "social environment". This lack of effort toward gaining increased knowledge about the environment is detrimental to an exhaustive comprehension of the creative process. For Csikszentmihalyi (2006), there is a common, perhaps ontological bias for psychology to study creativity with the lens focused on the individual and less on the environment. Thus our understanding of the multivariate creative process will be more comprehensive with a true contribution of contextual/environmental variables.

This chapter will discuss how the social environment impacts the development of creativity. This implies first to differentiate social from physical environment, which might be an extremely difficult task, for the reason that past and present physical environments of creative individuals are and have been permanently shaped and selected by cultural processes that are also social in nature. As a result, the present chapter, while concentrating on the various social variables at play in the developmental processes of the creative person, such as the presence of siblings, peers, parents, schooling experiences, work environments and culture at large, will also have to discuss how these variables indirectly affect the creative process via the physical environments of the person.

As presented in this volume, comparing and contrasting the numerous fields of creative endeavors is an ongoing process in creativity research. For a broader perspective, we wish here to adopt an inclusive definition of the creative process, and consider the short and long-term processes that lead to creative ideas, discoveries, or objects. In the short term, we must consider the immediate influences the social groups have on the creator in the process of being/becoming creative (what kind of advice can he get, especially in the first part of the process? Is the social environment willing to accept novelty?). Longer-term processes are individual developmental processes (the school-child interaction) and more macro-social processes (such as cultural evolution(s)).

One useful framework for investigating the social contexts in creativity is Bronfenbrenner's ecological systems theory (1979, 1986), which proposes that the individual's psychological development results from interactions with different types of environmental systems that range from local to global. Consider how a better understanding of each of these systems could help us grasp the effect of social environment variables on the individual's development of creativity.

First are *microsystems*, or social groups in which the individual participates, such as family, peer groups, schools, as well as religious communities, workmates and neighborhoods.

Next are *mesosystems*, which represent the relationships and interactions between microsystems, as experiences in each of these groups affect experiences in the other

circles. At times these interactions are very intricate, such as private schooling within a religious perspective and community, or employers that provide for virtually all of their employees' living needs (housing, dating services, schooling of children, cultural outgoings, *etc.*…). Third are *exosystems*, or parameters of the environment that only indirectly affect human development. These systems are for instance the work environment of the parents (what is the status of creativity in the parents' jobs ?), that may induce specific representations of creativity in the rearing practices (cf. the notion of social reproduction, Bourdieu & Passeron, 1964, 1970). The fourth level is the cultural level or *macrosystem*, which includes variables like socioeconomic status, ethnicity, as well as culturally shared values and identity. Last in Bronfenbrenner's model comes the *chronosystem*, which represents the lifelong evolution of the four previous systems over time. This last and overall system is hard to grasp, because it includes many multivariate interactions and retroactions with strength varying in time. Yet the notion of change in the environment with time is central in our conception of creativity, which is the result of lifelong experience, and which occurs in an evolving environment. Even if some environmental variables cannot be easily categorized in Bronfenbrenner's model, we will adopt it as a useful framework to describe the various influences of past and present social worlds on the individual's creativity.

2 Microsystems

2.1 The Family

2.1.1 Birth Order

Let's first consider the family microsystem. Demographic differences such as the presence or absence of siblings, their gender, age differences and birth order have been examined with respect to creativity development (Baer et al., 2005). Birth order have been discussed at length in recent years after the publication of Sulloway's book "Born to rebel" (1996, see also Zweigenhaft & Von Ammon, 2000), which asserted, based on historical case studies, that laterborns were more supportive of radical rebellions than were first-borns. This birth order effect Sulloway claimed was later nuanced, saying that it was strongest within families and people living together, and less potent outside family contexts (Sulloway & Zweigenhaft, 2010, p. 12). For example, Forland et al. (2012), using historical data from the 60s student protests in Norway ($n = 1246$), found no birth order effect, with upbringing in an urban environment and parental personality and values as the strongest predictors of the child's subsequent radicalisation. The creativity-birth order connection is indeed a controversy, as several empirical studies failed to replicate Sulloway's findings, while others found an over-representation of first born in other creative

fields (for example, in musical creativity; Schubert et al., 1977). Using an experimental approach, Baer and collaborators (2005) found that creative potential, based on teammates' evaluation of undergraduates' creative responses to human resources and product development problems, was positively associated to the first birth rank, but only when the firstborn had either a large group of siblings close of age, or a large group of siblings of opposite sex. Here is one of many observations of the complexity of doing research in creativity, as we see that examining the effect of a single environmental microsystem entails to fully take into account the interactions between variables within that system, not considering the interactions with the other systems.

2.2 Parenting Style

The link between parenting style and creativity has also been scientifically investigated. However, no data has been able to fully falsify one of two opposing views regarding the role of parenting styles in creativity development. On the one hand, experimental data on child and adolescent creativity has shown that a nurturing parental environment (such as Baumrind's [1966] authoritative style) was positively associated with creative potential (Harrington et al. 1987; Lubart et al., 2003; Mouchiroud & Bernoussi, 2008), whereas an authoritarian parenting style was negatively associated with the child's creative potential (Fearon et al., 2013). This is in accordance with developmental perspectives such as Carl Rogers', that of a positive effect on child development of a family environment that provides both psychological safety and psychological freedom, an environment that is psychologically scaffolding, encouraging and with delayed criticism. In the same vein, Mumford and Gustafson (1988) propose that the environment most favorable to creativity development is the one in which children can learn that some stability exists, but also that modification can be possible as a result of one's own action.

Yet an opposite view proposes that the family environment that is more likely to lead to creative offspring must include obstacles to be overcome, as a sort of problem solving exercises that will "train" the creator. In order to become creative, the child must learn to overcome hardship and be independent. Metaphorically speaking, the child facing family hardship is akin to the butterfly which needs the long and strenuous task of breaking through its cocoon to become able to properly fly into adulthood. Based on biographical data, authors such as Ochse (1990) thus found that a significant portion of creators came from "unstable" families or lacking emotional support (broken family, parents rejecting or absent).

These two contrasting results could be interpreted in terms of the type of data considered to assess creativity: In one former case, the creative potential of children in experimental studies; in the latter, reports and writings on the "actual" creativity of famous artists and inventors. As we cannot be certain that each member of the first group actually becomes part of the second after a few years, it could be said that the

former investigates "everyday creativity," whereas the latter is more concerned with "historical creativity" (Boden, 1990).

In sum, the family composition and functioning already shows us the complex interactive effects of social variables on the development of creativity, which entails a complex and interactive model of the creative process.

2.3 Peers

The influence of peers on creativity development can be of two kinds. First, dyadic relationships between peers can shape in part the psychological characteristics of the child. It can be extended that particular friendship during childhood also affects the creative personality of the individual. Second, peer groups can act as a sort of micro culture in the child's personality development, influencing it via group norms and evaluations. According to Harris (1995, 2009), peer groups have actually a strong influence on the child and adolescent personality development, stronger than the influence of both parents and school systems. She proposed a group socialization developmental model, whose validity is still under debate (see Vandell, 2000), as no empirical study has yet incorporated longitudinal designs and genetic controls together with all the possible social predictors of adult psychological characteristics. In spite of the absence of data, we should consider peers (both in close friendships as well as in the peers' social circles) as potential influences on subsequent creativity careers.

2.4 Schooling

The school environment is one additional microsystem that impacts creativity development. Some educators have actually crafted curricula specially designed to foster creativity development (see Chapter "Creativity in the Classroom: Advice for Best Practices").

Before addressing the link between school environment and creativity, one particular teaching environment that must be discussed is homeschooling. This form of education has been growing steadily in the past decades in developed countries, yet to date no empirical research has been set to measure its potential effect on creativity. In a literature review of some of the educational, psychological and sociological impacts of homeschooling, Murphy (2014), while stating that research in this area is scarce and not exempt of sampling and/or methodological biases, provides evidence that homeschooled children do not on average score below children in regular or private schools when comparing performances in classical achievement tests, as well as in success in subsequent university graduation. On the contrary, some of the variables that usually significantly affect school achievement, such as family income and parental education, do not predict as strongly performances in the home

schooled children sampled. Last, the hypothesis of home schooled children socially at risk because of their "isolation" from the usual school social circle is not supported by research. Home schooled children and adolescents seem to demonstrate appropriate pro-social behaviors and social responsibility, while homeschooled families on average are more socially and civically engaged in their community than are regular families. These interesting results again point at the need for longitudinal research on the effect of home school environment on creative life-long achievements.

Class schooling, or school in the classroom, can also host various kinds of learning environments. In a study on the development of creative abilities in primary school children, Besançon and Lubart (2008) contrasted traditional pedagogy from alternative pedagogy in learning environments. In the traditional type, knowledge is mainly provided by the teacher ("the authority figure"), and this knowledge can be at time quite remote from everyday life. Next, pupils are ranked by a grading system, which may impact on self-perception and motivation to pursue excellence. Last, in traditional pedagogy, little time is devoted to divergent thinking, an essential aspect of creative abilities. Instead, traditional pedagogy emphasizes teaching of classical subjects such as math or language. In contrast, alternative pedagogies promote the acquisition of knowledge through actions, so that the role of teachers is here to provide learning contexts that will foster the motivation to learn. Knowledge is considered the child's own construction (or creation). In addition, alternative pedagogies usually put more emphasis on the development of imagination, via more creative and/or artistic activities. Empirical research on the influence of regular vs alternative school environments on creativity have been rare, and results are still non-conclusive. In their study, Besançon and Lubart (2008) compared regularly schooled children with ones enrolled in two alternative schools, following the pedagogy proposed by Montessori (1958/2004) or by Freinet (1990), using both divergent thinking and integrative tasks. Complex pattern of results emerged, with observed influence of pedagogy, teacher and type of creativity measurement. To sum up, children in alternative pedagogy showed on average higher creative potential than children in traditional pedagogy. In addition, their longitudinal design showed progression of creativity measures for children schooled in the Montessori school after at least one year of schooling.

In future research, studies on the effect of the types of pedagogy should be investigated together with types of teachers, as their psychological characteristics can affect their representations and implementations of teaching methods (Cheung & Leung, 2013). Even though most teachers declare they foster creativity in their classroom, this intention often contradicts their conception of the "good" student, conceived as one that complies to the rules and does not question authority (Verkasalo et al., 1996). Cropley (1997) identifies traits common to "creativity school teachers": they encourage independent learning, they encourage cooperation in and outside of the classroom, they motivate pupils to acquire the basic knowledge that can be later creatively combined, they foster flexible thinking by giving them a large array of learning contexts, they delay evaluation and favour the pupil's own self-evaluation, they take seriously pupils' questions and suggestions, and they help pupils overcome their frustrations and failures when the creative process does not lead (or takes time to lead) to a creative production. (see Kaufmann chapter in this volume).

2.5 Mentors

One last learning environment in the early years must be discussed, the one provided by the presence of a mentor. Here again the empirical evidence is scarce, yet the positive effect of mentorship has been observed in some studies (Nakamura et al., 2009; see also Torrance's 22 year longitudinal study, 1983) on the number of creative contributions a person produces in a lifetime. In the same vein, Zukerman (1983) notes that most Nobel Laureates reported they have had mentors to help them lead their career.

2.6 The Work Environment

During adulthood, other more proximal variables affect the probability of occurrence of creativity. The type of professional activity will predict in part the possibilities for creative accomplishments. Whereas (every minutes of) some occupations are extremely structured through strict procedures that cannot be circumvented, thus leaving virtually no room for creativity, others come with an environment specially designed to foster creative ideas: quick access to information and latest technological tools, a work atmosphere that can offer both stimulation (in the preparation and illumination phases of the classical creative process model) and calmness (in the incubation and verification phases), as well as a relative freedom from temporal constraints. As this ideal work environment is not often observed in most firms, it is no wonder why creators and inventors often "individualize" their work environment, by creating their own company.

Even if most work environments are highly structured and leave little room for creative behaviors, creativity still manages to find its way through the work constraints, whatever the individual's position in the firm's hierarchy (see examples in Lubart et al., 2003). In addition, in many cases, work problems cannot be solved using the usual procedure. For those types of problems (i.e., real problems), a creative solution is always needed.

To sum up this part on the environmental micro-systems potentially acting on creativity development, more research is needed to isolate the variance explained by each systems (the effect of neighborhood and religious local institutions in creativity development remains to be empirically tested). Yet, we must consider the possibility of interactions between micro-systems, that is, mesosystems in Bronfenbrenner's ecological model.

3 Mesosystems

Mesosystems are defined as interconnections between micro-systems. In spite of its relevance in a multivariate model of creativity, studies investigating mesosystems are even scarcer than those investigating microsystems. In one study however, Mouchiroud and Bernoussi (2008) examined how children's performances in the domain of social creativity could be linked to social and individual variables. Among other results, they reported that both popularity in the school peers group and type of parental education predicted a significant portion of variance of creative potential.

Future directions for research on mesosystems should begin with the exploration of a matrix that enumerates all the possible interactions: for example, the interaction between family and school (are parents involved in the school life? Are teachers' judgments of pupils' abilities biased by their previous experiences with older siblings ?), or between family and peers (are parents favoring interactions between their child and peers, for example via their willingness [or not] to invite their children's peers at home?).

4 Exosystems

Exosystems deal with environmental variables that can indirectly affect the child's psychological development, such as changes in parental work environments (for example, how a promotion at work can affect the family environment), or changes in the neighborhood (for example, how the building of a new factory, or the closure of one, can impact the child's microsystems: strong variations in the school's functioning, with opening or closure of classes, evolution in the child's peer groups, …). In turn, each of these changes in exosystems can impact the development of creativity. For example, in the previous example of the parents' work environment, a promotion could lead both to less financial pressure on the family, which could result in a richer and more varied physical environment, possibly a good thing for creativity, and to longer working hours, leading to less interactions between the child and his or her parent(s), a change that could be detrimental to creativity development. Unfortunately, even though the previous examples illustrate the potential influence of exosystems on creativity, to our knowledge no empirical study has been devoted to this type of investigation.

5 Macrosystem and Chronosystem: The Influence of Culture

The culture macrosystem refers to the thoughts, behaviors, traditions, values, representations and symbols people share. Culture is the variable with the larger spectrum of influence on creativity, as it impacts societal variables, but it also indirectly affects narrower systems, such as the neighborhood, family and school systems. Cultural factors that can influence creativity are the era in which the child grows, the importance of religion, the current political ideologies and type of policies, as well as the socio-economic status (SES) of the parents, which includes not only financial, but also social and cultural capital. Concerning the SES variable, empirical evidence supports the existence of a creativity gap, similar to the well-known academic achievement gap (Dai et al., 2012; Dudek et al., 1994; Karwowski, 2011).

Culture structures the way a group of persons will interact with its physical and social environment, influencing both the type of experiences the child will have and how these experiences will be interpreted. The culture of one community is learned from one generation to the other, yet it evolves according to cultural innovations created within or borrowed from other cultures. This change in time suggests that culture should be considered a macrosystem as well as a chronosystem. Yet beside temporal variability, we must acknowledge the existence of inter-cultural variations that have a strong impact on creativity. Several empirical studies have investigated the impact of cultures on the creative potential. More than differences between cultures, researchers emphasize the fact that exposure to multiple cultures can have a significant impact on divergent thinking and creative thinking (Çelik et al., 2016; Cheung et al., 2016; Forthmann et al., 2018; Lau et al., 2013; Storme et al., 2017a, 2017b). Several explanations have been suggested, focusing mostly on the impact of cultural complexity on executive functions (Tadmor et al., 2009). Though interesting and informative, such studies are often limited because they rely on a culturally influenced definition of what creativity is. Indeed, studies show that each culture has its own conception of what is a creative act. In addition, the cultural framework acts on the level of creative activities as on the possibilities to behave creatively, depending on the domains of expression.

5.1 The Cultural Definition of Creativity

The definition of creativity that is referred to as the "consensual" definition refers to the idea of a creative act that is both original and adapted to the task. Yet this definition is rooted in the European cultures. One crucial aspect of this definition lies in the tangible nature of the creative act: the creative process leads to the production of an "object", which characteristics can be assessed by a panel of judges (Amabile, 1996). This conception of creativity centered on the creative product is coherent with the "occidental" perspective on creation, underlined by a continuous motion toward

a new achievement, and incidentally by a continuous growth of innovations. This can be traced in part back to Genesis, which lasted six days, with each working day producing significant creations: earth, animals, etc. From a precise zero point (the void, in most western tales), the process leads to a concrete product, the universe, which the divine creator finds satisfying.

There are however other conceptions of creativity than those derived from western cultures. Among the most contrasted ones are the perspectives originating in the oriental or Asian cultures. In this case, creativity is less related to the production of novel objects than to the truthfulness of the discovery process. Creativity corresponds to a feeling of plenty, to the establishment of a link with a traditional world, to the expression of a deep self, of an ultimate reality (or an ultimate illusion, in the Buddhist framework). Meditation takes a central role, by helping the individual to discover the true nature of one object, one event, one motion and ultimately of one's own consciousness. In the artistic field, Li (1997) proposes a spatial metaphor to account for the east vs. west contrast in conceptualizing creativity: artistic expression would be "vertical" in eastern cultures, in which novelty derives from well-defined fundamentals, whereas western cultures would be more "horizontal", as they authorize novelty in virtually every aspects of the piece of art.

Promotion (or prohibition) of creativity varies dramatically from one culture to another, and from one field to another within a given culture. In his historiometric research, Simonton (1997) shows for example that the presence of eminent creators in one field in a given generation predicts in part the level of creativity in the same field in the next generation. In addition, increased creative activity can also be predicted by the proximity of cultural, commercial or industrial places.

The values transmitted by the cultural environment stimulate or impede creative activities, depending on the importance given to the individual or to the group. The more individualistic societies (such as North America and Europe), tend to consider the individual as an autonomous and independent person, contrary to more collectivist societies (such as Asian countries), which define the individual first with reference to his or her social context (social and family norms). At the psychological level, this cultural framework will influence the way the individual will differentiate himself or herself from other members of the community (the individuation process). In a study on the artistic creativity of American and Malaysian students, Burns and Brady (1992) note that these two groups differ in the expression of their need for individuation, in their use of rare and innovative materials, as well as in their endorsement of original behaviors or ideas. In the same vein, Ng (2001) states that the differences between eastern and western cultures in terms of creativity can be largely explained by the individualism-collectivism cultural variable.

Related to the individualism-collectivism continuum is the place given to the respect of traditions. Some cultures more than others allow for behaviors that depart from traditions. There also exists cultural beliefs and attitudes that promote or hinder creativity. In the western world, Adams (1986) identified some beliefs that can block creativity: "fantasy and reflection are a waste of time", "adults should not be playing", "reasoning, logic and success are positive; intuition, emotions and failures are negatives".

5.2 The Cultural Definition of Creative Products

Perhaps as much as they explain the activity of creating, different cultural contexts shape the way that creative tasks and creative problems are defined. By changing the criteria for judging creative products, culture does not only change creativity evaluations, but also redefines creativity and changes an individual's creative activity. Indeed, one of the components of culture is the definition of creative or aesthetic "standards" to define superior creative achievements. For example, in the domain of figural creativity, in spite of (incomplete) evidence of cultural invariance in evaluations of quality of execution (see Myszkowski & Zenasni, 2020), different cultural environments define aesthetic value differently (e.g., one culture may favor round shapes or symmetry more than the other), orienting the individual's creative products towards (or in opposition to) a form of "good taste", which varies depending on the cultural context (Myszkowski et al., 2020).

This relationship between culture-specific standards and the creative activity is a probable explanation for artistic movements: Specific standards are favored and even sometimes overtly promoted (consider how Vinci's *Vitruvian Man* or Dürer's *Man Drawing A Lute* are at the same time works of art and prescriptions to artists that shape creativity), and creators respond to these standards. They may respond to standards in different ways, such as following them, expanding them, refining them, pastiching them or transgressing them, but either way, their creative activity is often essentially a response to (and thus, in some ways, a product of) the cultural environment. Empirical research suggests that the ability to recognize aesthetic standards is indeed a predictor of creative potential (Myszkowski et al., 2014; Myszkowski & Zenasni, 2016), that creating new objects is often based on the use of "natural" and "classical" rules observed in the environment (Ward, 1994; Ward & Sifonis, 1997; Ward et al., 2004), and that the evaluation of one's creative ideas is in fact a component of the creative process itself (Cropley, 2006). This series of results, advocates for the idea that culture, through the constant production and refining of standards, provides creators with a path towards a product that is likely to be judged creative—and, more generally, favorably—in a specific cultural context, and therefore defines and orients creative products towards (or away from) specific features.

5.3 The Shaping of the Social Environment via New Cultural Tools

In westernized cultures, the rate of technical innovations (chronosystem) has set a rapid pace of change in the social environment, that in turn affects creativity and its development. Technologies, particularly information technologies, are new cultural artefacts that have taken an increasingly central place in children's environment, in the time spend in the family as well as with peers and in school. Data shows that today children and adolescents watch more TV, play more video games and stay longer on

the web than before, and they do this at an increasingly younger age (see Calvert & Valkenburg, 2013). As the evidence generally establishes a negative relationship between media use, particularly television, and the development of creativity, more research is needed to assess the impact of these tools on the micro and meso systems we discussed above. As Gaudin (2005) states, we can draw opposite hypotheses regarding this impact. On the one hand, due to the multiple solicitations of communication tools, is there a risk for the developing individual to grow schizoid symptoms, that is multiple personalities scattered between several "software programs"? On the other hand, since the individual is being trained to permanently negotiate between these multiple processes, thus replacing the affirmation of a unitary "self", might the collective processes of creativity become more "natural" and more desirable than centralized creativity structures? Again longitudinal research is needed to support one of these two opposite predictions.

6 Conclusion

The multivariate model of creativity implies to investigate the numerous individual and contextual variables that can predict individual differences. This task is not a small one, as we only presented in this chapter multiple aspects of the social environment that could be associated with better creative performances. Even if the empirical evidence is scarce in this domain, we presented significant findings that link social environment variables to creativity and to its development. Yet how the environmental systems interact with the acquisition of individual resources necessary for creativity remains largely unexplored.

Research on creativity has made notable progress in improving our understanding of the creative process, but the individual/psychological approach alone is unable to fully grasp the complexity of this process. With the integration of the additional viewpoints provided by social perspectives, we should be able to benefit from a larger and more heuristic/comprehensive science of creativity.

References

Adams, J. L. (1986). *Conceptual blockbusting, a guide to better ideas.* Addison-Wesley.

Amabile, T. M. (1996). *Creativity in context*. Westview Press.

Baer, M., Oldham, G. R., Hollingshead, A. B., & Jacobsohn, G. C. (2005). Revisiting the birth order-creativity connection: The role of sibling constellation. *Creativity Research Journal, 17*(1), 67–77.

Baumrind, D. (1966). Effects of authoritative parental control on child behavior. *Child Development, 37*, 887–907.

Besancon, M., & Lubart, T. I. (2008). Differences in the development of creative competencies in children schooled in diverse learning environments. *Learning and Individual Differences, 18*, 381–389.

Boden, M. A. (1990). The creative mind: Myths and mechanisms Weidenfeld. *Abacus & Basic Books*, *4*.

Bourdieu, P., & Passeron, J.-C. (1964). *Les héritiers: les étudiants et la culture* [The inheritors: French students and their relations to culture]. Edition de Minuit.

Bourdieu, P., & Passeron, J.-C. (1970). *La Reproduction. Éléments pour une théorie du système d'enseignement* [Reproduction in education, society and culture]. Les Éditions de Minuit.

Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Harvard University Press.

Bronfenbrenner, U. (1986). Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology, 22*(6), 723–742.

Burns, D. J., & Brady, J. (1992). A cross-cultural comparison of the need for uniqueness in Malaysia and the United States. *The Journal of Social Psychology, 132*(4), 487–495.

Calvert, S. L., & Valkenburg, P. M. (2013). The influence of television, video games and the internet on children's creativity. In M. Taylor (Ed.), *The Oxford handbook of the development of imagination* (pp. 438–450). Oxford University Press.

Çelik, P., Storme, M., & Forthmann, B. (2016). A new perspective on the link between multiculturalism and creativity: The relationship between core value diversity and divergent thinking. *Learning and Individual Differences, 52*, 188–196.

Cheung, R. H. P., & Leung, C. H. (2013). Preschool teachers' beliefs of creative pedagogy: Important for fostering creativity. *Creativity Research Journal, 25*(4), 397–407.

Cheung, P. C., Lau, S., Lubart, T., Chu, D. H., & Storme, M. (2016). Creative potential of Chinese children in Hong Kong and French children in Paris: A cross-cultural comparison of divergent and convergent-integrative thinking. *Thinking Skills and Creativity, 22*, 201–211.

Cropley, A. J. (1997). Fostering creativity in the classroom: General principles. In M. A. Runco (Ed.), *Creativity research handbook* (Vol. 1, pp. 83–114). Hampton Press.

Cropley, A. (2006). In praise of convergent thinking. *Creativity Research Journal, 18*(3), 391–404.

Csikszentmihalyi, M. (1988). Society, culture, and person: A systems view of creativity. In R. J. Sternberg (Ed.), *The nature of creativity: Contemporary psychological perspectives* (pp. 325–339). Cambridge University Press.

Csikszentmihalyi, M. (2006). *La créativité: Psychologie de la découverte et de l'invention* [Creativity: Psychology of discovery and invention]. Robert Laffont.

Dai, D. Y., Tan, X., Marathe, D., Valtcheva, A., Pruzek, R. M., & Shen, J. (2012). Influences of social and educational environments on creativity during adolescence: Does SES matter? *Creativity Research Journal, 24*(2–3), 191–199.

Dudek, S. Z., Strobel, M., & Runco, M. A. (1994). Cumulative and proximal influences of the social environment on creative potential. *Journal of Genetic Psychology, 154*, 487–499.

Fearon, D. D., Copeland, D., & Saxon, T. F. (2013). The relationship between parenting styles and creativity in a sample of Jamaican children. *Creativity Research Journal, 25*(1), 119–128.

Forland, E., Korsvik, T. R., & Christophersen, K.-A. (2012). Brought up to rebel in the sixties: Birth order irrelevant, parental worldview decisive. *Political Psychology, 33*(6), 825–838.

Forthmann, B., Regehr, S., Seidel, J., Holling, H., Çelik, P., Storme, M., & Lubart, T. (2018). Revisiting the interactive effect of multicultural experience and openness to experience on divergent thinking. *International Journal of Intercultural Relations, 63*, 135–143.

Freinet, C. (Ed.). (1990). *Co-operative learning and social change: Selected writings of Celestin Freinet*. Ontario Institute for Studies in Education Press.

Gaudin, T. (2005). *La prospective*. Presses Universitaires de France.

Harrington, D. M., Block, J. H., & Block, J. (1987). *Testing aspects of Carl Roger's theory of creative environments: Child-rearing antecedents of creative potential in young adolescents*. Cambridge University Press.

Harris, J. R. (1995). Where is the child's environment? A group socialization theory of development. *Psychological Review, 102*, 458–489.

Harris, J. R. (2009). *The nurture assumption: Why children turn out the way they do*. Touchstone.

Karwowski, M. (2011). It doesn't hurt to ask…But sometimes it hurts to believe: Polish students' creative self-efficacy and its predictors. *Psychology of Aesthetics, Creativity, and the Arts, 5*(2), 154–164.

Lau, S., Cheung, P. C., Lubart, T. I., Tong, T. M., & Chu, D. H. (2013). Bicultural effects on the creative potential of Chinese and French children. *Creativity Research Journal, 25*(1), 109–118.

Li, J. (1997). Creativity in horizontal and vertical domains. *Creativity Research Journal, 10*(2–3), 107–132.

Lubart, T. I., Mouchiroud, C., Tordjman, S., & Zenasni, F. (2003). *La psychologie de la créativité* [Psychology of creativity]. Armand Colin.

Montessori, M. (1958/2004). *Pédagogie scientifique, Tome 2: éducation élémentaire* [Scientific pedagogy, vol 2: Elementary education]. Desclée de Brouwer.

Mouchiroud, C., & Bernoussi, A. (2008). An empirical study of the construct validity of social creativity. *Learning and Individual Differences, 18*(4), 372–380.

Mumford, M. D., & Gustafson, S. B. (1988). Creativity syndrome: Integration, application, and innovation. *Psychological Bulletin*, *103*(1), 27–43. https://doi.org/10.1037/0033-2909.103.1.27

Murphy, J. (2014). The social and educational outcomes of homeschooling. *Sociological Spectrum: Mid-South Sociological Association, 34*(3), 244–272.

Myszkowski, N., Çelik, P., & Storme, M. (2020). Commentary on Corradi et al.'s (2019) new conception of aesthetic sensitivity: Is the ability conception dead? *British Journal of Psychology*, *111*(4), 659–662.

Myszkowski, N., Storme, M., Zenasni, F., & Lubart, T. (2014). Is visual aesthetic sensitivity independent from intelligence, personality and creativity? *Personality and Individual Differences, 59*, 16–20.

Myszkowski, N., & Zenasni, F. (2016). Individual differences in aesthetic ability: The case for an aesthetic quotient. *Frontiers in Psychology, 7*, 750.

Myszkowski, N., & Zenasni, F. (2020). Using visual aesthetic sensitivity measures in museum studies. *Frontiers in Psychology, 11*, 1–4.

Nakamura, J., Shernoff, D., & Hooker, C. (2009). *Good mentoring*. Jossey-Bass.

Ng, A. K. (2001). *Why are Asians less creative than westerners?* Prentice-Hall.

Ochse, R. A. (1990). *Before the gates of excellence: The determinants of creative genius*. Cambridge University Press.

Schubert, D. S. P., Wagner, M. E., & Schubert, H. J. P. (1977). Family constellation and creativity: Firstborn predominance among classical music composers. *The Journal of Psychology, 95*, 147–149.

Simonton, D. K. (1997). Creative productivity: A predictive and explanatory model of career trajectories and landmarks. *Psychological Review, 104*, 66–89.

Storme, M., Çelik, P., Camargo, A., Forthmann, B., Holling, H., & Lubart, T. (2017a). The effect of forced language switching during divergent thinking: A study on bilinguals' originality of ideas. *Frontiers in Psychology, 8*, 2086.

Storme, M., Lubart, T., Myszkowski, N., Cheung, P. C., Tong, T., & Lau, S. (2017b). A cross-cultural study of task specificity in creativity. *The Journal of Creative Behavior, 51*(3), 263–274.

Sulloway, F. J. (1996). *Born to rebel: Birth order, family dynamics, and revolutionary genius*. Pantheon.

Sulloway, F. J., & Zweigenhaft, R. L. (2010). Birth order and risk taking in athletics: A meta-analysis and study of major league baseball. *Personality and Social Psychology Review, 14*, 402–416.

Tadmor, C. T., Tetlock, P. E., & Peng, K. (2009). Acculturation strategies and integrative complexity the cognitive implications of biculturalism. *Journal of Cross-Cultural Psychology, 40*(1), 105–139.

Torrance, E. P. (1983). Role of mentors in creative achievement. *The Creative Child and Adult Quarterly, 8*, 8–15.

Vandell, D. L. (2000). Parents, peer groups, and other socializing influences. *Developmental Psychology, 36*(6), 699–710.

Verkasalo, M., Tuomtvaara, P., & Lindeman, M. (1996). 15-year-old pupils' and their teachers' values, and their beliefs about the values of an ideal pupil. *Educational Psychology*, *16*(1), 35–47. https://doi.org/10.1080/0144341960160103

Ward, T. B. (1994). Structured imagination: The role of category structure in exemplar generation. *Cognitive Psychology, 27*(1), 1–40.

Ward, T. B., Patterson, M. J., & Sifonis, C. M. (2004). The role of specificity and abstraction in creative idea generation. *Creativity Research Journal, 16*(1), 1–9.

Ward, T. B., & Sifonis, C. M. (1997). Task demands and generative thinking: What changes and what remains the same? *Journal of Creative Behavior, 31*(4), 245–259.

Zukerman, H. (1983). The scientific elite: Nobel laureates' mutual influence. In R. S. Albert (Ed.), *Genius and eminence* (pp. 241–252). Pergamon Press.

Zweigenhaft, R. L., & Von Ammon, J. (2000). Birth order and civil disobedience: A test of Sulloways's 'born to rebel' hypothesis. *The Journal of Social Psychology, 140*(5), 624–627.

The Place to Be: Organizational Culture and Organizational Climate for Creativity

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Keywords Organizational culture · Organizational climate · Work environment · Creativity

1 Introduction

In the workplace, creativity is situated in and affected by the organizational context. Creativity cannot be fully understood in isolation from that context. However, creativity does not occur easily in the workplace; creativity emerges from a complex interaction between a person and his/her work situation (Woodman et al., 1993). Successful creative efforts depend on the extent to which organizations adopt creativity-supporting cultural values, how organizations implement creativity-facilitating organizational settings, and in what way organizational members experience the context (e.g., Amabile et al., 1996; Mumford, 2000; Shalley & Gilson, 2004; Tesluk et al., 1997; Woodman et al., 1993).

Over the last decades, creativity researchers in fields such as psychology and management have studied how organizational culture and climate can facilitate employees' creativity. In this chapter, we examine this research and we explore how culture and climate influence individual creativity in organizational settings. We focus on individual creativity, not on team creativity. This chapter is organized as follows. A first section examines the concepts of organizational culture and climate

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and their relationship. Second, we discuss the impact of organizational culture and climate on creativity, in particular how both the social-organizational work environment, and the physical work environment can support creativity. The third section discusses the main findings, limitations and future research, and provides practical recommendations. The goal of this chapter is to review the literature, raise key issues, highlight major trends, and provide illustrations of research findings. In this way, this chapter offers a complementary view to previous syntheses about culture and climate for creativity (e.g., Amabile et al., 1996; Anderson et al., 2004, 2014; Dul et al., 2011; Egan, 2005; George, 2007; Hunter et al., 2007; Lone et al., 2014; Rank et al., 2004; Runco, 2004; Shalley & Gilson, 2004; Shalley et al., 2004; Zhou & Shalley, 2003).

2 Organizational Culture and Climate

2.1 The Concepts of "Organizational Culture" and "Organizational Climate"

Creativity researchers describe the broader organizational context that affects creativity usually in terms of "culture" or "climate" for creativity. Many times the terms culture and climate are used interchangeably. When discussing characteristics and dimensions of culture and climate for creativity many characteristics and dimensions indeed seem to overlap. Mumford et al. (2002) consider culture to be the organization's normative expectations regarding behavior, and climate to be people's perceptions of organization's actual actions regarding these behaviors. They argue that most studies on the effect of organizational context and creativity do not distinguish between culture and climate. For example with respect to effects of risk taking on creative behaviors no distinction may be made between the perceptions of normative expectations regarding risk taking (e.g., the culture that it is appreciated when people take risks) and the perception of the organization's actual actions regarding risk taking (the climate in which people do take risks).

Although Parker et al. (2003) claim that the conceptual confusion in climate and culture research has diminished, still many studies today lack a clear distinction between organizational culture and organizational climate. A conceptual and methodological confusion between culture and climate may cause conflicting results on the effects of organizational culture and climate on creativity. To avoid such difficulties in this chapter we present in Table 1 a classification of the concepts of "organizational culture" and "organizational climate". In this table we also distinguish between the focal unit of the theory: individual (psychological) level of culture and climate, and contextual (organizational) level. At the individual level, culture and climate are perceptions of individuals, whereas at organizational level culture and climate refer to collectively shared or agreed views.

This classification differentiates between organizational culture and organizational climate on the one hand, and between the focal unit (level) of the theory:

Table 1 Classification of the concepts "Organizational culture" and "Organizational climate"

	Organizational culture	Organizational climate
Focal unit of the theory	*Individual level* Individually perceptions of organizational assumptions, beliefs and values	*Individual level* Individually perceptions of organizational practices, policies and procedures
	Organizational level Collectively shared or agreed organizational assumptions, beliefs and values	*Organizational level* Collectively shared or agreed perceptions of organizational practices, policies and procedures

organization or individual on the other hand. Culture is about "assumptions, beliefs and values", and climate is about "practices, policies and procedures". Organizational level refers to "collectively shared or agreed views" by the organizational members, and individual level refers to "perceptions of individual organizational members". Below we will discuss these differences in more detail.

2.1.1 Definition "Organizational Culture"

Since the early 1980s, many scholars have discussed the concept of organizational culture. Defining organizational culture is complex because the conceptual base of culture emerged from various disciplines, such as anthropology and sociology (Ouchi & Wilkins, 1985). Conceptual variations among organizational culture researchers (Denison, 1996) have caused different approaches and several dilemmas, such as about the focal unit (level) of theory and the measurement approach (Desphande & Webster, 1989). Some researchers consider organizational culture as a phenomenon at the individual level: the organizational values and beliefs as perceived by the individual. Others consider organizational culture at the organizational level: collectively shared or agreed values and beliefs about the organization. Accordingly, depending on the level, the concept is measured differently. As an individual concept organizational culture can be measured at the individual level. As an organizational level concept, organizational culture can be measured directly at the organizational level, or indirectly as common or aggregated individual perceptions (the collective of persons' views of the organization).

Nowadays, culture researchers commonly share the opinion that organizational culture is primarily a phenomenon occurring at the organizational level, "the psychosocial glue that holds the organization together" (Schein, 2004, p. 293). Culture is defined as a group phenomenon (Schneider et al., 2013) that relates to the collectively agreed meanings that are socially learned at a certain time (Pettigrew, 1979). In this sense, organizational culture is a set of values, beliefs, and underlying assumptions that are shared or collectively agreed by organizational members (e.g., Desphande & Webster, 1989; Ouchi, 1981; Pettigrew, 1979; Sathe, 1983; Schein, 1985; Schwartz & Davis, 1981). Culture refers to deep level assumptions, values and

beliefs that are difficult to observe, possibly unconscious, collectively held, and difficult to change (Ashforth, 1985; Schein, 1990; Schneider, 1987; Schneider et al., 1996; Schwartz & Davis, 1981). Organizational culture resides in the cognitive structures of individuals and in interactions among members of organization (Harris, 1994; Jelinek et al., 1983).

The above description of organizational culture refers to assumptions, beliefs and values. As shown in Table 1 (left) culture can be individually perceived (individual level) or collectively shared (organizational level). *Consequently a creativity-supporting organizational culture refers to individually perceived, or collectively shared or agreed assumptions, values and beliefs about organizational support for creativity.* For example, an organization may value that organizational members take risks to enhance their creativity. Collectively, the organizational members may share or agree that this is an element of the organizational culture for supporting creativity (organizational culture at organizational level). Still, individual members of the organization may perceive that risk taking is not a part of the organization's values (organizational culture at individual level). Hence, this chapter discusses organizational culture at the individual level, as the individual views about the organizational values ("Here they allow to take risk") and neither as individual values of the person ("I like to take risk") nor as the individual views about what the organizational values should be ("I think it is good that organizations allow people to take risk").

2.1.2 Definition of "Organizational Climate"

The interest in organizational climate research started with the studies of psychologists around the 1970s (Schneider et al., 2013). Since then conceptualizing organizational climate is subject to debate. Many approaches to organizational climate exist (Denison, 1996). There is however general agreement that organizational climate is about *perceptions of organizational practices, policies and procedures.* Although organizations objectively have practices, policies and procedures in place (sometimes referred to as the objective "work environment"), climate is about *perceptions* of organizational members of the objective work environment. The objective work environment can be directly observed in the organization. Climate is the interpretation of that work environment (James & James, 1989). This interpretation guides and shapes attitudes and behaviors of organizational members (Carr et al., 2003). The objective work environment conveys messages to employees on what is important for the organization, and what kind of behaviors or efforts are worthy of reward and support in the organization (Schneider, 1987; Schneider et al., 1996). For example, job descriptions or job appraisal talks that include statements about creative task performance and creative output; rewards and recognition of creative ideas, etc. send messages about desired behavior (Shalley & Gilson, 2004).

Employees may interpret these organizational messages differently depending on their needs and expectations (e.g., Desphande & Webster, 1989; Schwartz & Davis,

1981). Different organizational members may interpret the objective organization's practices, policies and procedures differently (organizational climate at the individual level), but the organizational members may also share these perceptions (organizational climate at the organizational level). Hence, similar to culture, climate exists both at the individual and group (i.e., organizational) level, as shown in Table 1.

Currently a clear distinction exists in the climate literature regarding the concept of "psychological climate" as individual perceptions of the work environment, and the concept of "organizational climate" as shared perceptions of organizational members of the work environment (e.g., Baltes et al., 2009; Glick, 1985; Parker et al., 2003). Nowadays researchers consistently make this distinction when studying organizational climate at the individual level (e.g., studies in the fields of psychology or organizational behavior) or at the organizational level (e.g., studies in the various topics of the management field). For example, scholars in the field of organizational behavior combine both approaches (multi-level studies). Climate studies at the individual level consider climate as a psychological construct (i.e., individual perception). Psychological climate is an individual's perception of the work environment that influences the individual's psychological situation (James & James, 1989).

Climate studies at the organizational level consider climate as a property of an organization: the shared or agreed perceptions of the members of an organization (Mathisen & Einarsen, 2004). Climate is then studied at the group level as an organizational construct (i.e. aggregation of individuals' perceptions) (Baltes et al., 2009; Drexler, 1977; Glick, 1985; James & Jones, 1974; Joyse & Slocum, 1984; Payne & Mansfield, 1978; Verbeke et al., 1998; Woodman & King, 1978; Young & Parker, 1999).

2.2 The Conceptual Link Between "Organizational Culture" and "Organizational Climate"

In the previous sections we defined organizational culture as "assumptions, beliefs and values" and organizational climate as "practices, policies and procedures". Although the concepts of culture and climate are different, they have similarities and are interrelated. Culture and climate share several features. Both reflect the "feel of an organization" (Schneider et al., 1996, p. 8) and building and changing social contexts that are collectively defined (e.g., Ashkanasy et al., 2000; Denison, 1996).

But how are the concepts related? Does culture affect climate or does climate affect culture? Organizational culture and climate researchers have argued about this relationship (e.g. Ashforth, 1985; Schein, 1990; Schneider, 1987; Schneider et al., 1994, 1996, 2013). A common view is that organizational culture causes organizational climate. According to this view organizational culture is manifested in the organizational climate, i.e., assumptions, beliefs, and values are reflected in organizational practices, policies and procedures (Ashforth, 1985; Schein, 1990;

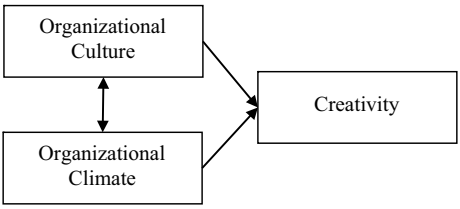

Fig. 1 The mutual relationship between organizational culture and organizational climate and their effects on creativity

Schneider & Reichers, 1983; Schneider et al., 1994, 2013; Tesluk et al., 1997). Organizational culture informs employees about the way to work,organizational priorities and making sense of their work environment (e.g. Ashforth, 1985; Schneider et al., 1994). Thus, employees make interpretations that will lead them to provide meaning or reason related to practices, policies, events that can guide their behaviors (Schneider, 1987; Schneider et al., 1994). For example, an organizational culture supportive for creativity can be reflected in the physical surroundings of the workplace (e.g., mobile seating areas, project rooms, informal meeting areas, open offices) which encourages desirable collaborative creative behaviors and efforts of employees (e.g. Earle, 2003; Moultrie et al., 2007; Voordt et al., 2003).

However, despite this common belief that culture causes climate, several scholars stress that sufficient evidence is lacking for this conclusion. For example, Anderson et al. (2014) state that the question of how a creativity-supporting organizational culture manifests as a creativity-supporting climate is still unanswered. Furthermore, several conceptual discussions among scholars (e.g., Ashforth, 1985; Schneider et al., 1996) and recent empirical studies (e.g., Kim & Yoon, 2015) suggest that climate also affects culture. Apparently, climate and culture are mutually related and can enhance each other, as illustrated on the left side in Fig. 1.

2.3 Domain Specificity of "Organizational Culture" and "Organizational Climate"

In the previous section culture and climate are mostly discussed in general terms without making specific reference to the domain of application. In organizational culture and organizational climate research, specific domains of application have been distinguished. Examples include safety culture/climate (e.g., Zohar, 1980), service culture/climate (e.g., Liden et al., 2014; Schneider et al., 1992, 1998), quality culture/climate (e.g., Michela & Burke, 2000), learning culture/climate (e.g., Hahn et al., 2015; Joo et al., 2014), and creative culture/climate (e.g., Amabile et al., 1996). These domains reflect the organization's focus on a specific desired individual or organizational outcome: safety, service, quality, learning, and creativity, respectively. The specific cultural values, beliefs and assumptions; and practices, policies and procedures that reflect climate strongly depend on this desired outcome.

For example, a safety culture/climate may include a dimension about people's attitudes and behaviors related to safety in production processes (Zohar, 1980). A service culture/climate may include a dimension about interpersonal relationships between service provider and receiver (Schneider et al., 1992), and a quality culture/climate may include dimensions such as communication, teamwork, and customer-drive (Michela & Burke, 2000). In this chapter we focus on the culture/climate domain of creativity (Fig. 1).

3 Organizational Culture and Organizational Climate for Creativity

Discussing culture and climate for creativity first requires a definition of the concept of creativity. Several conceptualizations exist in the literature, which can be classified into creative abilities, creative processes and creative outcomes (of both individuals and organizations). In the context of organizational culture and organizational climate the dominant definition is based on creative outcomes (Drazin et al., 1999). Then creativity is defined as the production of novel or original and potentially useful ideas, products and procedures (Amabile, 1988; Oldham & Cummings, 1996). In this chapter we follow this definition.

It is important to distinguish between creativity and innovation. The difference between creativity and innovation is evident from Amabile's well known statement: "All innovation begins with creative ideas" (Amabile et al., 1996, p. 1154). Hence, creativity is a prerequisite for innovation; it is not the same as innovation. This view links to the field of innovation management, which recognizes creativity as "idea generation" that takes place at the "fuzzy front end of innovation" (Smith & Reinertsen, 1991), and that in subsequent phases of the innovation process, the generated ideas are promoted ("idea promotion") and subsequently implemented ("idea implementation"). From this perspective creativity is idea generation, and innovation is idea implementation. Such a distinction is also possible at the individual level. Although in many studies idea generation, idea promotion and idea implementation are mixed into the concept of "creative behavior" (e.g., George & Zhou, 2001), in other studies the aggregation of these dimensions are called "innovative work behavior" (Janssen, 2000) or "innovative behavior" (Holman et al., 2005). In this chapter we consider creativity as idea generation and innovation as idea implementation, hence as separate constructs. We will focus on creativity, guided by the following classification on the elements of culture and climate for creativity (Table 2). We identify six organizational culture elements that are commonly mentioned in the literature (e.g. Amabile, 1988; Ekvall, 1997; Farr, 1990; Gundry et al., 1994; McDermott & O'Dell, 2001; Shalley & Gilson, 2004; Tesluk et al., 1997; Woodman et al., 1993). These culture elements are, risk taking, tolerance for mistakes, experimentation, open communication and knowledge sharing, and participation. Regarding the organizational climate we identify nine social-organizational climate elements based on

Table 2 Example elements of a creativity-supporting organizational culture and climate

Organizational culture (organizational assumptions, beliefs and values)	*Organizational climate* (organizational practices, policies and procedures)	
• Risk taking • Tolerance for mistakes • Experimentation • Open communication and knowledge sharing • Participation	*Social-organizational*	*Job design* • Job challenge • Job autonomy • Teamwork • Task rotation *Leadership* • Idea thinking time • Rewards • Goals for creative outcomes • Resources for creative projects or works • Social support, evaluation and feedback
	Physical	*Interior design* • Plants • Color *Building design* • Window view • Illumination • Physical distractions

the studies of Amabile et al. (1996), Shalley and Gilson (2004), Dul and Ceylan (2011), and five physical climate elements based on Dul and Ceylan (2011). The social-organizational climate elements are divided into elements that can be influenced by job design (job challenge, job autonomy, teamwork, task rotation), and elements that can be influenced by leadership (idea thinking time, rewards, goals for creative outcomes, resources for creative projects or works, social support, evaluation and feedback). The physical climate elements are divided into elements that can be influenced by interior design (plants, color), and elements that can be influenced by building design (window view, illumination, physical distractions). The separate culture and climate elements will be discussed below in detail.

3.1 Organizational Culture for Creativity

Several scholars have proposed that organizational culture in terms of values, beliefs and assumptions has effects on creativity (e.g., Andriopoulos, 2001; Gundry et al., 1994; Isaksen et al., 2001; Martins & Martins, 2002; Martins & Terblanche, 2003; McLean, 2005; Mumford, 2000; Shalley & Gilson, 2004; Tesluk et al., 1997; Woodman et al., 1993). A creativity-supporting organizational culture can develop creativity skills and capabilities, support creative outcomes, and attract creative

people to the organization (e.g., Gundry et al., 1994; Mumford, 2000; Pitta et al., 2008; Shalley & Gilson, 2004; Tan, 1998; Zhou et al., 2017).

Over the last decades, various studies have identified cultural elements that can support creativity in organizations. Previous creativity research suggests that creativity is enhanced in an organizational culture that is encouraging risk taking, tolerating failures of employees, and supporting experimentation, open communication and knowledge sharing, and participation (e.g. Abbey & Dickson, 1983; Amabile, 1988; Arad et al., 1997; Baer & Oldham, 2006; Choo, 2013; De Long & Fahey, 2000; Dougherty, 2008; Ekvall, 1997; Farr, 1990; Gundry et al., 1994; Kanter, 1988; McDermott & O'Dell, 2001; O'Reilly, 1989; Shalley & Gilson, 2004; Tesluk et al., 1997; Woodman et al., 1993; Zamanou & Glaser, 1994).

Employees' willingness to *take risks* stimulates their creative efforts (e.g., Dewett, 2004, 2007), and avoiding risks is a barrier to creativity (e.g., Sadi & Al-Dubaisi, 2008). Shalley and Gilson (2004) argued that intrinsically motivated employees feel encouraged for taking risks and do not fear making mistakes. An organizational culture that allows taking risks is particularly supportive for employees who have a high level of creativity because those employees wish to explore, learn and try new things, and accept potential risks of the work outcomes (Hunter et al., 2012). An organization's culture that encourages risk taking enhances creativity (e.g., Amabile et al., 1996; Ekvall, 1997; Gundry et al., 1994; Shalley & Gilson, 2004; Tesluk et al., 1997). For example, Nyström (1990) found that high creative divisions stress risk taking more than other divisions in a manufacturing company. Schepers and van den Berg (2007) find that employees who perceive a culture of risk taking, creative problem solving, and innovation ("adhocracy culture") experience that the work environment values and encourages creativity.

An organizational culture that *tolerates mistakes* is supportive of creativity. When mistakes are not allowed during the creative process employees may feel unsafe, which can inhibit their creativity, hence, a mistake-tolerating culture may send messages to employees for being safe to generate new and novel ideas (George, 2007). Ekvall (1997) suggests that employees' creative efforts decrease if organizational culture nurtures the fear of making mistakes among organizational members.

Similarly an organizational culture that allows *experimentation* of new ideas can be supportive for creativity (e.g., Abbey & Dickson, 1983; Auernhammer & Hall, 2014; Gundry et al., 1994). During a "trial and error" process employees can test alternative ways, and generate new ideas or solutions (Andriopoulos & Lowe, 2000). In an experimentation-oriented culture employees feel encouraged to experiment, even if they are under the risk of failure (Auernhammer & Hall, 2014). Employees who are engaged in exploration and experimentation behaviors can exhibit creativity (e.g. Baer & Oldham, 2006).

Organizations that value and encourage *open communication* and *knowledge sharing* are supportive for creativity and innovation (e.g., Arad et al., 1997; Kanter, 1988; O'Reilly, 1989; Tesluk et al., 1997). Agin and Gibson (2010) suggest that an organizational culture that promotes open communication can increase trust and

knowledge exchange among employees, and can lead to more creativity. Gundry et al. (2016) find that knowledge sharing between a group of people (i.e., collaborative communication) develops trust-based relationships and commitment, leading to higher levels of creativity and innovation. Researchers have suggested embedding knowledge sharing in organization's values to encourage organizational members to share their ideas (e.g. McDermott & O'Dell, 2001). De Long and Fahey (2000) argue that organizational culture supportive for creativity and innovation creates specific patterns for knowledge sharing, above what traditional cultures can do.

An organizational culture of involvement, engagement and *participation* of employees (e.g., Denison, 1984, 1990; Denison & Mishra, 1995) is important for creativity (e.g., Arad et al., 1997). Zamanou and Glaser (1994) suggest that employees feel more involved for decision making, perceive more information flowing from top levels, and feel their ideas and opinions more valued in a participative organizational culture. For example, as a reflection of culture, practices such as team participation in decision making or use of suggestion systems can enhance creativity (e.g., De Dreu & West, 2001; Kimberly & Evanisko, 1981; Schepers & van den Berg, 2007; Tesluk et al., 1997). With this regard, when employees experience their work context as supportive of a high-level of participation, they perceive that their work context encourages creativity (Schepers & van den Berg, 2007).

3.2 Organizational Climate for Creativity

Research on organizational climate and creativity has gained much attention since the 1980s, when discussions started on the environmental influences on creativity in organizational settings (e.g., Amabile, 1988). Many scholars have proposed that organizational climate affects creativity (e.g., Amabile et al, 1996; Mumford et al., 1997; Woodman et al., 1993). In this section we first give an overview of the effect of separate social-organizational elements on creativity. We focus on the following nine elements: (1) job challenge, (2) job autonomy, (3) idea thinking time, (4) task rotation, (5) goals for creative outcomes, (6) resources for creative projects or works, (7) recognition and rewards, (8) teamwork, and (9) social support, evaluation and feedback. Second, we give an overview of the effect of separate physical elements on creativity, focusing on five elements: (1) plants, (2) color, (3) window view, (4) illumination, and (5) physical distractions. Finally we present three frameworks and instruments that consider the overall climate for creativity, by combining separate elements.

3.2.1 Specific Social-Organizational Climate Elements

Complex, *challenging*, high demanding *jobs* stimulate employees' interests, desires and excitement about their work, subsequently, leading to higher creative performance (e.g., Oldham & Cummings, 1996; Shalley et al., 2004). Positive relationships have been found between job challenge and creativity (e.g. Carmeli et al., 2007; Coelho et al., 2011; Ohly et al., 2006). Creative employees need growth and development in their job, and providing a challenging job can stimulate employees' creative behaviors (Carmeli et al., 2007). Demanding jobs may increase creative self-efficacy, in particular, if employees have a high-level of intrinsic motivation (Zhou et al., 2012). Several contextual characteristics may strengthen the relationship between job complexity and creativity, for example, supervisory support (e.g., Oldham & Cummings, 1996).

Job autonomy refers to the degree of employees' control on the way of doing their jobs (Hackman & Oldham, 1980). Job autonomy can foster creativity (e.g., Amabile, 1988; Amabile et al., 1996; Bailyn, 1985; Coelho & Augusto, 2010; Ohly et al., 2006; Unsworth & Clegg, 2010; Yoo et al., 2019). With job autonomy, employees may feel more engaged and subsequently may show more innovative behavior (De Spiegelaere et al., 2014). Unsworth and Clegg (2010) find that job autonomy increases employees' feelings of capability, hence, employees feel that their creative actions are worthwhile, and subsequently, employees perform more creative actions.

Task rotation, which refers to a work schedule with different tasks to be performed simultaneously (Dul & Ceylan, 2011), may enhance creativity (e.g., Lukersmith & Burgess-Limerick, 2013). Through task rotation employees can develop various skills and knowledge which can help them to exhibit creative behaviors (Chen et al., 2011). For example, in an experimental study, Madjar and Oldham (2006) found that individuals who prefer to be involved in various tasks exhibit higher levels of creativity with task rotation.

Recent years, *idea thinking time* has gained much interest among creativity researchers. Time resources are recognized as an important factor in deciding to take a role in creative actions (Unsworth & Clegg, 2010). Studies examine how sufficient time or having a short time (i.e., time pressure) plays a role in fostering or inhibiting creativity in day-to-day work. For example, Amabile, Mueller, et al. (2002) present a study on a sample of employees who are working in project teams. Their study demonstrates that time pressure has a negative direct effect on creativity. However, Baer and Oldham (2006) find an inverted U-shaped curvilinear relationship between time pressure and creativity for manufacturing employees who are open to experience, and receive much support for creativity; hence an optimum level of available time, not too little and not too much, appears to support creativity. In another study, Amabile, Hadley, et al. (2002) report that time pressure contributes to creativity when employees are able to focus on work activities, understand the critical importance of task completion, and feel urgency for completing tasks. Boogerd et al. (2015) found that time pressure increases creativity for highly demanding creativity tasks, but not for less demanding tasks. The studies above indicate that time directly

affects creativity, yet in order to understand how time resources influence creativity, individual or contextual factors are also important.

Researchers distinguish between extrinsic and intrinsic *rewards*. Extrinsic rewards increase extrinsic motivation, whereas intrinsic rewards increase intrinsic motivation. Intrinsically motivated individuals perform activities because they want to, so they are satisfied from the activity itself. Extrinsically motivated individuals take actions because they are externally motivated to do so (e.g., financial rewards). Studies have shown that intrinsic rewards can have a positive direct effect on creativity (e.g., Yoon et al., 2015). However, the effect of extrinsic rewards on creativity is less clear. Some scholars argue that extrinsic rewards decrease intrinsic motivation, and in turn lower creativity (Amabile, 1983, 1997; Gagne & Deci, 2005). Other scholars argue that extrinsic rewards may be beneficial for creativity (e.g., Eisenberger & Rhoades, 2001), depending on individual and contextual factors. Moderators such as job complexity, cognitive style (Baer et al., 2003), procedural justice, willingness to take risks (Zhang et al., 2015) or reward importance (Yoon et al., 2015) may influence this relationship. Recently, some scholars have found that extrinsic rewards play a moderating role in the relationship between several job characteristics such as skill variety and autonomy and employee creativity (Yoo et al., 2019).

Extrinsic rewards can also increase employees' intrinsic motivation. For example, Malik et al. (2015) show that extrinsic rewards affect creative performance through intrinsic motivation for employees with an internal locus of control. Extrinsic rewards may be detrimental in the stages of idea generation and idea promotion but beneficial in the stage of idea implementation (Caniëls et al., 2014).

Assignment of *goals for creative outcomes* appears to be beneficial for creativity (Carson & Carson, 1993; Shalley, 1991, 1995). Setting specific goals can help employees to give attention and spend energy to accomplish these goals (Zhou & Shalley, 2003). The assignment of creative goals helps employees focus their attention on creativity (Madjar & Shalley, 2008). For example, Dysvik and Kuvaas (2012) find that the relationship between intrinsic motivation and work effort was more positive for employees who have high levels of goals for becoming specialized at their tasks. Managers or supervisors have a role in setting goals for creativity. For example, Amabile and Gryskiewicz (1987) find that setting goals for projects by the management and giving enough autonomy to employees for planning their goals is crucial for creativity. A recent study of Sijbom et al. (2015) shows that leaders' goals affect their reactions to subordinates' creative outputs. In particular, these findings demonstrate that the leaders who follow mastery goals are more motivated and more supportive for creative ideas presented by their subordinates than the leaders who strive for goals of high performance. Miron-Spektor and Beenen (2015) find that setting learning and performance goals can enhance product creativity. Hence all these studies above demonstrate that assigning goals for achieving creative outcomes (i.e., creative ideas, creative thoughts, and creative problem solutions) is conducive to creativity.

Allocating sufficient *resources for creative projects or works* appears to affect creativity in organizations (Amabile, 1988). Such resources may include funds, space, and time (Kanter, 1988). When sufficient resources are available, employees

may perceive that their creative activities are valued by the organization (Amabile et al., 1996). Restricted resources may be beneficial to creativity. Csikszentmihalyi (1997) suggests that allocating too many resources may inhibit people' focus on creative activities, and be detrimental to creativity. With financial constraints, individuals who have high novelty-seeking characteristics focus better on the creative task and exhibit more creativity (Scopelliti et al., 2014). Allocating sufficient resources can be beneficial for creativity; however, excess of resources can be harmful for creativity.

Teamwork influences employee's creativity. Several team factors such as team cognition, team identification, helping among teammates and team diversity have impact on team members' creativity. If team members share a common view during the problem solving process, they can work more efficiently and more actively on the problems (Shalley & Perry-Smith, 2008). Team members' creativity increases if individual team members identify themselves as closely connected to the team (Tang et al., 2014). Team creativity is enhanced when all team members share the belief that creativity should be valued in teams. (Zhang et al., 2020). Employees' creativity increases in teams where a team climate focused on collaboration prevails (Zhou et al., 2018). In a team, an employee can seek help from teammates, which can contribute to the employee's creativity (Mueller & Kamdar, 2011). Team members with high creative self-efficacy can benefit from teams that consist of a cognitively diverse group of people (Shin et al., 2012). The relationship between creative self-efficacy and individual creativity may be larger for teams with shared knowledge and diversity in functional background (Richter et al., 2012). Hence, working in a cognitively diverse team may be beneficial for employee creativity.

Social support, evaluation and feedback are the support that an employee receives from supervisors and co-workers. This is commonly considered as a creativity stimulating factor (e.g., Amabile et al., 1996; Yu & Frenkel, 2013), although some studies find no such effects (e.g. Diliello et al., 2011). Supervisory support and noncontrolling supervision enhance employees' creativity (e.g. Madjar et al., 2002; Oldham & Cummings, 1996) by facilitating intrinsic motivation, role conflict and role ambiguity (Coelho et al., 2011). Greater supervisory support strengthens the relationship between creative self-efficacy and creativity (Diliello et al., 2011). Support from a supervisor may have different effects among high and low creative employees. For example, Zhou (2003) finds that when creative coworkers are present, in particular less creative employees are more creative when supervisors give more developmental feedback and do less monitoring. The effect of coworkers' support on creativity is less clear. Some studies show positive effects (e.g., Baer & Oldham, 2006; Madjar et al., 2002), whereas others find no effect (e.g., Van Dyne et al., 2002), or a negative effect (e.g., Coelho et al., 2011).

Evaluation of task performance can influence creativity. For example, Schoen (2015) finds that intrinsically motivated employees exhibit higher creative performance when they expect evaluation of their work. However, Amabile et al. (1990) found, that individuals who expect evaluation exhibit lower creativity than individuals who do not expect this. It is possible that only when individuals work alone on assigned creative tasks, expected evaluation enhances creativity (Shalley, 1995), or

that expected evaluation is only beneficial for creativity when the goal is to produce appropriate ideas rather than novel ideas (Yuan & Zhou, 2008).

Getting *feedback* on work enhances employees' creative performance (De Stobbeleir et al., 2011). Informational or developmental feedback from supervisors may enhance creativity (Zhou & Shalley, 2003). For example, Hon et al. (2013) demonstrate that when employees receive high-level positive feedback about their work from supervisors they exhibit high-levels creativity, when they are under the stress of challenging work. However, other studies suggest that feedback from supervisors may hinder creativity of employees when they have creativity-demanding jobs (George, 2007).

3.2.2 Specific Physical Climate Elements

The physical climate is important for creativity (e.g., Amabile et al., 1996; Dul, 2019; George, 2007; Shalley & Gilson, 2004; Woodman et al., 1993; Zhong & House, 2012). Vithayathawornwong et al. (2003) propose that the physical climate moderates the relation between the social-organizational climate and creativity, but Dul et al. (2011) find no such effect. Separate physical elements of the physical climate may enhance creativity directly, as shown in studies such as McCoy and Evans (2002) or Dul et al. (2011). A case study among office-working digital artists indicates that a large number of physical elements can increase creativity: workplaces with lower distractions (e.g., noise), good lighting, moveable furniture, privacy, open spaces, home-like workspaces, glass walls, moveable partitions, pastel or neutral colored walls, and plants (Hoff & Öberg, 2015). Another effect of the physical climate is that the physical climate may shape the creativity-supporting organizational culture. For example, Brockbank (1999) suggests that "office or plant layout" can create a culture of creativity and innovation. Similarly, Kallio et al. (2015) suggest that the physical climate affects the organizational cultural factors openness, collectivity and equality, and thus contributes to creativity.

In the remainder of this section we will evaluate the effect of specific physical elements: the presence of plants, color, window view, illumination, and physical distractions on creativity. Recently, Dul (2019) proposed to integrate separate effects of physical elements into a single theoretical framework. This 'triple path' framework describes three possible paths towards creativity: *functionality* (the ability of the physical environment to facilitate creative activities), *meaning* (the symbolic meaning concealed in a set of physical properties of the environment), and *mood* (the ability of physical items to induce emotional responses over the short term).

Many authors suggest that nature (including *plants*) can help people "restore" themselves (e.g., Hartig & Evans, 1993; Kaplan & Kaplan, 1989; Ulrich, 1993). Nature can capture a person's attention, reduce mental fatigue, and restore cognitive capacity. Plants in the work environment (potted plants) can have two types of effects on people (Bringslimark et al., 2009). First, according to attention restoration theory (Kaplan, 1995; Kaplan & Kaplan, 1989) plants can help people to restore more effectively from an effort. When people move to an area with plants during a break

they may restore more. With more restoration, people can become more creative. However when plants are present while doing an attention demanding task they may be distracting (Shibata & Suzuki, 2001). Second, plants can be a source of information to facilitate performance on a creative task (Shibata & Suzuki, 2002, 2004). Plants may contain cues that help people to make associations, and therefore can help people to be more creative. Shibata and Suzuki (2002) show that people perform better on a creative task with plants in front of them, but worse in a more attentionally demanding task. Ceylan et al. (2008) find that managers prefer offices with plants, rather than offices without plants when solving a complex problem that needs the generation of many new ideas. Andrew and Pitt (2009) observe that employees in offices with plants perceive more creativity than employees in the offices without plants. In all the presence of plants can be beneficial for creative task performance.

Color in the work environment can have psychological and physiological effects on people (Küller et al., 2009). For example, the influences of warm colors (e.g., red, yellow), and cool colors (e.g., blue, green) may be different. Warm colors may stimulate people, whereas cool colors may relax people. Warm colors in the work environment can be beneficial for people with low demanding tasks, whereas cool colors can be beneficial for people with high demanding tasks. Limited research is available on the effect of color on performance of a creative task, and the studies that are available are usually done in the laboratory. Küller et al. (2009) compare creative performance (number of words of a written essay) in a red room with the performance in a blue room, but find no differences. Similar to Kwallek et al., (1997, 2007) they conclude that there are substantial individual differences in response to color. Lichtenfeld et al. (2012) find that green color in comparison to white, gray, red and blue enhances creative performance. McCoy and Evans (2002) investigated students' perceptions of creativity potential of the physical environments and found that cool colors are negatively associated with perceived creativity potential. However, in a similar study with managers, Ceylan et al. (2008) found that offices with cooler colors were perceived to have more creativity potential. Managers with highly demanding tasks may prefer relaxing, less stimulating environments. This may suggest that colors in the work environments must be adaptable to the task (De Korte et al., 2011) and to the individual needs.

A *Window view* can have an effect on creativity. Windows are not only a traditional source of light. Windows also symbolize freedom (Verderber, 1986). Windows can induce responses that are beneficial for creativity. When people have a window view to natural elements (plants, trees, etc.), similar to indoor plants, they have an opportunity for restoration (McCoy & Evans, 2002). Heerwagen and Orians (1986) suggest that without windows people may attempt to create window substitutes with natural decor. Zhong and House (2012) argue that the view of flowing water gives a feeling of flexibility and helps the flow of ideas freely, hence, increasing creativity. A window view on nature or human-made objects can also be a source of information. In an experiment, Stone (1998) showed that people while performing a creative task (generating novel answers) look more around in their environment in a windowless room than when a window was present, suggesting that they may have been searching for information cues while performing the creative task. However she did not find a

direct effect of windows on creativity. On the other hand, Stone and Irvine (1994) found that a windowed room results in more positive perceptions about creative tasks, and that creative task performance is greater in the direct window view condition than in the indirect view. Stone (2003) suggests that looking at a picture or scene might have the same effect as when viewing a scene through a window. Thus a window view fosters creativity.

The majority of studies in the field of environmental psychology about effects of *illumination* in the work environment focus on the effect of light on people's mood. However, the results are contradictory (Spivack et al., 2010). Surprisingly little research is available on the effect of light on creativity. Knez (1995) finds that color temperature of the light and illumination level interacts: warm white light with a high illumination level has a positive effect on creative task performance, whereas cool color temperature with a high illumination level has a negative effect on creative task performance. Research on the effect of illumination level on perceived creativity potential of environments shows contrasting results as well. Ceylan et al. (2008) found that bright light is associated with high creativity, whereas McCoy and Evans (2002) found no such effect. Steidle and Werth (2013) found that darkness enhances creative performance when dim illumination increases individuals' perceptions on the freedom from constraints. A complex interaction of light with many individual factors and other environmental factors may exist. This suggests that individually adaptable light conditions are preferred. However, Veitch and Gifford (1996) found that when people are given a choice over lighting, creative performance decreases.

Physical distractions are factors in the work environment that can hinder creativity. Examples are loud noise, bad smell, and limited working space (crowding/high spatial density, lack of privacy). Stokols et al. (2010, p. 137) state that "environmental distractions and poor social climate at work can restrict employees' experiences of creativity by interfering with their concentration on job-related tasks or by heightening feelings of unpredictability and uncontrollability, thereby fostering the belief that the workplace does not support their efforts to be creative." Stokols et al. (2010) studied the effect of three types of distractions near an employees' workstation: noise, foot traffic, and visual exposure (lack of privacy). They found a negative correlation between environmental distraction and perceived support for creativity at work. Roskes (2015) proposed that noise may inhibit creativity when creative task performance depends strongly on cognitive resources. Mehta et al. (2012) found that noise is not always bad: depending on the level, noise fosters or hinders creativity. A medium (70 dB) versus low (50 dB) level of noise can foster creativity, but a high level of noise (85 dB) hinders creativity. Similarly, smell can have positive effects (nice smell) and negative effects (bad smell). Studies on the effect of positive smell (e.g., lemon, lavender) on mood and creativity are not conclusive (e.g., Knasko, 1992; Weber & Heuberger, 2009), but the effect of negative smell (e.g., sodium-sulfide: rotten eggs) have clearly a negative effect on mood. May et al. (2005) show that when people have a little space available they perceive 'crowding' (high degrees of spatial density). Crowding has a negative effect on creativity. Aiello et al. (1977) found that individuals working in a low density space perform better on a creativity task than individuals in crowded space. Alencar and Bruno-Faria (1997) also found that lack

of space hinders creativity. In general, serious distractions like high levels of noise, very bad smell, and too crowded work environments hinder creativity.

3.2.3 Overall Climate

Several theoretical frameworks and measurement instruments have been developed for identifying organizational climate factors that are related to creativity. For organizational climate, a distinction can be made between social-organizational climate and physical climate, each consisting of several separate elements. For example, creativity supporting social-organizational frameworks and instruments include elements such as job autonomy, creative goal setting, supportive leadership styles, etc. Creativity-supporting physical frameworks and instruments may include color, lights, plants, etc.

The vast majority of frameworks and instruments consider only the social-organizational work environment (Hunter et al., 2005). Two of the most common social-organizational frameworks and measurement instruments are KEYS and CCQ (Mathisen & Einarsen, 2004). KEYS (Amabile et al., 1996) identifies six creativity-supporting climate dimensions: organizational encouragement (e.g., reward and recognition of creativity), supervisory encouragement (e.g., supportive leadership styles), work group support (e.g., teamwork), sufficient resources (e.g., facilities, information), challenging work (e.g. intellectual challenge), freedom (e.g., job autonomy) and two creativity-inhibiting dimensions: organizational impediments (e.g., formal management structures), and workload pressure (e.g., time pressure). The Creative Climate Questionnaire (CCQ; Ekvall, 1996) is a framework and instrument that consists of ten (partly similar to KEYS) social-organizational climate dimensions: challenge, freedom, idea support, trust/openness, dynamism/liveliness, playfulness/humor, debates, conflicts, risk taking, and idea time. The Creativity Development Quick Scan (CDQS, Dul & Ceylan, 2011) is one of the few frameworks and instruments that also considers physical climate. In this instrument the nine social-organizational elements are challenging job, teamwork, task rotation, autonomy in job, coaching supervisor, time for thinking, creative goals, recognition of creative ideas and incentives for creative results, and the eleven physical elements are furniture, indoor plants/flowers, calming colours, inspiring colours, privacy, window view to nature, any window view, quantity of light, daylight, indoor (physical) climate, sound (positive sound) and smell (positive smell).

All frameworks and instruments presume that each separate climate dimension or element can contribute to creativity, and together add to affect creativity. Hence, when more of a dimension or element is present, and more dimensions or elements are present the climate is more supportive for creativity. This additive logic also implies that dimensions and elements can compensate for each other. However research to evaluate whether overall creativity-supporting climate enhances creativity is surprisingly scarce.

Amabile and Conti (1999) used KEYS to evaluate the climate for creativity before, during and after a downsizing, and found that the KEYS dimensions and creativity

change in the expected direction. Several studies have evaluated whether underlying dimensions of KEYS (factor structure) are consistent with the theoretical dimensions. For example Mikdashi (1999) used the KEYS survey among front-line managers working in different companies and found that the factor structure was different than in the original study of Amabile et al. (1996) with people from the USA, which may be caused by cultural differences. Mikdashi (1999) finds that only the dimensions of workgroup support and workload pressure affect creativity.

Sometimes researchers used modifications of KEYS to represent the overall creative climate. For example Hsu and Fan (2010) modified KEYS to examine the effect of a creative climate on employee creativity. They used KEYS without the dimension related to time pressure, and presumed that time pressure is a moderator of the relationship between overall climate and creativity. They suggested that in a weak overall creativity-supporting climate, time pressure enhances creativity, whereas in a strong creativity-supporting climate, time pressure decreases creativity.

Also CCQ-based researchers used separate dimensions of overall climate to study the effect of these dimensions (not the overall climate) on creativity. For example, Sundgren et al. (2005) used and adapted six dimensions (trust/openness, idea support, freedom, playfulness, debates and dynamism/liveliness) of the original ten CCQ's dimensions to study the effects of information sharing, learning culture, and intrinsic and extrinsic motivation on perceived creative climate, but not on creative performance. They found that all factors are significantly related to perceived creative climate.

Regarding CDQS, no studies are available on the effect of the overall creative climate (social-organizational plus physical) on creativity, but only for the separate effects of the social organizational climate and the physical climate. Dul et al. (2011) found that each dimension of creativity-supporting climate has a direct effect on the creativity of knowledge workers.

The three instruments (or adaptations) have also been used to evaluate the effects of a creativity-supporting climate on innovation performance at the firm level. For example, Çokpekin and Knudsen (2012) adapted KEYS and CCQ and found that a creativity-stimulating climate may enhance product innovation, but not process innovation. Parry et al. (2009) used an adaptation of CCQ and showed that a firm's creative climate may shorten the firm's new product cycle time. Dul and Ceylan (2014) used CDQS and showed that the firm's overall climate for creativity may increase the number of new products that are introduced on the market and the financial success in terms of new product sales.

4 Discussion

4.1 Main Findings

This chapter discusses how "the place to be" can enhance Homo Creativus' output. We focus on the workplace, and describe how the organizational context can foster or hinder employee creativity.

The organizational context is defined in terms of organizational culture and organizational climate. The literature on organizational psychology, organizational behavior and related fields frequently confuses "culture" and "climate". Culture refers to the people's perceived *assumptions, values and beliefs* in the organization. Climate refers to the peoples' perceived organizational *practices, policies and procedures.* Although the two concepts are fundamentally distinct, culture and climate are also related. Culture shapes climate, and climate shapes culture.

An organization's culture and climate can be defined for specific (desired) organizational outcomes. For example, a safety culture/climate refers to the organization's values and practices and policies regarding safety. A service culture/climate refers to the organization's values and practices and policies regarding service performance. Obviously, in this chapter we focus on the domain "creativity". Hence we describe the organizational culture and climate for creativity. We emphasize that creativity and innovation are distinct concepts. Creativity is the *production* of ideas, whereas innovation is the *implementation* of ideas. We focus only on creativity and use a common definition of creativity in organizational science: the employee's production of novel ideas that are potentially useful for the organization. Employee creativity can be used for the organization's product innovation, process innovation, organizational innovation, marketing innovation, ecological innovation, business model innovation, incremental innovation, radical innovation, etc.

Many elements of the organizational *culture* for creativity can enhance employees' creativity. Organizations that value risk taking, show tolerance for making mistakes, allow experimentation, have a culture of open communication and knowledge sharing, as well as promote participation are considered to be more supportive for creativity than organizations that lack these cultural elements. Also many elements of the organization's *climate* for creativity can enhance employee creativity. We distinguish between elements of the social-organizational climate and elements of the physical climate. More creativity is possible in social-organizational climates where employees perceive jobs as: challenging and autonomous, providing time for idea thinking, teamwork, task rotation, clear goals for creative outcomes, resources for creative activities, recognition for creative output, rewards for such output, and social support from managers and co-workers. Also several physical climate elements can influence creativity. The perception of plants, window view, color and illumination can enhance creativity. On the other hand, creativity may reduce when employees perceive physical distractions such as noise or bad smell. The above elements may interact, but the literature does not provide clear answers yet on these interaction effects.

Climate elements have been combined additively into overall climates for creativity. For example two instruments to define overall social-organizational climate are KEYS (Amabile et al., 1996) and CCQ (Ekvall, 1996). The CDQS instrument (Dul & Ceylan, 2011) also includes physical elements. Such instruments quantify and evaluate overall climates for creativity. Organizations with higher scores for overall climate (cumulation of scores of separate elements) appear to have a better creative performance than organizations with lower overall scores.

4.2 Limitations and Future Research

In this chapter we describe a selection of culture and climate elements that have been discussed in the psychology and management literature over the last decades. Most studies were performed in a period of time when organizations were relatively stable. With the rise of information and communication technologies, as well as the ongoing globalization trend requiring flexibility and innovation, the structures and coherence of organizations are changing, and the context is being redefined. Employees seldom work in small flexible and innovative firms, for example, in startup companies, or in single person companies where the employee is the leader as well. Large organizations nowadays need to be more flexible and innovative, and expect "intrapreneurship" from their employees. The dynamics in current and future organizations is different from the dynamics in past organizations. Furthermore, employees not only work in the workplace that is provided by the organization, but also elsewhere including home. These developments may result in different meanings of concepts such as privacy, autonomy and social support.

Hence results of past research may not be always applicable in current and future organizations. Therefore ongoing research about the effect of contexts on creativity is needed. For example, research is desirable about the different effects of culture/climate on creativity for a younger generation of employees who, compared to an older generation of employees, have less loyalty to the organization, have more loyalty to their career and financial benefits, change their workplace easily, desire more flexible work times and workplaces, and are more familiar with information and communication technologies including the use of social media. Furthermore, research is desired about the optimal context for highly talented employees who may have different expectations, needs and career goals than other employees have. For example, highly talented employees may want, more than other employees, to accomplish new exciting projects, announce their new ideas, and to be heard and supported by managers. Also more research is desired about new ways of working: working at different places (including home), at different times (flexible working hours) and on different information and communication devices (desktop computer, notebook, smartphone, etc.). For example, when communicating with others, employees can meet and express themselves in the real world (face to face), through visual, auditory and textual electronic communication (mail, social media, video-conferencing, etc.), and in the virtual world. In the virtual world employees can express themselves via

digital self-representations ("avatars"), which may make them feel safe and comfortable. The virtual social-organizational and virtual physical work environment may provide new types of support. Research is desirable about the effects on employees' creativity in such different modes of information sharing and environments.

Although in this chapter we provide indications that specific culture and climate elements can enhance creativity, the empirical evidence is still thin. Much (psychological) research is conducted in the laboratory. Studies with isolated elements can provide strong causal evidence in that particular setting, but the effects may not be transferable to real-life contexts due to complexities such as interactions. On the other hand, when (management) research is done in the real-life context, the vast majority of studies are observational studies (cross-sectional studies). Observed correlations between selected elements and creativity may then suffer from endogeneity such that no proper causal conclusions can be drawn. For example, a high level of challenge in a job may cause a higher level of creativity, but it is also possible that a highly creative employee perceives a job as more challenging than a less creative employee (reverse causality). In observational studies the strength of the effect may be overestimated (or under-estimated) due to the absence in the model of variables that both cause the creativity-supportive element and creativity. For example, when setting creative goals is not part of the model, an observed effect of a challenging job on creativity can be spurious because setting creative goals can make the job more challenging and can also promote creativity (omitted variable bias). The reader should consider and use results presented this chapter with care, and we would welcome that readers cite our statements including this caveat.

Longitudinal studies and randomized control trials (RCT's) are research designs that can offer more firm conclusions about the causal effects of culture and climate elements on employee creativity in real life contexts. However, such studies (in particular RCT's), considered the gold standard in fields like medicine, are seldom (if at all) performed in the organizational sciences. We suggest therefore that rather than doing one-shot experimental and observational studies, future research, if feasible, should focus more on larger scale longitudinal studies (Aguinis & Edwards, 2014), and in particular on RCT's, for example, by combining human resources and financial resources.

Organizational researchers might also consider using a different logic than just the conventional additive logic that "focuses on the net effect of independent variables, assuming that, in general, each variable by itself would be capable of bringing about the outcome of interest, holding constant the effect of all other candidate variables" (Delbridge & Fiss, 2013, p. 328). One such alternative considers groups of variables as configurations that are *sufficient* (but not necessary) for the outcome, hence can produce the outcome (QCA, Qualitative Comparative Analysis, Ragin, 2000, 2008). Another alternative logic considers single (or combinations of single) elements as *necessary* but not sufficient conditions for a high outcome to occur (e.g., NCA, Necessary Condition Analysis, Dul, 2016). Such critical conditions need to be present to prevent guaranteed failure of a high outcome, independently of the other variables. This approach may be particularly relevant in creativity research (Dul et al., 2020). We suggest further investigating the effect of single and groups of social-organizational

and physical elements on employee creativity by using an array of research designs and logics. We suggest also focusing more on physical elements, as relatively few studies are available for this aspect of the climate.

In discussing the effect of culture and climate elements on creativity, we use examples of studies presented in the psychology and management literature. We have not performed a systematic review of all studies available. The published and unpublished studies in this field are scattered around in many different disciplines. Collectively the isolated research communities could strongly benefit from systematic interdisciplinary reviews, in particular quantitative meta-analyses. Such analysis provides more solid evidence about the size and variation of the direct effects of contextual elements on creativity, and how this relation is moderated. We therefore suggest performing quantitative meta-analyses, rather than attempting to generalize from single studies.

Most of the studies presented in this chapter suggest that "more is better". For example, a culture with more risk taking is better than a culture with less risk taking, or a climate with more job challenges or plants is better than a climate with less challenge or plants. Hence, a continuous (usually linear) increasing relationship is presumed between the element and creativity. However one may state that both "too little" and "too much" is not good. Having too little or having too much challenge or plants may hinder creativity. Therefore the true relationship between the creativity-supporting element and creativity may be curvilinear: there may be an optimum level of the element between low and high. This nonlinearity may explain contradictory results between studies; in studies where the element is present at a relatively low level (below the optimum), an increase of the level of the element results in increased creativity. However in studies where the element is present at relatively high level (above the optimum) an increase of the level of the element results in decreased creativity. This may have occurred, for example, in comparable studies on the effect of physical complexity of the environment on creativity. One study finds that a higher level of complexity is beneficial for creativity (McCoy & Evans, 2002), and another study a lower level of complexity is better (Ceylan et al., 2008). It is also possible that a medium level is not good. For example, Stetler and Magnusson (2015) find a curvilinear relationship between goal clarity and creativity: either high or low levels of goal clarity enhance creativity. We suggest therefore, when theoretically justified, to consider a U-type or inverted-U-type non-linear relationship rather than a linear relationship, when designing studies and analyzing effects of culture and climate elements on creativity.

In this chapter we have primarily discussed the evidence of direct effects of separate culture and climate elements on employee creativity at the individual level (see Table 2). However, employee creativity occurs in a complex environment and cannot be explained by direct effects of single elements only. Several strategies have been used to capture better these complexities. One strategy considers the separate elements to have complex direct, mediating and moderating effects on employee creativity. Examples of interactions that include elements discussed above are the interaction of job autonomy and supervisor support (Coelho & Augusto, 2010), the interaction of job complexity and job autonomy (Sia & Appu, 2015), the interaction

of time pressure and social supervisor support (Noefer et al., 2009), the interaction of rewards and supervisory support (Gilson et al., 2012), and the interaction of challenging job, and job autonomy and goals (Paulus, 2000). With modern data analysis techniques such as Structural Equation Modeling (SEM) and Partial Least Squares (PLS), if properly applied, these complexities may be better understood. Multilevel studies also address interactions between the different levels of context (individual, group, organization, and beyond). Another way of addressing interactions is using a person-environment fit approach. This approach focuses on the interaction between a culture/climate element that is provided by the organization, and this element as desired by the person. The concept of overall context, addressed in this chapter, is another strategy to capture the complexity by considering the separate climate elements as additive contributing factors to an overall work environment for creativity (see KEYS, CCQ and CDQS). Then the researcher combines scores of separate elements into a formative index representing the (dimensions of) overall climate for creativity. Yet another strategy is to define a global organizational climate, such as "Perceived Organizational Support" (Kurtessis et al., 2015) that captures the climate for creativity, but also other climates, for example "safety climate", "production effectiveness climate", and "innovation climate" (Törner et al., 2015). Hence, a global organizational climate may drive an organizational climate for creativity.

Despite numerous efforts to predict employee creativity, all our current approaches normally are not able to predict more than 50% of the variance of employee creativity, and if so one may question whether methodological and analytic problems such a single source bias or omitted variable bias may have partly caused the results. This situation is not different in other fields of the social sciences. Hence still much is unclear about how creativity occurs in organizations. We suggest that research on the effect of the organizational context on creativity also uses one of the above systems or holistic approaches to address the organizational complexity of employee creativity (i.e., structural models, multilevel models, person-environment fit, overall creativity-supporting climates, global climates, etc.).

A different type of complexity refers to the type of creativity that needs to be supported by the context. It may be that the context for "continuous/incremental creativity" should be different than the context for "sudden/radical creativity". When creativity is part of everyday work and the organization expects from employees to continuously produce ideas for improvements, the creativity-supportive context may be different than when the organization asks employees to produce novel ideas more rarely and for a specific creative task. For example, in purpose-built facilities called "future centers" (Edvinsson, 1997; Kahn & Dempsey, 2012), "innovation spaces" (Moultrie et al., 2007), or "innovation labs" (Magadley & Birdi, 2009), a group of employees is working to produce highly innovative solutions for a common problem. The group is isolated from the day-to-day work to facilitate thinking outside conventional wisdom (Price, 2009). Research is needed on the effects of such isolated facilities on creativity, and whether the creativity-supportive context in such a setting is different from the creativity-supportive context for day-to-day creativity. Similarly,

in different phases of the creativity process, different creativity- supporting contexts may be needed. For example convergent thinking for creative problem solving may require a different context than divergent thinking for ideation (Haner, 2005).

4.3 Practical Recommendations

"The place to be" matters for creativity. The effect of the individual's context may be larger than the effect of the individual's abilities. For example, practitioners in human resource management and human factors/ergonomics believe that more than half of the creative performance originates from the context, and less than half from individual characteristics (Ceylan & Dul, 2007). Also an empirical study comparing the relative effects of creative characteristics, social-organizational context, and physical context on creative performance suggests that the context (social-organizational plus physical) is more important than the individual characteristics (Dul et al., 2011). Hence apart from recruiting and selecting employees with creative abilities, or training them for creative performance, organizations must shape employees' context towards a creativity-supporting culture and climate.

Despite the limitations and the obvious need for more research as mentioned in the previous section, and with the assumption that future research will confirm the results presented in this chapter, Table 2 provides guidance for managerial actions to foster employee creativity. According to the basic model that is proposed in this chapter (Fig. 1), a creativity-supporting organizational culture and climate can enhance creativity. The organization's culture for creativity can be influenced by the organization's strategy in which innovation is emphasized based on changing requirements in the external environment, and that acknowledges the role of employees' creativity. This strategy and the values, beliefs and assumptions of senior management regarding risk taking, tolerance for mistakes, experimentation, open communication, and participation (Table 2, left column) can help to shape a culture for creativity. Decisions of senior managers regarding the organization's practices, policies and procedures (Table 2, right column) must be aligned with these values and with what appears to be a supportive climate for creativity. Organizations can select and develop leaders, managers and supervisors to fit the intended organizational culture and climate. Decisions of leaders, managers and supervisors regarding practices, policies and procedures will help to establish an organizational climate for creativity, hence the extent to which employees perceive that creativity-supportive organizational practices, policies, and procedures are present in the organization (i.e., climate for creativity). Conversely, the climate for creativity can shape and strengthen the organization's culture for creativity.

Organizations can implement the practices, policies, and procedures through, for example, human resource management, facility management, and human factors/ergonomics approaches focusing on the context (rather than on recruitment, selection and training of individual employees). Through *job design,* organizations

can make jobs challenging, facilitate team work and provide autonomy and job rotation. Through *leadership* employees can receive goals for creative outcomes, idea thinking time, resources for creative projects or works, recognition and rewards, and social support (from managers and co-workers). Organizations can address physical elements through interior design (to ensure availability of plants, color, illumination, and absence of physical distractions, etc.) and building design (e.g., window view). An organization may use a stepwise approach to improve the culture and climate for creativity. It starts with an analysis of the current culture and climate. Next, the organization is benchmarked against other organizations or a gold standard. Then, the results are discussed between management and employees to set priorities and formulate improvements. Finally, the organization selects, implements and evaluates the solution. Organizations can use instruments like KEYS (Amabile et al., 1996), CCQ (Ekvall, 1996) and CDQS (Dul & Ceylan, 2011) to support this approach.

In a globalized world, no organization will survive without continuous renewal of products and processes. Any employee in the organization, independently of the formal position, is a source of ideas for innovation ("bottom up innovation"). This source will be better utilized in a supportive culture and climate for creativity, not only for the benefit of the organization, but also for the benefit of the employee. We therefore presume that Homo Creativus wants to live and work in a Creative Home.

References

Abbey, A., & Dickson, J. W. (1983). R&D work climate and innovation in semiconductors. *The Academy of Management Journal, 26*(2), 362–368.

Agin, E., & Gibson, T. (2010). Developing an innovative culture. *T+D, 64(7)*, 52–55

Aguinis, H., & Edwards, J. R. (2014). Methodological wishes for the next decade and how to make wishes come true. *Journal of Management Studies, 51*(1), 143–174.

Aiello, J. R., DeRisi, D. T., Epstein, Y. M., & Karlin, R. A. (1977). Crowding and the role of interpersonal distance preference. *Sociometry, 40*, 271–282.

Alencar, E. M. L. S., & Bruno-Faria, M. F. (1997). Characteristics of an organizational environment which stimulate and inhibit creativity. *The Journal of Creative Behavior, 31*(4), 271–281.

Amabile, T. M. (1983). *The social psychology of creativity*. Springer-Verlag.

Amabile, T. M. (1988). A model of creativity and innovation in organizations. In B. M. Staw & L. L. Cumming (Eds.), *Research in organizational behavior* (Vol. 10, pp. 123–167). JAI Press.

Amabile, T. M. (1997). Motivating creativity in organizations: On doing what you love and loving what you do. *California Management Review, 40*(1), 39–58.

Amabile, T. M., & Conti, R. (1999). Changes in the work environment for creativity during downsizing. *Academy of Management Journal, 42*, 630–640.

Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the work environment for creativity. *The Academy of Management Journal, 39*(5), 1154–1184.

Amabile, T. M., Goldfarb, P., & Brackfield, S. C. (1990). Social influences on creativity: Evaluation, coaction, and surveillance. *Creativity Research Journal, 3*(1), 6–21.

Amabile, T. M., & Gryskiewicz, S. S. (1987). *Creativity in the R&D laboratory* (Technical Report No. 30). Center for Creative Leadership.

Amabile, T. M., Hadley, C. N., & Kramer, S. J. (2002b). Creativity under the gun. *Harvard Business Review,* Special Issue on the Innovative Enterprise: Turning Ideas into Profits, *80*(8), 52–61.

Amabile, T. M., Mueller, J. S., Simpson, W. B., Hadley, C. N., Kramer, S. J., & Fleming, L. (2002a). *Time pressure and creativity in organizations: A longitudinal field study*. Harvard Business School Working Paper, No. 02-073.

Anderson, N., De Dreu, C. K. W., & Nijstad, B. A. (2004). The routinization of innovation research: A constructively critical review of the state-of-the-science. *Journal of Organizational Behavior, 25*, 147–173.

Anderson, N., Potočnik, K., & Zhou, J. (2014). Innovation and creativity in organizations: A state-of-the-science review, prospective commentary, and guiding framework. *Journal of Management, 40*(5), 1297–1333.

Andrew, S., & Pitt, M. (2009). Sustainable workplaces: Improving staff health and well-being using plants. *Journal of Corporate Real Estate, 11*(1), 52–63.

Andriopoulos, C. (2001). Determinants of organizational creativity: A literature review. *Management Decision, 39*(10), 834–840.

Andriopoulos, C., & Lowe, A. (2000). Enhancing organizational creativity: The process of perpetual challenging. *Management Decision, 38*(10), 734–742.

Arad, S., Hanson, M. A., & Schneider, R. J. (1997). A framework for the study of relationships between organizational characteristics and organizational innovation. *Journal of Creative Behavior, 31*(1), 42–58.

Ashforth, B. E. (1985). Climate formation: Issues and extensions. *The Academy of Management Review, 10*(4), 837–847.

Ashkanasy, N. M., Broadfoot, L. E., & Falkus, S. (2000). Questionnaire measures of organizational culture. In N. M. Ashkanasy, C. P. M, Wilderom, & M. F. Peterson (Eds.), *Handbook of organizational culture & climate* (pp. 131–146). Sage.

Auernhammer, J., & Hall, H. (2014). Organizational culture in knowledge creation, creativity and innovation: Towards the Freiraum model. *Journal of Information Science, 40*(2), 154–166.

Baer, M., & Oldham, G. R. (2006). The curvilinear relation between experienced creative time pressure and creativity: Moderating effects of openness to experience and support for creativity. *Journal of Applied Psychology, 91*(4), 963–970.

Baer, M., Oldham, G. R., & Cummings, A. (2003). Rewarding creativity: When does it really matter? *The Leadership Quarterly, 14*, 569–586.

Bailyn, L. (1985). Autonomy in the industrial R&D lab. *Human Resource Management, 24*(2), 129–146.

Baltes, B. B., Zhdanova, L. S., & Parker, C. P. (2009). Psychological climate: A comparison of organizational and individual level referents. *Human Relations, 62*(5), 669–700.

Boogerd, P., van Ruysseveldt, J., & van Dam, K. (2015). Creative under pressure: The role of time pressure, creative requirements and creative orientation in creative behavior. *Gedrag & Organisatie, 28*(2), 134–153.

Bringslimark, T., Hartig, T., & Patil, G. G. (2009). The psychological benefits of indoor plants: A critical review of the experimental literature. *Journal of Environmental Psychology, 29*, 422–433.

Brockbank, W. (1999). If HR were really strategically proactive: Present and future directions in HR's contribution to competitive advantage. *Human Resource Management, 38*, 337–352.

Caniëls, M. C. J., De Stobbeleir, K., & De Clippeleer, I. (2014). The antecedents of creativity revisited: A process perspective. *Creativity and Innovation Management, 23*(2), 96–110.

Carmeli, A., Cohen-Meitar, R., & Elizur, D. (2007). The role of job challenge and organizational identification in enhancing creative behavior among employees in the workplace. *Journal of Creative Behavior, 41*(2), 75–90.

Carr, J. Z., Schmidt, A. M., Ford, J. K., & DeShon, R. P. (2003). Climate perceptions matter: A meta-analytic path analysis relating molar climate, cognitive and affective states, and individual level work outcomes. *Journal of Applied Psychology, 88*(4), 605–619.

Carson, P. P., & Carson, K. D. (1993). Managing creativity enhancement through goal setting and feedback. *Journal of Creative Behavior, 27*, 36–45.

Ceylan, C., & Dul, J. (2007). Expert opinions on human resources practices for creativity stimulating work environments for innovation in Turkey, The Netherlands and Brazil. In *Proceedings of the*

9th International Human Resource Management Conference (IHRM2007): Changes in Society, Changes in Organizations, and the Changing Role of HRM: Managing International Human Resources in a Complex World, Tallinn, Estonia.

Ceylan, C., Dul, J., & Aytac, S. (2008). Can the office environment stimulate a manager's creativity? *Human Factors and Ergonomics in Manufacturing, 18*(6), 589–602.

Chen, C.-J., Shih, H.-A., & Yeh, Y.-C. (2011). Individual initiative, skill variety, and creativity: The moderating role of knowledge specificity and creative resources. *The International Journal of Human Resource Management, 22*(17), 3447–3461.

Choo, C. W. (2013). Information culture and organizational effectiveness. *International Journal of Information Management, 33*, 775–779.

Coelho, F., & Augusto, M. (2010). Job characteristics and the creativity of frontline service employees. *Journal of Service Research, 13*(4), 426–438.

Coelho, F., Augusto, M., & Lages, L. F. (2011). Contextual factors and the creativity of frontline employees: The mediating effects of role stress and intrinsic motivation. *Journal of Retailing, 87*(1), 31–45.

Çokpekin, Ö., & Knudsen, M. P. (2012). Does organizing for creativity really lead to innovation? *Creativity and Innovation Management, 21*(3), 304–314.

Csikszentmihalyi, M. (1997). *Creativity: Flow and the psychology of discovery and invention.* Harper Perennial.

De Dreu, C. K. W., & West, M. A. (2001). Minority dissent and team innovation: The importance of participation in decision making. *Journal of Applied Psychology, 86*(6), 1191–1201.

De Korte, E., Kuijt, L., & Van Der Kleij, R. (2011). Effects of meeting room interior design on team performance in a creativity task. *Ergonomics and health aspects of work with computers* (pp. 59–67). Springer.

Delbridge, R., & Fiss, P. C. (2013). Editors' comments: Styles of theorizing and the social organization of knowledge. *Academy of Management Review, 38*(3), 325–331.

De Long, D. W., & Fahey, L. (2000). Diagnosing cultural barriers to knowledge management. *The Academy of Management Executive, 14*(4), 113–127.

Denison, D. R. (1984). Bringing corporate culture to the bottom line. *Organizational Dynamics, 13*(2), 4–22.

Denison, D. R. (1990). *Corporate culture and organizational effectiveness*. Wiley.

Denison, D. R. (1996). What is the difference between organizational culture and organizational climate? A native's point of view on a decade of paradigm wars. *The Academy of Management Review, 21*(3), 619–654.

Denison, D. R., & Mishra, A. K. (1995). Toward a theory of organizational culture and effectiveness. *Organization Science, 6*(2), 204–223.

Desphande, R., & Webster, F. E., Jr. (1989). Organizational culture and marketing: Defining the research agenda. *The Journal of Marketing, 53*(1), 3–15.

De Spiegelaere, S., Van Gyes, G., De Witte, H., Niesen, W., & Van Hootegem, G. (2014). On the relation of job insecurity, job autonomy, innovative work behaviour and the mediating effect of work engagement. *Creativity and Innovation Management, 23*(3), 318–330.

De Stobbeleir, K. E. M., Ashford, S. J., & Buyens, D. (2011). Self-regulation of creativity at work: The role of feedback-seeking behavior in creative performance. *Academy of Management Journal, 54*(4), 811–831.

Dewett, T. (2004). Employee creativity and the role of risk. *European Journal of Innovation Management, 7*(4), 257–266.

Dewett, T. (2007). Linking intrinsic motivation, risk taking, and employee creativity in an R&D environment. *R&D Management, 37*(3), 197–208.

Diliello, T. C., Houghton, J. D., & Dawley, D. (2011). Narrowing the creativity gap: The moderating effects of perceived support for creativity. *The Journal of Psychology, 145*(3), 151–172.

Dougherty, D. (2008). Bridging social constraint and social action to design organizations for innovation. *Organization Studies, 29*, 415–434.

Drazin, R., Glynn, M. A., & Kazanjian, R. K. (1999). Multilevel theorizing about creativity in organizations: A sensemaking perspective. *The Academy of Management Review, 24*, 286–307.
Drexler, J. A. (1977). Organizational climate: Its homogeneity within organizations. *Journal of Applied Psychology, 62*(1), 38–42.
Dul, J. (2016). Necessary condition analysis (NCA). Logic and methodology of "Necessary but not sufficient" causality. *Organizational Research Methods, 19*, 10–52.
Dul, J. (2019). The physical environment and creativity. In J. C. Kaufman & R. J. Sternberg (Eds.), *The Cambridge handbook of creativity* (2nd ed., pp. 481–510). Cambridge University Press.
Dul, J., & Ceylan, C. (2011). Work environments for employee creativity. *Ergonomics, 54*(1), 12–20.
Dul, J., & Ceylan, C. (2014). The impact of a creativity-supporting work environment on a firm's product innovation performance. *Journal of Product Innovation Management, 31*(6), 1254–1267.
Dul, J., Ceylan, C., & Jaspers, F. (2011). Knowledge workers' creativity and the role of the physical work environment. *Human Resource Management, 50*(6), 715–734.
Dul, J., Karwowski, M., & Kaufman, J. C. (2020). Necessary condition analysis in creativity research. In *Handbook of research methods on creativity* (pp. 351–368). Edward Elgar Publishing.
Dysvik, A., & Kuvaas, B. (2012). Intrinsic and extrinsic motivation as predictors of work effort: The moderating role of achievement goals. *British Journal of Social Psychology, 52*, 412–430.
Earle, H. A. (2003). Building a workplace of choice: Using the work environment to attract and retain top talent. *Journal of Facilities Management, 2*, 244–257.
Edvinsson, L. (1997). Developing intellectual capital at Skandia. *Long Range Planning, 30*(3), 366–373.
Egan, T. M. (2005). Factors influencing individual creativity in the workplace: An examination of quantitative empirical research. *Advances in Developing Human Resources, 7*, 160–181.
Eisenberger, R., & Rhoades, L. (2001). Incremental effects of reward on creativity. *Journal of Personality and Social Psychology, 81*(4), 728–741.
Ekvall, G. (1996). Organizational climate for creativity and innovation. *European Journal of Work and Organizational Psychology, 5*(1), 105–123.
Ekvall, G. (1997). Organizational conditions and levels of creativity. *Creativity and Innovation Management, 6*(4), 195–205.
Farr, J. L. (1990). Facilitating individual role innovation. In M. A. West, & J. L. Farr (Eds.), *Innovation and creativity at work: Psychological and organizational strategies* (pp. 207–230). John Wiley & Sons.
Gagne, M., & Deci, E. L. (2005). Self-determination theory and work motivation. *Journal of Organizational Behavior, 26*, 331–362.
George, J. M. (2007). Creativity in organizations. *The Academy of Management Annals, 1*(1), 439–477.
George, J. M., & Zhou, J. (2001). When openness to experience and conscientiousness are related to creative behavior: An interactional approach. *Journal of Applied Psychology, 86*, 513–524.
Gilson, L. L., Lim, H. S., D'Innocenzo, L., & Moye, N. (2012). One size does not fit all: Managing radical and ıncremental creativity. *The Journal of Creative Behavior, 46*(3), 168–191.
Glick, W. H. (1985). Conceptualizing and measuring organizational and psychological climate: Pitfalls in multilevel research. *The Academy of Management Review, 10*(3), 601–616.
Gundry, L. K., Kickul, J. R., & Prather, C. W. (1994). Building the creative organization. *Organizational Dynamics*, *22*(4), 22–37.
Gundry, L. K., Muñoz-Fernandez, A., Ofstein, L. F., & Ortega-Egea, T. (2016). Innovating in organizations: A model of climate components facilitating the creation of new value. *Creativity and Innovation Management, 25*(2), 223–238.
Hackman, J. R., & Oldham, G. R. (1980). *Work redesign.* Addison-Wesley.
Hahn, M. H., Lee, K. C., & Lee, D. S. (2015). Network structure, organizational learning culture, and employee creativity in system integration companies: The mediating effects of exploitation and exploration. *Computers in Human Behavior, 42*, 167–175.
Haner, U. (2005). Spaces for creativity and innovation in two established organizations. *Creativity and Innovation Management, 14*(3), 288–298.

Harris, S. G. (1994). Organizational culture and individual sensemaking: A schema-based perspective. *Organization Science, 5*(3), 309–321.

Hartig, T., & Evans, G. W. (1993). Psychological foundations of nature experience. In T. Gärling & R. G. Golledge (Eds.), *Behavior and environment: Psychological and geographical approaches* (pp. 427–457). North-Holland.

Heerwagen, I. H., & Orians, G. H. (1986). Adaptations to windowlessness: A study of the use of visual decor in windowed and windowless offices. *Environment and Behavior, 18*, 623–639.

Hoff, E. V., & Öberg, N. K. (2015). The role of the physical work environment for creative employees—A case study of digital artists. *The International Journal of Human Resource Management, 26*(14), 1889–1906.

Holman, D., Totterdell, P., Axtell, C., Stride, C., & Port, R. (2005, May). *Individual innovation behaviours: The development of a measure and examination of antecedents.* In XII European Congress of Organizational and Work Psychology. Istanbul, Turkey.

Hon, A. H. Y., Chan, W. W. H., & Lu, L. (2013). Overcoming work-related stress and promoting employee creativity in hotel industry: The role of task feedback from supervisor. *International Journal of Hospitality Management, 33*, 416–424.

Hsu, M. L. A., & Fan, H.-L. (2010). Organizational innovation climate and creative outcomes: Exploring the moderating effect of time pressure. *Creativity Research Journal, 22*(4), 378–386.

Hunter, S. T., Bedell, K. E., & Mumford, M. D. (2005). Dimensions of creative climate: A general taxonomy. *The Korean Journal of Thinking & Problem Solving, 15*(2), 97–116.

Hunter, S. T., Bedell, K. E., & Mumford, M. D. (2007). Climate for creativity: A quantitative review. *Creativity Research Journal, 19*(1), 69–90.

Hunter, S. T., Cushenbery, L., & Friedrich, T. (2012). Hiring an innovative workplace: A necessary yet uniquely challenging endeavor. *Human Resource Management Review, 22*, 303–322.

Isaksen, S. G., Lauer, K. J., Ekvall, G., & Britz, A. (2001). Perceptions of the best and worst climates for creativity: Preliminary validation evidence for the Situational Outlook Questionnaire. *Creativity Research Journal, 13*(2), 171–184.

James, L. A., & James, L. R. (1989). Integrating work environment perceptions: Explorations into the measurement of meaning. *Journal of Applied Psychology, 74*(5), 739–751.

James, L. R., & Jones, A. P. (1974). Organizational climate: A review of theory and research. *Psychological Bulletin, 81*, 1096–1112.

Janssen, O. (2000). Job demands, perceptions of effort-reward fairness and innovative work behavior. *Joumal of Occupational and Organisational Psychology, 73*, 287–302.

Jelinek, M., Smircich, L., & Hirsch, P. (1983). An introduction: A code of many colors. *Administrative Science Quarterly, 28*, 331–338.

Joo, B., Yang, B., & McLean, G. N. (2014). Employee creativity: The effects of perceived learning culture, leader–member exchange quality, job autonomy, and proactivity. *Human Resource Development International, 17*(3), 297–317.

Joyse, W. F., & Slocum, J. W. (1984). Collective climate: Agreement as a basis for defining aggregate climates in organizations. *The Academy of Management Journal, 27*(4), 721–742.

Kahn, K., & Dempsey, J. L. (2012). An investigation of centers for innovation. *International Journal of Innovation Science, 4*(2), 89–100.

Kallio, T. J., Kallio, K.-M., & Blomberg, A. J. (2015). Physical space, culture and organisational creativity—A longitudinal study. *Facilities, 33*(5/6), 389–411.

Kanter, R. M. (1988). When a thousand flowers bloom: Structural, collective, and social conditions for innovation in organizations. *Research in Organizational Behavior, 10*, 169–211.

Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology, 15*, 169–182.

Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective*. Cambridge University Press.

Kim, S., & Yoon, G. (2015). An innovation-driven culture in local government: Do senior manager's transformational leadership and the climate for creativity matter? *Public Personnel Management, 44*(2), 147–168.

Kimberly, J. R., & Evanisko, M. J. (1981). Organizational Innovation: The influence of individual, organizational, and contextual factors on hospital adoption of technological and administrative innovations. *The Academy of Management Journal, 24*(4), 689–713.

Knasko, S. (1992). Ambient odor's effect on creativity, mood, and perceived health. *Chemical Senses, 17*(1), 27–35.

Knez, I. (1995). Effects of indoor lighting on mood and cognition. *Journal of Environmental Psychology, 15*(1), 39–51.

Küller, R., Mikellides, B., & Janssens, J. (2009). Color, arousal, and performance. A comparison of three experiments. *Color Research & Application, 34*(2), 141–152.

Kurtessis, J. N., Eisenberger, R., Ford, M. T., Buffardi, L. C., Stewart, K. A., & Adis, C. S. (2015). Perceived organizational support. A meta-analytic evaluation of organizational support theory. *Journal of Management, 31*, 874–900.

Kwallek, N., Soon, K., & Lewis, C. M. (2007). Work week productivity, visual complexity, and individual environmental sensitivity in three offices of different color interiors. *Color Research & Application, 32*, 130–143.

Kwallek, N., Woodson, H., Lewis, C. M., & Sales, C. (1997). Impact of three interior color schemes on worker mood and performance relative to individual environmental sensitivity. *Color Research & Application, 22*, 121–132.

Lichtenfeld, S., Elliot, A. J., Maier, M. A., & Pekrun, R. (2012). Fertile green: Green facilities creative performance. *Personality and Social Psychology Bulletin, 38*(6), 784–797.

Liden, R. C., Wayne, S. J., Liao, C., & Meuser, J. D. (2014). Servant leadership and serving culture: Influence on individual and unit performance. *Academy of Management Journal, 57*(5), 1434–1452.

Lone, J. A., Bjørklund, R. A., Østerud, K. B., Anderssen, L. A., Hoff, T., & Bjørkli, C. A. (2014). Assessing knowledge-intensive work environment: General versus situation-specific instruments. *European Journal of Work and Organizational Psychology, 23*(3), 469–482.

Lukersmith, S., & Burgess-Limerick, R. (2013). The perceived importance and the presence of creative potential in the health professional's work environment. *Ergonomics, 56*(6), 922–934.

Madjar, N., & Oldham, G. R. (2006). Task rotation and polychronicity: Effects on individuals' creativity. *Human Performance, 19*(2), 117–131.

Madjar, N., Oldham, G. R., & Pratt, M. G. (2002). There's no place like home? The contributions of work and nonwork creativity support to employees' creative performance. *Academy of Management Journal, 45*(4), 757–767.

Madjar, N., & Shalley, C. E. (2008). Multiple tasks' and multiple goals' effect on creativity: Forced incubation or just a distraction? *Journal of Management, 34*, 786–805.

Magadley, W., & Birdi, K. (2009). Innovation labs: An examination into the use of physical spaces to enhance organizational creativity. *Creativity and Innovation Management, 18*(4), 315–325.

Malik, M. A. R., Butt, A. N., & Choi, J. N. (2015). Rewards and employee creative performance: Moderating effects of creative self-efficacy, reward importance, and locus of control. *Journal of Organizational Behavior, 36*, 59–74.

Martins, E., & Martins, N. (2002). An organizational culture model to promote creativıity and innovation. *SA Journal of Industrial Psychology, 28*, 58–65.

Martins, E. C., & Terblanche, F. (2003). Building organisational culture that stimulates creativity and innovation. *European Journal of Innovation Management, 6*, 64–74.

Mathisen, G. E., & Einarsen, S. (2004). A review of instruments assessing creative and innovative environments within organizations. *Creativity Research Journal, 16*(1), 119–140.

May, D. R., Oldham, G. R., & Rathert, C. (2005). Employee affective and behavioral reactions to the spatial density of physical work environments. *Human Resource Management, 44*(1), 21–33.

McCoy, J. M., & Evans, G. W. (2002). The potential role of the physical environment in fostering creativity. *Creativity Research Journal, 14*(3&4), 409–426.

McDermott, R., & O'Dell, C. (2001). Overcoming cultural barriers to sharing knowledge. *Journal of Knowledge Management, 5*(1), 76–85.

McLean, L. D. (2005). Organizational culture's influence on creativity and innovation: A review of the literature and implications for human resource development. *Advances in Developing Human Resources, 7*, 226–246.

Mehta, R., Zhu, R. (Juliet), & Cheemals, A. (2012). Is noise always bad? Exploring the effects of ambient noise on creative cognition. *Journal of Consumer Research, 39*(4), 784–799.

Michela, J. L., & Burke, W. W. (2000). Organizational culture and climate in transformations for quality and innovation. In N. M. Ashkanasy, C. P. M Wilderom & M. F. Peterson (Eds.), *Handbook of organizational culture & climate* (pp. 225–244). Sage.

Mikdashi, T. (1999). Constitutive meaning and aspects of work environment affecting creativity in Lebanon. *Participation & Empowerment: an International Journal, 7*(3), 47–55.

Miron-Spektor, E., & Beenen, G. (2015). Motivating creativity: The effects of sequential and simultaneous learning and performance achievement goals on product novelty and usefulness. *Organizational Behavior and Human Decision Processes, 127*, 53–65.

Moultrie, J., Nilsson, M., Dissel, M., & Haner, U.-E., Janssen, S., & Van der Lugt, R. (2007). Innovation spaces: Towards a framework for understanding the role of the physical environment in innovation. *Creativity and Innovation Management, 16*, 53–65.

Mueller, J. S., & Kamdar, D. (2011). Why seeking help from teammates is a blessing and a curse: A theory of help seeking and individual creativity in team contexts. *Journal of Applied Psychology, 96*(2), 263–276.

Mumford, M. D. (2000). Managing creative people: Strategies and tactics for innovation. *Human Resource Management Review, 10*(3), 313–351.

Mumford, M. D., Scott, G. M., Gaddis, B., & Strange, J. M. (2002). Leading creative people: Orchestrating expertise and relationships. *The Leadership Quarterly, 13*, 705–750.

Mumford, M. D., Whetzel, D. L., & Reiter-Palmon, R. (1997). Thinking creatively at work: Organization influences on creative problem solving. *Journal of Creative Behavior, 31*(1), 7–17.

Noefer, K., Stegmaier, R., Molter, B., & Sonntag, K. (2009). A great many things to do and not a minute to spare: Can feedback from supervisors moderate the relationship between skill variety, time pressure, and employees' innovative behavior? *Creativity Research Journal, 21*(4), 384–393.

Nyström, H. (1990). Organizational innovation. In M. A. West & J. L Farr (Eds.), *lnnovation and creativity at work: Psychological and organizational strategies* (pp. 143–161). John Wiley & Sons.

Ohly, S., Sonnentag, S., & Pluntke, F. (2006). Routinization, work characteristics and their relationships with creative and proactive behaviors. *Journal of Organizational Behavior, 27*, 257–279.

Oldham, G. R., & Cummings, A. (1996). Employee creativity: Personal and contextual factors at work. *The Academy of Management Journal, 39*(3), 607–634.

O'Reilly, C. (1989). Corporations, culture, and commitment: Motivation and social control in organizations. *California Management Review, 31*(4), 9–25.

Ouchi, W. G. (1981). *Theory Z*. Addison-Wesley.

Ouchi, W. G., & Wilkins, A. L. (1985). Organizational culture. *Annual Review of Sociology, 11*, 457–483.

Parker, C. P., Baltes, B. B., Young, S. A., Huff, J. W., Altmann, R. A., Lacost, H. A., & Roberts, J. E. (2003). Relationships between psychological climate perceptions and work outcomes: A meta-analytic review. *Journal of Organizational Behavior, 24*, 389–416.

Parry, M. E., Song, M., Weerd-Nederhof, P. C., & Visscher, K. (2009). The impact of NPD strategy, product strategy, and NPD process on perceived cycle time. *Journal of Product Innovation Management, 26*, 627–639.

Paulus, P. B. (2000). Groups, teams, and creativity: The creative potential of idea-generating groups. *Applied Psychology: An International Review, 49*(2), 237–262.

Payne, R., & Mansfield, R. (1978). Correlates of individual perceptions of organizational climate. *Journal of Occupational Psychology, 51*, 209–218.

Pettigrew, A. M. (1979). On studying organizational cultures. *Administrative Science Quarterly, 24*(4), 570–581.

Pitta, D. A., Wood, V. R., & Franzak, F. J. (2008). Nurturing an effective creative culture within a marketing organization. *Journal of Consumer Marketing, 25*, 137–148.
Price, I. (2009) Space to adapt: Workplaces, creative behaviour and organizational memetics. In T. Rickards, M. A. Runco, & S. Moger (Eds.), *The Routledge companion to creativity*. Routledge.
Ragin, C. C. (2000). *Fuzzy-set social science*. University of Chicago Press.
Ragin, C. C. (2008). *Redesigning social inquiry: Fuzzy sets and beyond* (pp. 190–212). University of Chicago Press.
Rank, J., Pace, V. L., & Frese, M. (2004). Three avenues for future research on creativity, innovation, and initiative. *Applied Psychology: an International Review, 53*(4), 518–528.
Richter, A. W., Hirst, G., van Knippenberg, D., & Baer, M. (2012). Creative self-efficacy and individual creativity in team contexts: Cross-level interactions with team informational resources. *Journal of Applied Psychology, 97*(6), 1282–1290.
Roskes, M. (2015). Constraints that help or hinder creative performance: A motivational approach. *Creativity and Innovation Management, 24*(2), 197–206.
Runco, M. A. (2004). Creativity. *Annual Review of Psychology, 55*, 657–687.
Sadi, M. A., & Al-Dubaisi, A. H. (2008). Barriers to organizational creativity. The marketing executives' perspective in Saudi Arabia. *Journal of Management Development, 27*(6), 574–599.
Sathe, V. (1983). Implications of corporate culture: A managers' guide to action. *Organizational Dynamics, 12*(2), 5–23.
Schein, E. H. (1985). *Organizational culture and leadership*. Jossey-Bass.
Schein, E. H. (1990). Organizational culture. *American Psychologist, 45*(2), 109–119.
Schein, E. H. (2004). *Organizational culture and leadership* (3rd ed.). Jossey-Bass.
Schepers, P., & van den Berg, P. T. (2007). Social factors of work environment creativity. *Journal of Business and Psychology, 21*(3), 407–428.
Schneider, B. (1987). The people make the place. *Personnel Psychology, 40*, 437–453.
Schneider, B., Brief, A. P., & Guzzo, R. A. (1996). Creating a climate and culture for sustainable organizational change. *Organizational Dynamics, 24*(4), 7–19.
Schneider, B., Ehrhart, M. G., & Macey, W. H. (2013). Organizational climate and culture. *Annual Review of Psychology, 64*, 361–388.
Schneider, B., Gunnarson, S. K., & Niles-Jolly, K. (1994). Creating the climate and culture of success. *Organizational Dynamics, 23*(1), 17–29.
Schneider, B., & Reichers, A. E. (1983). On the etiology of climates. *Personnel Psychology, 36*(1), 19–39.
Schneider, B., Wheeler, J. K., & Cox, J. F. (1992). A passion for service: Using content analysis to explicate service climate. *Journal of Applied Psychology, 77*(5), 705–716.
Schneider, B., White, S. S., & Paul, M. C. (1998). Linking service climate and customer perceptions of service quality: Tests of a causal model. *Journal of Applied Psychology, 83*(2), 150–163.
Schoen, J. L. (2015). Effects of implicit achievement motivation, expected evaluations, and domain knowledge on creative performance. *Journal of Organizational Behavior, 36*, 319–338.
Schwartz, H., & Davis, S. M. (1981). Matching corporate culture and business strategy. *Organizational Dynamics, 10*(1), 30–48.
Scopelliti, I., Cillo, P., Busacca, B., & Mazursky, D. (2014). How do financial constraints affect creativity? *Journal of Product Innovation Management, 31*(5), 880–893.
Shalley, C. E. (1991). Effects of productivity goals, creativity goals, and personal discretion on individual creativity. *Journal of Applied Psychology, 76*(2), 179–185.
Shalley, C. E. (1995). Effects of coaction, expected evaluation, and goal setting on creativity and productivity. *Academy of Management Journal, 38*(2), 483–503.
Shalley, C. E., & Gilson, L. L. (2004). What leaders need to know: A review of social and contextual factors that can foster or hinder creativity. *The Leadership Quarterly, 15*, 33–53.
Shalley, C. E., & Perry-Smith, J. E. (2008). The emergence of team creative cognition: The role of diverse outside ties, sociocognitive network centrality, and team evolution. *Strategic Entrepreneurship Journal, 2*, 23–41.

Shalley, C. E., Zhou, J., & Oldham, G. R. (2004). The effects of personal and contextual characteristics on creativity: Where should we go from here? *Journal of Management, 30*(6), 933–958.

Shibata, S., & Suzuki, N. (2001). Effects of indoor foliage plants on subjects' recovery from mental fatigue. *North American Journal of Psychology, 3*, 385–396.

Shibata, S., & Suzuki, N. (2002). Effects of the foliage plant on task performance and mood. *Journal of Environmental Psychology, 22*, 265–272.

Shibata, S., & Suzuki, N. (2004). Effects of an indoor plant on creative task performance and mood. *Scandinavian Journal of Psychology, 45*, 373–381.

Shin, S. J., Kim, T.-Y., Lee, J.-Y., & Bian, L. (2012). Cognitive team diversity and individual team member creativity: A cross-level interaction. *Academy of Management Journal, 55*(1), 197–212.

Sia, S. K., & Appu, A. V. (2015). Work autonomy and workplace creativity: Moderating role of task complexity. *Global Business Review, 16*(5), 772–784.

Sijbom, R. B. L., Janssen, O., & Van Yperen, N. W. (2015). Leaders' receptivity to subordinates' creative input: The role of achievement goals and composition of creative input. *European Journal of Work and Organizational Psychology, 24*(3), 462–478.

Smith, P. G., & Reinertsen, D. G. (1991). *Developing products in half the time.* Van Nostrand Reinhold.

Spivack, A. J., Askay, D. A., & Rogelberg, S. G. (2010). Contemporary physical workspaces: A review of current research, trends, and implications for future environmental psychology inquiry. *Environmental psychology: New developments* (pp. 37–62). Nova Science Publishers, Inc.

Steidle, A., & Werth, L. (2013). Freedom from constraints: Darkness and dim illumination promote creativity. *Journal of Environmental Psychology, 35*, 67–80.

Stetler, K. L., & Magnusson, M. (2015). Exploring the tension between clarity and ambiguity in goal setting for innovation. *Creativity and Innovation Management, 24*(2), 231–246.

Stokols, D., Clitheroe, C., & Zmuidzinas, M. (2010). Qualities of work environments that promote perceived support for creativity. *Creativity Research Journal, 14*(2), 137–147.

Stone, N. J. (1998). Windows and environmental cues on performance and mood. *Environment and Behavior, 30*, 306–321.

Stone, N. J. (2003). Environmental view and color for a simulated telemarketing task. *Journal of Environmental Psychology, 23*, 63–78.

Stone, N. J., & Irvine, J. M. (1994). Direct and indirect window access, task type, and performance. *Journal of Environmental Psychology, 14*, 57–63.

Sundgren, M., Dimenäs, E., Gustaffson, J.-E., & Selart, M. (2005). Drivers of organizational creativity: A path model of creative climate in pharmaceutical R&D. *R&D Management, 35*(4), 359–374.

Tan, G. (1998). Managing creativity in organizations: A total system approach. *Creativity and Innovation Management, 7*(1), 23–31.

Tang, C., Shang, J., Naumann, S. E., & von Zedtwitz, M. (2014). How team identification and expertise identification affect R&D employees' creativity. *Creativity and Innovation Management, 23*(3), 276–289.

Tesluk, P. E., Farr, J. L., & Klein, S. R. (1997). Influences of organizational culture and climate on individual creativity. *Journal of Creative Behavior, 31*(1), 27–41.

Törner, M., Pousette, A., Larsman, P., Eklöf, M., & Hemlin, S. (2015, September 23–25). *Health and good fortune! Organizational climate for health, safety, team effectiveness and innovations.* In 8th Conference Working on Safety, Porto, Portugal.

Ulrich, R. S. (1993). Biophilia, biophobia, and nature landscapes. In S. R. Kellert & E. O. Wilson (Eds.), *The biophilia hypothesis* (pp. 73–137). Island Press/Shearwater Book.

Unsworth, K. L., & Clegg, C. W. (2010). Why do employees undertake creative action? *Journal of Occupational and Organizational Psychology, 83*, 77–99.

Van Dyne, L., Jehn, K. A., & Cummings, A. (2002). Differential effects of strain on two forms of work performance: Individual employee sales and creativity. *Journal of Organizational Behavior, 23*, 57–74.

Veitch, J. A., & Gifford, R. (1996). Choice, perceived control, and performance decrements in the physical environment. *Journal of Environmental Psychology, 16*(3), 269–276.
Verbeke, W., Volgering, M., & Hessels, M. (1998). Exploring the conceptual expansion within the field of organizational behavior: Organizational climate and organizational culture. *Journal of Management Studies, 35*(3), 303–329.
Verderber, S. (1986). Dimensions of person-window transactions in the hospital environment. *Environment and Behavior, 18*, 450–466.
Vithayathawornwong, S., Danko, S., & Tolbert, P. (2003). The role of the physical environment in supporting organizational creativity. *Journal of Interior Design, 29*(1&2), 1–16.
Voordt, T. J. M., van der Meel, J., van Smulders, F., & Teurlings, S. (2003). Corporate culture and design. *Environments by DESIGN, 4*(2), 23–43.
Weber, S. T., & Heuberger, E. (2009). The impact of natural odors on affective states in humans. *Chemical Senses, 33*(5), 441–447.
Woodman, R. W., & King, D. C. (1978). Organizational climate: Science or folklore? *The Academy of Management Review, 3*(4), 816–826.
Woodman, R. W., Sawyer, J. E., & Griffin, R. W. (1993). Toward a theory of organizational creativity. *The Academy of Management Review, 18*(2), 293–321.
Yoo, S., Jang, S., Ho, Y., Seo, J., & Yoo, M. H. (2019). Fostering workplace creativity: Examining the roles of job design and organizational context. *Asia Pacific Journal of Human Resources, 57*, 127–149.
Yoon, H. J., Sung, S. Y., & Choi, J. N. (2015). Mechanisms underlying creative performance: Employee perceptions of intrinsic and extrinsic rewards for creativity. *Social Behavior and Personality, 43*(7), 1161–1180.
Young, S. A., & Parker, C. P. (1999). Predicting collective climates: Assessing the role of shared work values, needs, employee interaction and work group membership. *Journal of Organizational Behavior, 20*, 1199–1218.
Yu, C., & Frenkel, S. J. (2013). Explaining task performance and creativity from perceived organizational support theory: Which mechanisms are more important? *Journal of Organizational Behavior, 34*, 1165–1181.
Yuan, F., & Zhou, J. (2008). Differential effects of expected external evaluation on different parts of the creative idea production process and on final product creativity. *Creativity Research Journal, 20*(4), 391–403.
Zamanou, S., & Glaser, S. R. (1994). Moving toward participation and involvement: Managing and measuring organizational culture. *Group & Organization Management, 19*(4), 475–502.
Zhang, H., Li, F., & Reynolds, K. J. (2020). Creativity at work: Exploring role identity, organizational climate and creative team mindset. *Current Psychology*. https://doi.org/10.1007/s12144-020-00908-9
Zhang, Y., Long, L., & Zhang, J. (2015). Pay for performance and employee creativity. *Management Decision, 53*(7), 1378–1397.
Zhong, C.-B., & House, J. (2012). Hawthorne revisited: Organizational implications of the physical work environment. *Research in Organizational Behavior, 32*, 3–22.
Zhou, J. (2003). When the presence of creative coworkers is related to creativity: Role of supervisor close monitoring, developmental feedback, and creative personality. *Journal of Applied Psychology, 88*(3), 413–422.
Zhou, J., & Shalley, C. E. (2003). Research on employee creativity: A critical review and directions for future research. In J. J. Martocchio & G. R. Ferris (Eds.), *Research in Personnel and Human Resource Management, 22*, 165–217.
Zhou, J., Wang, X. M., Song, L. J., & Wu, J. (2017). Is it new? Personal and contextual influences on perceptions of novelty and creativity. *Journal of Applied Psychology, 102*(2), 180–202.
Zhou, Q., Hirst, G., & Shipton, H. (2012). Promoting creativity at work: The role of problem-solving demand. *Applied Psychology: an International Review, 61*(1), 56–80.

Zhou, Y.-Q., Gardner, D. G., & Chen, H.-G. (2018). Relationships between work team climate, individual motivation, and creativity. *Journal of Management, 44*(5), 2094–2115.
Zohar, D. (1980). Safety climate in industrial organizations: Theoretical and applied implications. *Journal of Applied Psychology, 65*(1), 96–102.

Types of Creativity

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Keywords Criterion-related validity · Everyday creativity · Personal creativity · Assessment · Creative potential

This chapter was prepared for the volume that focuses on the 7 Cs of creativity. The 7 Cs are Creators, Creating, Cooperation, Context, Creations, Consumption, and Curricula. This chapter explores the various ways that creativity is expressed, and as such best fits into the Creations category. It distinguishes between creative potential and creative performance and covers the assessment of each. There is a discussion of objectivity and subjectivity in assessments, the pros and cons of the various assessments, and criticism of some of the research being reported. As is the case with the other chapters in this same volume, a brief historical overview is given first. That is followed by a review of the relevant theories and key empirical results. The final section of this chapter pinpoints debates and concerns and offers suggestions about advancing the field.

Several key terms and concepts should be defined right up front. As a matter of fact something must be said about the word *creativity*. Elsewhere I have proposed that the noun *creativity* should only be used sparingly, or better yet not used at all, at least in the academic literature. That is because there are so many different kinds of creativity. It can be expressed in a multitude of ways—and these are not always all that strongly related to one another. There are domain differences in creativity (Agnoli et al., 2016; An & Runco, 2016; Baer, 1998), for example, indicating that creative performance in the arts may differ from creative performance in the sciences, mathematics, drama, dance, and so on. There is no consensus about which domains are in fact distinct, nor even agreement on which criteria should be used to confirm distinctiveness among

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them. Gardner's (1993) list of criteria (e.g., biological bases, experimental evidence, and developmental trajectories) remains the most tenable. New domains have been proposed, including naturalistic creativity, technological creativity, and everyday creativity (Cropley, 1990; Richards, 2007; Runco & Bahleda, 1986). Some of these are only distinct if creative potential is recognized as meaningful and extricable from actual creative performance.

This brings us to the next key definition, or definitions, namely between *creative potential* and actual *creative performance*. No measurement can be done without recognizing the separation of the two. This dichotomy also supports the idea that the noun *creativity* is just too vague to use. Many people have creative potential, but not everyone performs in a manifestly and unambiguously creative fashion. Further, creative potential can be assessed (details below) but that may tell you little about creative performance, just as creative performances can be measured but tell you little if anything about the full range of any individual's creative potential. With this in mind Runco (2007) restructured the classic 4P framework (as did Lubart et al., in the Introduction to the present volume) in order to clearly distinguish creative potential from creative performance. Runco (2007) took the original 4Ps—person, press (or place), process, and product—and subsumed each to either potential or performance. The most useful part of this reorganization was that it allowed all 4Ps to be functionally tied to one another. Personality and Press factors, for example, were placed under Creative Potential because a person can have critical tendencies, such as openness to experience, risk tolerance, wide interests, intrinsic motivation, or any of the other core characteristic of the creative personality, but still not actually perform in a creative fashion. The characteristics are indicative of mere potential. The same is true of "press" or place factors. ("Press" is the term from psychology of the 1940s and 1950s and was used to label given to pressures on behavior. Some of these, called beta press factors, depend on the individual's interpretation. More recent theories tend to refer to "places," or settings, contexts, or environmental factors rather than "press.") These too do not guarantee actual creative performance. Creative products, also in the 4P model, are under the Creative Performance category of the new framework presented by Runco (2007). After all, if there is a product, there has been an actual performance, at least in the sense that there is a manifest result or outcome. The distinction between potential and performance is vital for understanding the various assessments and will be used throughout this chapter. That distinction is also important for Creations because sometimes there is a clear outcome of creative efforts (e.g., a product or performance) but other times the creation is a new understanding, an idea, or even an emotion. These are related to creative potential but are unlikely to be viewed as socially recognized performances.

While on the topic of terminology, something more should be said about the title of this chapter. It is a bit deceiving to use the noun, *creativity*, given what was just said, but then again, using the noun provided the opportunity to dive into the distinction of potential and performance! The second part of the title that needs explanation is the word, "type." Carl Jung (1923) went into great deal about psychological types and influences. Various measurement efforts, including the *Myers-Briggs Type Indicator* (MBTI; Myers et al., 1998) target types. The MBTI focuses on Thinking vs. Feeling

and Intuition vs. Sensation. Isaksen et al. (2003) offered a history of Jungian types as well as empirical data relating type to cognitive styles. The title of the present chapter, "Types of Creativity," is being used in part because *Type* has such broad application, having been related to attitude, perceptual tendencies, the intentional direction of one's energies, and even ego function (see Isaksen et al., 2003). This broad definition is useful, given the common view that creativity is itself a complex or syndrome (MacKinnon, 1965; Mumford & Gustafson, 1988). In the present chapter the different kinds of creativity are designated by the accompanying nouns, including *potential, performance, personality, product*, and so on. Each of these is in a sense a distinct type of creativity and reasonable expectations depend on the type.

1 A Brief History

The work of Jung (1923) provides a nice segue to the brief history, promised above. Research in that same direction (e.g., personality and characteristics) dominated the earlier investigations of creativity in the 1950s. Much of it was conducted at IPAR, in Berkeley, California (Barron, 1955, 1995; Helson, 1999; MacKinnon, 1962, 1965), and most used one or another personality assessment. This early work found creative individuals to stand out in those core characteristics mentioned above (intrinsic motivation, risk tolerance, and so on). It also confirmed the existence of domain differences, though the domains studied were somewhat limited (e.g., architecture, mathematics, writing). There was research on domain differences in the 1930s (Patrick, 1935, 1937, 1938) but it was not often cited in the psychological literature of the 1940s, 1950s, and 1960s. There was in fact very little on creativity until IPAR. The IPAR researchers brought respectability to creativity research, as did J. P. Guilford (1950).

Guilford (1950) lamented the lack of attention given to creativity and reported statistics from the psychological literature showing that it was not often studied. Guilford also introduced the idea that creative potential represents a critical natural resource, an idea taken up again in the 1990s and used in economic and investment theories of creativity (Rubenson, 1991; Rubenson & Runco, 1992; Sternberg & Lubart, 1995). These theories characterize creative potential as a form of human capital and a highly valuable asset. Guilford's major contribution was probably the distinction between *divergent production* (now usually called divergent thinking [DT]) and *convergent production* (CT), and the methodologies he developed for the measurement of each. DT and CT were parts of Guilford's *Structure of Intellect* (SOI) model. It posited 180 distinct kinds of thinking! The SOI thus represents one of the extreme views of how human cognition can be delineated. At the other extreme is the theory that there is one general form of human cognition ("g") that influences all thinking. Guilford's theory was not without critics. Far from it. His research was hotly criticized, especially because his method for isolating factors (the "cells" in his SOI model) were fairly subjective. The SOI is no longer widely used (cf. Bachelor & Michael, 1997; Michael & Bachelor, 1990; Mumford, 2001; Runco,

2001). Guilford's distinction between divergent thinking and convergent thinking, on the other hand, remains enormously popular (see Acar & Runco, 2019). Educators and researchers who wanted a reliable method for estimating creative potential saw divergent thinking in particular as filling a gap, and no doubt for that reason divergent thinking tests remain among the most commonly used measures in the creativity research.

Divergent thinking tests are often used as estimates of creative potential because, unlike most convergent thinking tests (e.g., IQ and most academic tests), they allow original thinking. Divergent thinking tests are open-ended (e.g., "name all of the strong things you can think of"), and respondents can generate a large number of ideas ("ideational fluency") using a variety of conceptual categories ("ideational flexibility"). Some of the ideas might be statistically rare or novel (indicative of "ideational originality"). The use of divergent thinking tests for estimates of creative potential is, then, justified in part by their allowing originality. Originality is absolutely key for all creative performances. The use of divergent thinking tests is additionally justified by their reliability (Guilford, 1968; Runco, 1991, 2013; Torrance, 1995). There is also some indication of long-term predictive validity (Runco et al., 2011; Torrance, 1995), at least with certain criteria of creative achievement.

Tests of divergent thinking have been used in research suggesting that there is a 4th grade slump in creative potential, as well as an old-age rigidity of thought (i.e., a loss of flexibility) (Chown, 1961; Torrance, 1972; Rubenson & Runco, 1995). Divergent thinking tests have been used to test the impact of various educational and enhancement efforts (Plucker et al., 2011). They have been adapted such that they offer information about the potential for *problem finding* (Alabbasi et al., 2020; Hu et al., 2010) and have also been used in scores of investigations intended to identify which attitudes, values, and traits are shared by creative individuals (Albert & Runco, 1989; Basadur, 1994; Basadur & Hausdorf, 1996). Some of the best test of divergent thinking present realistic problem situations instead of something simple and abstract. Instead of "name strong things" examinees might be given a problem from their own lives but asked to generate a range of options. These options are then evaluated for fluency, flexibility, and originality. Divergent thinking tests are also being used in very recent research on brain correlates of creative thinking (Weisberg, 2013; Yoruk & Runco, 2014).

Divergent thinking tests have been used with a very large range of samples, including preschool children (Bijvoet-van den Berg & Hoicka, 2014; Moran et al., 1983; Tegano & Moran, 1989), primary school children (Runco, 1986a; Torrance, 1995), college students (Runco et al., 2006), and older adults (Gott, 1992). Divergent thinking tests have also been used in exceptional samples, such as entrepreneurs (Ames & Runco, 2005). Such a wide range of samples will come as no surprise, at least if creative potentials are assumed to be widely distributed.

There is a question about using divergent thinking tests with productive adults. That is because productive adults are by definition involved in actual performances or perhaps creating some sort of product or artifact, and instead of assessing the

creative potential that is estimated with a divergent thinking test, or any paper-and-pencil test for that matter, it is quite possible to look instead to the products and actual performances of the adults.

Before elaborating on the possibility of assessing actual products instead of creative potential, something should be said about the method just mentioned and the phrase, "paper and pencil tests." This is dated; many divergent thinking tests are now given digitally, no paper in sight (e.g., Beketayev & Runco, 2016; Cheung & Lau, 2010). Apparently there are differences between digital and paper-and-pencil administrations (Guo, 2016), which should come as no surprise given how much evidence there is for divergent thinking tests to be collected under just the right conditions. If those conditions (e.g., liberal time allotment, de-emphasis on testing and consequences, explicitly directing examinees away from typical test-like expectations) are not met, people are not very original, even if the task is open-ended. This is a significant concern, given how much research is done digitally these days and given the possibility that it may not really be telling us anything about creative potential. I will return to this concern in the Conclusions section of this chapter, but for now the point is that divergent thinking tests are not always given in paper-and-pencil format.

A second point to emphasize about divergent thinking is that it often collaborates with convergent processes (Basadur, 1994; Lubart et al., 2013; Runco, 2003; Runco & Vega, 1990; Runco & Chand, 1995). In fact, actual creative performances and achievements certainly depend on various things, including knowledge, analytic thinking, judgment, and motivation. This kind of collaboration is suggested by the *two-tier model* of the creative process (Runco & Chand, 1995) which has problem finding, ideation (divergent thinking), and evaluation on the primary tier and motivation (both intrinsic and extrinsic) and knowledge (both conceptual and procedural) on a secondary tier. Lubart et al. (2013) were equally explicit about the role of convergent processes in their work on an instrument called the *Evaluation of Creative Potential* (EpoC). This has shown great promise and is reviewed later in this chapter, under the **Creative Products** section. It is mentioned here just because of its recognition of both divergent (and exploratory) and convergent processes.

2 Four Creative Populations

Decisions about what type of Creations can be reasonably expected depend a great deal on the individual. There are at least four populations (i.e., groups of individuals) that should be recognized. First there are children who have creative potential but are not yet producing artifacts that are socially-recognized as creative. Their originality might be entirely personal (Runco, 1996), and in fact their behavior or ideas only original against their own previous actions. In other words a child might show originality by doing something new and novel for him- or herself, in which case it *is* original even if it not original against any social norms or standards. Keep in mind here (a) that this is just originality and not creativity—unless the new idea or behavior is also effective, in which case the standard definition (Runco & Jaeger,

2012) applies and the label "creative" is appropriate; (b) all creative achievement, even that at the highest level, starts with and therefore depends on this same kind of personal creative potential, though eminent creativity requires various other things, such as persistence, knowledge, and social recognition (Runco, 1995); and (c) the child just described is only displaying creative *potential*. Divergent thinking tests are fitting assessments for children's original thinking and their creative potential. It is most accurate to say that divergent thinking tests are useful estimates of the potential for creative thinking. They are *estimates* because they are imperfect, which is true of all tests and measures. Hence the need to calculate reliabilities and validities. This is best done each and every time a test is given.

A second population represents adults who express their creative talents, but only in personal ways, such as self-enlightenment, self-actualization, and everyday or mundane creative thinking and behavior (Kinney et al., 2012; Runco et al., 1991; Tan, 2016). They do original and effective things, but they may not produce artifacts that are socially recognized as creative. Adults who do produce such artifacts represent the third population of creative individuals. They start new businesses, patent an original and useful device, publish, or do something that is socially-recognized as "creative." The study of entrepreneurs, cited above, represents research with this population. They are creative in a socially-recognized and mature fashion, but they are not *eminently creative.* The eminently creative represent the fourth population. Not only have they produced something that is socially-recognized as creative; they have changed the way others think and their work has stands the test of time (Albert, 1975). Simonton (1988) has written extensively about the eminently creative and described how they are *persuasive*—a nice label for how eminently creativity persons change the way others think. *Persuasion* also represents a 6th P, to go along with *Potential, Personality, Process, Product*, and *Place* (Rhodes, 1961; Runco, 2007).

The four groups just identified (children with creative potential, self-actualized adults and those involved in everyday creative actions, creatively productive adults, and the eminently creative) are each well-represented in creativity research, and they can be easily distinguished from one another, as I have tried to do in the paragraph above. Everyday creativity is probably the least well represented in the research, no doubt because of the difficulties in operationalizing criteria, which is why the work of Cropley (1990) and Kinney et al. (2012) is so welcome. More on this below.

Assessments can be chosen such that they fit the particular population. Generalizations from one population to the other should be avoided, though care must be taken such that the groups are not presumed to be completely and permanently distinct. Children with creative potential can, after all, develop their talents and become creatively productive adults or even eminent creators. As a matter of fact, that is probably the ideal outcome of education and the creativity research—to fulfill creative potentials, thereby improving the quality of life of the individual (through self-actualization) and to the benefit of society.

Care must also be taken because too often eminent creativity is completely separated from the other types of creativity. This probably applies to Ghiselin's (1963) attempt to identify criteria for different levels of creativity, and it certainly is apparent

whenever *Big C creativity* is distinguished from *little c creativity*. When totally extricated from one another, the absolutely important connection between the two is forgotten. This is why Runco (2014) called the Big C/ little c distinction a false dichotomy; he emphasized the connection between little c (potential) and its eventual expression in mature or even world-shaking creations. In other words, professional and eminent creativity depend on personal creativity. All manifest creative behavior, including all adult, mature, eminent, or in any way socially-recognized, begins as creative potential.

3 Creative Products

As noted above, sometimes there is a possibility of collecting data about actual creative products and performances instead of estimating creative potential from divergent thinking or perhaps a personality test. Certainly there are a number of good performance measures and a handful of useful methods for assessing productivity. Inventions have been counted and examined (Huber, 1998; Simonton, 2012), as have works of art, publications, patents, scores, and so on (see Lindauer, 1990; Simonton, 1984). With certain samples products such as collages, poems, and works of art can be elicited and assessed (Amabile, 1982; Hennessey, 1994; Lubart et al., 2013; Runco et al., 1994). Amabile's *Consensual Assessment Technique* (CAT) has been proven to be reliable with various populations, including the first two mentioned above, children and non-eminent adults. The CAT requires that judges are involved in the domain being judged (e.g., instructors of poetry judge poems), but intriguingly, *creativity* is not defined for the judges; they are to use their own implicit definitions. They are also asked to rate the technical skill of the product being judged.

Very often overlooked is that the CAT was not developed to assess individual differences in creative ability. Instead it was developed to determine if creative expression varied among different experimental and control conditions. Reliabilities of the CAT are quite good across a wide range of samples and media (Amabile, 1982). The CAT does not lend itself to broad comparisons because the scoring is done with reference to the sample at hand. There are also differences among ratings of the judgments obtained from judges representing different levels of experience or backgrounds. Runco (1989), for example, found that professional artists disagreed with art teachers and art students. Hence generalizations from one group of judges to another is not warranted.

Lubart et al.'s (2013) EPoC, mentioned briefly above, is also a domain-specific assessment of products. It requires that children produce something within (a) graphic or artistic, (b) verbal or literary, and (c) social problem solving domains. It allows assessment of divergent-exploratory thinking and convergent-integrative thinking. Because different domains are represented in this assessment, and there are different indices of creative potential, Lubart et al. are able to profile each student and identify strengths and weaknesses. This leads directly to recommended experiences and curriculum.

Standing back, there are two questions for all assessments of creative products. First, who is to judge the products? And, as Murray (1959) asked long ago, who is to judge the judges? It might be put this way: whenever judgment is involved in assessment, there is subjectivity. It would be quite unwise to take any assessment or research seriously if judgment is involved and no index of inter-judge reliability is given (or if it is low). Further, good inter-judge reliability is really just one check of the value and meaning of any assessment. Inter-judge reliability only provides some index of the degree to which judges agree. There are different reasons why they might agree, and not all of them confirm the meaning of the assessment (e.g., halo effects, expectancy effects, or agreement based on appeal rather than creativity).

A second question about actual products is, what are you trying to understand? Why are you doing the assessment? Often the interest is in *potential*, which means that the concern may be about the future and how the individual might perform at a later time. Any educational program will be interested in potential, for example, as will efforts to encourage or train creative thinking. There is always risk when assessing potential. There is some uncertainty, precisely because potential is inferred and is more ambiguous than actual performances. Recall here that potential is not all that highly correlated with performance. Obviously the person who has performed in a creative fashion has potential, and has used it, but that does not necessarily mean that he or she will continue performing regularly in the same fashion. As evidenced by one-hit wonders (Kozbelt, 2008) or Shakespeare's last two sonnets (which tend to be excluded from collections of quality works; Simonton, 2012), the past is no guarantee of the future.

Sometimes the interest is in historically important creators, in which case it is entirely appropriate to examine products, be they inventions, publications, works of art, or the like. Sometimes the interest is in socially-recognized creativity, and here again, performances and products would be best for this kind of work. As a matter of fact, a case has been made for avoiding all tests. This point of view is based on (a) the idea that all tests are samples of behavior and artificial (i.e., not indicative of what occurs in the natural environment), and (b) the notion that, if it is possible to examine people who are unambiguously creative, there simply is no need for the estimate that is provided by a test.

The first of these ideas (a) is reasonable and is a useful reminder that good tests are representative samples. Short or over-constrained tests are not good samples and not representative of naturally-occurring creative behavior. The dismissal of tests does ignore the fact that the predictive validity of tests can be assessed. Such validation provides precise information about how indicative the tested sample is of naturally-occurring creative behavior—at least if the criterion is indicative of what occurs in the natural environment. The second idea (b) is also reasonable, but it ignores the usefulness of estimating potential. Consider the interest in the creative potential of children. They have yet to prove themselves creatively in a socially-meaningful way (e.g., publishing a novel) but it is informative to know if they have potential. Looking to unambiguously creative products is similarly irrelevant to the everyday creativity (which does not lead to a product or a socially-shared activity) mentioned earlier.

These views have been debated for many years. Shapiro (1970) and Taylor (1964; Taylor & Holland, 1962), for example, went into great detail about the *criterion problem.* This problem is a result of the fact that, whenever you have a predictor of creativity, you can only be sure it is a good one if you assess its predictive validity, and that requires a valid criterion. In fact, psychometric textbooks often describe predictive validity as a special kind of *criterion-related validity*. But how do you validate the criterion? You need another valid measure—in effect, another criterion! Sometimes it is also reasonable to ask why you need a predictor at all if you have a valid criterion. keep in mind what was said about the value of studying creative potential.

Hocevar and Bachelor (1989) recognized the criterion problem in their review of creativity assessment and asked, "why not go directly to the criteria that have face validity? This can best be accomplished through studying eminent individuals, evaluating creative products, or using an inventory of creative activities and accomplishments" (1989, p. 63). Sometimes unambiguously creative individuals can be evaluated, but sometimes they cannot, and often, as is the case with educational efforts, there is more of an interest in potential than unambiguously creative performances and individuals.

4 Creative Achievement

Ludwig (1992) developed the *Creative Achievement Scales* (CAS) to assess eminent, unambiguously creative individuals. As is often the case with eminent creators, tests cannot be administered and the only way to measure creative talent is biographically. The CAS uses various biographical data and provides ratings of the individual's personality, process of work, and lifetime productivity, each on a scale recognizing minor, intermediate, and major contributions. It has good inter-rater reliability. Ludwig (1992) used the CAS with over 1000 individuals and reported some of the clearest findings available on domain differences, psychopathology and creativity, and the correlation with background variables (e.g., family).

Kinney et al. (2012) developed the *Lifetime Creativity Scales* (LCS). The LCS represents a unique approach in that the intent is to measure the quantity and quality of creative accomplishments taking into account the entire adult lifetime. By looking across the individual's lifetime Kinney et al. are able to identify peak levels of creativity, as well as the continued efforts throughout the lifetime (or what they call the "pervasiveness of creative activity"). The LCS focus on "creative outcomes (that is, on products, behaviors, or major ideas that have been communicated to other people) and take into account both vocational and avocational activities." Examples of moderate creative activity include the following: "a person: (a) paints an original landscape; (b) improvises a beautiful new song; (c) writes an original and entertaining story enjoyed by friends; (d) helps a neighbor find new and effective solutions to personal problems; (e) makes up a series of novel games which excite and entertain children; (f) makes original modifications to recipes that greatly improve

the taste and appearance of dishes; or (g) designs and builds original customized and functional furniture." Unlike many approaches, such as the CAT, the LCS require that the examiner is extensive trained.

A related approach also asks about vocational and avocational creative activity and recognizes difference domains. Unlike the CAS and the LCS, *Creative Activity and Achievement Check lists* (CAAC) use self-reported data. This method was developed decades ago, when there was serious concern over the discriminant validity of creativity. In other words, there was uncertainty about the separation of creative ability vs. "g" and academic skills. The seminal work of Wallach and Kogan (1965) and Wallach and Wing (1969) put this question to rest, the latter doing so in part by adapting Holland's (1961) CAAC for students. Holland (1961, 1965) himself had used a CAAC to demonstrate that academic achievement (e.g., winning academic awards) was unrelated to extracurricular creative achievement. As the same implies, this is one objective of the CAAC—to assess creative achievements that occur in the natural environment and are not required by school. In particular, these creative achievements (and activities, such as designing one's own scientific apparatus, or writing poetry) are not assigned by teachers nor required in any way. They reflect choices made by the child or student him- or herself. Milgram and Hong (1999) also reported convincing data about such discretionary, intrinsically-motivated creativity, with their own version of a CAAC. Milgram and Hong were interested in what individuals do during their *leisure time.* They reported that creative activities and achievements done outside of school, during leisure time, are highly predictive of later adult creative achievements.

The CAAC allows different domains to be assessed. Traditional domains (mathematics, writing, drama, dance, leadership, art, crafts, music) are often included, and recent efforts have also included Technology, Moral creativity, Political creativity, and Everyday creativity. One version of the CAAC was developed for college students and included architecture, engineering, and biology. The CAAC is almost always a self-report, which does imply that various measurement concerns (i.e., memory, honesty, socially desirable responding) are relevant. Runco et al. (1990) found good reliability in a sample of mothers who evaluated their children with a special version of the CAAC. Paek (in press) summarized all research done using the various CAACs.

Runco (1986a) had both Quantity of activities and Quality of achievement scores in his version of the CAAC. He reported canonical and bivariate correlational analyses that showed that certain domains (e.g., writing) were more highly associated with divergent thinking than other domains (e.g., music). He also found that the Quantity CAAC scores were more highly related to divergent thinking than the Quality CAAC scores. The Quantity and Quality CAAC scores were far from redundant and not highly correlated with one another. Carson et al.'s (2005) *Creative Achievement Questionnaire* also recognizes the distinction between performance quantity and quality. The CAQ is like the CAAC in that it allows domain-specific assessment. It assumes that broadly socially-recognized achievements are the most creative and is weighted accordingly in CAQ scores.

There is debate about the relationship of quality and quantity within creativity assessments. Any quality score requires a judgment, and as noted above, judgments

open the door to subjectivity. This is why there is frequently such poor agreement among different groups of judges (Runco et al., 1994). There is some reason to think that quantity is strongly associated with quality (Simonton, 1984), at least on a behavioral level (which includes products), though it certainly makes little sense on the level of ideas. Divergent thinking tests use the labels fluency for quantity and originality for quality, and often the two are highly correlated—but not always! The separation of quality and quantity is evidenced by the fact that the unique variance for originality is reliable, at least in certain samples, even with the variance attributed to fluency is removed (Maio et al., 2020; Runco & Albert, 1985). At least as convincing, experimental evidence using explicit instructions has demonstrated that originality can be manipulated without changing fluency, which would be impossible if they were interdependent. In fact, originality can increase while fluency decreases (Runco, 1986b). Then there is the theoretical separation of originality and fluency. Simply put, creativity theory gives great weight to originality. Virtually every definition of creativity includes originality. Quantity is not a part of those definitions.

5 Brain and Neuroimaging Studies

The most important questions in creativity research concern the mechanisms involved. How do creative ideas and insights come about? The answer to this question is by far the most likely to be provided by the neurosciences. Fortunately, the biggest increase in the creativity research is probably that which is focused on the brain. A large number of fMRI studies have been reported, for example, with interesting results. Unfortunately, many results are questionable. Reviews of the neuroscientific research on creativity have been quite critical of the underlying theories, as well as the methods used (Dietrich, 2007; Weisberg, 2013; Yoruk & Runco, 2014). Dietrich (2007), for example, pinpointed four key problems. One has already been covered in the present chapter: divergent thinking is not synonymous with creativity. Dietrich sees this as a huge problem, as do I, but dozens of neuroscientific studies refer to divergent thinking "creativity tests" and collect only divergent thinking data. Divergent thinking tests, when administered and scored correctly (see Runco, 1991, 2013), offer useful information about creative potential, but to really understand creative potential, more than divergent thinking scores would be needed. In addition, divergent thinking tests are predictors, not criteria. As Wallach (1970) explained 50 years ago, a predictor is one thing, a criterion something else altogether. Mistaking divergent thinking tests for criteria of creativity may also explain why so often they are called tests of creativity. At the risk of being redundant, divergent thinking tests are useful *estimates* of the *potential* for creative thinking.

Dietrich's (2007) second criticism was that creative processes are too often assigned to the right hemisphere. This assignment no doubt resulted from the fascinating work on "split brains" and commissurotomies (see Hoppe & Kyle, 1990), but investigations of creativity within hemisphere have not been rigorous, and the

theories cited to support that assignment misguided, to say the least. Further, Dietrich's criticism is really more general and concerns localization; any attempt to use one part of the brain to explain creativity indicates a misunderstanding of creativity. Dietrich referred to research finding hints of creativity in all kinds of different locations, including the prefrontal cortex (which is probably the most popular location at present), visual cortex, hippocampus, amygdala, cerebellum, and even the basal ganglia. He tied this kind of thinking to the claims that "creative individuals use more of their brains; their brains are more efficient (whatever that means); they have more dopamine receptors, or more neurons, or those little nerve cells are more densely packed. The list of platitudes is practically endless" (p. 24). Any assignment of location assumes one location, which makes no sense, given the way the brain works (it uses systems and networks) *and* given what is required for creativity. As noted earlier, creativity is a syndrome, or complex (MacKinnon, 1965; Mumford & Gustafson, 1988). Creativity is not, in Dietrich's terms, "monolithic". This conclusion is entirely consistent with a theme of the present chapter, that there are different types of creativity, some indicating creative potential, others actual performance. Some can be expected of children, others only seen in adults. Everyday creative behavior is one thing, eminent creative achievement something else.

Dietrich (2007) next questioned the neuroscientific research emphasizing *de-focused attention* for creative thinking. Here again the problem is really just simplification. Dietrich did not entirely dismiss de-focused attention, no doubt because in some instances broad attentional horizons do facilitate original thinking. His point was that sometimes focused attention plays a role in creative thinking; it is not always de-focused attention. Along the same lines, and Dietrich's fourth criticism, was that the creative process does not depend on an altered state of consciousness, nor on mood disorders or some other tendency towards psychopathology. As Dietrich described it, there are many more creative insights among individuals who are not in altered states nor experiencing psychopathology than those who are in an altered state or psychopathological.

These are worthy concerns, and I certainly agree that the neurosciences need to do a better job of looking to sound theory. Dietrich nodded to the cognitive sciences, which makes an enormous amount of sense, particularly given the need to identify underlying mechanisms. I would add that not only should the neuroscientific approach to creativity look more carefully at the research on creative cognition; it should also look much more carefully at the broader creativity literature, and in particular at the 60 years of research on the assessment of creativity. Sadly, important lessons are being ignored in fMRI studies, bringing many, perhaps even most, of the recent findings into question. Some fMRI studies are making the same mistake made in the early 1960s (e.g., Getzels & Jackson, 1962), where creativity was viewed as just another intellectual skill and therefore creativity tests are administered just like other kinds of tests.

In addition to the fact that earlier lessons are being ignored is a problem arising because fMRI research tends to require short testing times. That means that the sample of behavior (e.g., the test outcome) is not indicative of authentic, spontaneous creativity, like that which occurs in the natural environment. More broadly,

fMRI research requires that tests of creative thinking are given under controlled environments (inside of the apparatus), and creative ideas suffer from precisely this kind of control. Since Wallach and Kogan (1965), divergent thinking testing has required that tasks be given as games and time de-emphasized (i.e., not mentioned) because it is such a distraction to examinees. Individuals taking a test of divergent thinking tend to be less original if they think the tasks are just like any other test. It is best to be quite explicit in the testing setting that the divergent thinking tasks are *not* tests. Otherwise respondents too easily jump to a test-taking mode of thought and think about time and spelling and points and grades and only conventionally-correct answers. That mode of thought needs to be avoided, which means that tasks should be administered only when examinee expectations about the tests are directed away from tests. Wallach and Kogan (1965) found that students who were unoriginal when they received divergent thinking tasks under *test-like conditions* became much more original when they received the same tasks under non-test-like conditions.

Just above I pointed out that understanding the mechanism underlying the creative process will depend on the neurosciences. It should be clear at this point that such understanding will also depend on the cognitive sciences, and, given the need for empirical work, on psychometrics as well. An inter-disciplinary collaboration is vital. If the neurosciences do look more carefully both at the cognitive sciences, as well as at the decades of research on how to assess the creative process in a meaningful manner, great strides are likely. Progress is especially likely if two of the problems with the fMRI research are avoided. These can be summarized as follows:

- Too often creativity is assessed with a single item measure, or a measure with very few items. Psychometric theory is quite clear that good tests are based on representative samples. If an assessment has one item, it is a pathetically small sample. Admittedly, when asking examinees to sit in an fMRI apparatus, there may be a need to collect the data in a very short period of time. Unfortunately this means that the data are not representative of authentic creative behavior as it has been described in the research for the last 60 years. It means that the sample of responses collected by the brief test are not representative of what the individual could do. The situation is too highly controlled to generalize to the spontaneous, intrinsically motivated creative behavior that is really of interest.
- The related problem is that timed assessment of creativity interfere with authentic creative expression. All too often, in controlled research or testing, examinees are given two minutes or some similarly brief amount of time to "perform." As noted above, this is contrary to research showing that examines are not original when timed, and in fact just the mention of time may put them in a test-taking mode or direct their thinking to extrinsic factors, both of which will inhibit creative thinking. Originality flourishes in permissive, game-like environments and it may take time to develop (Mednick, 1962; Paek et al., 2021). So again, results from the research with short (e.g., 1, 2, or 3-items measures) or timed-tests are not really telling us much about authentic creative talents. They do not use an adequate sample of behavior.

These criticisms have been leveled at various neuroimaging projects, and the rebuttal has been, "the creativity tests are reliable." That may be true, but reliability is only one requirement for a meaningful assessment. Meaningful assessments are also in some way valid—and they are meaningful with respect to what is known about the creative process. Consider the theory of remote associates. This predicts that original ideas are often remote—they are far removed from the initial idea or problem. Time is needed to get to those remote ideas (Paek et al., 2021). An assessment that gives a divergent thinking test with a 2 or 3 min time limit may provide reliable scores, but who knows what the participants would have been capable of if the testing conditions were more supportive of creative thinking? What if those same participants had been given 10 min, or better yet, no time limits? They would not have been distracted by time; they would not be led to believe that they were being tested (and as such should be conventional); and the work on test-like conditions suggests that many people who are not original with a time limit can be original without time limits. So again, creative potentials are not well assessed with short, timed-tests, and a test can give reliable scores and yet say nothing about the creative process.

Some fMRI research stands out because the creative process seems to be unconstrained enough to be authentic. This is the work of Limb (Barrett & Limb 2020; also see National Endowment for the Arts, 2015). In this work jazz and rap musicians are positioned, one at a time, in an fMRI apparatus and asked to play something overlearned, by memory. They were then asked to improvise. The differences in the fMRIs were quite obvious. Limb does not point to any one brain location, either. Neuroanatomical circuits and networks are involved in improvisation. The fact that there was a rote experimental condition against which the improvisation could be compare suggests that, even though the musicians were in the fMRI apparatus, they were able to tap authentic creative processes.

6 Concerns and Conclusions

This chapter draws from psychometric theory as well as the creativity research. It pinpoints questions that must be asked when empirical research on Creations is conducted. These include, which population is being sampled? What is the focus, creative potential or actual creative performance? Caveats are also covered, the broadest concerning generalizations. Simply put, if creative potential is assessed, generalizations to actual creative performance are only as good as the reliability and predictive validity of the particular measure. Conversely, if performance is assessed, perhaps with one of the product methods or the CAS, LSC, or CAAC, the data are postdictive rather than predictive, and again, generalizations are often not warranted.

This is not to say that creativity assessment is impossible or worthless. Far from it. Good thing, because just about all creativity research depends on good measurement! There are caveats and precautions to be taken, but there are also quite a few good measures, and the good ones provide useful information. None is a test of creativity. There is no such thing. But there are reliable measures of creative potential, good

methods for evaluating products, and sound measures of (past) creative performances. None alone tells the whole story, but each provides useful information.

I started this chapter by explaining the title. This allowed me to offer a definition of creativity and led nicely to the distinction of creative potential and creative performance. I will close now by using that same distinction, but this time I will refer to the title of the volume, *Homo Creativus*. That title suggests that humans are creative. It is in fact a part of our being, a part of our nature, a reflection of our genetic make-up. Although the present chapter identified important distinctions among types of creativity, there is also a creative universal. I am referring to creative potential. This potential may be expressed in different ways, which is why there are different types of creative performance, and why eras and cultures differ, but there is a universal as well. I am confident that volumes such as the present one will help to advance our understanding of these creative potentials such that they are fulfilled. Each of our lives will be richer if we do.

References

Acar, S., & Runco, M. A. (2019). Divergent thinking: New methods, recent research, and extended theory. *Psychology of Aesthetics, Creativity, and the Arts, 13*, 153–158. http://dx.doi.org/10.1037/aca0000231

Agnoli, S., Corazza, G. E., & Runco, M. A. (2016). Measuring creativity through a multiple-measurement approach within scientific and artistic domains. *Creativity Research Journal, 28*, 171–176. https://doi.org/10.1080/10400419.2016.1162475

Alabbasi, A. M. A., Paek, S. H., Cramond, B., & Runco, M. A. (2020). Problem finding and creativity: A meta-analytic review. *Psychology of Aesthetics, Creativity, and the Arts, 14*, 3–14. https://doi.org/10.1037/aca0000194

Albert, R. S. (1975). Toward a behavioral definition of genius. *American Psychologist, 30*, 140–151.

Albert, R. S., & Runco, M. A. (1989). Independence and cognitive ability in gifted and exceptionally gifted boys. *Journal of Youth and Adolescence, 18*, 221–230.

Amabile, T. M. (1982). Social psychology of creativity: A consensual assessment technique. *Journal of Personality and Social Psychology, 43*, 997–1013.

Amabile, T. M. (1985). Motivation and creativity: Effects of motivational orientation on creative writers. *Journal of Personality and Social Psychology, 48*, 393–399.

Ames, M., & Runco, M. A. (2005). Predicting entrepreneurship from ideation and divergent thinking. *Creativity and Innovation Management, 14*, 311–315.

An, D., & Runco, M. A. (2016). General and domain-specific contributions to creative ideation and creative performance. *Europe's Journal of Psychology, 12*, 523–532. https://doi.org/10.5964/ejop.v12i4.1132

Bachelor, P. A., & Michael, W. B. (1997). The structure-of-intellect model revisited. In M. A. Runco (Ed.), *Creativity research handbook* (Vol. 1). Hampton Press.

Barron, F. (1963). The disposition toward originality. In C. W. Taylor & F. Barron (Eds.), *Scientific creativity: Its recognition and development* (pp. 139–152). Wiley.

Baer, J. (1998). The case for domain specificity of creativity. *Creativity Research Journal, 11*, 173–178.

Barrett, K. & Limb, C. (2020). Functional magnetic resonance imaging (fMRI) and the neural correlates of artistic creative production. In M. A. Runco & S. Pritzker (Eds.), *Encyclopedia of creativity.* Elsevier.

Barron, F. (1955). The disposition towards originality. *Journal of Abnormal and Social Psychology, 51*, 478–485.
Barron, F. (1995). *No rootless flower: An ecology of creativity*. Hampton Press.
Basadur, M. (1994). Managing the creative process in organizations. In M. A. Runco (Ed.), *Problem solving, problem finding, and creativity* (pp. 237–268). Ablex.
Basadur, M., & Hausdorf, P. A. (1996). Measuring divergent thinking attitudes related to creative problem solving and innovation management. *Creativity Research Journal, 9*, 21–32.
Beketayev, K., & Runco, M. A. (2016). Scoring divergent thinking tests with a semantics-based algorithm. *Europe's Journal of Psychology, 12*(2), 210–220. https://doi.org/10.5964/ejop.v12i2.1127
Bijvoet-van den Berg, S., & Hoicka, E. (2014). Individual differences and age-related changes in divergent thinking in toddlers and preschoolers. *Developmental Psychology, 50*, 1629–1639.
Carson, S. H., Peterson, J. B., & Higgins, D. M. (2005). Reliability, validity, and factor structure of the creative achievement questionnaire. *Creativity Research Journal, 17*, 37–50.
Cheung, P. C., & Lau, S. (2010). Gender differences in the creativity of Hong Kong school children: Comparison by using the new electronic Wallach-Kogan creativity tests. *Creativity Research Journal, 22*, 194–199.
Chown, S. M. (1961). Age and the rigidities. *Journal of Gerontology, 16*, 353–362.
Cropley, A. J. (1990). Creativity and mental health in everyday life. *Creativity Research Journal, 3*, 167–178.
Dietrich, A. (2007). Who's afraid of a cognitive neuroscience of creativity? *Methods, 42*, 22–27.
Gardner, H. (1993). *Creating minds*. Basic Books.
Getzels, J. A., & Jackson, P. W. (1962). *Creativity and intelligence: Explorations with gifted students*. Wiley.
Ghiselin, B. (1963). Ultimate criteria for two levels of creativity. In C. W. Taylor & F. Barron (Eds.), *Scientific creativity: Its recognition and development* (pp. 30–43). Wiley.
Guilford, J. P. (1950). Creativity. *American Psychologist, 5*, 444–454.
Guilford, J. P. (1968). *Intelligence, creativity, and their educational implications*. R.R. Knapp.
Guo, J. (2016). The development of an online divergent thinking test. Doctoral Dissertations. 1304. https://opencommons.uconn.edu/dissertations/1304
Helson, R. (1999). Institute of personality assessment and research. In M. A. Runco & S. Pritzker (Eds.), *Encyclopedia of creativity* (pp.71–79). Elsevier.
Hennessey, B. A. (1994). The consensual assessment technique: An examination of the relationship between ratings of product and process creativity. *Creativity Research Journal, 7*(2), 193–208.
Hocevar, D. (1981). Measurement of creativity: Review and critique. *Journal of Personality Assessment, 45*, 450–464.
Hocevar, D., & Bachelor, P. (1989). A taxonomy and critique of measurements used in the study of creativity. In J. A. Glover, R. R. Ronning, & C. R. Reynolds (Eds.), *Handbook of creativity*. Plenum Press.
Holland, J. L. (1961). Creative and academic achievement among talented adolescents. *Journal of Educational Psychology, 52*, 136–147.
Hoppe, K., & Kyle, N. (1990). Dual brain, creativity, and health. *Creativity Research Journal, 3*, 150–157.
Hu, W., Shi, Q. Z., Han, Q., Wang, X., & Adey, P. (2010). Creative scientific problem finding and its developmental trend. *Creativity Research Journal, 22*(1), 46–52. https://doi.org/10.1080/10400410903579551
Huber, J. C. (1998). Invention and inventivity is a random, poisson process: A potential guide to analysis of general creativity. *Creativity Research Journal, 11*, 231–241.
Gott K. (1992). Enhancing creativity in older adults. *J. Creat. Behav*, 26, 40–49.
Isaksen, S. G., Lauer, K. L., & Wilson, G. V. (2003). An examination of the relationship between personality type and cognitive style. *Creativity Research Journal, 15*, 343–354.
Jung, C. G. (1923). *Psychological types* (H. B. Baynes, Trans.). Harcourt, Brace.

Jung, C. G. (1971). *Psychological types*. In H. Read, M. Fordham, & G. Adler (Eds.), *The collected works of C. G. Jung* (Vol. 6). Princeton University Press. (Original work published 1921).
Kinney, D. K., Richards, R. L., & Southam, M. (2012). Everyday creativity, its assessment, and the lifetime creativity scales. In M. A. Runco (Ed.), *Creativity research handbook* (Vol. 2). Hampton Press.
Kozbelt, A. (2008). One-Hit Wonders in Classical Music: Evidence and (Partial) Explanations for an Early Career Peak. *Creativity Research Journal*, 20(2), 179–195. https://doi.org/10.1080/10400410802059952
Lindauer, M. S. (1990). Reactions to cheap art. *Empirical Studies of the Arts, 8*, 95–110.
Lubart, T., Zenasni, F., & Barbot, B. (2013). Creative potential and its measurement. *International Journal for Talent Development and Creativity, 1*, 41–50.
Ludwig, A. M. (1992). The creative achievement scale. *Creativity Research Journal, 5*, 109–119.
MacKinnon, D. W. (1962). The nature and nurture of creative talent. *American Psychologist, 17*, 484–495.
MacKinnon, D. W. (1965). Personality and the realization of creative potential. *American Psychologist, 20*(4), 273–281. https://doi.org/10.1037/h0022403
Maio, S., Dumas, D., Organisciak, P., & Runco, M. (2020). Is the reliability of objective originality scores confounded by elaboration? *Creativity Research Journal, 20*, 201–205.
Mednick, S. (1962). The associative basis of the creative process. *Psychological Review*, *69*, 220–232.
Michael, W. M., & Bachelor, P. A. (1990). Higher-order structure-of-intellect creativity factors in divergent production tests: A re-analysis of a Guilford data base. *Creativity Research Journal, 3*, 58–74.
Milgram, R. M., & Hong, E. (1999). Creative out-of-school activities in intellectually gifted adolescents as predictors of their life accomplishments in young adults: A longitudinal study. *Creativity Research Journal, 12*, 77–88.
Moran, J. D., Milgram, R. M., Sawyers, J. K., & Fu, V. R. (1983). Original thinking in preschool children. *Child Development, 54*, 921–926.
Mumford, M. D. (2001). Something old, something new: Revisiting Guilford's conception of creative problem solving. *Creativity Research Journal, 13*, 267–276.
Mumford, M. D., & Gustafson, S. B. (1988). Creativity syndrome: Integration, application, and innovation. *Psychological Bulletin, 103*, 27–43.
Murray, H. A. (1959). Vicissitudes of creativity. In H. H. Anderson (Ed.), *Creativity and its cultivation* (pp. 203–221). Harper.
Myers, I. B., McCaulley, M. H., Quenk, N. L., & Hammer, A. L. (1998). *MBTI manual: A guide to the development and use of the Myers-Briggs type indicator* (3rd ed.). Consulting Psychologists Press.
National Endowment for the Arts. (2015). *How creativity works in the brain: Insights from a working group of the Santa Fe Institute*. NEA.
Paek, S.-H. (in press). Creative activity and accomplishment checklists. In M. A. Runco & S. Acar (Eds.), *Handbook of creativity assessment.* Elgar.
Paek, S.-H., Alabassi, A. M. A., Acar, S., & Runco, M. A. (2021). Is more time better for divergent thinking? A meta-analysis of the time-on-task effect on divergent thinking. *Thinking Skills and Creativity, 41*. https://doi.org/10.1016/j.tsc.2021.100894
Patrick, C. (1935). Creative thought in poets. *Archives of Psychology, 26*, 1–74.
Patrick, C. (1937). Creative thought in artists. *Journal of Psychology, 5*, 35–73.
Patrick, C. (1938). Scientific thought. *Journal of Psychology, 5*, 55–83.
Plucker, J., Runco, M. A., & Hegerty, C. B. (2011). Enhancement of creativity. In M. A. Runco & S. Pritzker (Eds.), *Encyclopedia of creativity* (2nd ed.). Elsevier.
Rhodes, M. (1961). An analysis of creativity. *Phi Delta Kappan, 42*, 305–310.
Richards, R. (2007). Everyday creativity: Our hidden potential. In R. Richards (Ed.), *Everyday creativity and new views of human nature* (pp. 25–54). American Psychological Association.

Rubenson, D. L. (1991). On creativity, economics, and baseball. *Creativity Research Journal, 4*, 205–209.
Rubenson, D. L., & Runco, M. A. (1992). The psychoeconomic approach to creativity. *New Ideas in Psychology, 10*, 131–147.
Rubenson, D. L., & Runco, M. A. (1995). The psychoeconomic view of creative work in groups and organizations. *Creativity and Innovation Management, 4*, 232–241.
Runco, M. A. (1986a). Divergent thinking and creative performance in gifted and nongifted children. *Educational and Psychological Measurement, 46*, 375–384.
Runco, M. A. (1986b). Flexibility and originality in children's divergent thinking. *Journal of Psychology, 120*, 345–352.
Runco, M. A. (1989). The creativity of children's art. *Child Study Journal, 19*, 177–189.
Runco, M. A., Noble, E. P., & Luptak, Y. (1990). Agreement between mothers and sons on ratings of creative activity. *Educational and Psychological Measurement*, *50*, 673–680.
Runco, M. A. (Ed.). (1991). *Divergent thinking*. Ablex Publishing Corporation.
Runco, M. A. (1995). Insight for creativity, expression for impact. *Creativity Research Journal, 8*, 377–390.
Runco, M. A. (1996). Personal creativity: Definition and developmental issues. *New Directions for Child Development, 72*(Summer), 3–30.
Runco, M. A. (2001). Introduction to the special issue: Commemorating Guilford's 1950 presidential address. *Creativity Research Journal, 13*, 245.
Runco, M. A. (2003). Idea evaluation, divergent thinking, and creativity. In M. A. Runco (Ed.), *Critical creative processes* (pp. 69–94). Hampton Press.
Runco, M. A. (2007). A hierarchical framework for the study of creativity. *New Horizons in Education, 55*(3), 1–9.
Runco, M. A. (Ed.). (2013). *Divergent thinking and creative potential*. Hampton Press.
Runco, M. A. (2014). "Big C, little c" creativity as a false dichotomy: Reality is not categorical. *Creativity Research Journal, 26*, 131–132.
Runco, M. A., & Albert, R. S. (1985). The reliability and validity of ideational originality in the divergent thinking of academically gifted and nongifted children. *Educational and Psychological Measurement, 45*, 483–501.
Runco, M. A., & Bahleda, M. D. (1986). Implicit theories of artistic, scientific, and everyday creativity. *Journal of Creative Behavior, 20*, 93–98.
Runco, M. A., & Chand, I. (1995). Cognition and creativity. *Educational Psychology Review, 7*, 243–267.
Runco, M. A., Ebersole, P., & Mraz, W. (1991). Self-actualization and creativity. *Journal of Social Behavior and Personality, 6*, 161–167.
Runco, M. A., & Jaeger, G. (2012). The standard definition of creativity. *Creativity Research Journal, 24*, 92–96.
Runco, M. A., Millar, G., Acar, S., & Cramond, B. (2011). Torrance tests of creative thinking as predictors of personal and public achievement: A 50 year follow-up. *Creativity Research Journal, 22*, 361–368.
Runco, M. A., McCarthy, K. A., & Svensen, E. (1994). Judgments of the creativity of artwork from students and professional artists. *Journal of Psychology, 128*, 23–31.
Runco, M. A., & Vega, L. (1990). Evaluating the creativity of children's ideas. *Journal of Social Behavior and Personality, 5*, 439–452.
Runco, M. A., Dow, G., & Smith, W. R. (2006). Information, experience, divergent thinking: An empirical test. *Creativity Research Journal*, 18, 269–277.
Shapiro, R. J. (1970). The criterion problem. In P. E. Vernon (Ed.), *Creativity* (pp. 257–269). Penguin.
Simonton, D. K. (1984). *Genius, creativity & leadership: Historiometric inquiries*. Harvard University Press.

Simonton, D. K. (1988). Creativity, leadership, and chance. In R. J. Sternberg (Ed.), *The nature of creativity: Contemporary psychological perspectives* (pp. 386–426). Cambridge University Press.

Simonton, D. K. (2012). Taking the U.S. patent office criteria seriously: A quantitative three-criterion creativity definition and its implications. *Creativity Research Journal, 24*, 96–107.

Sternberg, R. J., & Lubart, T. I. (1995). *Defying the crowd: Cultivating creativity in a culture of conformity*. Free Press.

Taylor, C. W. (1964). *Creativity: Progress and potential*. McGraw Hill.

Taylor, C. W., & Holland, J. (1962). Development and application of tests of creativity. *Review of Educational Research, 32*, 91–102.

Tan, C. (2016). Creativity and confucius. *Journal of Genius and Eminence, 1*(1), 79–84.

Tegano, D. W., & Moran, J. D. (1989). Sex differences in the original thinking of preschool and elementary school children. *Creativity Research Journal, 2*, 102–110.

Torrance, E. P. (1972). Predictive validity of the torrance tests of creative thinking. *Journal of Creative Behavior, 6*, 236–252.

Torrance, E. P. (1995). *Why fly?* Hampton Press.

Wallach, M. A. (1970). Creativity. In P. H. Mussen (Ed.), *Carmichael's manual of child psychology* (Vol. 1, pp. 1273–1365). Wiley.

Wallach, M. A., & Kogan, N. (1965). *Modes of thinking in young children: A study of the creativity-intelligence distinction*. Holt, Rinehart & Winston.

Wallach, M. A., & Wing, C. (1969). *The talented student: A validation of the creativity-intelligence distinction*. Hold, Rinehart & Winston.

Weisberg, R. W. (2013). On the "demystification" of insight: A critique of neuroimaging studies of insight. *Creativity Research Journal, 25*(1), 1–14. https://doi.org/10.1080/10400419.2013.752178

Yoruk, S., & Runco, M. A. (2014). The neuroscience of divergent thinking. *Activitas Nervosa Superior, 56*, 1–16. https://doi.org/10.1007/BF03379602. http://rdcu.be/A5rL

The Black Box of the Consensual Assessment Technique: Some Questions and Doubts on the Subjective Rating of Creativity

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Keywords Consensual Assessment Technique · Creativity · Methodology

From the simple idea to a concrete realization, to what extent can we consider that a production in any particular domain is really creative? How can we evaluate that this production is both original and adapted to its context?

These questions can be answered from two different approaches. The first consists of using standardized rating scales in order to evaluate the creativity of a production. Many rating scales can be found and the most used is certainly the "Creative Product Semantic Scale" (CPSS; O'Quin & Besemer, 1989). In this case, the evaluation of a creative production is based on three different dimensions: Novelty, Resolution, and Elaboration and synthesis. This scale presents quite acceptable metric qualities (for example, Besemer, 1998, 2000; Besemer & O'Quin, 1986, 1999; O'Quin & Besemer, 1989, 2006). However, the use of such a scale has been largely discussed because it presents the disadvantage of relying on a particular theoretical conception of creativity that is the conception of the authors of the scale. Therefore the proposed rating criteria appear to be scarcely objectively specified (for example, Amabile, 1996; Kaufman et al., 2008).

The second approach is based on subjective ratings collected from people suited and competent to estimate creativity. Amabile (1996), then Hennessey et al. (2011) proposed a brief history of these methods which seems to originate in Galton's work on eminence. The same authors also noted various objections toward these methods. First, subjective evaluation seems relatively disconnected from scientific conceptions

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of creativity. Second, the typical application of this approach does not allow for the distinction between the evaluation of creativity and proximal characteristics such as esthetic or technical qualities.

Therefore, Amabile developed a method called the "Consensual Assessment Technique" (CAT) (Amabile, 1982, 1996; Hennessey et al., 2011). Since the first publication, the essential of the CAT methodological principles did not evolve. Actually, the CAT is used frequently in research on creativity, making it the "Gold Standard" of creativity evaluation (Carson, 2006). Kaufman et al. (2008) identified at least three reasons to explain such popularity among researchers: the CAT rates creativity such as it can be observed through simple productions, it does not rely on a particular theoretical conception of creativity and it fits how creativity is evaluated concretely in everyday life.

1 The Consensual Assessment Technique

Originally, the CAT has been conceived from a clear distinction between two definitions of creativity. The first definition corresponds to researchers' conception of creativity whereas the second is more operational and is based on the implicit conceptions of individuals requested to evaluate the creativity of a production. According to Amabile (1996, p. 35), « a product or response will be judged as creative to the extent that (a) it is both a novel and appropriate, useful, correct or valuable response to the task at hand, and (b) the task is heuristic rather that algorithmic». This conception is steeped into the standard definition of creativity which has a long history (e.g., Runco & Jaeger, 2012) and has been progressively adopted by most of the researchers in the field. According to Amabile (1996), criteria that enable the identification of creative productions can neither be defined nor objectively measured (see also, Runco & Jaeger, 2012). For this reason, it is necessary to rely on subjective criteria. Then, she proposed an operational definition called the "consensual definition of creativity" and stated that: "a product or response is creative to the extent that appropriate observers independently agree it is creative. Appropriate observers are those who are familiar with the domain in which the product was created or the response articulated. Thus, creativity can be regarded as the quality of products or responses judged to be creative by appropriate observers, and it can also be regarded as the process by which something so judged is produce" (Amabile, 1996, p. 33). Thus, the consensual definition identified creativity through the process of evaluation. However, these definitions fill different functions while being closely linked: "In essence, the conceptual definition is a best guess as to what characteristics appropriate observers are looking for when they assign ratings of 'creativity' to products" (Amabile, 1996, p. 37).

1.1 Methodological Principles

Therefore, the CAT represents the operationalization of the consensual definition of creativity. However, there are methodological principles that need to be respected by researchers in order to make optimal use of the CAT (for a critical review see Cseh & Jeffries, 2019). These principles refer first to the characteristics of the productions under evaluation, and second to the evaluation procedure. Because these principles have been well documented previously (e.g., Amabile, 1982, 1996; Baer & McKool, 2009; Hennessey et al., 2011; Kaufman et al., 2008), we will briefly present them.

Regarding the first principle, the productions under evaluation should have been created under open-ended work conditions. In this way, there is a greater chance to obtain enough variability and novelty in the answers of different subjects. Moreover, whatever the domain of production is, the work conditions need to be accessible so judges can easily rate them. Second, regarding the evaluation procedure, we need to ensure that the judges have sufficient experience in the domain of endeavor in order to be able to identify productions that are creative. Regarding the assessment process, productions should be presented in a random order. Then judges should rate independently the level of creativity for each production relative to the others and in accordance with their own conception of creativity (Baer & Kaufman, 2019). Hence, researchers should not provide empirical criteria or a definition of creativity. Moreover, it is recommended to ask judges to rate alternative dimensions besides creativity such as esthetic or technical qualities. In this way, it is possible to appreciate the extent to which the rating of creativity has been made independently from other related characteristics of the productions.

1.2 Statistical Validity

Different strategies of statistical analysis can be used in order to establish the validity of the creativity ratings obtained via the CAT. Discriminant validity enables us to verify the extent to which the creativity ratings are independent from alternative dimensions (Amabile, 1996). Concretely, it can be tested using two different strategies. The first consists of asking judges to rate the productions on different criteria and then to perform a factor analysis in order to test if one factor gathers the creativity relevant criteria and if this factor can be isolated from others gathering the alternative dimensions. In a study conducted by Amabile (1996, study 1), collages produced by children were rated on several criteria. Results from the analysis distinguished two relatively independent factors, creativity and technical goodness. These factors have also been found by Čorko and Vranić (2004) in a study using the same procedure. In a second study conducted by Amabile (1996, study 14), judges were asked to rate creativity among other criteria of poems written by students. In contrast, the analysis discerned in this case three different factors (creativity, style and technique) and the creativity factor was less clearly distinct than in previous studies.

The second strategy to assess discriminant validity consists of correlating a score of creativity with the rating of another dimension. A first series of results focused on the correlation between creativity and technical goodness (Amabile, 1996, study 1 to 8). But we notice that the correlation actually depends on respective reliabilities of the two rated dimensions. When reliabilities are between 0.70 and 0.80, the correlations between creativity and technical goodness vary from 0.13 to 0.28. However, when reliabilities are between 0.80 and 0.90, correlations vary from 0.70 to 0.77. Čorko and Vranić (2004) obtained a correlation of 0.63 between these two dimensions, considering that the weakest interrater agreement was 0.77. Thus, if we take into account this dampening effect, we should conclude that the ratings of creativity are quite considerably correlated with the technical goodness of productions.

However, most researchers do not test the discriminant validity of ratings obtained from judges. They are satisfied with the reliability analysis of creativity ratings. It is effectively important to test reliability in order to ensure that the variance of creativity ratings is explained by differences in the estimated creativity level rather than the error variance. Since the first research conducted by Amabile (1982, 1996; Hennessey et al., 1999), most of CAT based research considered that the interrater agreement regarding creativity ratings of productions was quite acceptable. This point is essential because the validity of the subjective evaluation, upon which the CAT is based, relies on the interrater reliability. Indeed, unlike the classical psychometric approach that seeks to test the validity of a measure, in this case the validity results from a reasoned argumentation stating that *if* the selected judges to rate creativity are familiar with the domain of production, and *if* the interrater reliability is high, *then* what raters agree on is necessarily creativity.

The following sections of this chapter will precisely question the principle of this line of argument. In the first part we will examine what types of judges should be selected in order to rate the creativity of productions from specific domains. We will also discuss how the judges' characteristics can influence their ratings. In the second part, we will try to identify the content of the implicit conceptions on creativity that guides the subjective evaluation of productions. Subsequently, we will verify if these implicit conceptions correspond to scientific theories and we will seek to understand the extent to which judges from the same domain of expertise have consistent implicit conceptions of creativity.

2 What Types of Judges Should be Selected to Rate the Creativity of Productions?

As stated by Amabile (1982, 1996), the validity of the consensual assessment relies on the selection of the individuals who will be asked to rate the creativity of productions. However, this author's stance seems to have evolved since. Indeed, in a first version of her reference work, she suggested that judges should be experts of the domain. According to Baer and Kaufman (2019), expertise is a necessary condition to ensure

the CAT validity. However, they do not provide evidence for such necessity nor define clearly what constitutes expertise. In most research using the CAT, expertise has been left behind and replaced by a simpler criterion of familiarity with the domain. Similarly, we can observe that the author's position evolved regarding the judges sample composition. Initially, Amabile considered that "the level of experience for all judges need not to be identical" (Amabile, 1996, p. 41). Then, she simplified the criterion, considering it sufficient if « they have roughly equivalent experience with the domain in question» (Hennessey et al., 2011, p. 255).

However, the CAT is based on the premise that if judges are sufficiently familiar with the domain of production they should be able to rate spontaneously the creativity of these productions. Following this logic, it is unnecessary, if not detrimental for Amabile (1982, 1996; Hennessey et al., 2011) to give the experts a normative definition of creativity, to ask them to rate productions according to explicit criteria (such as the different aspects from the theoretical definition: originality and appropriateness), or even to train them to use such criteria. Consequently, we make the assumption that judges who are sufficiently familiar with a certain domain should agree on the extent to which the productions of this domain are creative. These premises have been shared tacitly and most often explicitly by every researcher using the CAT (for example, Baer & McKool, 2009; Kaufman & Baer, 2012; Kaufman et al., 2008).

3 Which Criteria Should We Use to Select Judges to Rate Creativity?

Selecting a group of appropriate judges should depend on two criteria. The domain from which the rated production belongs but also the type of objective pursued through this evaluation: practical or scientific. It is in this sense that the term appropriate should be understood and applied when selecting judges.

However, regarding the first criteria, the notion of familiarity with the domain is insufficient to select appropriate raters according to Kaufman and Baer (2012). They noted that it is theoretically possible to observe a high degree of consensus in a group of raters who are relatively novice within the domain of production. Thus, they consider that it is crucial to seek a high degree of interrater agreement from a truly expert group from the specific domain of production. Research has recently examined different levels of expertise and their effects on the reliability of creativity ratings.

Following these principles, Kaufman and Baer (2012) identified three types of judges according to their level of expertise: (1) the experts who have at least ten years of specific experience within the domain and have received an honor for their exceptional realizations within the same domain. (2) quasi experts that are experienced but have not been recognized for their expertise, and (3) novices that have no expertise in the domain but have skills that are related to the type of production (such

as graduate students, teachers or professors on creativity). According to the same authors, if this distinction between the types of judges is relevant, we should observe differences in results among the groups. Within the experts' group, the interrater agreement should be high, much higher than within the group of quasi experts and or even the group of novices. Next, between the clusters, experts' rating should have a weak correlation, if any at all, with quasi experts' ratings and even less with novices' ratings.

Such predictions have been tested by two kinds of research in creativity. The first kind consisted of comparing research that selected only experts or quasi experts to rate creative productions to research that opted for novices as judges. The scientific objectives of the selected research were not taken into account. The aim of this comparison was too investigate if the reliabilities of the ratings were different between the different categories of judges. We will present the principal results regarding the comparison between experts and novices. Readers who are interested in more details on the comparison between experts and quasi experts can refer to a synthesis published by Kaufman and Baer (2012).

Following the first research published by Amabile (1982, 1996), it has been demonstrated that experts' ratings of creativity had good reliability (for example, Baer, 1997, 2003; Baer et al., 2004). To our knowledge, few studies failed to demonstrate that experts had an acceptable interrater reliability (Gerrard et al., 1996; Hickey, 2001). However, this rarity might only be due to the unlikeliness of finding published research showing that expert judges had insufficient interrater reliability. Regarding novices rating creativity, we can observe that interrater reliability can reach and even exceed the conventional cutoff of 0.70–0.80. This cutoff will be discussed later in this chapter. This high reliability was found in research on artistic or literary creativity where selected judges were students enrolled in an artistic program, which accredits a certain familiarity with the domain, but also students enrolled in a non-related program (for example, Baer, 1996; Chen et al., 2002, 2005; Joussemet & Koestner, 1999; Kasof et al., 2007; Niu & Sternberg, 2001). According to Kaufman and Baer (2012), if these results confirm that novices' ratings can result in a consensual evaluation, this does not indicate the validity of the evaluation because the raters are not experts.

A second kind of research tests more precisely the predictions made by Kaufman and Baer (2012). In this line of research, ratings of judges from different levels of expertise are compared but in rigorously equivalent conditions. In a first publication on the CAT, Amabile (1982; experiment 1) asked children from seven to eleven years old, with limited creative abilities, to make collages using pre-cut pieces of paper. The creativity of these productions were rated by three types of judges with different levels of expertise: members of the Stanford University psychology department (faculty and graduate students), elementary- and secondary-school art teachers (who happened to be taking a course at Stanford), undergraduate and graduate artists from the art department at Stanford University, each of whom had spent at least 5 years working in studio art. Results show that psychologists' ratings had a relatively acceptable consistency ($\alpha = 0.73$), but weaker than art teachers' ratings ($\alpha = 0.88$) and almost equivalent to artists' ratings ($\alpha = 0.77$). Furthermore, the correlation between psychologists and art teachers' ratings was too weak ($r = 0.44$)

to conclude that these judges agree on their evaluation of creativity productions. But this correlation was slightly higher between art teachers and artists' ratings ($r = 0.65$). These results are particularly interesting because they illustrate the difficulties we can encounter in research comparing the evaluations of various types of experts. These difficulties relate both in the selection of appropriate judges and in the interpretation of the results. Kaufman and Baer (2012) presented this work in their literature review as an example of comparative research on experts and quasi experts' ratings. They consider that «although the psychologists lacked artistic expertise, they did have a different type of expert knowledge (i.e., understanding children) that might have been relevant to making these judgments, and thus cannot be considered complete novices» (p. 87). They pointed out also that according to Amabile (1996), appropriate judges should have at least a certain level of educational background and experience in the specific domain of production. If we agree with these statements, then who can be considered as a complete novice but sufficiently familiar with the domain? This question is complex and the possible answer seems to depend on the rating context and the objectives pursued. However, in the present context, we would argue that psychologists should be considered as novices because they have no expertise in the artistic domain and their so-called familiarity with the domain is based only on their experience in psychology. If the judges were developmental or educational psychologists, it could have conferred them a certain expertise regarding children's creative skills, but this information was not indicated.

In a third experiment published in the same article, Amabile (1982) asked two kinds of judges to rate creativity of collages made by children from six to eight years old. Alpha coefficients were respectively 0.81 for the artists judges and 0.83 for the non-artists. Furthermore, the correlation between artists and non-artists' ratings was $r = 0.69$. In this research realized in comparable conditions with the precedent one, the intergroup agreement is much higher. Nevertheless, this effect might be caused by the fact that the group of non-artists was composed of undergraduate and graduate students in psychology (i.e., novices) but also by elementary school teachers (i.e., who may be considered as quasi experts). Also, we do not have much information on the characteristics of the artists. Thus one might wonder if the expertise of the artists is certified according to criteria of Kaufman and Baer (2012). If our interpretation is correct, we might conclude that these groups of judges are not sufficiently contrasted to consider one group as novice and another as experts. Once again, the interpretation of such results is complex, even more due to the fact that this study was not designed to systematically compare the ratings from judges with different levels of expertise.

Fortunately, research with more interpretable results exists. For example, Hickey (2001) systematically compared the ratings of different kinds of judges on musical productions. First, she asked children aged from nine to eleven enrolled in music schools to compose short music tracks. Then, these productions were rated by different kinds of judges: three professional composers who had at least 15 years of experience with writing music in a wide variety of genres (composers), college theory professors with at least 10 years' experience in teaching music theory (music theorists), different categories of music teachers (10 "instrumental" music teachers, 4 "mixed-experience" teachers–teachers who taught a combination of instrumental and

choral or instrumental and general music– and 3 "general/choral" music teachers– elementary general music teaching with some choral music), seventh-grade children, and second-grade children. A first important result is that composers showed no consistency in their evaluations ($\alpha = 0.04$). However, according to Kaufman and Baer (2012), composers are the only group of judges that can be considered as truly expert. The interrater reliability of the quasi experts (the music teachers) varies with the type of teaching. The reliability coefficients were relatively acceptable for the general/choral music teachers ($\alpha = 0.81$) and the music theorists ($\alpha = 0.73$). In contrast, the reliability coefficients were less satisfactory for the instrumental music teachers ($\alpha = 0.65$) and the mixed-experience teachers ($\alpha = 0.53$). In this research, younger and older children compared to those who created the music tracks composed the two groups of novices. Not surprisingly, the reliability coefficients were weak for the two groups ($\alpha = 0.50$ for the group composed of 7–8 years old children and $\alpha = 0.61$ for the group composed of 12–13 years old children). Even if these coefficients seem weak, they are equivalent to those obtained by the less consistent groups of teachers. The analysis of the correlations between these different groups of raters showed that three kinds of teachers agreed between themselves but also with the music theorists (inter correlations varied from $r = 0.63$ to $r = 0.88$). Also, the ratings from the two groups of children showed a strong correlation ($r = 0.83$). However, the children's ratings did not correlate well with the teachers' ratings (the strongest observed correlation was only 0.41). This study was interesting because it attempted to study systematically the consistency of ratings from different experts. However, the absence of interrater reliability makes it impossible to aggregate the experts' ratings and to correlate this composite score with that of other raters.

A series of studies made it possible to compare the consistency of ratings from different types of experts. In a first study, Kaufman et al. (2010) asked 205 students to write a small poem and a short story from a given title. The creativity of these two kinds of productions was rated by two types of judges. Poets who had published composed the group of experts and students with no particular skill in the domain composed the group of novices. Regarding poems, with a comparable sample of judges, the experts' interrater reliability was higher than novices' (respectively $\alpha = 0.83$ and $\alpha = 0.57$). The correlation between ratings from the two groups was weak but significant ($r = 0.22$) (Kaufman et al., 2008). For the creativity ratings of the short stories, the interrater reliabilities were comparable to the ones found for poems. However, the correlation between ratings made by poets and students was stronger in this case ($r = 0.71$) (Kaufman et al., 2009). In view of these findings, it seems difficult to conclude that novices are not consistent in their evaluations and that their evaluations do not correlate with the ones made by the experts. These results might also confirm the necessity to select very precisely the expert judges. Indeed, it is also possible to conclude that poets differentiate more with novices when rating poems than when rating short stories because the second type of production was not exactly their field of expertise. Thus, we cannot consider that the large domain of literature can be rated by judges from different literary specialities.

However, for Galati (2015), the scientific debate on expert—novice comparisons has not sufficiently taken into account an important methodological aspect: the variable complexity of the tasks with which raters are confronted. This complexity is defined by the author as "the difficulty to judge something (an idea, a product, a painting, etc.) in function of the particular assessing situation (object's and the judge's characteristics)" (Galati, 2015, p. 25). The complexity of an evaluation is in fact determined by (a) the originality of the product, its appropriateness regarding the context, the complexity of the product itself and its level of diffusion (i.e. the extent of use of the product), and (b) two characteristics of the judges: their experience and their expertise regarding the production domain. The results of Galati's (2015) research on the creativity of paintings showed that novices' ratings had acceptable reliability (0.83) but lower than experts' ratings (0.97). Moreover, Galati asked an expert in the history of art to indicate the complexity for non-experts for rating the creativity level of different paintings. It demonstrates above all that in simple situations, the mean novices' rating did not significantly differ from the experts' mean rating. In contrast, paintings were evaluated as more creative by novices when the evaluation situation was complex.

Based on current scientific knowledge, it seems difficult to conclude on the effect of the different levels of expertise on the subjective evaluation of creativity. Ratings of creative productions by novices can be consistent, and sometimes even superior to domain experts's ratings. Furthermore, we sometimes observe a correlation between experts and novices' ratings but not in every case. These results, in accordance with the Consensual Assessment Technique, are insufficient to render satisfactory novices' ratings of creative productions (Kaufman & Baer, 2012; Kaufman et al., 2009). It seems best to opt for experts' ratings insofar as such experts actually exist and are accessible and willing to participate. However, according to Galati (2015), it is possible to resort to novices' ratings in simple rating situations. On the contrary, it is necessary to select experts in complex situations of evaluation because novices' ratings can be misaligned.

4 Beside the Level of Expertise, What Makes Subjective Evaluations Vary?

The level and type of expertise constitute important sources of evaluation variability, but other personal characteristics that are less studied might also lead to individual differences in creativity evaluation. For example, regarding the creativity level of advertisements, White and Smith (2001) noticed that ratings were significantly correlated with demographical variables (sex and age), reading newspapers and professional experience in the field.

But certain characteristics related to judges' creative potential could also result in individual differences in creativity evaluation. To our knowledge, Hood (1973) was the first author to test this hypothesis. First, he asked participants to indicate as many

unusual uses of a given object as possible. This exercise evaluated the participants' level of originality. Then in a second part, the same participants had to rate the originality of ideas obtained via the same exercise they had to complete previously. The author observed that judges who have less original ideas are more sensitive to variations of productions' originality. Indeed, participants with a moderate or high level of originality discriminated less the variation of originality level and rated the productions more generally as low on originality. These results suggest that judges with a higher level of originality could conceive creativity more narrowly and thus consider that only extremely original productions are creative. Moreover, Caroff and Besançon (2008) in a study on the evaluation of creative advertisements found also the existence of an interaction between judges' levels of originality and their evaluations of productions' creativity, but this interaction showed the opposite effect. Indeed, results indicated that the more judges showed originality in a divergent thinking task, the more they were sensitive to variations of the advertisements' creativity level.

Some authors started to expand their research to further variables. Storme and Lubart (2012) studied how individual differences of intelligence and personality could influence the evaluation of creativity. Their results showed that factor *g* and a personality trait, preference for novelty, were both related to the importance that judges attributed to originality in their evaluation of creativity. In a slightly different perspective, Silvia (2008) studied the effect of personality on people's capacity to discern their own creativity. Participants with a high level of openness in a big five test realized the most creative productions in a divergent thinking task and were also the most exacting when they were asked to select their most creative productions.

To conclude, while seeking to select appropriate judges to rate creativity, it is important to give careful consideration to their type and level of expertise within a specific domain. However, certain variables should also not be neglected, such as the experience or the creative potential related characteristics, because they have an effect on judges' subjective evaluation of creativity.

5 Implicit Conceptions of Creativity as the Base of the Evaluation

Amabile postulates the existence of a common subjective construct of creativity shared by similar judges but she did not seek to understand in detail the nature of this construct (Spiel & von Korff, 1998). The definition of creativity refers to what is in the heads of judges, without specifying their conception or criteria for evaluating it (Katz & Giacommelli, 1982). However, as we highlighted previously that different judges might still agree on creativity ratings, it seems necessary to study implicit conceptions of creativity in order to understand how experts evaluate the creativity of productions.

5.1 Studying Implicit Theories of Creativity

For Runco and Bahleda (1986), implicit theories «are derived from individuals' belief-systems, and are important because they presumably function as a prototype against which (…) behaviors are gauged» (p. 93). Subsequently, Runco and Johnson (2002) developed this definition stating that "implicit theories, from which expectations are formed, are the constellations of thoughts and ideas about a particular construct that are held and applied by individuals" (p. 427). They specified also that these implicit theories are involved, intentionally or not, when we seek to evaluate certain characteristics or behaviors. This idea was developed by Szen-Ziemiańska (2013) who considers that a person will evaluate creativity more or less precisely according to the nature of their implicit conceptions. But implicit theories do not only play a role in the subjective evaluation of creativity. For example, Katz and Giacommelli (1982) supposed that implicit theories might also drive how people will foresee producing something creative. Ultimately, Glăveanu (2014) proposed that implicit theories of creativity presented several common characteristics with social representations.

Few studies have been published on implicit theories of creativity compared to other topics (Ramos & Puccio, 2014; Spiel & von Korff, 1998). A common objective is to extract the experts or novices' implicit conceptions. To do so, authors resort to diverse methodologies. The predominant one consists of an open question. For example, subjects can be asked to write their personal conception of creativity, (Petocz et al., 2009; Spiel & von Korff, 1998; Szen-Ziemiańska, 2013; Tsai & Cox, 2012), to list synonyms of creativity (Ramos & Puccio, 2014; Runco, 1984), behaviors of a creative person (Runco, 1984; Sternberg, 1985), traits that characterize a creative person (Runco, 1984), characteristics of different forms of creativity—artistic, scientific, and daily living (Runco & Bahleda, 1986); to indicate the relation between creativity and a given professional domain (Petocz et al., 2009; Tsai & Cox, 2012), or to imagine a creative product and then describe the characteristics of the person who could have created it (Hass, 2014). However, we can also seek to identify implicit conceptions from standardized material. For example, Katz and Giacommelli (1982) asked researchers to select from the Adjective Check List (Gough & Heilbrun, 1965) the adjectives that described the best the activity of problem-solving. Next, the adjectives were categorized freely by students. Half of the students received the information that the adjectives characterized an activity of problem-solving. For the other half, the adjectives characterized a creative activity which enabled to discriminate specific implicit conceptions of creativity. In a set of experiments on the evaluation of children's creativity, Runco (1989; Runco & Johnson, 2002; Runco et al., 1993) asked a first group of participants to select adjectives from the Adjective Check List (Gough & Heilbrun, 1965) that characterized a creative child. The selected adjectives were then used to build a questionnaire from which a second group of participants rated children's creativity. A third methodological approach consists of analyzing observations and structured interviews of creative persons who were potentially recruited (Elsbach & Kramer, 2003), or to analyze the content of job

offers targeted to select creative persons (Christensen et al., 2014). Finally, there are methodologies used in research on social representations (Glăveanu, 2014).

5.2 *Does the Existing Knowledge on Implicit Conceptions of Creativity Enable Us to Test the Assumptions Behind the CAT?*

The hypotheses formulated by Amabile (1996) state the existence of a rudimentary form of creativity, a basic quality of the product that judges perceive and use to rate the level of creativity. She assumes that this conception should not differ from the scientific conception of creativity that includes two criteria: the levels of originality and adaptation of productions. These assumptions raise two questions. First, do the judges' implicit conceptions of creativity fit the scientific conception? Second, even if the numerous empirical results of Amabile and her research team lead to the conclusion that « the existence of a *unique* subjective construct called « creativity» has been demonstrated[1]» (Amabile, 1983, p. 61) the question is to understand if implicit theories of creativity ascertain a unitary conception of what makes a production creative. Even if it seems very difficult to synthesize our current knowledge, few studies highlight the content of implicit conceptions and how they drive the evaluation of creativity.

Christensen et al. (2014) suggest that research has not suffciently looked at the correspondence between implicit and scientific conceptions of creativity. However, it would be of great interest to retrieve from the implicit conceptions the two criteria of originality and adaptation on which the scientific community bases the study of creativity.

Some research has started to address this issue. Spiel and von Korff (1998) studied implicit conceptions of creativity by asking politicians, scientists, artists and teachers to associate expressions with the word creativity. For these four groups of subjects, the most given expression was "novelty", the second was "idea". Ramos and Puccio (2014) also proposed a free association task with the word "creativity" to two convenient samples. Among the most given answers, we found originality related expressions: New, Unusual, Different and Unique. Szen-Ziemiańska (2013) asked managers and CEOs what they meant by "creativity". From the content of the answers, creativity refers to the aptitude to think creatively, to solve problems by generating new ideas. It is worth noting that there was no expression linked with creativity that refers directly or indirectly to the second scientific criteria of creativity—adaptation.

Even if there is not much research, these scientific results support only partially the hypothesis formulated by Amabile (1996) according to which the conceptual definition of creativity—a production that is both original and adapted—is aligned with

[1] Which we wish *to highlight our point*.

experts' lay conceptions of creativity that is used when evaluating creative productions. If some research has shown that originality is a frequently-cited component of creativity, the criteria of adaptation has never been cited either spontaneously or incidentally.

The CAT has been mostly used to assess the creativity of productions. However, according to Amabile (1996) it can be used under certain conditions to assess individual differences. Thus, it seems relevant to study how a creative person is conceived based on implicit theories of creativity. For example, Katz and Giacommelli (1982) asked their colleagues to select from the Adjective Check List (Gough & Heilbrun, 1965) the adjectives that best described the activity of problem solving. Then, the selected adjectives were freely classified by students so that each category represented an aspect of creativity. The category analysis led the authors to conclude that subjective conceptions of creativity are composed of one dimension of general openness to ideas, situations and actions. Szen-Ziemiańska (2013) obtained an equivalent result. But other studies attempted to conciliate more systematically implicit and scientific conceptions of the creative person. Runco (1984) identified student teachers' stereotypes of a creative person. The expressions resulting from his study were "Flexible", "Non-conforming" and "Challenging" which fit the previous research findings on creative personality. More recently, an original research analyzing job ads conducted by Christensen et al. (2014) highlighted that ads that explicitly sought to recruit creative people feature significantly more terms related to Openness to experience and to a lesser extent Extraversion. Conversely, they feature significantly fewer terms related to Conscientiousness. These results show clearly the correspondence between scientific findings and implicit theories on creative personality.

Moreover, some researchers sought to study more broadly implicit theories of creativity. For example, in a previously cited research Spiel and von Korff (1998) analyzed the participants' answers to determine how the content of implicit theories referred to the "4P" of creativity (Rhodes, 1961). Results indicate that implicit conceptions refer principally to the person or the creative process compared to the product. Moreover, the process is very rarely raised. Furthermore, Szen-Ziemiańska (2013) showed that managers 'conceptions of creativity were globally consistent with scientific theories.

Even if the main objective of the CAT is to provide a subjective but rigorous evaluation of creative productions, these different results establish the applicability of the CAT to evaluate creative people. Indeed implicit conceptions of traits associated with a creative person are consistent with scientific theories. Particularly, openness to experience is in both cases an important determinant of individuals' creative potential. These results strengthen the conviction that appropriate judges' subjective evaluation of creativity offers an alternative solution to evaluation methods based on scientific conceptions.

Finally, can we suppose reasonably that a consistent implicit conception of creativity is more or less shared by equivalent judges? Inversely, do conceptions of creativity vary according to the type of solicited judges (experts, quasi experts or novices) or even among a group of experts in a given domain? If so, the opportunity to aggregate ratings from several judges might be compromised. Implicit theories of

creativity have been collected and studied from different types of potential judges. For example, several studies have been conducted on students (Hass, 2014; Katz & Giacommelli, 1982; Ramos & Puccio, 2014; Runco & Bahleda, 1986), teachers (Runco, 1989; Runco & Johnson, 2002; Runco et al., 1993), and professors in art, business, philosophy, and physics (Sternberg, 1985). To pursue the aim of this chapter, it would be of great interest to find studies comparing implicit conceptions from different judges (experts, quasi experts and novices for example) when confronted with the same experimental design. However, such studies are almost nonexistent. An exception is the notable work of Runco (1989; Runco & Johnson, 2002; Runco et al., 1993) who compared implicit theories on school children's creativity from two groups of judges—parents and teachers. On the 25 adjectives chosen by parents and teachers (from the Adjective Check List, Gough & Heilbrun, 1965), only 7 were common to both groups: Artistic, Curious, Imaginative, Independent, Inventive, Original, and Wide interest (Runco, 1989). Such a low rate of overlap leads us to the conclusion that regarding children's creativity the two groups of "experts" have different implicit conceptions but further research is needed to draw conclusions.

6 What is the Coefficient Alpha Measuring in the Case of Subjective Evaluations of Creativity?

In the classical psychometric approach, we seek to test the validity of a measure. In contrast, in the approach suggested by Amabile (1982), validity is tested by a logical argument stating that: *if* solicited judges are sufficiently familiar with the domain of the creative production (even experts, depending on the criteria we decide to select) and *if* the reliability of their evaluations is high, *then* what experts agree on can only be creativity. However, an implicit assumption underlies this argument: the reliability of evaluations among judges, demonstrated by a high value of the alpha coefficient, is traducing that experts assess collectively *the same characteristic* in different productions. It is indeed tempting to believe that a reliable evaluation of productions by experts is reflecting the level of creativity of these productions. Thus, the evaluation would be valid. But the accuracy of such reasoning is based on the premise that creativity consists of a unique characteristic that is present in every production and that experts recognize it unanimously. Empirically, it means that the reliability coefficient, most of the time estimated by the Cronbach's alpha coefficient, should be interpreted as an indicator of the homogeneity and not only as the internal consistency. Therefore, if our understanding is exact, this reasoning is faulty because it considers that the alpha coefficient allows us to estimate the homogeneity of experts' evaluations regarding creative productions.

A preliminary comment on how authors interpret the value of the reliability index is appropriate before going further in our analysis of Amabile's argumentation. Kaufman et al. (2008) noted that in research using the CAT, the value of inter-rater reliability coefficient ranges from 0.70 to 0.90. For some authors (for example

Hennessey et al., 2011), a reliability index that is at least of 0.70 certifies an acceptable interrater agreement. In fact, the idea that the alpha coefficient should reach 0.70 or 0.80 to conclude satisfactory reliability is widespread among researchers in psychology (Cho & Kim, 2015). Yet, such thresholds have never been supported by empirical testing, psychometric justification nor rational analysis (Churchill & Peter, 1984; Cortina, 1993; Peterson, 1994). In fact, we should avoid concluding mechanically based a simple comparison of the alpha value with some kind of index value (Cho & Kim, 2015). Instead one has to put in more effort to take into account the context and the objective of the evaluation in order to interpret appropriately the alpha (Cortina, 1993).

6.1 When is Alpha a Valid Measure of Reliability?

It is necessary to verify the reliability of ratings. In this way we can ensure that the proportion of error is negligible and that differences of scores reflect the judges' systematic rating of productions (Tinsley & Weiss, 2000). Amabile used different indexes to estimate interrater reliability (Amabile, 1982, 1996), but the alpha coefficient seems to be the most popular lately among researchers using the CAT. Yang and Green (2011) supposed that this preference could be explained because it is an easily interpretable index. Yet, we will see that it is not as easy as it appears.

Generally the alpha coefficient, as any psychometric index, is used to estimate the reliability of a composite score if the hypotheses from which the scores are derived have been respected in empirical conditions. In practice, it is likely that these hypotheses are violated which can skew the empirical estimation of the composite score reliability. Such questions have been extensively studied in the psychometric literature (for example, Cho & Kim, 2015; Cortina, 1993; Green & Yang, 2008; Green et al., 1977; Lucke, 2005; Schmitt, 1996; Sijtsma, 2009; Yang & Green, 2011). Our objective is only to raise issues that we might encounter if we do not respect the validity conditions of this index while we use it to estimate interrater reliability in the case of the subjective evaluation of creativity. We will discuss the appropriateness of this index regarding its utility for the consensual assessment technique.

The well-known assumptions underpinning the alpha coefficient follow the classical theory of composite score reliability that has been calculated from different elementary scores. According to this theory, each elementary score is actually composed of two parts: the true score (for example the real level of creativity of a production) that we seek to estimate, and the measurement error that is supposed to be random. Furthermore, it posits that for each pair of elementary measures, measurement errors must not be correlated. However, since the first work on alpha coefficients (Cronbach, 1951) or equivalent indexes such as the one developed by Guttman (1945), authors conclude that this index provides a lower bound estimation of the real reliability of a composite score. Subsequently, Novick and Lewis (1967, Theorem 3.1) demonstrated that the necessary and sufficient condition for alpha to

really estimate reliability was that every elementary measure would be essentially tau-equivalent which means that for each assessed characteristic, the estimated true scores from two distinct measures are linked by linear functions. Green and Yang (2008) sought to test the importance of the reliability estimation bias from fictive scales that did not respect the presumption of tau-equivalent measures. They verify that the alpha value is always below the reliability value but that this estimation bias stays low (less than 5%) in most of their studied cases. Nevertheless, it can reach 10% of the real reliability value when there are few items and they present very contrasted factor loading values regarding the latent dimension. Most of the time, we observe that the presumption of tau-equivalent measures is not respected in practice (Green & Yang, 2008; Yang & Green, 2011). Thus, the use of alpha underestimates the reliability of measurement scales.

Some research studied the infringement of a second assumption. We pointed out the classical theory on reliability postulates that measurement errors should be random and thus should not correlated. We consider in psychometrics that correlations between errors can occur when subjects do not answer independently to every item composing the test. In other words, when their answers to two items are linked by a second variable that is generally ignored by researchers and that is different from their true score (Lucke, 2005; Raykov, 2001). Numerous reasons have been evoked to explain correlations between errors (Cho & Kim, 2015; Green & Yang, 2008; Lucke, 2005; Yang & Green, 2011). This is certainly why little attention has been paid to consequences of the infringement of this presumption on the reliability estimation (Green et al., 1977; Lucke, 2005), even if this bias is well-known since the article of Guttman (1953). But whatever the reason is to explain correlations between errors, these correlations should skew the calculation of the alpha because the covariance between errors in taken into account in the calculation of the mean covariance between items, which appears in the numerator of alpha.[2] This bias has been highlighted in different studies. Analyses show that alpha overestimates the reliability when covariance between errors is positive (Raykov, 1998, 2001) and underestimates it when the covariance is negative (Raykov, 2001). The effect of correlated errors on alpha had been subject of simulation studies conducted by Lucke (2005) then Cho and Kim (2015). Respectively they found biases in the reliability of congeneric measures and on the alpha value. Indeed the more the measurement errors are correlated, the more the measurement reliability decreases while at the same time alpha tends to overestimate reliability.

[2] The definition formula proposed by Cronbach (1951; Eq. 2) is well-known: $\alpha = \frac{n}{n-1}\left(1 - \frac{\sum_i V_i}{V_t}\right)$, where n is the number of items, V_i is the variance of an item i and V_t is the variance of the composite score. From this equation, the author derived two other formulas: $\alpha = \frac{n}{n-1}\left(\frac{\sum_i \sum_j C_{ij}}{V_t}\right)$ where C_{ij} is the covariance between each different pairs of items ($i \neq j$) and $\alpha = \frac{n^2 \bar{C}_{ij}}{V_t} where \bar{C}_{ij}$ is the covariance between every items (Cronbach, 1951; Eqs. 24 and 16 respectively).

6.2 *How Should We Interpret Alpha When Estimating Interrater Reliability?*

Infringing on the two assumptions presented earlier is not the only risk that affects the interpretation of the coefficient and the conclusions to be drawn. The value of alpha depends also on empirical conditions from which it is estimated. It has been argued that the value of alpha for a composite score varies according to different parameters: the number of items, their mean correlation or even the number of dimensions that are truly measured by the items. We will address successively the effect of these different parameters and their impact when the alpha coefficient is used to estimate interrater reliability.

The relation between alpha and the number of measures composing the test is familiar to psychometricians and known among researchers using the subjective evaluation of creativity. Amabile (1982; note 2, p. 1003) stated herself: « to the extent that the judging is a difficult task and the mean inter-judge correlation is low, the number of judges should be increased. However, if the mean correlation is high, good reliabilities can be obtained with fewer judges». This idea had been further promoted by Kaufman et al. (2008), for whom the more the number of judges asked to assess creativity is high, the more the interrater reliability has chances to be high. According to them, an optimal number of judges should lie between five and ten in most evaluation situations. Resorting to less than five judges means taking the risk to obtain insufficient reliability. On the other hand, seeking to obtain more than ten judges might often be unnecessary and costly. Aside from the fact that this recommendation is certainly too general, none of the thresholds given were justified by the authors. Thus we cannot draw appropriate conclusions as to the interpretation of alpha regarding the consensual assessment technique.

We can rely on formulas derived from Cronbach (1951) to demonstrate that the value of the index depends on the number of items but also the mean correlation between items.[3] Green et al. (1977) were the first to analyze the effect of the number of items on alpha. Results from their Monte Carlo study attest the increase of alpha when the number of items composing the scale increases. Subsequently, Cortina (1993) demonstrate that on the one hand increasing the number of items enhanced considerably the value of alpha, particularly when the mean correlation between items was weak (i.e. 0.30), and on the other hand that if the scale contains sufficient items (i.e. more than twenty) the value of alpha exceeded 0.70 even when the mean correlation between items was weak (i.e. 0.30). Therefore, if internal consistency means that items composing a test are interrelated (Cortina, 1993; Green et al., 1977; Schmitt, 1996; Sijtsma, 2009), we cannot conclude only from the value of alpha because this index depends on mean correlation between items (i.e. their interrelation) and on the length of the test. A correct interpretation of alpha implies that the number of items and the mean correlation between items be taken into account simultaneously. When this index is used to evaluate the reliability of subjective ratings of

[3] See previous footnote.

creativity, we should cautiously take Kaufman et al. (2008) recommendations to have five to ten judges, as well as Hennessey et al. (2011) who consider that reliability is acceptable from the threshold of 0.70. How should interrater reliability be interpreted in such conditions? A part of the answer can be found thanks to the following example. From a derived formula of alpha (Peterson, 1994), we can estimate that a coefficient of 0.70 calculated from evaluations of ten judges should correspond to a mean correlation of 0.19 which obviously translates a weak consistency between individual evaluations (in the exact same condition, an alpha value of 0.80 would correspond to a mean correlation of 0.29).

We mentioned that following the CAT, the interrater reliability is conceived tacitly as the index of homogeneity among subjective evaluations, meaning that every judge is evaluating the same characteristic. Yet, if alpha cannot be directly interpreted as an index of internal consistency, neither can it be interpreted as an index of homogeneity. In psychometrics, if a common factor for every measure exists then it leads necessarily to an index of high internal consistency. But the opposite is not true. It is possible to obtain a high alpha even when more than a common factor can explain the score variance, including orthogonal factors (Cortina, 1993; Green & Yang, 2008; Green et al., 1977; Sijtsma, 2009). In fact, an analysis demonstrates that the value of alpha varies depending more on the increase of the explained variance for each score than the structure of the measure itself (the number of more or less important of factors and their relations) (Cho & Kim, 2015; Green & Yang, 2008). Acknowledging this should lead us to question the dimensionality of subjective evaluations of creativity. Using alpha to estimate interrater reliability would lead to skewed results if we have any reason to think that judges will base their evaluation of creativity on more than one dimension. These dimensions can incorporate, as stated by Amabile (1996) creativity and one or more other dimensions that are common to every production. But these dimensions can also not refer to creativity or represent different facets of creative production (for example originality and adaptation).

To conclude, the direct interpretation of the value of alpha should be avoided. We should analyze and interpret this index by taking into account different parameters of the CAT: number of solicited judges, the mean correlation between their evaluations and the dimensionality of the obtained measures of creativity.

7 Conclusion and Perspectives

This chapter sought to address three general questions related to the use of the CAT. What type of judges should be selected to rate creative productions? What implicit conceptions on creativity are guiding the judges' evaluations? And, does the alpha coefficient give an adequate estimate of the reliability of the evaluations? In other words, we aimed to discuss how valid can be considered the results from the consensual assessment technique. The analysis of the numerous results in the literature leads us to several conclusions.

- The original hypothesis on which the CAT is based is that a subjective construct of creativity exists and is common to different judges as long as they have an equivalent level of expertise in a given domain (Amabile, 1996). Research results led us to think judges assess creativity based on implicit conceptions that are not as reliable as we could wish. Moreover, it has not been demonstrated yet that these implicit conceptions fit with scientific theories and conceptions.
- Regarding the selection of judges, experts in the domain seem obviously in the best position to assess the creativity of productions and should be favored every time it is possible. However if we want to stick with strict criteria, for example Kaufman and Baer's criteria (2012), it is often impossible to access judges who have at least ten years of specific experience within the domain and have received an honor for their exceptional realizations within the same domain. In fact, expert judges are not necessarily required in every case. It depends on the productions that we wish to assess. Results show that novices were able to assess efficiently creative productions in certain conditions. Thus we can conclude that the selection of judges should be guided by pragmatic considerations.
- The use of the evaluation technique itself should strictly follow the methodological principles that have been outlined by Amabile (1982, 1996; Hennessey et al., 2011). However, we observe that two important principles are forgotten in numerous studies. First, we deplore that judges are most of the time asked to evaluate each production directly on a rating scale (such as "not creative at all"—"very creative"). Instead they should be asked to compare and rate each production related to the others. Second, we need to ask judges to rate other aspects of the productions (such as technical and aesthetic qualities, or other aspects). These recommendations are rarely put into practice when using the CAT. However, they should be applied systematically. By doing so, we will be in position to establish without ambiguity that judges are indeed rating creativity independently from other related and assessed aspects that may be taken into account or confounded when rating creativity.
- The estimations of rating reliability cannot be established by interpreting directly the alpha coefficient. Even if this statistical technique is actually privileged by a majority of researchers, we should be cautious and take into account different parameters that influence the value of the alpha. Indeed, we recall that depending on the number of solicited judges, the mean correlation between ratings and the dimensionality of creativity measures can lead to an overestimation or an underestimation of the interrater reliability. This bias varies in its proportion and might not be easily identifiable. Given this, we should reconsider using the inter class correlation coefficient previously adopted by Amabile (1982, 1996).
- Finally, a more or less high interrater agreement cannot by itself lead to conclude about the validity of the creativity rating. Theoretically, we cannot definitively exclude that judges (even experts) may rate productions coherently but on a different construct than creativity. Also, their creativity ratings might be contaminated by other characteristics of the productions. This argument is even more crucial given that, as stated before, most researchers do not control that creativity ratings differ from related aspects (esthetical or technical qualities) when using the

CAT. The empirical validity of the creativity evaluation needs to be approached from a different perspective.

If one statement is to be remembered, it is the difficulty to rely blindly on experts ratings, even when reliable, to consider that this technique leads to a valid evaluation of creativity.

The current approach to test empirical validity based only on a statistical agreement between judges' ratings is problematic because we do not seek to understand what are the judges' implicit conceptions of creativity, if they are coherent between judges, or how such implicit conceptions guide judges' evaluations. According to Runco and Johnson (2002), one limit of research on implicit theories is the tendency to remain descriptive rather than seeking to explain behaviors. Thus, they suggest « to study the conceptions of creativity in conjunction with the observed behaviors of their application» (Runco & Johnson, 2002, p. 437). Symmetrically, we consider that the subjective assessment of creativity would gain in comprehension and the evaluations in validity if the judgments were confronted to judges' implicit conceptions. Amabile (1996) conducted a first study of this kind. She aimed to verify that judges perceived a creative production as both new and adapted. To do so, judges had first to rate creative productions then to answer an open question in order to describe their subjective impressions. But the results were deceiving: answers were unclear, difficult to analyze and presented a high degree of variability.

However, we are convinced that it is possible to enhance the validity of this technique by modifying it in at least two ways. Runco (1984) was the first to offer an alternative to evaluate creativity. Runco shares with Amabile (1982, 1996) the desire to develop a socially valid instrument to evaluate creativity, but his approach consists, first, of collecting implicit conceptions from adequate people regarding the production under evaluation, and then based on these implicit theories, to *construct* an instrument of evaluation (for example, Runco, 1984; Runco & Bahleda, 1986). This approach should guarantee the instrument better ecological validity than if it was constructed based only on scientific theories (Runco, 1984; Sternberg, 1985). Concretely, a first strategy consisted of asking teachers to list expressions that were synonyms of creativity, observed behaviors that are specific to creative children and personality traits that would be common to all of them (Runco, 1984). The most frequently cited items were retained for the questionnaire assessing children's creativity. It is important to identify the most appropriate people to collect their implicit theories. If not, we may obtain different items from different types of experts (Runco & Bahleda, 1986). A second strategy consists of updating an approach previously used by Domino (1970) and Gough (1979). They asked parents and teachers to select among the 300 items of the Adjective Check List (ACL; Gough & Heilbrun, 1980) the traits that were, in their opinion, related to children's creativity (Runco, 1989; Runco et al., 1993). Once again, the questionnaire to assess creativity was constructed using the most frequently cited adjectives. Existing results tend to suggest good validity for this technique (Runco, 1989; Runco & Bahleda, 1986; Runco & Johnson, 2002; Runco et al., 1993). Inspired by these examples, it is certainly possible to develop other subjective evaluation techniques of creativity that are socially valid.

A second approach would consist of transgressing a powerful interdiction resulting from a certain methodological orthodoxy. Stating that judges should rate creativity according to their own conception of such dimensions translates the interdiction to provide us with any kind of definition or criteria to use in order to rate the productions. This injunction results from the statement made by Amabile (1982, 1996) that it is not possible to specify to which objective characteristics of the productions creativity corresponds. For this reason she decided to dissociate conceptual and operational definitions of creativity. But while doing so, she also postulated that the consensual assessment of creativity made by judges should certainly rely on the two dimensions stipulated in the standard definition of creativity: novelty and the appropriateness of productions. In opposition to her recommendations, we think that we could ask judges to rate these two criteria according to their own conceptions, without giving them indications. By doing so, we would request their expertise to rate the two dimensions that constitute creativity rather than asking them a subjective and implicit evaluation of creativity. Thus we would be able to align conceptual and operational definitions of creativity.

Finally, regardless of the different issues highlighted in this chapter, another question remains unanswered. We still do not know how judges evaluate the creativity of a production. Amabile (1996) herself pointed out the necessity for complementary research in order to understand which characteristics of the judgment task and the judges themselves might influence interrater agreement. Hennessey (1994) called for studying the differences between judges for themselves, and not only to seek to enhance ratings' reliability. In the same vein, Runco and Charles (1993) called for research exploring how judges proceed to rate the creativity of productions. Indeed, we need to verify that judges effectively take into account the relevant dimensions of productions. Then, we will be able to seek to understand how they integrate the adaptation dimension to the originality dimension when giving a global judgment of creativity.

Bibliography

Amabile, T. M. (1982). Social psychology of creativity: A consensual assessment technique. *Journal of Personality and Social Psychology, 43*(5), 997–1013. https://doi.org/10.1037//0022-3514.43.5.997

Amabile, T. M. (1983). A consensual technique for creativity assessment. In *The social psychology of creativity* (pp. 37–63). Springer.

Amabile, T. M. (1996). *Creativity in context*. Westview Press.

Baer, J. (1996). Does artistic creativity decline during elementary school? *Psychological Reports, 78*(3), 927–930. https://doi.org/10.2466/pr0.1996.78.3.927

Baer, J. (1997). Gender differences in the effects of anticipated evaluation on creativity. *Creativity Research Journal, 10*(1), 25–31. https://doi.org/10.1207/s15326934crj1001_3

Baer, J. (2003). The impact of the core knowledge curriculum on creativity. *Creativity Research Journal, 15*(2–3), 297–300. https://doi.org/10.1080/10400419.2003.9651422

Baer, J., & Kaufman, J. C. (2019). Assessing creativity with the consensual assessment technique. In I. Lebuda & V. P. Glăveanu (Eds.), *The Palgrave handbook of social creativity research.* Springer International Publishing. https://doi.org/10.1007/978-3-319-95498-1

Baer, J., Kaufman, J., & Gentile, C. (2004). Extension of the consensual assessment technique to nonparallel creative products. *Creativity Research Journal, 16*(1), 113–117. https://doi.org/10.1207/s15326934crj1601_11

Baer, J., & McKool, S. S. (2009). Assessing creativity using the consensual assessment. In C. S. Schreiner (Ed.), *Handbook of research on assessment technologies, methods, and applications in higher education* (pp. 65–77). Information Science Reference.

Besemer, S. P. (1998). Creative product analysis matrix: Testing the model structure and a comparison among products—Three novel chairs. *Creativity Research Journal, 11*(4), 333–346. https://doi.org/10.1207/s15326934crj1104_7

Besemer, S. P. (2000). To buy or not to buy: Predicting the willingness to buy from creative product variables. *Korean Journal of Thinking and Problem Solving, 10*(2), 5–18.

Besemer, S. P., & O'Quin, K. (1986). Analyzing creative products: Refinement and test of a judging instrument. *The Journal of Creative Behavior, 20*(2), 115–126. https://doi.org/10.1002/j.2162-6057.1986.tb00426.x

Besemer, S. P., & O'Quin, K. (1999). Confirming the three-factor creative product analysis matrix model in an American sample. *Creativity Research Journal, 12*(4), 287–296.

Besemer, S. P., & Treffinger, D. J. (1981). Analysis of creative products: Review and synthesis. *The Journal of Creative Behavior, 15*(3), 158–178. https://doi.org/10.1002/j.2162-6057.1981.tb00287.x

Caroff, X., & Besançon, M. (2008). Variability of creativity judgments. *Learning and Individual Differences, 18*(4), 367–371. https://doi.org/10.1016/j.lindif.2008.04.001

Carson, S. (2006, April 19). *Creativity and mental illness.* Invitational panel discussion hosted by Yale's mind matters Consortium, New Haven, CT.

Chen, C., Kasof, J., Himsel, A., Dmitrieva, J., Dong, Q., & Xue, G. (2005). Effects of explicit instruction to "be creative" across domains and cultures. *The Journal of Creative Behavior, 39*(2), 89–110. https://doi.org/10.1002/j.2162-6057.2005.tb01252.x

Chen, C., Kasof, J., Himsel, A. J., Greenberger, E., Dong, Q., & Xue, G. (2002). Creativity in drawings of geometric shapes: A cross-cultural examination with the consensual assessment technique. *Journal of Cross-Cultural Psychology, 33*(2), 171–187. https://doi.org/10.1177/0022022102033002004

Cho, E., & Kim, S. (2015). Cronbach's coefficient alpha: Well known but poorly understood. *Organizational Research Methods, 18*(2), 207–230. https://doi.org/10.1177/1094428114555994

Christensen, B. T., Drewsen, L. K., & Maaløe, J. (2014). Implicit theories of the personality of the ideal creative employee. *Psychology of Aesthetics, Creativity, and the Arts, 8*(2), 189–197. https://doi.org/10.1037/a0036197

Churchill, G. A., & Peter, J. P. (1984). Research design effects on the reliability of rating scales: A meta-analysis. *Journal of Marketing Research, 21*(4), 360–375. https://doi.org/10.2307/3151463

Čorko, I., & Vranić, A. (2004). Effects of setting creative goals of different specificity on judged creativity of the product. *Review of Psychology, 11*(1–2), 67–73.

Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology, 78*(1), 98–104. https://doi.org/10.1037/0021-9010.78.1.98

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*(3), 297–334. https://doi.org/10.1007/BF02310555

Cseh, G. M., & Jeffries, K. K. (2019). A scattered CAT: A critical evaluation of the consensual assessment technique for creativity research. *Psychology of Aesthetics, Creativity, and the Arts, 13*(2), 159–166. https://doi.org/10.1037/aca0000220

Domino, G. (1970). Identification of potentially creative persons from the adjective check list. *Journal of Consulting and Clinical Psychology, 35*(1), 48–51. https://doi.org/10.1037/h0029624

Elsbach, K. D., & Kramer, R. M. (2003). Assessing creativity in Hollywood pitch meetings: Evidence for a dual-process model of creativity judgments. *Academy of Management Journal, 46*(3), 283–301. https://doi.org/10.2307/30040623

Galati, F. (2015). Complexity of judgment: What makes possible the convergence of expert and nonexpert ratings in assessing creativity. *Creativity Research Journal, 27*(1), 24–30. https://doi.org/10.1080/10400419.2015.992667

Gerrard, L. E., Poteat, G. M., & Ironsmith, M. (1996). Promoting children's creativity: Effects of competition, self-esteem, and immunization. *Creativity Research Journal, 9*(4), 339–346. https://doi.org/10.1207/s15326934crj0904_5

Glăveanu, V. P. (2014). Revisiting the "art bias" in lay conceptions of creativity. *Creativity Research Journal, 26*(1), 11–20. https://doi.org/10.1080/10400419.2014.873656

Gough, H. G. (1979). A creative personality scale for the adjective check list. *Journal of Personality and Social Psychology, 37*(8), 1398–1405. https://doi.org/10.1037/0022-3514.37.8.1398

Gough, H. G., & Heilbrun, A. B. jr. (1965). *The adjective check list manual*. Consulting Psychologists Press.

Green, S. B., Lissitz, R. W., & Mulaik, S. A. (1977). Limitations of coefficient Alpha as an index of test unidimensionality. *Educational and Psychological Measurement, 37*(4), 827–838. https://doi.org/10.1177/001316447703700403

Green, S. B., & Yang, Y. (2008). Commentary on coefficient Alpha: A cautionary tale. *Psychometrika, 74*(1), 121–135. https://doi.org/10.1007/s11336-008-9098-4

Guttman, L. (1945). A basis for analyzing test-retest reliability. *Psychometrika, 10*(4), 255–282. https://doi.org/10.1007/BF02288892

Guttman, L. (1953). Reliability formulas that do not assume experimental independence. *Psychometrika, 18*(3), 225–239. https://doi.org/10.1007/BF02289060

Hass, R. W. (2014). Domain-specific exemplars affect implicit theories of creativity. *Psychology of Aesthetics, Creativity, and the Arts, 8*(1), 44–52. https://doi.org/10.1037/a0035368

Hennessey, B. A. (1994). The consensual assessment technique: An examination of the relationship between ratings of product and process creativity. *Creativity Research Journal, 7*(2), 193–208. https://doi.org/10.1080/10400419409534524

Hennessey, B. A., Amabile, T. M., & Mueller, J. S. (1999). Consensual assessment. *Encyclopedia of Creativity, 1*, 347–359.

Hennessey, B. A., Amabile, T. M., & Mueller, J. S. (2011). Consensual assessment. In M. A. Runco & S. Pritzker (Eds.), *Encyclopedia of creativity* (2nd ed., Vol. 1, pp. 253–260). Academic Press.

Hickey, M. (2001). An application of Amabile's consensual assessment technique for rating the creativity of children's musical compositions. *Journal of Research in Music Education, 49*(3), 234–244. https://doi.org/10.2307/3345709

Hood, R. W. (1973). Rater originality and the interpersonal assessment of levels of originality. *Sociometry, 36*(1), 80–88. https://doi.org/10.2307/2786283

Joussemet, M., & Koestner, R. (1999). Effect of expected rewards on children's creativity. *Creativity Research Journal, 12*(4), 231–239. https://doi.org/10.1207/s15326934crj1204_1

Kasof, J., Chen, C., Himsel, A., & Greenberger, E. (2007). Values and creativity. *Creativity Research Journal, 19*(2–3), 105–122. https://doi.org/10.1080/10400410701397164

Katz, A. N., & Giacommelli, L. (1982). The subjective nature of creativity judgments. *Bulletin of the Psychonomic Society, 20*(1), 17–20. https://doi.org/10.3758/BF03334789

Kaufman, J. C., & Baer, J. (2012). Beyond new and appropriate: Who decides what is creative? *Creativity Research Journal, 24*(1), 83–91. https://doi.org/10.1080/10400419.2012.649237

Kaufman, J. C., Plucker, J. A., & Baer, J. (2008). The consensual assessment technique. In *Essentials of creativity assessment* (pp. 52–83). Wiley.

Kaufman, J. C., Baer, J., & Cole, J. C. (2009). Expertise domains and the consensual assessment technique. *The Journal of Creative Behavior, 43*(4), 223–233. https://doi.org/10.1002/j.2162-6057.2009.tb01316.x

Kaufman, J. C., Baer, J., Agars, M. D., & Loomis, D. (2010). Creativity stereotypes and the consensual assessment technique. *Creativity Research Journal, 22*(2), 200–205

Lucke, J. F. (2005). "Rassling the Hog": The influence of correlated item error on internal consistency, classical reliability, and congeneric reliability. *Applied Psychological Measurement, 29*(2), 106–125. https://doi.org/10.1177/0146621604272739

Niu, W., & Sternberg, R. (2001). Cultural influences on artistic creativity and its evaluation. *International Journal of Psychology, 36*(4), 225–241. https://doi.org/10.1080/00207590143000003

Novick, M., & Lewis, C. (1967). Coefficient Alpha and the reliability of composite measurements. *Psychometrika, 4866*(1), 1–13. https://doi.org/10.1007/BF02289400

O'Quin, K., & Besemer, S. P. (1989). The development, reliability, and validity of the revised creative product semantic scale. *Creativity Research Journal, 2*(4), 267–278. https://doi.org/10.1080/10400418909534323

O'Quin, K., & Besemer, S. P. (2006). Using the creative product semantic scale as a metric for results-oriented business. *Creativity and Innovation Management, 15*(1), 34–44. https://doi.org/10.1111/j.1467-8691.2006.00367.x

Peterson, R. A. (1994). A meta-analysis of Cronbach's coefficient Alpha. *Journal of Consumer Research, 21*(2), 381. https://doi.org/10.1086/209405

Petocz, P., Reid, A., & Taylor, P. (2009). Thinking outside the square: Business students' conceptions of creativity. *Creativity Research Journal, 21*(4), 409–416. https://doi.org/10.1080/10400410903297998

Ramos, S. J., & Puccio, G. J. (2014). Cross-cultural studies of implicit theories of creativity: A comparative analysis between the United States and the main ethnic groups in Singapore. *Creativity Research Journal, 26*(2), 223–228. https://doi.org/10.1080/10400419.2014.901094

Raykov, T. (1998). Coefficient Alpha and composite reliability with interrelated nonhomogeneous items. *Applied Psychological Measurement, 22*(4), 375–385. https://doi.org/10.1177/014662169802200407

Raykov, T. (2001). Bias of coefficient α for fixed congeneric measures with correlated errors. *Applied Psychological Measurement, 25*(1), 69–76. https://doi.org/10.1177/01466216010251005

Rhodes, M. (1961). An analysis of creativity. *The Phi Delta Kappan, 42*(7), 305–310.

Runco, M. A. (1984). Teachers' judgments of creativity and social validation of divergent thinking tests. *Perceptual and Motor Skills, 59*(3), 711–717. https://doi.org/10.2466/pms.1984.59.3.711

Runco, M. A. (1989). Parents' and teachers' ratings of the creativity of children. *Journal of Social Behavior & Personality, 4*(1), 73–83. https://doi.org/10.1207/S15326934CRJ1434_12

Runco, M. A., & Bahleda, M. D. (1986). Implicit theories of artistic and everyday creativity. *Journal of Creative Behavior, 20*(2), 93–98. https://doi.org/10.1002/j.2162-6057.1986.tb00423.x

Runco, M. A., & Charles, R. E. (1993). Judgments of originality and appropriateness as predictors of creativity. *Personality and Individual Differences, 15*(5), 537–546. https://doi.org/10.1016/0191-8869(93)90337-3

Runco, M. A., Illies, J. J., & Eisenman, R. (2005). Creativity, originality, and appropriateness: What do explicit instructions tell us about their relationships? *Journal of Creative Behavior, 39*(2), 137–148. https://doi.org/10.1002/j.2162-6057.2005.tb01255.x

Runco, M. A., & Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal, 24*(1), 92–96. https://doi.org/10.1080/10400419.2012.650092

Runco, M. A., & Johnson, D. J. (2002). Parents' and teachers' implicit theories of children's creativity: A cross-cultural perspective. *Creativity Research Journal, 14*(3–4), 427–438. https://doi.org/10.1207/S15326934CRJ1434_12

Runco, M. A., Johnson, D. J., & Bear, P. K. (1993). Parents' and teachers' implicit theories of children's creativity. *Child Study Journal, 23*(2), 91–113. https://doi.org/10.1207/S15326934CRJ1434

Schmitt, N. (1996). Uses and abuses of coefficient Alpha. *Psychological Assessment, 8*(4), 350–353. https://doi.org/10.1037/1040-3590.8.4.350

Sijtsma, K. (2009). On the use, the misuse, and the very limited usefulness of Cronbach's Alpha. *Psychometrika, 74*(1), 107–120. https://doi.org/10.1007/s11336-008-9101-0

Silvia, P. J. (2008). Discernment and creativity: How well can people identify their most creative ideas? *Psychology of Aesthetics, Creativity, and the Arts, 2*(3), 139–146. https://doi.org/10.1037/1931-3896.2.3.139

Spiel, C., & von Korff, C. (1998). Implicit theories of creativity: The conceptions of politicians, scientists, artists and school teachers. *High Ability Studies, 9*(1), 43–58. https://doi.org/10.1080/1359813980090104

Sternberg, R. J. (1985). Implicit theories of intelligence, creativity, and wisdom. *Journal of Personality and Social Psychology, 49*(3), 607–627. https://doi.org/10.1037//0022-3514.49.3.607

Storme, M., & Lubart, T. (2012). Conceptions of creativity and relations with judges' intelligence and personality. *The Journal of Creative Behavior, 46*(2), 138–149. https://doi.org/10.1002/jocb.10

Szen-Ziemiańska, J. (2013). Psychometric and self-rated creativity of Polish managers: Are implicit theories of creativity relevant to self-assessment? *The International Journal of Creativity & Problem Solving, 23*(1), 59–69.

Tinsley, H. E., & Weiss, D. J. (2000). Interrater reliability and agreement. In H. Tinsley & S. Brown (Eds.), *Handbook of applied multivariate statistics and mathematical modeling* (pp. 95–124). Academic Press.

Tsai, K., & Cox, S. (2012). Business students' beliefs about creativity. *Journal of Business, 4*(2), 1–10.

White, A., & Smith, B. L. (2001). Assessing advertising creativity using the creative product semantic scale. *Journal of Advertising Research, 41*(6), 27–34.

Yang, Y., & Green, S. B. (2011). Coefficient Alpha: A reliability coefficient for the 21st century? *Journal of Psychoeducational Assessment, 29*(4), 377–392. https://doi.org/10.1177/0734282911406668

Waste Creatively: The Intersection of Creativity and Consumerism

Beth Hennessey

> We have learned that the way to break the vicious deadlock of a low standard of living is to spend freely, and even waste creatively. (Frederick, 1929, p. 81)

Keywords Consumerism · Distributed creative participation · Distributed cultural participation

"Waste creatively." This was *Ladies Home Journal* consulting editor and home economist Christine Frederick's 1929 admonition to housewives whom she believed needed to be transformed into perpetual purchasers. In her influential and, for her time, amazingly insightful book entitled *Selling Mrs. Consumer*, Fredericks rejected the idea that products should be made to last and instead argued for "stylistic obsolescence" as a kind of "creative waste" that would keep the industrial economy with its mass production of goods running smoothly. In Frederick's view, creativity and consumerism were entirely intertwined. But are these two constructs systematically related? And if so, How?

1 Historical Perspective

The answer to these questions is very much bound by historical time and place and how we choose to conceptualize creativity. In ancient times, it was believed that creativity could only come from the Gods. The Greeks and Romans credited the Muses, the goddesses of invention, for the creativity of mortals. Humans were seen only as the vessels, the conduits whereby creative acts were accomplished through divine intervention (Sawyer, 2006; Weiner, 2000); and no one during this time period could even conceive of the concept of consumerism.

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The term "genius" was first used to describe creative individuals in the eighteenth century (Sawyer, 2006); and later, beginning in the early nineteenth century, Romanticism came to dominate Western philosophical thought. During this "Romantic" period, the focus turned to the emotional or sentimental aspects of creativity (Sawyer, 2006; Weiner, 2000). Creativity was now believed to stem from the special cognitive abilities or unique personality traits of the individual rather than the divine; and those who displayed creative abilities in the arts or other creative domains were looked upon as creative geniuses (Sawyer, 2006; Weiner, 2000).

This "lone genius" idea, in fact, dominated contemporary thinking about creativity for quite some time. According to this view, creativity is thought to stem from the unconscious and often appears in sudden bursts of insight (Sawyer, 2006). Within this conceptual framework, there was no room for a consideration of consumers, or anyone or anything else, beyond the creator him or herself. The notion of consumerism stood in direct conflict with the Romantic view of creativity. However, over time, a growing group of researchers came to argue that this "lone genius" view in no way captures the complexities of the creative process. In more recent years, some contemporary theorists have argued convincingly for the abandonment of this "myth" (Montuori & Purser, 1995, 1999; Weisberg, 1986, 1993), calling instead for an application of Vygotskian principles to the study of creativity (John-Steiner, 2000). Within this Vygotskian, person-culture interactional framework, knowledge construction in general and creative behavior in particular is seen as a social, motivational, cooperative venture (Moran & John-Steiner, 2003, 2004). Creative behavior is seen as a product of social/environmental influences and others interacting with the creator. Similarly, Glăveanu's (2010b, 2010c) work on creativity as distributed cultural participation incorporates a three-way focus on creator, audience and existing artifacts. This theory, based on the work of Dewey, rests on an action framework for the analysis of creative acts and operationalizes creativity as a relational and intersubjective phenomenon (Glăveanu et al., 2013), much like the conceptualization in a Vygotskian framework.

Gone are the days when creativity scholars can justify the stance that creative output stems from the largely *impersonal* connection between individuals and their environment, most especially other persons in their environment. Creativity does not come about in a vacuum; and, in the words of Glăveanu, researchers must now "think more beyond the 'I' and towards the 'We' of creativity (Glăveanu, 2011, p. 474). Even a cursory examination of the memoirs of Nobel laureates and other individuals credited with groundbreaking scientific discoveries or the introduction of entirely new movements in the arts reveals that these "geniuses" virtually never work alone. Historical accounts abound with concrete examples of the importance of collaboration. Wilhelm Fleiss served as a constant supporter and critic of Sigmund Freud as Freud developed his psychoanalytic theory and techniques. The groundbreaking musical creativity of the Beatles did not stem from the contribution of any one band member working in isolation but instead came from a constant exchange and synergy between John Lennon and Paul McCartney, as well as their managers. And at the height if his creative period, Picasso rendezvoused nightly in Parisian cafés, soliciting feedback and moral support from colleagues, collaborating with Brague on the development of Cubism and sparring with Matisse.

2 More Contemporary Conceptions

While these biographical accounts and others like them fly in the face of the notion of the "lone genius", they fit perfectly well with the far more contextualized view that creativity is a socio-cultural phenomenon that incorporates not only the expertise, talent and inspiration of any one individual, or team of individuals, but also a complex web of social influences including support networks, collaboration, education and cultural background. In fact, some contemporary theorists (e.g., Weisberg, 1986, 1993) go so far as to maintain that there is nothing particularly special about the person (or team) credited with the act of creation at the center of this web. According to this approach, what society labels as "creativity" results from nothing more than the thought processes that underlie everyday action and idea generation, coupled with an unusual amount of perseverance and hard work. Yet even if we are to adopt this still somewhat controversial idea that creative thinking is no different than everyday thinking, we must acknowledge the fact that as a society, we continue to label only a relatively small subset of scientific accomplishments, musical pieces or examples of the visual arts as creative. What are the criteria at play here?

While earlier conceptions of creativity were centered on the stipulation that a product or idea be novel, more recent operationalizations of creativity typically incorporate two complementary requirements: Novelty and appropriateness/usefulness (Amabile, 1996; Lubart, 2000; Sternberg & Lubart, 1996). The addition of this appropriateness criterion fits nicely with the growing realization that creativity is as much a socio-cultural as it is an individual act. Assessments of the appropriateness of a product, idea or problem solution must, by definition, be made by society, or at the very least by the subset of society in which a new product, approach or idea is being vetted. In other words, contemporary definitions of creativity are very much based on consensual assessment. "A product or response is creative to the extent that appropriate observers agree it is creative" (Hennessey et al., 2011, p. 253). This focus on the consensus of others fits nicely with considerations of consumerism. In fact, it may be much more than mere coincidence that the evolution of theoretical conceptions of creativity parallels closely the popularization of the concept of consumerism.

3 The Rise of Consumerism

Google's Ngram viewer reveals that, in the English lexicon, the use of "consumerism" was extremely infrequent until at least 1960. Although the term was first used in 1915 and sporadically showed up in the press from time to time, it was not until the 1950s that the word "consumerism" came to be employed with any regularity. Some historical accounts credit the popularization of this term to John S. Bugas, a vice president of the Ford Motor Company, who in 1955 set out to contrast the American economy to that of the Soviet Union and proposed that "consumerism be substituted

for "capitalism" as a more appropriate depiction of the U.S. system (Eriksson & Vogt, 2013). This period in our nation's economic history, as well as the economic history of many other Western industrialized nations, saw unprecedented economic growth. The post-war business cycle was accompanied by almost 100% full employment. The U.S. population had grown by 10.5% in 10 years, and wages were double or triple what they had been in 1935 (U.S. Department of Labor, 2006). In fact, the average family's income had increased by 178% since 1935 and was nearly six times greater than in 1901. Even after adjusting for inflation, households at mid-century paid a far smaller percentage of their total revenues for food, clothing and housing than they had in the past (U.S. Department of Labor, 2006). The U.S. economy was booming. Economic growth saw a 37% increase in the 1950s and there was an unprecedented availability of commodities to be purchased, including "luxury" goods. With this new economic order came the perhaps inevitable ideology of consumerism. If the economy was to keep growing, citizens needed to be encouraged to acquire goods and services at an ever-increasing rate. Towards this end, mass media stepped in to fuel the public's desire and convince them that the clothing they wore and the cars that they drove could transform their lives and deliver true happiness. Consumption shifted from a means to meeting material needs to a vehicle for attaining self-fulfillment, immediate gratification and prestige, not to mention the creation of a new personal identity (Hamilton, 2010). The concept of "life style" was born; and, slowly but surely, the public was trained to define themselves through what and how they consumed. Cultural norms were shifted (Assadourian, 2013).

Fast forward to today, when consumerism feels so natural and is such an integral part of our global culture that it virtually goes unnoticed. It is impossible to imagine society without it. However, the idea of consumerism can carry with it a somewhat negative connotation. Concerns about sustainability and "conspicuous consumption" are increasingly being voiced (Hamilton, 2010). In the purer sense of the term, "consumerism" captures all of the many complex relations, both positive and negative, of production and exchange in the social, political, cultural and technological culture. Contemporary notions of consumerism tend to emphasize the connection between participation and consumerism: With the citizen consumer making free choices in the marketplace (Eriksson & Vogt, 2013).

In much the same way that creativity has come to be viewed as distributed, cultural participation (Glăveanu, 2010a, 2010b, 2010c, 2014a; Moran & John-Steiner, 2003, 2004; Sawyer & DeZutter, 2009), so too consumerism now incorporates an element of distributed, creative participation. Rather than simply use products and services in the ways that were intended, so-called "creative consumers" *change* products; and those product changes or new ways of accessing services can have profound consequences. While some particularly astute companies welcome and even leverage such customer innovation, others sometimes respond negatively, ignoring or even restraining customer creative input ("The Rise", 2005). Emphasizing this interplay between creator(s) and consumer(s), Moran (2015) offers a new and provocative view of creativity. According to this formulation, "creativity is the label for the aggregated, time-dependent, subjective judgments by creators and adopters".

4 Real Artists Don't Paint Pictures to Match Couches

In my own extended family, one quip heard fairly frequently makes a distinction between commercial/consumer-driven art and "real art". My artist husband and graphic design relatives remind the rest of us that real artists don't paint pictures to match their clients' couches. Fine art, creative art and the principles of mass-production and consumerism just don't mix. But in reality, unless they are independently wealthy or of the caliber of a Picasso, almost every artist, architect, composer, director, designer or other professional hoping to earn a living in one of the creative industries must consider the tastes and wishes of clients and potential consumers out there in the marketplace.

Is there a negative effect on the level and quality of creative products when creators need to consider the consumer? Empirical studies of the "social psychology of creativity" reveal that extrinsic constraints such as these, constraints including the receipt of a commission/promise of reward, expected evaluation, or competition, serve to kill creators' intrinsic motivation and creativity of performance (Amabile, 1983, 1996; Hennessey, 2003). As argued previously, creativity does not come about in a vacuum. Not only do many creative professionals find distasteful the need to accommodate their personal vision to the whims and wishes of both their bosses and consumers, but this accommodation can, and frequently does, significantly undermine the quality of their performance as well.

Pop artist Andy Warhol famously circumvented this problem. Biographers and friends report that Warhol came to welcome and wished to celebrate the democratization and proliferation of goods in the US. He viewed the newfound culture of consumerism as a powerful force for the unification of America and made everyday consumer objects the focal points of his art (Gompertz, 2013). Applying the same assembly line techniques in force in the factories, he abandoned his easel and oils and opted instead for silkscreens and polymer paints. Warhol's art came as the result of mass-production and was devoid of the personal. In fact, he went so far as to term his assistants the "Factory", giving them instructions as to color and number and other variations so that, in many cases, he would not even touch some of his "own" works. Everything was about repetition and replication. In fact, Warhol was said to relish the fact that people would talk about their desire to buy "a Warhol", but almost never did they specify which Warhol. By the end of his life, Warhol had successfully turned even himself into a consumer brand (Gompertz, 2013).

5 Consumerism Impedes Our Creativity

Warhol' may have been successful at using commercialism to his advantage, but he was definitely the exception to the rule. The majority of creative professionals, as well as researchers and theorists whose work focuses on creativity, see commercialism and mass-production as a threat. In their view, there are only two options: Artists,

designers, architects and the like can either embrace consumerism or strive to be true to their creative impulses. But never both! In their view, mass-production and novelty are mutually exclusive. Consumerism and creativity are mutually exclusive. Or are they?

A host of different arguments have been made that consumerism is antagonistic toward creativity—not only the creativity of professionals but the creativity of the consuming public as well. In the art world, an elite and relatively small group of gallery directors, museum curators and critics have long dictated not only what the rest of us will deem as "good" or "creative" art, but also what the viewing (and consuming) public will be exposed to in the first place. The highly recommended 2006 movie *Who Gets to Call It Art?* chronicles the work of New York's Metropolitan Museum of Art Director Henry Geldzahle, who is credited by many with introducing pop art to the American consciousness. The centerpiece of this film is the telling of how the controversial and hugely influential show "New York Painting 1940–1970" came to be. Although the MET is an expansive place and this exhibition was one of the largest ever before conceived, Geldzahle still had to pick and choose. Almost single-handedly, it was he who selected which pieces and which artists would be included and which would be left out.

The general public, the non-elite consumers, have little, if any, say as to what art they will see in galleries, museum exhibitions, or theatres. They have no opportunity to exercise their creativity as they interpret the work of others. Instead, they are told what is good and what is not. They are told what this or that piece "means" and they are stripped of their confidence about their own interpretations, likes or dislikes. "Good" art is the art that the experts, the critics, the sellers say is good. Good visual art is expensive art. Consumerism drives aesthetic judgment. As argued by Florida (2003), this "creative class", composed of critics, gallery owners, museum directors, producers, directors and unbelievably wealthy investors who support them, not only dictates our aesthetic judgments but also drives our cities' economic growth.

But this process can, and does, work in reverse as well. In the art world, commercial hype and artificially high market values prevent the majority of consumers from developing their own creative "sense" or even purchasing art and enjoying first-hand the creativity of others; but when it comes to more mundane, everyday consumer goods, readily available products at cheap prices can be the creativity killers. When our existing gizmos break, the majority of us will choose to immediately purchase new ones rather than attempt to make a fix. And even if a current gizmo is working just fine, we are much more likely to go out and buy the latest new and improved version than we are to try to jerry-rig improvements to our existing model. It is just too easy and too tempting to be the constant consumer, or maybe even among the first adapters, of other people's creativity. And, as we fill our world with others' creativity, the possibility of our exercising our own creativity greatly diminishes. If we immediately place an order on Amazon or run to our local Walmart or Ace Hardware every time we have a need or a want to satisfy, we deprive ourselves of the time it takes to come up with a creative solution. We become creatively lazy.

Necessity is the mother of invention. Although the origin of this proverb is unclear, Plato is often given credit for this idea that persists even today in the popular press. In an especially influential *Newsweek* article appearing in 2010, readers were told that, "It's also true that highly creative adults frequently grew up with hardship. Hardship by itself doesn't lead to creativity, but it does force kids to become more flexible—and flexibility helps with creativity" (Bronson & Merryman, 2010). My own search of the scholarly literature failed to turn up empirical evidence to back up this link between hardship/deprivation and creative behavior, but the majority of us need not be concerned either way. Our consumer-driven economy makes deprivation highly unlikely (or at least this was the situation pre-COVID).

6 Consumerism and Creative Development in Children

We are all too busy consuming to be creative. We shop, comparison shop, troll the Internet for bargains, and spend our lives lusting after the "next big thing". We devour social media at alarming rates and strive to dress like and live like the movie stars and music performers we admire most. We have no time to think, to use our imaginations or to explore our own creative impulses. Young people and even young children are also caught in this consumerism trap. They too are barraged by media messages encouraging purchasing and tying the consumption of material goods to their developing self-image. In effect, children are now largely viewed by marketers in terms of their spending capacity. The structure of childhood is eroding and children are suffering serious physical, emotional and social harm directly driven by the drive to consume (Hill, 2011).

Perhaps nowhere is this consumer-driven transformation more evident than in the area of play. Like the adults who love and care for them, they too are playing and exploring far less than they used to. From an early age, children too are being groomed to become hard-core consumers. Advertisers work purposefully to introduce even young preschoolers to our material culture (see especially the work (published in French) of Gilles Brougère), and there is growing evidence that toy manufacturers and marketers are significantly altering the frequency of and style of children's play. If these claims are true, they may prove to have dire consequences.

The work of theorists including Piaget, Vygotsky, and Singer and Singer underscores the importance of play for children's emotional development and cognitive processing as well as for the development of their imaginations and creativity. The ability to pretend within the context of imaginary play is central to early creativity development (Wood & Attfield, 2005). In fact, some researchers (e.g., Marzollo & Lloyd, 1972) go so far as to argue that if the opportunity to play is not made available to children, or if the range of play possibilities is severely limited, dangerous and irreversible consequences can result. Most especially, if creative exploration is not engaged in during the naturally creative childhood years, more advanced abilities to think originally and with maturity may not be developed later in life.

In a particularly persuasive paper, O'Connor (2012) explores the impact of commercialized play on children's cognitive, social and creative development in Ireland. Television directed at preschoolers in that nation is now entirely merchandise-driven. In fact, some observers have argued that televised programming aimed at children amounts to nothing more than half-hour-long toy commercials (O'Connor, 2012). Storylines are specifically developed to create interest and develop brand loyalty. This branding pervades all aspects of a child's life—from the foods they eat, to the toys they play with, to the images on their clothes and the ways in which their rooms are decorated. Moreover, when away from the TV set, children's imaginary play continues to focus on these televised characters and their adventures (O'Connor, 2012). Importantly, these recreations are far more controlled and rule-bound than were the plots created by children in previous generations. The marketed storyline directs the play rather than the child's own imagination. Play is in no way immune from the commercial. In fact, the commercialization of childhood has become an internationally recognized phenomenon (Calvert, 2008). In the words of O'Connor, "… the modern child is exposed to pressure from an early age to see themselves as consumers. It [the commercialization of childhood] is the result of the evolution of childhood into a marketing opportunity" (O'Connor, 2012, p. 55). And the development of children's imagination and creativity rests in the balance.

7 The Other Side to the Story: Creativity at the Core of Consumerism

Lost opportunities for pretend play. Gatekeepers deciding just what the rest of us will see or deem as important or creative art, design or innovation. The conspicuous consumption of tangible goods and social media. And the potential that the extrinsic constraints of the commercial marketplace will serve to kill the intrinsic motivation of artists and designers. None of these factors bode well for the promotion of creativity among the masses. But there is another side to the story as well. Emerging markets allow for bottom-up innovation, and increasingly available creative technologies now frequently offer the consumer the opportunity to customize products and experiences. Online gaming is one prime example. Game creation now frequently involves a mix of professional developers and a network of game players and testers who give extensive feedback and input surrounding creative design (Potts et al., 2008). As observed by Shorthose (2004), the traditional distinction between consumption and production is becoming blurred, as the act of consumption becomes the moment of production. More and more, user-generated content/open-source innovation and even hacking have come be seen as creative acts in and of themselves. No longer does it make sense to view consumers as being at the dead-end of a step-wise progression in creativity and innovation. Creativity may be a prerequisite for innovation and product development and production, but consumer-driven creativity can (and often does) also come *after* a product has been marketed.

As argued earlier, in much the same way that creativity has come to be seen as distributed cultural participation, so too consumerism is now seen to incorporate an element of distributed creative participation. According to this systems view, consumers are anything but powerless or passive. Devotees of a particular brand do not just blindly accept the images and affordances the advertisers and marketers have decided to promote. Instead, they actively "decode" the brand, incorporating into the construction of their own image only the elements that are important to them. In fact, the most loyal consumers create their own brand materials. Griffiths (2014) offers examples of Harley Davidson owners who post entries about their travels on the corporate website. Another example from my own consumer experience would be devotees to the Orla Kiely brand who market on Etsy and Ebay hand-made cell phone covers, bags and home goods bearing Kiely's signature stem patterns. This co-creation, as it has come to be called, is everywhere. In fact, when it comes to the consumption of technological communication and social media products, consumerism literally demands creativity. We are constantly inventing and reinventing our profiles, our images on these platforms, orchestrating exactly how we wish to be seen by others. Even the quest to find and buy "just the right" handbag, watch, sunglasses or car can be seen as a creative act. As consumers, we are constantly re-creating ourselves, developing a new image and altering how we want to see ourselves and how we wish to be seen by others. Any planned purchase has to complement both our self-image and the image we are trying to project.

A growing number of researchers and theorists have begun to apply their expertise in the areas of marketing, consumer behavior and creativity to the study of consumption/consumerism as a creative act. Some recent scholarship (e.g., Potts et al., 2008; Taillard et al., 2014) focuses on Internet use and its role in facilitating communication among consumers and between consumers and producers. According to this view, the Web "takes away much (if not all) of the traditional information asymmetry between producers and consumers. It shifts control back to consumers, and allows them to exchange information with each other, to act publicly, either individually or collectively in relation to the brand" (Taillard & Glăveanu, 2012, p. 520). Consumers consume in ever evolving creative ways; and in so doing, they add value to their own experience of the brand and have the potential to take value out of and away from the brand if they criticize or complain publicly. Taillard describes brand forums as "veritable petri dishes of creativity" (Taillard & Glăveanu, 2012, p. 520). Enthusiastic and sometimes even passionate consumers interact spontaneously, share, solve problems, and create new practices. Over time, what starts out as individual conversations builds into creative outcomes—fueling the argument that consumerism is best conceived of as distributed creative participation.

8 Education as Commodity

As a conclusion to this chapter, I will focus on what in my own view is an especially disturbing and dangerous development at the intersection of creativity and consumerism. I have been trained as a social-developmental psychologist and the bulk of my research addresses creativity in the classroom. My decision to focus on this area was driven by my own previous personal experience as an elementary school teacher. I was concerned about what I saw as a slow but steady decline in my young students' intrinsic motivation and excitement about learning as well as their creativity and decided to try to do something about it. My colleagues and I now understand a great deal more about the interplay between motivational orientation and creativity of performance than we did just a few decades ago when I started graduate school. Over 35 years of empirical investigation tells us that intrinsic motivation is conducive to creativity, whereas extrinsic motivation is usually detrimental (Amabile, 1983, 1996; Hennessey, 2003). As outlined earlier in this paper, extrinsic constraints such the expectation of a reward, expected evaluation, or competition, serve to kill creators' intrinsic motivation and creativity of performance. And, as it turns out, these killers of task motivation and creativity are just as powerful with 5, 10 and 15-year-olds as they are with creative professionals in the workplace (Hennessey, 2003).

Intrinsic motivation is an especially delicate and fleeting state. This essential ingredient for creative performance is easily destroyed, and educators wishing to preserve and promote their students' motivation must work diligently to do so. Student intrinsic task motivation cannot be taken for granted. When given a choice of open-ended tasks requiring a creative solution, extrinsically motivated students tend to opt for the easiest possible problems (Condry & Chambers, 1978; Pittman et al., 1982). Intrinsically motivated students, on the other hand, are more likely to take risks and explore solutions to questions or activities that represent for them an appropriate level of difficulty and challenge. As argued previously, while intrinsic motivation and creative behavior are typically conceived of as resulting from an essentially internal phenomenological state, they must also be seen as social phenomena. Even the most gifted and talented of students cannot go it alone. They need classroom and overall school environments that promote an intrinsic motivational orientation and that are reasonably free of extrinsic constraints. They also need the "license" to experiment with ideas and to make mistakes as well as the time and materials to do so. Research conducted by investigators like Cordova and Lepper (1996) calls for the construction of classroom situations that allow for multiple opportunities for students to exercise self-determination coupled with the contextualization and personalization of lessons. Individualized or small-group instruction incorporating elements of choice in terms of what to learn and how to learn is, the data tell us, one of the key tools teachers can use to maintain and grow student intrinsic motivation.

Having spent my entire academic career exploring the question of how best to set up classroom environments so that they are optimally conducive to student intrinsic motivation and creativity, it is probably easy to understand the excitement I felt

in 2011 when I first learned that my home state of Massachusetts had passed a bill requiring that schools provide frequent, high quality opportunities for students to engage in creative work. A fundamental component of this mandate was the Massachusetts Creativity Challenge Index spearheaded by playwright and founding partner of a Boston public relations firm Dan Hunter (Robelen, 2012). This comparative measure of schools focused on inputs (e.g., resources and opportunities for students to demonstrate their creativity) rather than student outcomes, with its developers arguing that, when it comes to creativity, the assessment of outputs is necessarily subjective (Rosenberg & Hunter, 2016) and was designed with the overarching goal of providing incentive for teachers to use their creativity and to be recognized for their innovative talents. In the words of Hunter, "Teachers are necessarily creative" (Hunter, 2008, p. 23).

Mindful of the overwhelming research showing that competition is detrimental to intrinsic motivation and creativity (Amabile, 1983, 1996; Hennessey, 2003), I was encouraged by this lack of direct assessment of students. But what of the creativity of the teachers who were charged with promoting creativity in their classroom? I worried that this effort being spearheaded by well-meaning politicians, business leaders and educators might do more harm than good.

In the United States, classroom teachers have long been burdened by the pressures that come with state-based as well as federally legislated indices. On a national level, the No Child Left Behind (NCLB) standards-based framework of 2002 ranked schools within communities and across states based on standardized testing outcomes; and although technically illegal, teacher salaries and retention decisions were also often tied to these student test scores. Over time, NCLB was replaced with the "Every Student Succeeds Act" of 2015 and associated "Common Core" curricular guidelines. And as if these high-pressure initiatives were not enough, the U.S. Department of Education also soon instituted "Race to the Top," yet another highly competitive program pitting schools against one another as they vie for generously funded grants in support of trail-blazing reform efforts.

Given the pressures of these various standards-based frameworks, regulations and testing, it is the rare teacher who can find the time, much less the motivation, to build opportunities for student creativity into the school day. The last thing teachers need is a "creativity" index that amounts to nothing more than another punitive checklist against which their own performance and the performance of their students will be judged. As it turns out, the Massachusetts Creative Challenge Index never got off the ground; but it is inevitable that other similar initiatives will be implemented in the future. What is happening here is that creativity is being viewed as a commodity. Even the term "index" gets us thinking about the rise and fall of the Dow Jones Industrial Average or the S&P 500. Craft (2008) convincingly presents this view that of creativity in schools has become almost entirely intertwined or infused with Western consumerism–creativity in service of the market. How did this happen?

An examination of the American popular press' "take" on the status of education reveals a steadily increasing number of newspaper and magazine articles focused on the inadequacies of the public schools. Rankings of educational systems worldwide consistently seem to show that when it comes to student performance, most

especially in the STEM disciplines, the US is at or near the bottom of the barrel as compared to not only other industrialized nations but also some developing countries as well. There are many reasons to argue that these international comparisons are oversimplified and misleading (see Carnoy & Rothstein, 2013), but of particular interest to me has been how this conversation has recently turned to specific concerns about American students' abilities to think creatively. The previously mentioned 2010 article appearing in *Newsweek* (Bronson & Merryman, 2010) focused on what the authors describe as a "creativity crisis". Citing the research of Kyung Hee Kim at the College of William and Mary (Kim, 2011), they report the finding that, like IQ scores, creativity scores (as measured by the Torrance Tests of Creative Thinking or TTCT) had, for quite some time, been steadily rising. But then something happened. Beginning in 1990, creativity scores for students in the US began sloping downward, with the decrease for kindergarten through third graders especially significant.

At the same time that these bleak data about the creativity (or lack thereof) of America's school children were being released, there came a call from U.S. corporations and businesses large and small for a revamping of the U.S. public school curriculum. Employers now consistently report that young people graduating from high school and college in the US do not exhibit the skills they are looking for in potential hires. Long gone are the days when an 18-year-old, recent high school grad will enter the workforce and utilize essentially the same set of skills across his or her lifetime of employment. The acquisition of "core knowledge" in a variety of subject areas is no longer nearly enough. The skills necessary for succeeding in the workplace are rapidly changing. In fact, no one can predict exactly what constellation of competencies will be needed 10 years from now, much less in decades to come. Many of the jobs to be held by the next generation of workers likely do not yet even exist. Yet the schools continue to push a curriculum developed 100 or more years ago. So-called skills for the twenty-first century—knowing how to learn, ways of thinking that involve creativity, risk taking, critical thinking, problem-solving, decision-making coupled with ways of working that include communication and collaboration are generally not being emphasized or nurtured in school environments. While some of the more recent educational rhetoric pays lip service to this list of priorities from employers, the reality is that NCLB, Common Core and Every Student Succeeds regulations leave little room for their development.

Students are rarely, if ever, given the opportunity to engage in long-term, creative-type, highly challenging open-ended activities and yet this is exactly the kind of experience they need if they are to meet the realities that await them in the workplace. A creativity index might make some sense were it not for the fact that rather than replace the high-stakes tests that have come to dominate the US educational landscape, the general aim has been to supplement those tests with yet another assessment, this time a checklist of how many opportunities for creativity are being offered to children at each school. Of course, all of the science fairs and school plays in the world will not guarantee that our children's creative skills are increased. Although undoubtedly well intentioned, the primary difficulty with the creativity index approach is that it stems from a consumer-driven tendency to view human beings, even children in school, as a means rather than end. American students are at risk of being valued not for their

inherent intrinsic value as human beings but for the instrumental value they can bring to the marketplace as workers (and consumers). Today, perhaps more than any other time in our nation's history, education is being seen in economic terms—produce more highly skilled workers and boost the economy. Graduate young people well prepared to enter the workplace and reduce the welfare rolls. Yes, creativity will be essential as we strive to turn around our schools. But the education of our children, their very futures, should not be driven by business models leading to the production of increasing numbers of consumers.

We must be vigilant about where our educational reforms may lead us. In fact, it is essential that we closely monitor the ever-changing dynamic between creativity and consumption across all economic sectors. Yes, creativity and consumerism are intertwined in interesting, exciting and often productive ways. The economic health and growth of any capitalistic system rests on the willingness and ability of its citizens to acquire goods and services at an ever-increasing rate; and, in large part, it is the creativity of those who produce and market new products and services that assures that the public will keep buying. But it is essential to remember that creativity is far more than just a marketing tool. Creativity is the fundamental force that drives civilizations forward, and the generation of new scientific and artistic insights must never take a back seat to the demands of the marketplace.

9 In Conclusion

A search of the literature produced over the past 10 years, surprisingly showed that there was very little work added on the intersection between creativity and consumerism. To his credit, Glăveanu (2014b) continues his insightful study of the psychology of creativity with a critical reading of the literature and the observation that our contemporary ideas about creativity often emphasize economic value and aspects of consumerism and capitalism. Hamilton (2010) and a few others explore consumerism, most especially conspicuous consumption, and its impact on societal inequalities. And a few other scholars briefly explore consumerism and its effect on children's play and creativity (e.g., O'Connor, 2012). But for the most part, despite its significance for a variety of societal domains, the creativity-consumerism intersection remains largely unexplored. The reasons behind this gap in the literature are undoubtedly many. The primary driving force may be the fact that the complexities of this relation make it especially difficult to quantify much less investigate empirically. But investigate we must!

One potentially fruitful starting point might be to examine how the ongoing COVID pandemic has necessitated high levels of both personal and societal creativity and has impacted consumerism in a wide variety of ways (see Olbert, 2021). Schools, hospitals, work environments, service providers, retailers, and restaurants have been

virtually re-invented to accommodate the need for social distancing. Creative solutions designed to keep afloat every aspect of society, including the economic marketplace, have transformed consumerism in ways no one could have possibly envisioned. The socio-cultural shifts brought about by COVID, the rapid changes in lifestyle, values, and individual/societal priorities, mean that our existing views of consumerism (and creativity!) must be reexamined to accommodate this new reality.

References

Amabile, T. M. (1983). The social psychology of creativity: A componential conceptualization. *Journal of Personality and Social Psychology, 45*(2), 357–376.

Amabile, T. M. (1996). *Creativity in context: Update to the social psychology of creativity.* Westview.

Assadourian, E. (2013). Re-engineering cultures to create a sustainable civilization. In E. Assadourian & T. Prugh (Eds.), *State of the world: Is sustainability still possible?* (pp. 113–125). Island Press.

Bronson, P., & Merryman, A. (2010, July 10). Creativity in America: The creativity crisis. *Newsweek*. Retrieved from http://www.newsweek.com/creativity-crisis-74665

Calvert, S. (2008). Children as consumers: Advertising and marketing. *The Future of Children, 18*(1), 205–234.

Carnoy, M., & Rothstein, R. (2013). *What do international tests really show us about U.S. student performance*. Economic Policy Institute. Retrieved from http://www.epi.org

Condry, J., & Chambers, J. (1978). Intrinsic motivation and the process of learning. In M. R. Lepper & D. Greene (Eds.), *The hidden costs of reward* (pp. 61–84). Lawrence Erlbaum.

Cordova, D. L., & Lepper, M. R. (1996). Intrinsic motivation and the process of learning: Beneficial effects of contextualization, personalization and choice. *Journal of Educational Psychology, 88*(4), 715–730.

Craft, A. (2008). Tensions in creativity and education: Enter wisdom and trusteeship? In A. Craft, H. Gardner, & G. Claxton (Eds.), *Creativity, wisdom and trusteeship: Exploring the role of education* (pp. 16–34). Corwin Press.

Eriksson, K., & Vogt, H. (2013). On self-service democracy: Configurations of individualizing governance and self-directed citizenship. *European Journal of Social Theory, 16*(2), 153–173.

Florida, D. (2003). *The rise of the creative class: And how it's transforming work, leisure, community, and everyday life.* Basic Books.

Frederic, C. (1929). *Selling Mrs. Consumer*. The Business Bourse.

Glăveanu, V. P. (2010a). Creativity as cultural participation. *Journal for the Theory of Social Behavior, 41*(1), 48–67.

Glăveanu, V. P. (2010b). Paradigms in the study of creativity: Introducing the perspective of cultural psychology. *New Ideas in Psychology, 28*(1), 79–93.

Glăveanu, V. P. (2010c). Principles for a cultural psychology of creativity. *Culture & Psychology, 16*(2), 147–163.

Glăveanu, V. P. (2011). How are we creative together?: Comparing sociocognitive and sociocultural answers. *Theory & Psychology, 21*(4), 473–492.

Glăveanu, V. P. (2014a). *Distributed creativity: Thinking outside the box of the creative individual*. Springer.

Glăveanu, V. P. (2014b). The psychology of creativity: A critical reading. *Creativity, 1*(1), 10–32.

Glăveanu, V., Lubart, T., Bonnardel, N., Botella, M., de Biaisi, P.-M., Desainte-Catherine, M., Georgsdottir, A., Guillou, K., Kurtag, G., Mouchiroud, C., Storme, M., Wojtczuk, A., & Zenasni, F. (2013). Creativity as action: Findings from five creative domains. *Frontiers in Psychology, 4*(176).

Gompertz, W. (2013). *What are you looking at?: The surprising, shocking, and sometimes strange story of 150 years of modern art*. Dutton.
Griffiths, J. (2014). *Create more—More creativity* [Web log comment]. Retrieved from http://www.planningaboveandbeyond.com/planningcraft/createmore/morecreativity/
Hamilton, C. (2010). Consumerism, self-creation and prospects for a new ecological consciousness. *Journal of Cleaner Production, 18*(6), 571–575.
Hennessey, B. A. (2003). The social psychology of creativity. *Scandinavian Journal of Educational Psychology, 47*(3), 253–271.
Hennessey, B. A., Amabile, T. M., & Mueller, J. S. (2011). Consensual assessment. In M. A. Runco & S. R. Pritzker (Eds.), *Encyclopedia of creativity* (2nd ed., Vol. 1, pp. 253–260). Academic Press.
Hill, J. A. (2011). Endangered childhoods: How consumerism is impacting child and youth identity. *Media, Culture & Society, 33*(3), 347–362.
Hunter, D. (2008). A proposal to nurture American creativity: The creative challenge index. *MASCD Perspectives, Fall*, 22–24. Retrieved from https://www.mascd.org
John-Steiner, V. (2000). *Creative collaboration*. Oxford University Press.
Kim, K.-H. (2011). The creativity crisis: The decrease in creativity thinking scores on the Torrance tests of creative thinking. *Creativity Research Journal, 23*(4), 285–295.
Lubart, T. I. (2000). Models of the creative process: Past, present and future. *Creativity Research Journal, 13*(3–4), 295–303.
Marzollo, J., & Lloyd, J. (1972). *Learning through play*. Harper & Row.
Montuori, A., & Purser, R. E. (1995). Deconstructing the lone genius myth: Toward a contextual view of creativity. *Journal of Humanistic Psychology, 35*(3), 69–112.
Montuori, A., & Purser, R. E. (1999). Social creativity: Introduction. In A. Montuori & R. Purser (Eds.), *Social creativity* (Vol. 1, pp. 1–45). Hampton Press.
Moran, S. (2015). Creativity is a label for the aggregated, time-dependent, subjective judgments by creators and by adopters. *Creativity: Theories—Research—Applications, 2*(1), 64–69.
Moran, S., & John-Steiner, V. (2003). Creativity in the making: Vygotsky's contribution to the dialectic of creativity and development. In K. Sawyer et al. (Eds.), *Creativity and development* (pp. 61–90). Oxford University Press.
Moran, S., & John-Steiner, V. (2004). How collaboration in creative work impacts identity and motivation. In D. Miell & K. Littleton (Eds.), *Collaborative creativity: Contemporary perspectives* (pp. 11–25). Free Association Books.
O'Connor, D. (2012). *Generation yes. How childhood consumerism is influencing play; Implications for creativity development*. In M. Bustreo & V. Russo (Eds.), *Proceedings of the child and teen consumption 2012 food consumption, communication, life styles and fashion, 5th international conference on multidisciplinary perspectives on child and teen consumption* (pp.48–60). Milan.
Olbert, M. (2021). Reimagining consumerism as a force for good: The future of consumer collectives is a human collective. *Journal of the Association for Consumer Research, 6*(4), 522–529. Retrieved from https://doi.org/10.1086/716073
Pittman, T. S., Emery, J., & Boggiano, A. K. (1982). Intrinsic and extrinsic motivational orientations: Reward-induced changes in preference for complexity. *Journal of Personality and Social Psychology, 42*(5), 789–797.
Potts, J. D., Hrtley, J., Banks, J. A., Burgess, J. E., Cobcraft, R. S., Cunningham, S. D., & Montgomery, L. (2008). Consumer co-creation and situated creativity. *Industry and Innovation, 15*(15), 459–474.
Robelen, E. W. (2012). Coming to schools: Creativity indexes. *Education Week, 31*(1), 12–13.
Rosenberg, S., & Hunter, D. (2016, December 27). *STEM to STEAM* [blog post]. https://blog.americansforthearts.org/2016/12/27/stem-to-steam
Sawyer, R. K. (2006). *Explaining creativity: The science of human innovation*. Oxford University Press.
Sawyer, R. K., & DeZutter, S. (2009). Distributed creativity: How collective creations emerge from collaboration. *Psychology of Aesthetics, Creativity, and the Arts, 3*(2), 81–92.

Shorthose, J. (2004). A more critical view of the creative industries: Production, consumption and resistance. *Capital & Class, 84*, 1–9.
Sternberg, R. J., & Lubart, T. (1996). Investing in creativity. *American Psychologist, 51*(7), 677–688.
Taillard, M., & Glăveanu, V. P. (2012). Creativity and marketing: Interview with Marie Taillard. *Europe's Journal of Psychology, 8*(4), 519–522.
Taillard, M., Voyer, B., Glăveanu, V., & Gritzali, A. (2014). Value creation and consumption: When consumer creativity creates value in online forums. *Advances in Consumer Research, 42*, 381–386.
The Rise. (2005, March 12). *The Economist.* https://www.economist.com/business/2005/03/10/the-rise-of-the-creative-consumer
US Department of Labor. (2006, May). *100 years of consumer spending: Data for the nation.* US Bureau of Labor Statistics. Report 991. Retrieved from http://www.bls.gov/opub/uscs/
Weiner, R. P. (2000). *Creativity and beyond: Cultures, values and change.* State University of New York Press.
Weisberg, R. (1986). *Creativity: Genius and other myths.* W. H. Freeman.
Weisberg, R. (1993). *Creativity: Beyond the myth of genius.* W. H. Freeman.
Wood, E. A., & Attfield, J. (2005). *Play, learning and the early childhood curriculum.* Sage.

Creativity and Consumer Behavior: An Economic Analysis

Louis Lévy-Garboua and Marco Gazel

Keywords Creativity · Consumer behavior · Adoption of novelty · Creative consumers and creative markets

1 Introduction

Creativity has been defined as "the ability to produce work that is both novel and appropriate" (Sternberg & Lubart, 1996). This definition of creativity focuses on productive activities. But, what about consumption? Is there any role for creativity in consumption? Including "household production" as a nonmarket form of production by households for their own use (Becker, 1965), creativity may be directly extended to so-called "creative consumers" who adapt, modify and transform market goods (Berthon et al., 2007) with consumer's time and creativity to produce utility increments. However, consumer creativity doesn't stop there because creative works need to be discovered and widely adopted. If they were not socially profitable, they would never become efficient innovations.

The goal of this paper is to review how economics describes creative consumer behavior and creative consumers, and to verify how far detailed creativity measures used in psychology (Lubart et al., 2011) are predictive of consumer behavior observed in economic experiments. In the next sections, we present a multidisciplinary

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literature review and illustrate empirically the economic approach to creativity in consumption with several new experiments realized by our team.[1] We hope that this economic look at consumer creativity may contribute to the development of a psychology of consumer creativity advocated, almost fifteen years ago, by Burroughs et al. (2008).

In a second section, we describe how economics can speak about creativity. Considered as a residual factor of economic growth, and a form of capital, consumer creativity requires "researchers" to discover the efficient innovations among the bulk of novel products and consumption styles, and "entrepreneurs" to exploit the most attractive new options and lead the mass of consumers towards them. Thus, a third section is devoted to consumer-researchers and the adoption of novelty whereas a fourth section is concerned with consumer-entrepreneurs who are the consumption leaders. Creative consumers, in other terms consumer-producers in economic language, are also discussed in the fourth section as they increasingly play the role of lead users. Finally, instead of considering creativity as an exogenous factor unequally distributed among consumers as in previous sections, a fifth section shows how competitive markets generate consumer creativity and distribute it more equally between all consumers. The last, sixth section, concludes.

2 Creativity in Economics

2.1 The Economic Approach to Creativity

According to Feinstein (2009), "creativity and its counterpart innovation are the root of progress and thus fundamental to the dynamics of economic systems". Thus, the potential of creativity—i.e., the potential to produce creative works—should be an important topic of interest for economists. However, although many economic studies have been devoted to economic growth and technological change, few have dealt explicitly with creativity or creative behavior so far (Florida, 2002; Menger, 2014; Romer, 1986; Rubenson & Runco, 1992; Schumpeter, 1934, are exceptions).

As a first step, an economist would ask whether creative workers are more productive than others, that is, whether creativity enhances their human capital or market skills. In the same way that investments in R&D, education, training, and the quality of labor were initially introduced into economic analysis as the "residual factors" of economic growth when the latter was explained essentially by quantities of labor and physical capital (Denison, 1962), can creativity and other personality variables

[1] These new experiments were realized for a large interdisciplinary project gathering psychologists and economists under the direction of Louis Lévy-Garboua. We acknowledge the ANR-10-CREA-008 MACCAN (Market for Art, Conformism, Creativity, and the Adoption of Novelty) for funding this research. The experiments were conducted at LEEP (Paris School of Economics and Centre d'Economie de la Sorbonne).

explain the large residual of human capital earnings functions?[2] This question has attracted a lot of attention among labor economists in the last twenty years. Bowles et al.'s (2001) influential survey of the determinants of earnings rates "non-cognitive personality variables, such as attitudes towards risk, ability to adapt to new economic conditions, hard work, and the rate of time preference" as potential factors of labor market success. Although not explicitly cited here, creativity was added to this list by other researchers, such as Sternberg (2001) and Garcia (2014). Borghans et al. (2008) set an important bridge between differential psychology and economics, confirming the predictive power of non-cognitive abilities and suggesting that they may play a role in many economic outcomes. The main idea is that each individual is endowed with a set of innate abilities and skills that are responsible for future outcomes, including schooling (Garcia, 2013).

The scarcity of research on creative behavior in the economics field may be attributed to the long neglect of the role of "non-cognitive abilities"[3]—including creativity—in economic outcomes up to the last decade (Borghans et al., 2008), and to the time cost of implementing available creativity tests (e.g., Lubart et al., 2011; Torrance, 1974).[4] However, the recent interest of economists for non-cognitive abilities and the evolution of research on creativity by psychologists in the last three decades[5] have put creativity in the spotlight for interdisciplinary research.

The new economic issue with consumer creativity is that of the adoption of novelty, of forces of conformism opposing it and forces of creativity accelerating it, of the price to be paid for an innovation to get public recognition (Sternberg & Lubart, 1995).

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[2] Human capital earnings functions predict the logarithm of earnings with years of education and training, and a quadratic function of market experience (Mincer, 1974). When available, a measure of cognitive ability like IQ is added.

[3] In the economic literature, cognitive ability refers to mental skills that are related to knowledge (memory, reasoning, learning, decision making); other skills, such as personality traits and motivation, are called non-cognitive. Creativity conveys both cognitive and non-cognitive skills.

[4] The assessment of creative potential in economic models is still problematic for two reasons. First, it takes time to measure creativity, and measurements are better done in the lab, or in any other controlled environment such as a classroom. The most reliable and complete measures use the production-based approach, in which individuals are asked to produce a work in a given creative domain. A comparison with the production of other individuals provides a measure of creativity (see, for instance, Charness & Grieco, 2019). Second, the assessment depends on the domain of creative productions (graphical or verbal) and on modes of thinking (divergent or convergent thinking).

A reliable and complete example of creative potential assessment among children at school is Lubart, Besançon and Barbot's EPoC battery (Evaluation du Potentiel Créatif, 2011), which measures the potential of divergent and convergent thinking in two different domains, namely graphic-artistic and verbal-literary. The validity of this procedure is attested by the high and significant correlation between divergent thinking and the traditional Torrance's test of creative thinking (Torrance, 1974), and by the correlation between the creativity measures of the EPoC and openness personality trait, in line to Costa and McCrae's (1992) observations that openness to new experiences facilitates divergent thinking. However, it takes about two hours to administer the complete battery of EPoC's test.

[5] Lubart et al. (2011) argue that in "the 90's, the creativity research literature increased exponentially with the appearance of new scientific journals, international conferences and book series on the topic, which coincided, on the other hand, with significant progress in psychometric science."

These questions have become of particular importance due to the rise of creative industries stretching far beyond the cultural sphere, to the globalization of markets which forces the leading economies to innovate and differentiate their products, and to the melting of increasingly distant cultures.

Creative goods are highly differentiated and require extensive learning. Growth of their consumption relies less upon an indefinite progress in the satisfaction of needs and functionalities than on the ability of creators to surprise and seduce consumers into driving them to discover new pleasures and adopt unfamiliar goods. The adoption of novelty lies at the heart of their problem.

2.2 Researchers and Entrepreneurs

Economics and psychology have different approaches to creativity because they have different perspectives. Whereas psychology is concerned with the decision process, economics has something to say about the innovation process. We begin by contrasting these two approaches before looking for their complementarities and convergence.

In psychology, the creative decision process is decomposed into a phase of mental divergence followed by a phase of mental convergence (Guilford, 1956). *Mental divergence* allows finding new ideas to problems; whereas *mental convergence* allows the rearrangement and synthesis of disparate ideas into a novel and appropriate solution. Obviously, both traits may be useful for innovating and act in coordination.

From an economic perspective, creative behavior must be judged by an individual's propensity to innovate in production and consumption activities. Innovating in production implies finding new ideas and techniques that will raise productivity and output. A creative person is not expected to be more productive than others in repetitive well-known tasks but should be more inventive by *searching* more than others and finding (new) solutions to unresolved issues or better solutions to old problems. Search may be a valuable activity because we have limited knowledge of the existing world and/or because the world changes unexpectedly. The ability to search is advantageous in a number of circumstances and disadvantageous in others. Perseverant search and exploration of alternatives enhances the rate of discovery of beneficial innovations in either production or consumption. In the context of production, such behavior prolongs the range of increasing marginal returns which are responsible for endogenous economic growth (Romer, 1986). If, on one hand innovation can be associated with economic development, on the other hand the lack of development of new products can cause recession and financial crisis (Hausman & Johnston, 2014). In the context of consumption, experience and learning allow consumers to discover their true preferences (Pareto, 1909, Chapter 3; Plott, 1996) and thus cause a permanent rise in their utility. However, repeated search forces the explorer to forego his or her currently best choice for some time and the short run costs must be balanced with the long run benefits of innovation. The *research ability* described here should correlate with perseverance and patience, that is, with low discounting of the

future. In a changing environment, a new type of search emerges: the *entrepreneurial capacity* to adapt to unexpected changes and reap unexpected opportunities (Schumpeter, 1934). In contrast with this research ability, entrepreneurship is not an ability to work efficiently with existing technologies. Indeed, creative workers are ranked poorly by supervisors within work groups because their independence is disruptive and judged as a lack of cooperation (Edwards, 1976, quoted by Bowles et al., 2001). An entrepreneurial mind is useless or even harmful in a static, unchanging, world. It only finds its place and justification in a changing, dynamic, world. Schultz (1975) attributed a significant portion of the economic return to education to this capacity which he designated as "the ability to deal with disequilibria" because the rents captured by entrepreneurs after technological shocks survive temporarily in a competitive economy, until markets reach a new equilibrium.

What the previous discussion has shown is that we must distinguish two types of economic innovators: *researchers and entrepreneurs*. These two types of creative behavior are equally found in production and in consumption. In consumption, researchers identify with consumers of creative goods and explorers of novel or unfamiliar styles and products; and entrepreneurs identify with leaders in the consumption and advertising of new goods likely to become fashionable, that is, in future high demand. Both "consumer-researchers" and "consumer-entrepreneurs" contribute in their own way to consumer creativity.

3 Consumer-Researchers

3.1 The Two Faces of Novelty

Imagine that you must choose between two songs of comparable quality from the same genre: a popular song and a new creation. Which one would you choose to listen to? An interesting answer to this question is given by two recent experiments on preference learning that took place in our research group (Berlin et al., 2015; Kim, 2015). Music was chosen as a suitable "model" for the study of consumer learning in the lab for its external validity: consuming music in the lab is no different from consuming music outside. Moreover, music meets four requirements: (i) choice and consumption of the good can be easily implemented and replicated many times in the lab; (ii) the good must be unfamiliar enough to leave room for preference learning; (iii) the good must be pleasant enough to avoid boredom; and (iv) the good must be differentiated enough to avoid satiety. In both experiments, subjects made repeated music choices, listened to the piece they had chosen, and rated their overall satisfaction on a ten-point scale. Moreover, the personality traits (Brief Big Five), risk aversion index and prior experience of each musical genre were reported in both experiments.

The first experiment[6] recruited 68 subjects (mean age: 21.2, SD: 3.15) who made free choices in isolation between four familiar genres: Pop/Rock, Classical, Rap/RnB, Jazz/Blues. Participants made 50 choices of one genre among these four without being told of the music track heard. Each listening episode lasted one minute. Each of the 200 music tracks were evaluated for their "novelty" independently by three external judges recruited from the same pool of participants and the mean appreciation taken as an exogenous measure of novelty. Kim (2015) found a significantly positive coefficient of correlation (0.20, $p = 0.00$) between this measure of novelty and the satisfaction derived from the piece of music. This shows that subjects liked novel music in a condition of "blind listening" where they had no knowledge of what they listened to nor of how novel this music was rated. This finding is meaningful because it stands in contradiction with the general dislike of novel music once people know that it is novel. Bornstein (1989) showed that music listeners prefer the kind of music that they already know or that they know better. Owen (2014) confirmed this finding for the pool of subjects just described, with coefficients of correlation between knowledge of the music style and overall satisfaction ranging from 0.38 to 0.64 across the genres.

The second experiment involved 110 high school students. The mean age of those 10th—graders from the Paris region was 15.1. Participants made 30 binary choices of songs from the same genre belonging either to the Top 30 category or to the New Artists' category composed of selected but yet unknown artists. Although the two groups were of comparable quality,[7] the Top 30 category was better rated than the New Artists category (Berlin et al., 2015). This is another confirmation that even young subjects tend to prefer popular songs than a novel song of comparable quality if they are asked to make an explicit choice.

To summarize, comparing two groups of young people,[8] those who were unaware of the difference in novelty liked the novel piece whereas those who were aware of such a difference preferred the popular music. Thus, there is something intrinsically good with new goods but consumers are afraid of trying. Trying a new "experience good" like music, that is, a good that you cannot rate before consuming it (Nelson, 1970), is risky so that risk-averse consumers expect a disutility if they select the novel good. Moreover, even after a single experience of music, they will usually continue to stick to their prejudice because discovering one's true taste for music generally takes much longer than that. On the other hand, trying a new experience good is attractive because it bears an option value: the new good may turn out to be more preferred than the goods already experienced. The good thing with novelty is the option value and the bad thing is the riskiness. Now, if we define the more creative consumers of music as those who opt more frequently for the new song controlling for quality, we predict that creativity correlates with risk-tolerance. Tyagi et al. (2017) confirmed recently that a creative personality and mind-set correlates with a risk-seeking attitude in the social domain, *i.e.*, the willingness to challenge

[6] For a complete description of this experiment, see Owen (2014, Chapter 2).

[7] The new artists' category was composed of the most popular songs of the French website Noomiz.

[8] The two samples had also an equal proportion of males and females (50%).

norms. If the more creative consumers are more attracted by the option value of search, it is expected that they rely more on random exploration to learn and eventually discover their own, initially unknown, latent preference. Indeed, this is what Lévy-Garboua et al. (2021) found with the data drawn from the first experiment. They estimated a structural economic model of myopic Bayesian learning which assumes that agents balance random exploration and systematic exploitation of the subjective signals derived from repeated experience of goods. Their structural model contains a parameter that captures the intensity of exploration behavior. It takes a zero value for agents who don't explore randomly and a very large value for those who explore almost all the time. The exploration parameter is significantly positive and declines over experience. In another study, Berlin et al. (2021) demonstrates that individuals with a high creative potential approximately follow an optimal learning strategy under outcome uncertainty characterized by early divergence (exploration) and subsequent convergence (exploitation) as they discover what they truly like. Thus, the declining random exploration of consumers may be analyzed as a rational investment within a finite time horizon, because an early investment is more profitable than a later one, and a sign of creative behavior on average.

3.2 Creativity and Conformism in the Adoption of Novelty

A third experiment was conducted by our research team in a middle school from a poor Parisian suburban area (Rosny-sous-Bois). It took place in three stages, each one as a regular class in presence of the teacher. In the first and second stages, a new multi-dimensional measurement of creativity (Lubart et al., 2011) was implemented. The EPoC measure, adapted to young pupils, makes use of both verbal and graphical tasks to elicit the two components of creative thought: divergent thinking, and integrative/convergent thinking. Divergent thinking consists of imagining as many creative solutions as possible whereas convergent thinking consists of integrating and synthesizing several ideas into a unique solution. Divergent and convergent thinking can be elicited in a verbal and in a graphical dimension, as people may be graphically but not verbally creative or vice-versa. Creativity scores are computed for each dimension on the basis of the number and originality of the proposed solutions. The in-class measurement of each dimension required a separate session of 50 min using paper and pencils. In the third stage, we used notebooks and tested the tendency of those 9th graders (mean age = 14.4 years) to like a musical style they were not familiar with over repeated experiences of that style. After checking that most students usually listened to Pop/Rock and Rap/RnB, we let them listen to their familiar music during four periods, and then forced them to listen exclusively to Jazz/Blues and Classical music during 20 periods and rate their satisfaction.[9] Finally, we submitted the students to tests of risk attitude, time preference and personality.

[9] Only five pupils frequently listened to Jazz/Blues and/or Classical music. They are withdrawn from the sample.

Interestingly, girls were significantly more agreeable, conscientious, and open than boys of the same age. They were also more risk-averse.

Berlin et al. (2021) analyzed the adoption of novelty among those middle-school students. On the whole, 9th graders gave low ratings to the unfamiliar music they had to listen to. Girls, however, were a bit less negative than boys. An OLS regression of satisfaction scores (on a 10-point scale) showed that the aggregate ability of those adolescents to adopt an alien "culture" is the result of the offsetting forces of creativity and conformism. Conformism dominated on average for this sample. Impatient and older students had a lower propensity to change than others and more extravert students appeared to be most conformist, perhaps because they are more sociable and share the largest in-group. However, the strategy of early divergence and subsequent convergence that characterizes optimal learning and creative behavior in a complex and changing environment significantly accelerates the adoption of unfamiliar music. Both graphical and verbal creativity had a similar effect. Indeed, individuals appreciate a novel piece of music if they are able to perceive the diversity/richness of sounds as high explorers would do and integrate it subsequently into a coherent picture or story as high convergers would do.

4 Consumer-Producers and Consumer-Entrepreneurs

Consumer-entrepreneurs are lead users: they alert the mass of consumers on the innovativeness of a new good or consumption style with the effect of being followed and benefiting from their influence. The reasons for being the first adopters of a product or service are twofold. First, they may experience needs still unknown to the majority of the target market (Von Hippel, 1986). In this respect, first users often coincide with "consumer-producers"[10] or creative consumers who creatively adapt, modify, or transform market goods (Berthon et al., 2007) to their own needs and anticipate market innovations. Second, early adopters take the risk of experiencing a new good while risk-averse potential consumers stay back. Whatever was their reason for being first, first users become leaders because they cover risk-averse consumers and the latter trust their creative choice and imitate it. As a growing number of followers are attracted, the prior creative choice transforms into a conformist choice and the distinctive feature of being the first user dissolves into the popular fashion of being with the crowd. Adopting a leader-approved novelty becomes gradually an act of conformism such that a large market can be reached by the new good or consumption style. Schreier et al. (2007), for instance, confirm that lead users demonstrate stronger domain-specific innovativeness and opinion leadership, and weaker opinion-seeking tendencies, than followers. Lead users appear to behave like entrepreneurs exploiting consumption changes to their profit in terms of status and prestige if not for the money. Thus, understanding consumer-producers' or consumer-entrepreneurs'

[10] Toffler and Alvin (1980) suggest the term *Prosumer* to characterize consumer producers.

experience may help organizations develop new products well-adapted to consumer needs.

These days, lead users are being sought for their creativity and used by marketers to promote useful innovations. Companies exploit the tenuous borderline between production and consumption because consumption may be described as a "household production" in which consumers produce their own utility by combining market goods with their own time and creativity. Household production of this sort is pervasive, for instance in home cooking, at the supermarket checkout counter, at the filling station or in co-creating a variety of experiences at an entertainment park (Ritzer & Jurgenson, 2010). However, household production remained idiosyncratic and non-reproducible until Internet allowed each consumer-producer to publicize her self-made innovations on collaborative platforms. Lead users gain prominence in this new environment: Gambardella et al. (2017) estimate consumer-innovators to represent 3.7% of the population aged 18 and over in Japan, 6.1% in the UK, and 5.2% in the US. These authors speak of a new paradigm of user innovation that converts the traditional top-down innovation led by firms into a bottom-up innovation led by users and diffused by crowdsourcing.

5 Creative Markets

So far, it was argued that the people who exhibit specific traits like divergent and convergent-integrative thinking are more creative. We shall now argue that a competitive market can also bring consumers to become more creative whereas word-of-mouth, and information from others in general, generate conformist behavior. Using data from the second experiment described earlier, Berlin et al. (2015) observe the time spent by their young subjects on popular songs and on songs from new artists of comparable quality. Each period lasted 90s. Subjects made an initial choice between the popular and the novel song and they were allowed to switch once to the other song. The time spent on new artists was measured under three conditions: (i) a market treatment, (ii) a word-of-mouth treatment and (iii) a control group. In the market treatment ($n = 36$, 2 sessions), two subjects were randomly selected to play the role of "sellers", one for each category of songs, and the remaining ones played the role of "consumers". The sellers are engaged in a monopolistic competition which forces them during each period to post a price per second that maximizes their expected profit[11] and the consumers must pay this price on the whole amount of time they decide to listen to the songs. As consumers receive a fixed endowment[12] at the beginning of each period, they spend one part of their income on the selected "stream of

[11] Prices can vary discretely between 0 and 20 ECU (experimental currency units). The sellers' receipts (and profits) are equal to the product of the fixed price per second and the time spent listening. The total profits are converted into candies at a fixed exchange rate.

[12] The endowment of 1800 ECU per period allows consumers to listen to a maximally-priced song during 90s.

music" and save the rest which is finally converted into candies in proportion to total savings. In the word-of-mouth treatment ($n = 41$, 2 sessions), subjects don't pay a price but they are told the mean rating of the songs before making a choice. These ratings[13] are those of the control group ($n = 33$, 2 sessions) such that participants select songs in isolation and listen to them free of charge. The time spent on new songs per period and participant was then regressed (with an OLS) on market and word-of-mouth dummies, on the difference in the average ratings of the two competing songs (computed on the whole sample), on a score of the frequency of listening to mainstream radios, on the "preference for novelty" (indicated by whether the new song was chosen first), and on a number of additional controls.[14] The coefficients of the three dummy variables (Market, Word-of-mouth, and Preference for novelty) measure the algebraic increase in time spent on new songs caused by these factors when the quality difference between the songs and other variables are controlled for. The regression shows that the preference for novelty and the presence of a market raise the time spent on new songs by 17.5s and 14.0s on average respectively, whereas word-of-mouth cuts this time down by 5.4s.[15] Thus, the degree to which a competitive market makes a consumer more creative approximately equals that of "Nature" (as reflected by the preference for novelty). On average, subjects increased their time spent on new songs by 32% relative to the control group in the market treatment but decreased it by 15% in the Word-of-mouth treatment. Indeed, the word-of-mouth publicizes the most popular songs and thus worsens the natural handicap of new songs. By contrast, the market compensates for this natural handicap by low pricing of the new artists and thus manages to raise substantially the demand for novelty.

Another study by Bernard et al. (2021) tempers and clarifies this conclusion by comparing monopolistic competition (with one seller of each musical genre) with a more severe form of price competition (with two sellers of each musical genre). As expected, prices are lower under the stronger form of competition and converge asymptotically toward zero while remaining positive under monopolistic competition. However, the large general reduction in prices generated by a stronger competitive pressure limits the volatility of prices, hence the exploration and subsequent adoption of unfamiliar musical genres permitted by their low pricing. Consequently, the stimulation of creative behavior by competitive markets owes more to the price volatility than to the large price reduction that it permits. Of course, the more creative consumers are more active in searching for lower prices and taking the risk of changing their habits. However, the market-induced volatility of prices stimulates search behavior and consumption change for all, thus increasing creative behavior relative to non-market situation. In Bernard et al.'s (2021) study, people chose massively popular genres when consumption was free. In the first half of the experiment, the proportion of subjects listening to the classical, less familiar, musical genres attained only 30% in the free consumption treatment versus 46% under monopolistic competition and 41% under stronger competition. Moreover,

[13] Songs are rated on a five-star scale with midpoints.

[14] The additional controls are: Round 1–15, Female, Age, and musical listening habits.

[15] These times must be appreciated relative to the 90s allocated to music listening per period.

those proportions moved downward in the free consumption and strong competition treatments in the second half of the experiment while staying flat under monopolistic competition. As a corollary, in leveling prices, the practice of uniform prices of differentiated goods would mostly benefit the less creative consumers and favor conformist behavior at the detriment of consumption diversity and creative behavior. Of course, such experimental results must be taken with a grain of salt as they greatly simplify the real world but they are indicative of a reality which cannot be ignored.

6 Conclusion

The creative potential of individuals in production and consumption is raising a new and growing interest in economics. Given the long tradition of economic research on innovation and growth, the present paper was an attempt to reformulate the issue of creativity in consumer behavior through the economic distinction between research and entrepreneurship which are the main drivers of market innovations. Consumer-researchers take the risk of exploring novel goods and consumption styles in the hope of discovering what they like best, and the more creative seem to discover earlier and faster than others. As consumers combine market goods with their own time in order to "produce" the utility derived from consumption, the more creative consumers may become lead users who adopt novel goods before the crowd, adapt them to their needs in anticipation of future demand, and persuade the more conformist to follow. Finally, we demonstrated that competitive markets can raise the apparent creativity of consumers through price manipulations of new goods rather than by a general reduction in prices. The market's superiority over Nature is to stimulate the search behavior of all consumers including the more creative ones and thus enhance consumption diversity and change.

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References

Becker, G. S. (1965). A theory of the allocation of time. *Economic Journal, 75*(299), 493–517.

Berlin, N., Bernard, A., & Fürst, G. (2015). Time spent on new songs: Word-of-mouth and price effects on teenager consumption. *Journal of Cultural Economics, 39*(2), 205–218.

Berlin, N., Dul, J., Gazel, M., Lévy-Garboua, L., & Lubart, T. (2021). "Do we need creativity?", submitted, Centre d'économie de la Sorbonne and LaPEA (Laboratoire de Psychologie et d'Ergonomie Appliquées).

Bernard, A., Lévy-Garboua, L., Owen, C., & Placido, L. (2021). "How do music market changes affect consumer demand and welfare? An experimental approach", submitted, Centre d'économie de la Sorbonne.

Berthon, P. R., Pitt, L. F., McCarthy, I., & Kates, S. M. (2007). When customers get clever: Managerial approaches to dealing with creative consumers. *Business Horizons, 50*(1), 39–47.
Borghans, L., Duckworth, A. L., Heckman, J. J., & Ter Weel, B. (2008). The economics and psychology of personality traits. *Journal of Human Resources, 43*(4), 972–1059.
Bornstein, R. F. (1989). Exposure and affect: Overview and meta-analysis of research, 1968–1987. *Psychological Bulletin, 106*, 265–289.
Bowles, S., Gintis, H., & Osborne, M. (2001). The determinants of earnings: A behavioral approach. *Journal of Economic Literature, 39*, 1137–1176.
Burroughs, J. E., Moreau, C. P., & Mick, D. G. (2008). Toward a psychology of consumer creativity. In C. P. Haugtvedt, P. M. Herr, & F. R. Kardes (Eds.), *Handbook of consumer psychology* (pp. 1011–1038). Taylor & Francis Group/Lawrence Erlbaum Associates.
Charness, G., & Grieco, D. (2019). Creativity and incentives. *Journal of the European Economic Association, 17*, 454–496.
Costa, P., & McCrae, R. (1992). *Revised NEO personality inventory (NEO PI-R) and NEO Five-Factor Inventory (NEO-FFI) professional manual*. Psychological Assessment Resources Inc.
Denison, E. F. (1962). *Sources of economic growth in the United States and the alternatives before us*. Committee for Economic Development.
Feinstein, J. S. (2009). Creativity and the economic system. *Encyclopedia of giftedness, creativity, and talent*. Sage.
Florida, R. (2002). *The rise of the creative class: And how it's transforming work, community and everyday life*. Basic Books.
Gambardella, A., Raasch, C., & Von Hippel, E. (2017). The user innovation paradigm: Impacts on markets and welfare. *Management Science, 63*, 1450–1468.
Garcia, E. (2013). What we learn in school: Cognitive and non-cognitive skills in the educational production function. Ph.D. dissertation, Columbia University.
Garcia, E. (2014). The need to address non-cognitive skills in the education policy agenda. EPI Briefing Paper, 1–36.
Guilford, J. P. (1956). The structure of intellect model. *Psychological Bulletin, 53*, 267–293.
Hausman, A., & Johnston, W. J. (2014). The role of innovation in driving the economy: Lessons from the global financial crisis. *Journal of Business Research, 67*(1), 2720–2726.
Kim, H. (2015). Emotions and well-being for novel and popular music: Demands, consumption, satisfaction and wellbeing of creative industry. Master thesis, Pantheon-Sorbonne and Paris Descartes Universities.
Lévy-Garboua, L., Owen C., Placido, L., & Rapoport, B. (2021). *"Learning to like", mimeo*. Centre d'Economie de la Sorbonne.
Lubart, T. I., Besançon, M., & Barbot, B. (2011). *Evaluation du potentiel créatif (EPoC)*. Editions Hogrefe.
Menger, P. M. (2014). *The economics of creativity*. Harvard University Press.
Mincer, J. (1974). *Schooling, experience, and earnings*. Columbia University Press for NBER.
Nelson, P. (1970). Information and consumer behavior. *Journal of Political Economy, 78*, 311–329.
Owen, C. (2014). Economic and behavioral analysis of the cultural market for music from an experimental perspective. Ph.D. thesis, Paris 1 Pantheon-Sorbonne University.
Pareto, V. (1909). *Manuel d'Economie Politique* (5th ed., 1981). Librairie Droze.
Plott, C. R. (1996). Rational individual behaviour in markets and social choice processes: The discovered preference hypothesis. *Rational Foundations of Economic Behaviour* (pp. 225–250). Macmillan Press Ltd.
Ritzer, G., & Jurgenson, N. (2010). Production, consumption, prosumption: The nature of capitalism in the age of the digital 'prosumer.' *Journal of Consumer Culture, 10*(1), 13–36.
Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy, 94*, 1002–1037.
Rubenson, D. L., & Runco, M. (1992). The psychoeconomic approach to creativity. *New Ideas in Psychology, 10*(2), 131–147.

Schreier, M., Oberhauser, S., & Prügl, R. (2007). Lead users and the adoption and diffusion of new products: Insights from two extreme sports communities. *Marketing Letters, 18*, 15–30.
Schumpeter, J. A. (1934). *The theory of economic development*. Oxford University Press.
Schultz, T. W. (1975). The value of the ability to deal with disequilibria. *Journal of Economic Literature, 13*, 872–876.
Sternberg, R. J., & Lubart, T. I. (1995). *Defying the crowd: Cultivating creativity in a culture of conformity*. Free Press.
Sternberg, R. J., & Lubart, T. I. (1996). Investing in creativity. *American Psychologist, 51*(7), 677–688.
Sternberg, R. J. (2001). What is the common thread of creativity? Its dialectical relation to intelligence and wisdom. *American Psychologist, 56*(4), 360–362.
Toffler, A., & Alvin, T. (1980). *The third wave* (Vol. 484). Bantam Books.
Torrance, E. P. (1974). *Torrance tests of creative thinking*. Personnel Press.
Tyagi, V., Hanoch, Y., Hall, S. D., Runco, M., & Denham, S. L. (2017). The risky side of creativity: Domain-specific risk-taking in creative individuals. *Frontiers in Psychology, 8*, n 145.
Von Hippel, E. (1986). Lead users: A source of novel product concepts. *Management Science, 32*(7), 791–805.

Creativity in the Classroom: Advice for Best Practices

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1 Creativity in the Classroom: Advice for Best Practices

How can creativity be incorporated into the classroom? This question may elicit a number of reactions that range from hope to trepidation. However, this approach may be too broad. Let us examine, for example, how teachers might support the creative growth of their students—a focus with more concrete presence in the research of creativity (Barron, 1969; Guilford, 1950), which has captured the interest of current educational policy makers, business leaders, and government officials (Beghetto & Kaufman, 2013). Creativity in schools is said to be an important goal, yet it has often gone neglected (Aljughaiman & Mowrer-Reynolds, 2005; Beghetto, 2021; Beghetto & Plucker, 2006). Educators must develop an understanding of creativity, or this goal will remain unrealized (Beghetto & Kaufman, 2013; Kaufman & Beghetto, 2014).

The aim of this chapter is to address how creativity can be nurtured in the classroom, including ways in which it may emerge or be stifled. Through the examination of several topics directly related to creativity and the classroom environment, we hope to instill a more thorough understanding of the psychological science behind the umbrella topic of creativity, and how to maximize development of student creativity

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in the classroom environment. We will close with a few recommendations for how creativity could be actively supported in the classroom. Broadening educators' understanding of environmental influences on creativity in the education system has potential to foster classroom environments more welcoming to creative expression.

2 What Is Creativity?

Before going too far, we must first consider what is meant by the word "creativity." What allows for an idea to be creative? What criteria do we use to identify one idea as creative and another as uncreative? Some may say that the idea has to be "outside the box," or show imagination. These are vague definitions at best. Similarly, a quick internet search for creativity will yield thousands upon thousands of definitions, with few commonalities. However, in creativity research, creativity is defined by two primary factors. First, to be creative, there must be something innovative, novel, or different about the idea. Second, the creative idea or product must be appropriate to the task or context (Barron, 1955; Kaufman, 2009; Sternberg et al., 2002). Thus, a creative idea will be both original and appropriate (Plucker et al., 2004; Simonton, 2012; Sternberg & Lubart, 1995).

There are many ways to measure creativity. The method of study should reflect whose creativity is being examined: for example, the direction would shift if the person of interest is widely famous actress Meryl Streep, her daughter, actress Grace Gummer, or one of her former school teachers. Measuring creativity in each of these individuals might necessitate different methodologies and tools. Therefore, it may be helpful to explore a model of creativity that enables categorization of the individual being studied.

3 The Four-C Model of Creativity

3.1 Big-C

The majority of creativity research tends to focus on one of two types of creators. The first, eminent individuals, refers to those people whose creative products have stood the test of time. Also called "Big-C" creators and creativity, this category of creator is explored in Simonton's (1997) investigation of classical and opera composers, whose works have lasted long after their death. Other Big-C creators might include winners of a prestigious award or those having encyclopedia entries longer than 100 sentences (Kaufman & Beghetto, 2009). Research focusing on Big-C creators has typically utilized the historiometric method, where data from reference materials such as biographies and other reference sources about a particular individual, are

gathered and analyzed. This allows for the study of many eminent individuals, which otherwise would not be possible (Kaufman & Beghetto, 2014).

There are several theories that focus on Big-C concepts, such as the Propulsion Theory of Creative Contributions (Sternberg & Kaufman, 2012; Sternberg et al., 2002), which addresses the possibility of a particular creation or creative idea to alter an entire field. Researchers have identified eight types of creative contributions. We will first discuss the four which represent the work that continues in the existing direction of the field: replication, redefinition, forward incrementation, and advanced forward incrementation. Replications, arguably the most basic types of contribution, are those that maintain the current status of the field or simply reproduce past works. Redefinitions, on the other hand, instead approach the domain as it exists from a different angle. The third type of contribution, forward incrementation, is regarded as the most immediately successful: These contributions tend not to be groundbreaking, but move the field forward. Similarly, advance forward incrementation moves the field forward in the existing direction, but with two steps instead of one. Oftentimes these creators are regarded after their death as having produced ideas that were ahead of their time.

The remaining four types of creative contribution do not exist within the current paradigm of the field, but instead attempt to replace the current framework with alternatives: redirection, reconstruction, reinitiation, and initiation. Redirections, as its name suggests, seek to alter the direction of the domain. Reconstruction/Redirection contributions try to take the field back to a point in its past and progress from that point in a different direction from what has already been explored. Reinitiations, more radically, seek to advance the field to an unreached point and begin their work from this new starting point. Integration, lastly, seeks to take two different domains and blend them in order to create something new.

Csikszentmihalyi's (1996, 1999) Systems Model of Creativity also investigates Big-C creativity. This theory considers three related concepts: domain, field, and person. The domain is the area of study, as broad as simply "art," or more specific, such as "impressionist paintings." The concept of field is defined as the "gatekeepers" who decide what is important, such as journal editors, teachers, or critics. The third concept, person, is the actual creator. In examining Big-C creativity, this theory emphasizes the interconnectedness and interactive nature of these three elements.

3.2 Little-C

Little-c creativity, on the other hand, describes everyday creativity achieved by the average person (e.g., Kaufman, 2012; Richards, 2007). Research focusing on little-c creativity argues that creativity is not found only in a select handful of individuals, but is much more widely distributed (see Kaufman & Baer, 2005 and Plucker et al., 2004, for reviews). One example of little-c creativity research examines how the layperson conceptualizes creativity, revealing a tendency to de-emphasize analytical abilities which are typically more closely associated with IQ tests. Instead, the layperson

conception of creativity is rooted in qualities such as being inquisitive, imaginative, and unconventional (Sternberg, 1985).

Amabile's (1996) componential model of creativity identifies three elements necessary for creativity to occur: domain-relevant skills, creativity-relevant skills, and task motivation. Domain-relevant abilities would be considered attributes such as knowledge, specific skills related to the domain, and specialized talent in the area. Creativity-relevant skills are characteristics related to being creative. One such example would be tolerance for ambiguity, or one's ability to handle uncertainty in different situations—i.e., not being completely sure what one's plans are for the weekend. Other creativity-relevant skills would include a willingness to take risks and possessing self-discipline. The final element of Amabile's theory is task motivation. She proposes that individuals who are motivated intrinsically (such as by enjoyment or passion) have a tendency to be more driven in their creative endeavor than those motivated by extrinsic factors (such as money or grades).

3.3 Pro-C and Mini-C

Although the dichotomy of Big-C and little-c creativity has been the subject of many studies, these categories may be too broad to accurately make distinctions between different types of creators. In which category would we place a professional musician who, in addition to performing, composes his own songs? He makes a living through his creativity, but is that enough to legitimize classification as Big-C creativity? There is also the question of how to categorize students learning new material and experiencing creative insights which may not normally meet the level of what would be considered creative. Would little-c also be expected to include this type of creativity? To incorporate situations like these, additional categories of creativity have been suggested: Pro-c and mini-c (Beghetto & Kaufman, 2007; Kaufman & Beghetto, 2009).

The addition of Pro-c was proposed to include those who have put forth effort in their given field and moved past what would be considered little-c contributions (Kaufman & Beghetto, 2009). Instead, those who achieve professional-level expertise are likely to be considered Pro-c creators. While some may be able to make a living from their creative endeavors, others who may be considered "amateurs" and pursue their creativity in addition to a job could also be considered Pro-c creators. The introduction of this category allows for accomplished creators to be recognized as such without inappropriately lumping them in with Big-C or little-c creators.

Mini-c, on the other hand, is a more personal experience. A student who has just begun his foray into writing poetry may not produce a poem considered to be novel or useful within the field of poetry. If that standard is used to judge poetry created during the learning process, external judgments of poetry would not allow for these products to be considered creative (Beghetto & Kaufman, 2007). However, these

poems are new and meaningful to the students who, in the course of their learning, have developed this product. With the inclusion of mini-c in this model, there is now an allowance for moments throughout the learning process that spark personal creative insights and interpretations to be recognized as such.

3.4 Mini-C Creativity in Schools and the Classroom Environment

The introduction of mini-c into this model has promise for helping integrate creativity into the classroom. Educators may have internalized traditional representations of creativity which might make it difficult for them to envision where creativity would fit in their classroom, as most students are not likely to have Big-C insights (Beghetto, 2007a; Beghetto & Plucker, 2006). Mini-c interpretations have the potential to evolve into little-c, and perhaps eventually Big-C contributions (Beghetto & Kaufman, 2007; Kaufman & Beghetto, 2013). In this way, mini-c can be viewed as a stepping stone to further creative insights that may lead to larger contributions (Kaufman & Beghetto, 2014).

4 Creativity in the Classroom

Students develop mini-c insights any time they learn something new and personally meaningful. It is therefore important for educators to be able to identify and acknowledge the mini-c insights of their students. One such way that mini-c creativity may manifest itself in the classroom would be through creative micro moments.

4.1 Creative Micro Moments

Creative micro moments are the brief moments when something unexpected occurs or when things go in an unanticipated direction. In the classroom, these moments can easily be overlooked, such as a student raising their hand but not being called on, or when a science experiment yields unexpected results (Beghetto, 2009, 2013a, 2013b). In other words, these instances occur when the planned curriculum meets actual classroom experiences (Aoki, 2004; Beghetto, 2017). When these unexpected moments occur, teachers sometimes feel they must immediately return to their lesson plan. As a result, they end up leaving these micromoments unnoticed or ignored. However, creative micromoments present the opportunity for student creativity to be recognized and developed.

Knowing how to react and move forward when confronted by these unexpected moments requires not only an awareness of these moments, but also practice and experience in teaching. More experienced teachers can more readily recognize the potential of micromoments and are better able to respond with flexibility to such moments (Borko & Livingston, 1989; Housner & Griffey, 1985; Sawyer, 2011). One technique that allows for exploration of the creative micromoments is disciplined improvisation (Sawyer, 2004).

Disciplined improvisation (DI) is a kind of balancing act for teachers. DI requires identifying what aspects of the content should remained "fixed" and what aspects of the content can be made "flexible" (Beghetto & Kaufman, 2011). The fixed aspects of the curriculum are usually determined by curricular standards, whereas the flexible aspects represent opportunities for students to voice original interpretations of the fixed content. Taken together, these two parts combine to form a creative learning experience. Teachers can approach their planning with DI. Sometimes opportunities for teaching with DI can occur during the unexpected micromoments of a lesson.

Although teaching with DI can go a long way in supporting creativity, teachers do not always use this strategy. Rather, there is evidence suggesting that teachers may not be comfortable providing the flexibility necessary to explore and develop students' ideas. For example, Beghetto (2007a, 2007b) found prospective teachers preferred expected ideas rather than novel or otherwise unexpected ideas, likely because unexpected ideas can be viewed as signifiers of impeding curricular chaos. Consequently, when surprising moments emerge in the classroom, teachers may be concerned that exploring such moments will take them off-task. This fear of the unexpected is one reason why teachers may not use disciplined improvisation as routine strategy. Instead, as a method of redirecting the students back to the planned curriculum, teachers may use soft dismissals to move away from these potentially distracting ideas (Beghetto, 2009).

The issue with the use of soft dismissals is that students could begin to believe that their unique ideas are not wanted or supported by the teacher (Black & Wiliam, 1998; Kennedy, 2005). When this happens, students can start losing confidence in their ideas and be less likely to take intellectual risks necessary to share and develop those ideas (Beghetto, 2013a). Moreover, not all dismissals are so soft. Sometimes students experience negative performance outcomes in a much more detrimental way and experience what has been called, *creative mortification.*

4.2 Creative Mortification

Creative mortification is defined as *the loss of one's willingness to pursue a particular creative aspiration following a negative performance outcome* (Beghetto, 2014). This experience can occur from a brief instance of negative feedback related to the creative expression. With the onset of creative mortification, an individual's creativity is not eliminated, but rather their will to be creative (Beghetto, 2013b). These experiences

are not only limited to what are considered to be more artistic domains (i.e., music, art, writing), but can span across academic and athletic endeavors as well. Given that creative mortification seems more likely to occur during early stages of creative development, the consequences of experiencing creative mortification can span a lifetime. Indeed, creative mortification may also result in the loss of enjoyment and positive benefits that creative hobbies or activities can offer across the life-span (Richards, 2007), or in talent loss: the failure to realize one's potential in a given area (Hong & Milgram, 2007).

Not everyone who experiences negative performance outcomes or receives negative feedback will experience creative mortification. Indeed, some people may even be motivated by such experiences. Why might some people experience mortification and others experience motivation? This is a key question. Although there has not been extensive research in this area, an exploratory investigation conducted by Beghetto (2014) has shed some light on the question. With respect to those who experience creative mortification, two factors played a key role. The first was a belief that improvement is no longer possible. The second is the experience of negative self-evaluative emotions (e.g., shame). Consequently, people seem likely to give up on pursuing their creative aspirations after negative performance outcomes if they come to believe that doing so would be nothing more than a painful exercise in futility. Conversely, people who are motivated by negative feedback tend to be older, believe improvement is possible, felt wronged by the situation, and want to prove others wrong. Given that teachers, parents, and coaches are key sources of feedback, it is important for educators to understand how their feedback might support, rather than impede, youngsters' creative potential.

4.3 Understanding Feedback

All students encounter successes and setbacks throughout their learning. How these experiences are interpreted plays an important role in whether they will persist or give up in the face of learning and creativity-related challenges (Beghetto, 2013b; Dweck, 2000). As previously noted, if students are ashamed or feel mortified, they may lose motivation to continue in those endeavors. Teachers play a key role in helping students with their interpretations of setbacks. They can, for example, help students reframe setbacks and focus on their strengths and how they might improve their current limitations. One method to support their students' development, both creatively and academically, is through supportive feedback (Beghetto, 2007b, 2013a, 2013b; Beghetto & Kaufman, 2007; Black & Wiliam, 1998).

Supportive feedback, as discussed by Beghetto (2007b), seems necessary for helping students to develop their creative competence. Such feedback can help students make the transition from personally meaningful interpretations (mini-c) to everyday creativity contributions (little-c). Doing so requires that teachers do the following: (a) take time to listen and try to understand how students are interpreting the material; (b) work with students to help them recognize instances when their

contributions may fit the requirements of a particular assignment or task; and (c) provide opportunities for students to develop their domain relevant skills so that they can make novel and appropriate contributions in the classroom.

Using supportive feedback focuses on the creative strengths students already possess and also highlights areas in need of improvement. This type of feedback aligns with what has been called the *Goldilocks Principle* of feedback (Beghetto & Kaufman, 2007). The key to this principle is the importance of striking the "just right" balance between encouraging students' originality and helping students meet specific task constraints. As has already been discussed, feedback that is too harsh can stifle creative motivation (or result in creative mortification). The same can be said for feedback that is too soft.

If students do not receive honest feedback in the safety of the classroom, they can be devastated the first time the experience real-world constraints (Beghetto et al., 2014). The danger of over-praising performance is illustrated in contestant-based reality shows such as *American Idol*. When subpar singers have received nothing but glowing praise they can be humiliated from the honest feedback provided by the judges. Although meaning well, this unearned praise can lead to poor insight about one's own creative ability (Kaufman et al., 2010) and stifle further creative development.

To illustrate the Goldilocks principle of balanced feedback, consider the imaginary case of Sophia (adapted from Beghetto et al., 2014), who submits a short story to be included in a school literary magazine. Her story shows potential, but it needs a lot of work before it can be published in the magazine. If Sophia receives judgment that is too harsh, she may believe she is not a creative writer and stop writing altogether. If, instead, she receives feedback that is overly praising of her work, Sophia will not be prepared to handle the rejection she would receive from the magazine.

The feedback practices described here are not something that can be learned and implemented overnight. However, by understanding the principles of supportive feedback teachers can start providing the kind of feedback that has potential to promote (rather than undermine) their students' creative development. In addition to understanding principles of supportive feedback, teachers can also benefit from honestly reflecting on their own views and beliefs about creativity itself.

4.4 Teacher Interpretations of Creativity

Whereas the importance of supporting creative development in the classroom may appear to be obvious, there are obstacles, including the views or biases teachers have about creativity. Although some evidence finds that teachers look favorably upon creative students (e.g., Runco et al., 1993), other studies have more unsettling findings (Cropley, 1992; Dawson, 1997). Additionally, what creativity means to researchers does not appear to be the same definition used by educators.

Whereas researchers would likely use definitions found in this chapter, emphasizing the balance between originality and task appropriateness, teachers' understandings of creativity tend to be more limited. Some associate creativity primarily with the arts (Diakidoy & Phtiaka, 2002), while others report liking creativity, although they may not understand what it actually means (Aljughaiman & Mowrer-Reynolds, 2005). For example, Westby and Dawson (1995) found that teachers reported that teachers liked having creative students in class, but when probed about what behaviors creative students demonstrate, they described them as "well-behaved" or "conforming." However, when given words that were more usual descriptors of creative individuals, these same teachers reported that they disliked those students. Further, students who demonstrate inappropriate behavior in the classroom or have lower academic achievement may have their creativity underestimated by their teacher, even when they demonstrate higher levels of creativity (Guo et al., 2020).

This does not mean that creativity is not valued by teachers, but suggests that there might be challenges associated with creative students, such as unwelcomed classroom behaviors (Aljughaiman & Mowrer-Reynolds, 2005). Brandau et al. (2007) found that the students who teachers identified as being hyperactive, impulsive, and disruptive also scored higher on a measure of creative fluency. Additionally, students who are more agreeable were not as likely to have had creative accomplishments (King et al., 1996). Such preferences tend not to be moderated by teacher age or level of experience, but teachers who themselves are more creative are more likely to see student traits associated with creativity as more desirable (Kettler et al., 2018). Humanities teachers are also more likely to see creativity as a desirable trait than STEM teachers (Cropley et al., 2019).

One possible explanation for the disconnect between teachers reporting valuing creativity yet disliking creative students is that these students display more poor behavior relative to their less creative peers. However, rather than teachers specifically disliking creative students or falsely reporting valuing creativity, they may simply be responding to the lack of an appropriate balance.

5 An Appropriate Balance

As we have discussed, creativity requires a combination of originality and task appropriateness. How might teachers view this balance in their classroom? One way to view this balance is to revisit the Four-C Model. At the mini-c level, creativity is being experienced at the subjective level. As such, mini-c insights typically will not disrupt the teaching and learning of others students. However, when students are asked to share those mini-c ideas, creativity is invited to move into the little-c and more public sphere of the classroom. When this happens, creativity starts having an impact on others (Kaufman & Beghetto, 2009; Stein, 1953). Given that not all situations or tasks welcome or warrant creative expression, creative expression can sometimes be too great a risk. Indeed, there is a time and place for creativity (Kaufman & Beghetto, 2013). Because mini-c creativity impacts the individual experience, it is low risk and

might be considered appropriate anytime. However, the higher levels of creativity carry more risk and more chance of disruption.

Teachers can support students' creative potential by helping them learn when it is worth the risk to break from the routine and when it might be more appropriate to conform. An example we frequently use to describe this decision is as follows. Airplane pilots would be well advised to conform to a routine landing during a routine flight rather than try out a creative water-landing when it is not needed. However, during an emergency situation, sticking to the routine might cost lives. A pilot would be more than justified to try a creative water landing if it might save passengers' lives. Of course, most students will never have to land a plane in an emergency situation. Still, there is value in teaching students how to distinguish between situations that are conducive to creative expression and those which are not. For this to happen, educators must "read the situation" to see (a) if creativity is appropriate; and (b) whether creativity is necessary at that specific time and place. This awareness necessitates the development of creative metacognition (Kaufman & Beghetto, 2013).

5.1 Creative Metacognition

Creative metacognition is a form of cognition that allows for individuals to be aware of and develop their creative competence. For our purposes, it will be defined as a blend of creative self-knowledge and knowledge of the context. The former is defined as awareness of one's creative strengths and shortcomings within specific domains or areas, as well as creativity as a general trait; the latter, then, is the recognition of the appropriate time and place for creativity as well as whether creativity is even called for (Kaufman & Beghetto, 2013). This definition is consistent with other conceptions of metacognitive knowledge (Flavell, 1979; Pintrich et al., 2000), which illustrates the nature of metacognition to be a combination of different, but related types of knowledge.

When looking more specifically at creative metacognition, an individual may utilize this skill in determining when, where, and why it may be useful to be creative relative to the context and the task at hand (Kaufman & Beghetto, 2013). One would not want a surgeon to be creative in stopping bleeding, unless all standard procedures had been exhausted and unsuccessful. Creative metacognition also involves more specific knowledge about individual domains, which would allow one to evaluate which strategies are applicable for creativity in different domains. Additionally, this skill involves knowledge about oneself and what strengths in creativity are present and which areas could use more work and development. Further, there is also a measure of self-reflection, self-regulation, and self-monitoring involved in creative metacognition (Kaufman & Beghetto, 2013). These three components, operating in conjunction, help students to maintain an appropriate balance of when and where are the places for their creative exploration.

Creative metacognition is present during mini-c creative expression, primarily in the form of recognizing that one has produced something that is subjectively creative. When considering the more observable levels of creativity, however, there is added importance as this skill helps to determine whether to express creativity at a given moment, or in a specific domain. For example, Big-C creators would be expected to display high levels of creative metacognition. Kozbelt (2007) analyzed Beethoven's self-assessments of his works and found a high level of self-awareness. Similarly high levels of self-awareness would be expected with Pro-c creators as well. Though there has not been extensive research examining Pro-c creators, Fayena-Tawil et al. (2011) investigated the creative process differences between Pro-c (or nearly Pro-c) artists and non-artists. They found that, though both artists and non-artists would evaluate their work throughout its creation, artists were more likely to also monitor their progress. In an earlier study, Kozbelt (2008) found that artists who produced artwork rated as being more creative were more likely to revisit, rework, and even erase their drawings than other artists whose products were rated as less creative.

However, when looking at the little-c and mini-c levels, there may be more variation in creative metacognition (Kaufman et al., 2016). Clearly there should be some level of self-awareness present, but creators at this level may not be the best judge of their own work. Most of the research on creative metacognition has focused on everyday creators, such as students. Hong et al. (2010) examined how metacognition, intrinsic motivation, and creative student performance were related. Metacognition was not related with more originality in homework, but was strongly related to intrinsic motivation. At these lower levels of creativity, high levels of creative metacognition may not be present.

Other research has found that creative individuals have higher levels of creative metacognition. People who yield more creative responses in a divergent thinking task are also better at rating which of their own responses are their most original (Runco & Dow, 2004). Using a similar task, Silvia (2008) asked participants to pick what they believed to be their best responses and compared their selections to what trained raters considered creative. He found that those who were able to more accurately select their creative responses were also more open to experience. Intelligence is also associated with higher creative metacognition (Karwowski et al., 2020).

With regard to everyday creators, it may be helpful to consider whether they are closer to little-c or mini-c in their accomplishments. When mini-c creative ability is held to the same standard of evaluation as little-c (or higher levels) creativity, lower levels of creative metacognitive ability can result in negative outcomes. Returning back to *American Idol*, when looking at the successful contestants, they are often at the Pro-c (or high little-c) level. However, consider the unsuccessful auditioning singers who may be at the mini-c level who believe that their abilities are comparable to the eventual winner. In this context, the low level of creative metacognition often results in the harsh evaluation by judges and televised ridicule.

These types of performers illustrate the Dunning-Kruger effect (e.g., Dunning et al., 2003; Kruger & Dunning, 1999): although high metacognitive abilities lead to better performance, lower levels of metacognition can also lead to poorer performance. Kruger and Dunning (1999) proposed that those who perform poorly in

intellectual and social areas may also have lower metacognitive abilities. These underperformers are not able to recognize their own poor performances. Therefore, whereas creative metacognition may be related to mini-c, it could also be one factor prohibiting the creator to progress to acceptable levels of public creative expression.

6 Conclusion and Recommendations

The purpose of this chapter was to highlight the place of creativity in the classroom and provide an understanding of how it can be more effectively incorporated. Though both creativity and teaching may appear to be very straightforward and, perhaps to some extent, intuitive, there are careful considerations that must be made in order to address the issue. The classroom can serve as a place for nurturing creativity, or a place where creativity is, unfortunately, stifled. With greater awareness, steps can be taken by educators to provide an environment in which student creativity can thrive while also increasing their academic knowledge.

Though there are suggestions and recommendations present in the literature on this subject, what follows is a summary of a few ways in which creativity can be further promoted in the classroom.

- **Recognize the benefits and costs of creativity**. Teachers can support their students' creative development by helping them become aware of the benefits and costs of creativity. Doing so can develop students' metacognitive skills. This involves helping students evaluate whether certain situations are appropriate for the sharing of their creative ideas, interpretations, or insights. When students learn how to distinguish between the potential value (e.g., developing new insights, outcomes) and potential costs (e.g., wasting time and effort, dismissal of ideas), they will be more able to evaluate their ideas and insights, and thereby make more informed decisions about whether sharing is appropriate. Risk taking by itself does not guarantee creativity; the important factor is sensible risk taking (Sternberg et al., 2008).
- **Help students gain a broader understanding of creativity**. A key component of the development of creative metacognition is to understand what exactly is meant by creativity. It is important that students recognize that creativity is not just about producing something that is original or novel, but that the product is also appropriate given the context in which it is created. Additionally, when there is a differentiation of levels of creativity (e.g., mini- to Big-C contributions), students may, with the aid of teachers, be better able to see that there is creativity in having their own personally novel interpretation during a lesson, while understanding that this interpretation is not necessarily considered new or appropriate at another level of creativity.
- **Help students recognize their creative strengths and limitations**. Teachers can help students in developing their creative metacognition through providing balanced feedback on students' strengths and areas to improve upon. Revisiting the

Goldilocks Principle (Beghetto & Kaufman, 2007), the feedback should neither be too harsh nor too gentle, finding a balance that supports and challenges students to improve.

- **Present opportunities for imagination and exploration**. An example of this is when teachers create class activities or assignments that allow students to develop their own strategies or solutions to problems. Such activities include helping students collaborate with others and share their mini-c insights with each other. Doing so can help students develop confidence in their ideas, explore new ideas, and receive helpful feedback on how to further strengthen those ideas.
- **Model and support creativity**. Teachers can also inspire creativity by modeling creative behaviors themselves. In business and industrial/organizational psychology, for example, creative leaders often model creativity to their employees (e.g., Redmond et al., 1993). This can also be applied to the classroom. If teachers model their creativity in their teaching, they are paving the way for their students to do the same. As research on this topic grows, there are also resources available to teachers to aid in providing learning environments supportive of creativity (e.g., Richardson & Mishra, 2018).

References

Aljughaiman, A., & Mowrer-Reynolds, E. (2005). Teachers' conceptions of creativity and creative students. *Journal of Creative Behavior, 39*, 17–34.

Amabile, T. M. (1996). *Creativity in context: Update to the social psychology of creativity*. Westview.

Aoki, T. T. (2004). Spinning inspirited images. In W. F. Pinar & R. L. Irwin (Eds.), *Curriculum in a new key: The collected works of Ted T. Aoki* (pp. 413–425). Lawrence Erlbaum Associates.

Barron, F. (1955). The disposition toward originality. *Journal of Abnormal and Social Psychology, 51*, 478–485.

Barron, F. (1969). *Creative person and creative process*. Holt, Rinehart, & Winston.

Beghetto, R. A. (2007a). Does creativity have a place in classroom discussions? Prospective teachers' response preferences. *Thinking Skills and Creativity, 2*, 1–9.

Beghetto, R. A. (2007b). Ideational code-switching: Walking the talk about supporting student creativity in the classroom. *Roeper Review, 29*, 265–270.

Beghetto, R. A. (2009). In search of the unexpected: Finding creativity in the micromoments of the classroom. *Psychology of Aesthetics, Creativity, and the Arts, 3*(1), 2–5.

Beghetto, R. A. (2013a). Creativity: Development and enhancement. In J. A. Plucker & C. M. Callahan (Eds.), *Critical issues and practices in gifted education: What the research says* (2nd ed.). Prufrock.

Beghetto, R. A. (2013b). *Killing ideas softly? The promise and perils of creativity in the classroom.* Information Age Publishing.

Beghetto, R. A. (2014). Creative mortification: An initial exploration. *Psychology of Aesthetics, Creativity, and the Arts, 8*, 266–276.

Beghetto, R. A. (2017). Creative openings in the social interactions of teaching. *Creativity: Theories-Research-Applications, 3*, 261–273.

Beghetto, R. A. (2021). Creativity in K-12 schools. In R. J. Sternberg & J. C. Kaufman (Eds.), *Creativity: An introduction* (pp. 447–464). Cambridge University Press.

Beghetto, R. A., & Kaufman, J. C. (2007). Toward a broader conception of creativity: A case for "mini-c" creativity. *Psychology of Aesthetics, Creativity, and the Arts, 1*, 13–79.

Beghetto, R. A., & Kaufman, J. C. (2011). Teaching for creativity with disciplined improvisation. In R. K. Sawyer (Ed.), *Structure and improvisation in creative teaching.* Cambridge University Press.

Beghetto, R. A., & Kaufman, J. C. (2013). Fundamentals of creativity. *Educational Leadership, 70*, 10–15.

Beghetto, R. A., Kaufman, J. C., & Baer, J. (2014). *Teaching for creativity in the common core classroom.* Teachers College Press.

Beghetto, R. A., & Plucker, J. A. (2006). The relationship among schooling, learning, and creativity: "All roads lead to creativity" or "You can't get there from here?" In J. C. Kaufman & J. Baer (Eds.), *Creativity and reason in cognitive development* (pp. 316–332). Cambridge University Press.

Black, P., & Wiliam, D. (1998). Inside the black box: Raising standards through classroom assessment. *Phi Delta Kappan, 80*, 139–148.

Borko, H., & Livingston, C. (1989). Cognition and improvisation: Differences in mathematics instruction by expert and novice teachers. *American Educational Research Journal, 26*, 473–498.

Brandau, H., Daghofer, F., Hollerer, L., Kaschnitz, W., Kellner, K., Kitchmair, G., Krammer, I., & Schlagbauer, A. (2007). The relationship between creativity, teacher ratings on behavior, age, and gender in pupils from seven to ten years. *Journal of Creative Behavior, 41*, 91–113.

Cropley, A. J. (1992). *More ways than one: Fostering creativity.* Ablex.

Cropley, D. H., Patston, T., Marrone, R. L., & Kaufman, J. C. (2019). Essential, unexceptional and universal: Teacher implicit beliefs of creativity. *Thinking Skills and Creativity, 34*, 100604.

Csikszentmihalyi, M. (1996). *Creativity: Flow and the psychology of discovery and invention.* HarperCollins.

Csikszentmihalyi, M. (1999). Implications of a systems perspective for the study of creativity. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 313–335). Cambridge University Press.

Dawson, V. L. (1997). In search of the wild bohemian: Challenges in the identification of the creatively gifted. *Roeper Review, 19*, 148–152. https://doi.org/10.1080/02783199709553811

Diakidoy, I. N., & Phtiaka, H. (2002). Teachers' beliefs about creativity. In S. P. Shohov (Ed.), *Advances in psychology research* (Vol. 15, pp. 173–188). Nova Science Publishers Inc.

Dunning, D., Johnson, K., Ehrlinger, J., & Kruger, J. (2003). Why people fail to recognize their own incompetence. *Current Directions in Psychological Science, 12*, 83–86.

Dweck, C. S. (2000). *Self-theories: Their role in motivation, personality, and development*. Psychology Press.

Fayena-Tawil, F., Kozbelt, A., & Sitaras, L. (2011). Think global, act local: A protocol analysis comparison of artists' and nonartists' cognitions, metacognitions, and evaluations while drawing. *Psychology of Aesthetics, Creativity, and the Arts, 5*, 135–145.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. *American Psychologist, 34*, 906–911. https://doi.org/10.1037/0003-066X.34.10.906

Guilford, J. P. (1950). Creativity. *American Psychologist, 5*, 444–454.

Guo, J., Ton, Y., & Pang, W. (2020). Teachers' perceptions of students' creativity in China's classrooms: The role of students' academic achievement and misbehaviors. *Journal of Creative Behavior, 55*(1), 228–240.

Hong, E., & Milgram, R. M. (2007). *Preventing talent loss.* Routledge.

Hong, E., Peng, Y., & Wu, J. (2010, August). *Effects of explicit instruction, metacognition, and motivation on creative performance*. Paper presented at the American Psychological Association, San Diego, CA.

Housner, L. D., & Griffey, D. C. (1985). Teacher cognition: Differences in planning and interactive decision making between experienced and inexperienced teachers. *Research Quarterly for Exercise and Sport, 56*, 45–53.

Karwowski, M., Czerwonka, M., & Kaufman, J. C. (2020). Does intelligence strengthen creative metacognition? *Psychology of Aesthetics, Creativity, and the Arts, 14*, 353–360.

Kaufman, J. C. (2009). *Creativity 101*. Springer.

Kaufman, J. C. (2012). Counting the muses: Development of the Kaufman-Domains of Creativity Scale (K-DOCS). *Psychology of Aesthetics, Creativity, and the Arts, 6*, 298–308.
Kaufman, J. C., & Baer, J. (Eds.). (2005). *Creativity across domains: Faces of the muse.* Lawrence Erlbaum.
Kaufman, J. C., & Beghetto, R. A. (2009). Beyond big and little: The Four C model of creativity. *Review of General Psychology, 13*, 1–12.
Kaufman, J. C., & Beghetto, R. A. (2013). In praise of Clark Kent: Creative metacognition and the importance of teaching kids when (not) to be creative. *Roeper Review, 35*, 155–165.
Kaufman, J. C., & Beghetto, R. A. (2014). Creativity in the schools: Renewed interest and promising new directions. In M. J. Furlong, R. Gilman, & E. S. Huebner (Eds.), *Handbook of positive psychology in the schools* (pp. 165–175). Routledge.
Kaufman, J. C., Beghetto, R. A., & Watson, C. (2016). Creative metacognition and self-ratings of creative performance: A 4-C perspective. *Learning and Individual Differences, 51*, 394–399.
Kaufman, J. C., Evans, M. L., & Baer, J. (2010). The American idol effect: Are students good judges of their creativity across domains? *Empirical Studies of the Arts, 28*, 3–17. https://doi.org/10.2190/EM.28.1.b
Kennedy, M. (2005). *Inside teaching: How classroom life undermines reform.* Harvard University Press.
Kettler, T., Lamb, K. N., Willerson, A., & Mullet, D. R. (2018). Teachers' perceptions of creativity in the classroom. *Creativity Research Journal, 30*(2), 164–171.
King, L. A., McKee-Walker, L., & Broyles, S. J. (1996). Creativity and the five-factor model. *Journal of Research in Personality, 30*, 189–203.
Kozbelt, A. (2007). A quantitative analysis of Beethoven as self-critic: Implications for psychological theories of musical creativity. *Psychology of Music, 35*, 147–172.
Kozbelt, A. (2008). Hierarchical linear modeling of creative artists' problem solving behaviors. *Journal of Creative Behavior, 42*, 181–200.
Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology, 77*, 1121–1134.
Pintrich, P., Wolters, C., & Baxter, G. (2000). Assessing metacognition and self-regulated learning. In G. Schraw (Ed.), *Metacognitive assessment*. University of Nebraska Press.
Plucker, J. A., Beghetto, R. A., & Dow, G. T. (2004). Why isn't creativity more important to educational psychologists? *Educational Psychologist, 39*, 83–96.
Redmond, M. R., Mumford, M. D., & Teach, R. (1993). Putting creativity to work: Effects of leader behavior on subordinate creativity. *Organizational Behavior and Human Decision Processes, 55*(1), 120–151.
Richards, R. (Ed.). (2007). *Everyday creativity and new views of human nature: Psychological, social, and spiritual perspectives.* American Psychological Association Press.
Richardson, C., & Mishra, P. (2018). Learning environments that support student creativity: Developing the SCALE. *Thinking Skills and Creativity, 27*, 45–54.
Runco, M. A., & Dow, G. T. (2004). Assessing the accuracy of judgments of originality on three divergent thinking tests. *Korean Journal of Thinking & Problem Solving, 14*, 5–14.
Runco, M. A., Johnson, D. J., & Bear, P. K. (1993). Parents' and teachers' implicit theories of children's creativity. *Child Study Journal, 23*, 91–113.
Sawyer, R. K. (2004). Creative teaching: Collaborative discussion as disciplined improvisation. *Educational Researcher, 33*, 12–20.
Sawyer, R. K. (Ed.). (2011). *Structure and improvisation in creative teaching.* Cambridge University Press.
Silvia, P. J. (2008). Discernment and creativity: How well can people identify their most creative ideas? *Psychology of Aesthetics, Creativity, and the Arts, 2*, 139–146.
Simonton, D. K. (1997). Creative productivity: A predictive and explanatory model of career trajectories and landmarks. *Psychological Review, 104*, 66–89.

Simonton, D. K. (2012). Taking the US patent office creativity criteria seriously: A quantitative three-criterion definition and its implications. *Creativity Research Journal, 24,* 97–106.
Stein, M. (1953). Creativity and culture. *Journal of Psychology, 36*, 311–322.
Sternberg, R. J. (1985). Implicit theories of intelligence, creativity, and wisdom. *Journal of Personality and Social Psychology, 49*, 607–627.
Sternberg, R. J., & Kaufman, J. C. (2012). When your race is almost run, but you feel you're not yet done: Application of the propulsion theory of creative contributions to late-career challenges. *Journal of Creative Behavior, 46*, 66–76.
Sternberg, R. J., Kaufman, J. C., & Grigorenko, E. L. (2008). *Applied intelligence.* Cambridge University Press.
Sternberg, R. J., Kaufman, J. C., & Pretz, J. E. (2002). *The creativity conundrum.* Psychology Press.
Sternberg, R. J., & Lubart, T. I. (1995). *Defying the crowd: Cultivating creativity in a culture of conformity.* Free Press.
Westby, E. L., & Dawson, V. L. (1995). Creativity: Asset or burden in the classroom? *Creativity Research Journal, 8*, 1–10.

Creative Problem Solving: From Evolutionary and Everyday Perspectives

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Keywords Evolution · Creative problem solving · Everyday creativity · Pretense · Play · Conformity bias

1 Introduction

More than 70 years ago an American businessman forwarded a bold proposition—creative solutions to problems could be deliberately facilitated through systematic strategies and, even more, people could learn to be more effective creative thinkers. In support of his radical claim, Alex Osborn (1953a) published his pioneering book, *Applied Imagination*, in which he described a learnable and teachable methodology for improving creative thought which he called Creative Problem Solving (CPS). Those interested in the historical roots of CPS, and in the pioneer whose work served as a catalyst to the worldwide interest in deliberate creativity, are encouraged to listen to Alex Osborn's (1953b) radio essay, recorded as part of Edward R. Murrow's program *This I Believe* (Osborn, 1953b, November 11). The potency of CPS was tested time and time again in Osborn's advertising agency as well as other organizations (Osborn, 1953a; Puccio & Cabra, 2010; Puccio et al., 2006). Beyond the applied experiences that underscored the value of Osborn's methods, academic researchers have conducted empirical studies to test the efficacy of Osborn's claims and have concluded that these deliberate methods significantly enhance the cognitive competencies associated with creative thinking (Basadur et al., 1986; Meadow & Parnes,

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1959; Parnes, 1985; Parnes & Meadow, 1959; Parnes & Noller, 1972; Puccio, Burnett, et al., 2018).

Over the years many straightforward descriptions of the history and mechanics of CPS have been written (e.g., Isaksen & Treffinger, 2004; Puccio & Cabra, 2009; Puccio et al., 2005). The goal of the present chapter is to depart from this approach. Rather, our intention is to locate this model for deliberate creative process within a broader and, we hope, deeper context, which is biological evolution in general and the evolution of the human species specifically. With this end in mind, this chapter is organized into three main sections. The first section examines the role creative problem solving played in human evolution. The question explored here is whether the ability to creatively solve problems provided humans with a unique competitive advantage and, if so, whether it is reasonable to suggest that this quality was passed from one generation to the next through the ongoing evolution of the human species. We delve into this topic from two perspectives—one historical and the other contemporary. Through the historical lens, we look at the evidence for creative thinking as reflected in human artifacts and the cross-disciplinary discourse on human evolution. From a more contemporary lens, we describe how everyday acts of creativity reflect the innate application of creative problem solving to life's challenges.

The second section of this chapter describes, by way of metaphor, how CPS aligns with some of the foundational precepts embedded in descriptions of biological evolution. Through this discussion we raise the possibility that CPS, as originally articulated by Osborn (1953a) and developed more recently by others (Isaksen et al., 1994; Puccio et al., 2011, 2012), reflects a primal creative process. To put it slightly differently, we believe there are striking parallels between the process of evolution and the creative process. By extending this metaphorical exploration, we humbly suggest that CPS provides a vehicle through which individuals can more deliberately call on their innate creative-thinking skills.

In the third, and final section of this chapter, we conclude that creativity alone is insufficient to explain the success of the human species. Instead, we describe how human ingenuity and innovation has been the direct result of an evolutionary polarity that features creativity and conformity. In short, creativity is a force that produces novel variation, yet it is conformity that enables this novelty to become embedded in the collective.

2 Human Evolution and Creativity

When compared to other species, humans are relatively weak and lack many of the innate physical characteristics that enable other species to adapt to the various physical conditions on planet Earth (Wilson, 2017). For example, humans do not have fur or great vision, they are not fast, and they cannot fly or breath under water. Given these obvious physical deficiencies is it reasonable to conclude that humans have been endowed with particular intellectual skills crucial for survival? Furthermore,

is it possible that the seeds for these intellectual assets were sown millions of years ago among the species that eventually gave rise to humans? To be more precise, is it reasonable to claim that humans' ability to engage in creative thinking, especially as applied towards the production of novel solutions to problems, has played a crucial role in our evolution and survival? The first section of this paper uses these questions as a platform to suggest that humans have long used their creativity to solve problems, therefore, we argue that creative thinking has played a crucial role in the evolution of the human species.

In 1974 an unusually complete skeleton of an extinct human relative *Australopithecus afarensis* was discovered in Tanzania, Africa. This specimen, nicknamed "Lucy", was preserved in sediment and is more than 3.6 million years old. Diminutive forerunners to humans, her species were about the size of a chimpanzee but walked upright. Though small in stature, this species existed for 800,000 years before dying off around 2.9 million years ago. What competitive advantage enabled such longevity? Perhaps a key skill was the ability to solve problems in creative ways, such as the imagination to turn physical objects into tools, along with collaboration and communication (Ansary, 2019). Palmer's (2010) study of this pre-human species suggests that creative thinking was necessary to make up for the lack of physical prowess:

> Out in the open these small australopithecines were at their most vulnerable to predators. Without sharp teeth, claws or the ability to run fast, their only protection was cooperative alertness, vocal communication, and intelligence, together with the use of hand-held simple weapons, such as sticks and stones. (pp. 59–61)

With the dawn of the *Homo* genus about 2.5 million years ago, the evolution of humanity began to leave a trail of artifacts that highlighted ever-expanding levels of creativity. The breadth of creative artifacts began with the advent of simple tools more than 2 million years ago and advanced slowly towards what is referred to as the 'creative explosion' about 40,000 years ago (Carruthers, 2002; Spivey, 2005). What distinguished Homo genus from previous species was a brain capacity of 600 ml, erect posture, bipedal gait, and precision handgrip. Though the line of human evolution did not advance in a linear manner, with competing branches of species often existing at the same time and in the same geography, a corollary has emerged over time such that as brain capacity grew there was a corresponding increase in the complexity of the products produced by the evolving homo species (Dunbar et al., 2007).

Homo habilis, with a brain capacity of about 50% of modern humans, created what has been referred to as flake tools. These single sided tools were made by breaking fine-grained rocks into sharp-edge flakes used to split fruit and nuts. Though these tools are the earliest known tangible creative products, dating back to 2.5 million years ago, it has been suggested that tools made of organic material existed previously. To highlight the conscious and deliberate construction of these tools, Palmer (2010) noted, "This was no random process of trial and error; rather, it was a well-established technique that had already been learned, refined, and passed down from many generations" (p. 192).

The next significant advancement in tool making was the symmetrically shaped hand axe, which originated about 1.5 million years ago. This innovation in technology featured a pear-shaped design that had a sharp point and edges on one side and a blunt end, held in the palm of the hand, on the other. This two-sided tool was created by a species, *Homo erectus*, whose brain size had increased to about 75% of today's human (850 ml). This development in tool making involved a more complicated production process that may be indicative of an evolution in some of the thinking skills associated with creativity. For example, Morriss-Kay (2010) argued that the relative complexity of the hand axe pointed to an ability to see the finished product 'in the mind's eye'. Palmer (2010) described a similar skill when he stated, "Making a hand axe requires greater skill, both manually and mentally, than a primitive flaked tool. The maker has to envisage the shape of the finished object and to keep this core goal in mind" (pp. 192–194).

Approximately 800,000 years ago additional species of early humans appeared with a cranial cavity of about 90% of modern humans (1000–1390 ml). Though various names have been ascribed to these larger brained human ancestors, they are commonly referred to as *Homo heidelbergensis*. The approximate species range given to *Homo heidelbergensis* is about 800,000–200,000 years ago. Along with a significant increase in brain size, Dunbar et al. (2007) noted that the *Homo heidelbergensis* produced more sophisticated tools. Palmer (2010) observed that while hand axes were still being produced during the Middle Paleolithic period (from approximately 300,000 to 30,000 years ago), there was an expansion in the variety of stone tools with the appearance of arrowhead-shaped points, serrated points, and points that took the form of a harpoon. Around 300,000 years ago it is believed that *Homo heidelbergensis* gave rise to a new even larger brained species in Europe called *Homo neanderthalensis*. With a brain capacity that closely approximates modern humans, Neanderthals began using scrapers for preparing skins, knifes for cutting, and spears for hunting (Dunbar et al., 2007; Palmer, 2010).

Well before the Neanderthals became extinct, which occurred about 28,000 years ago, modern humans (*Homo sapiens*) appeared in Africa. With the arrival of the anatomically modern human, around 160,000 *years* ago, came a significant increase in creative output. For more than a million years the primary tool constructed by early humans was the flake tool, followed by the hand axe, which enjoyed a similar product lifecycle. In a significantly shorter time span, *Homo sapiens* brought paradigmatic shifts to tools and introduced completely new forms of creativity. With respect to innovation in tools, about 100,000 *years* ago *Homo sapiens* were credited with revolutionizing weaponry by developing implements that could be launched at one's quarry, as opposed to the earlier thrusting weapons (Ansary, 2019). Completely new lines of products were created as well. As Dunbar et al. (2007) summarized, "By the time the modern humans arrived in Europe (around 40,000 years ago sometime before the Neanderthals became extinct), this technology had blossomed into fully-fledged art—buttons, beads, needles, Venus figurines, cave paintings and deliberate burials complete with grave goods" (p. 33). Other forms of creativity to emerge during this time period included: body painting (about 16,000 years ago); the oldest

known musical instrument (40,000 years ago); the construction of the first purpose-built shelter (40,000 years ago); and the production of clothing by means of sewing (27,000 years ago) (Palmer, 2010).

While the numerous artifacts left behind by *Homo sapiens* underscore a significant expansion in the application of human creativity, it would seem that creative thinking has long been a characteristic of early humans and our ancestral predecessors (Allman, 1996). As Palmer (2010) observed, "many experts argue that the cognitive development that enabled the production of artworks is very ancient and certainly predates the evolution of *Homo sapiens*" (p. 217). Indeed, it could be argued that this ability to apply creative thinking to solve problems was one of the primary qualities that ensured a competitive advantage to our ancestral species. Overtime this ability to apply imagination to create tools that assured survival grew and expanded in accordance with the evolution of the human species. And we would argue that the initial application of creative thinking to solve problems of survival eventually grew to be applied in broader ways, thus resulting in the rich and diverse aspects of human culture. As simply put by Morriss-Kay (2010), "without these survival-enhancing functional origins, it is unlikely that we would have the neural equipment to create art" (p. 174).

Humans cannot fly, do not possess great vision, do not have fur, but our species is endowed with an ability to create. And perhaps it is our ability to apply imagination to produce novel responses to life's challenges that has been a key to our survival. *Homo sapiens* and Neanderthals shared the Earth at the same time, but despite similar sized brains the Neanderthals became extinct. Why? Again, perhaps the answer lies in the effectiveness in deploying creative-thinking abilities. As Palmer (2010) suggested, "This new technology, developed by modern humans, was probably part of the reason they were able to survive the climate swings of the latter part of the ice age, with which the Neanderthals finally could not cope" (p. 198).

The evolution of human intelligence might be thought of as the evolution of creative problem solving. In a paper exploring the evolution of the brain Roth and Dicke (2005) used a definition of intelligence that reflected a clear connection to creativity. They defined intelligence as "the degree of mental or behavioral *flexibility* resulting in novel solutions" (p. 256). They went on to argue that evidence for such intelligence can be observed in changes to tactics in problem solving and in innovation rates, which are often used as indices of creativity (Roth & Dicke, 2005, 2017). Carruthers (2002) provided further support for the link between creative thinking and problem solving when he argued that reproductive pressures may have influenced selection of a more creative mate—individuals who displayed a greater ability to creatively solve problems may have been seen as more appealing partners. This tendency to select mates based on their creative problem-solving skills helped to ensure the survival of the species and thus the trait would be passed along to future generations.

The physiological evolution of the brain has given humans an advantage with respect to creative thinking and examination of the brain's development may give clues to the evolution of this unique human quality. And brain size alone is not the sole physiological predictor of the capacity for complex and creative thinking.

Indeed, humans do not have the largest brains on planet Earth, whales and elephants have larger and heavier brains. Thus, Roth and Dicke (2005) concluded that other anatomical differences may account for variation in intellectual ability. In comparison to other species human brains possess a much greater information processing capacity, which is determined by the high cell density in the cortex, along with higher conduction velocity and relatively smaller distances between neurons. It is perhaps this physiological difference, according to Roth and Dicke's (2005) analysis, that provides the best explanation for why humans, more so than any other creature on our planet, display an ability to engage in mental and behavioral flexibility that results in the production of novel solutions to problems.

Through this albeit brief review of human evolution, we hope to have raised the possibility that creative thinking provided humans with an evolutionary advantage that helped to ensure survival. With this possibility in mind, we suggest that humans have evolved to be creative problem solvers. At first this capacity to create was primarily directed at solving the practical problems of survival, i.e., creating tools for utilitarian purposes. Once this ability to think creatively was well established in the *homo* genus, which came about through the compounding effects of biological evolution and sexual selection, it is likely to have expanded towards other purposes. As Darwin (2003) described the modes of transition in organs, an organ designed for one purpose can evolve towards another function; perhaps the same is true of the human brain (Gould, 1996). Originally formed to generate novel solutions to practical problems, this organ may have expanded this same core creative capacity to produce art, music, storytelling, cultural rituals and more. While Osborn's recent methods for promoting deliberate creative thinking are new, the intellectual capacity to creatively solve problems is likely to be as old as humankind. The forces of evolution have wired humans to be creative. Creativity is the sine qua non of our species. As biologist, and Pulitzer Prize winning author, E. O. Wilson (2017) argued:

> What, then, is creativity? It is the innate quest for originality. The driving force is humanity's instinctive love of novelty — the discovery of new entities and processes, the solving of old challenges and disclosure of new ones, the aesthetic surprise of unanticipated facts and theories, the pleasure of new faces, the thrill of new worlds. (p. 3)

3 Everyday Creativity as Everyday Creative Problem Solving

If humans have evolved to be creative then there should be evidence that creative thinking is exhibited by all humans, and on a regular basis. Some evidence for the universal human disposition to be creative can be found in Carruthers' (2002) description of childhood play. According to Carruthers the young of all species engage in play, and such play is closely linked with skills necessary for survival as an adult. Young felines, for example, stalk, pounce, and wrestle. Later in life these same skills become crucially important for adult cats. Carruthers goes on to argue that what is true of children, across all cultures, is pretend play. The offspring of humans,

like no other species on our planet, engage in wholly imaginative play that produces elaborate scenarios that are conjured by the mind. Carruthers (2002) suggested that "if we ask what human *pretend* play is for, the answer will be: its function is to practice for the sorts of imaginative thinking which will later manifest themselves in the creative activities of adults" (p. 229).

If Carruthers is correct, then we should expect to see acts of creativity in all adult humans. To be open to this possibility requires a perceptual shift in how many laypeople view creativity. When most adults are asked if they are creative, the typical response is a clear and immediate 'no'. This is unfortunate and, given our position on the role of creativity and creative problem solving in human evolution, inaccurate. So why do so many people believe that they are not creative? Perhaps this is due to the fact that our society celebrates and makes legends out of those who achieve eminence as a result of their creative acts. In the face of such luminaries as Picasso, Edison, Newton, Shakespeare, Carver, Mozart, Angelou, what ordinary human would claim to be creative? It is analogous to asking someone if he or she can sing; many will say no, but the reality is that all humans can sing (just not equally well) (Mithen, 2006).

For many decades creativity research has been focused on understanding the nature of creativity by studying those recognized by society as being highly creative. This made methodological sense, as creativity is a complex phenomenon it made good sense to begin by examining those individuals who were demonstrably creative. In the last several decades the research on creativity has expanded to include a more egalitarian view of creativity. Though known by various names, such as everyday creativity (Modrzejewska-Świgulska, 2015; Richards, 1999; Szmidt, 2018), personal creativity (Runco, 2006), little 'c' creativity (Craft, 2001), and mini-c creativity (Kaufman, 2016), the egalitarian view of creativity holds that all humans can display creative behavior in activities associated with their day-to-day lives. As Richards (2010) stated "the construct of everyday creativity is defined in terms of human originality at work and leisure across the diverse activities of everyday life" (p. 190). If all humans can display small acts of creativity in their everyday lives, then it could be concluded that our creativity, like our vision, our opposable thumbs, and other attributes, was formed through evolution. We turn again to Richards (1999) for support of this position, "If there is evolutionary value to creativity it would be at the level of everyday creativity, not eminent contribution. To be a reproductive or evolutionary advantage, creativity must happen at each level on a day to day basis" (p. 684).

Perhaps the everyday creativity of the modern human is closely aligned with early humans' use of creativity for the practical problems of survival. If viewed in this functional manner, everyday creativity can be thought of as a creative problem-solving ability. As Richards (1999) put it:

> Nevertheless, authors and scholars have long seen creativity of everyday life as both a survival capability — representing the "phenotypic plasticity" that allow humans to adapt to changing environments — and a humanistic force in ongoing growth, personal development, and even transcendence. New research on creativity and health further underlines its potential as a force in survival and evolution. (p. 684)

Though modern humans generally do not have to contend with the physical threats faced by early humans, everyday life is fraught with challenges and changing conditions. We would hold that such situations are more likely to be resolved when humans exercise their creative problem-solving skills. Modrzejewska-Świgulska (2013, 2014) and Chmielińska and Modrzejewska-Świgulska's (2020) qualitative studies of everyday creativity revealed that participants clearly saw their own creativity as a form of problem solving, as a thought process and set of behaviors that enabled them to effectively respond to life's difficulties, problems, and barriers. Modrzejewska-Świgulska's work found that research participants cited the application of everyday creative problem solving as an important factor in the successful implementation of a variety of new and long-term projects. These projects included: professional (e.g., establishing a new educational institution in accordance with one's own philosophy); social (e.g., activating the local community to save vanishing historical graveyards); and personal (e.g., taking the hard decision to end an unhealthy marriage and then conducting one's own divorce case).

We believe these examples of everyday creativity exemplify the application of human's innate creative-thinking talents to the problems associated with daily life. Life can be fraught with challenges and often these challenges require creative responses, but humans do not have to wait for a creative solution to emerge by chance. Rather, individuals can learn to direct and expand their creative problem-solving skills, thereby improving the probability of producing a novel solution. In other words, evolution provided all humans with the capacity to think creatively, and with training this innate gift can be expanded and exercised on demand. And one of the most well-researched and effective methods for enhancing creative thinking is Creative Problem Solving (Scott et al., 2004).

4 Examining Creative Problem Solving Through the Lens of Evolution

In this section we explore how our innate creativity can be deliberately bred using a formal creative-thinking process called Creative Problem Solving (note to the reader, Creative Problem Solving in uppercase refers to the formal methodology originally developed by Osborn and elaborated by others). To depart from past descriptions of Creative Problem Solving (CPS), we continue with the central theme of this chapter, evolution, to (re)examine the broad purpose of CPS, as well as the specific structure and operations associated with this creativity method. The goal of this discussion is not to claim a direct and profound relationship between CPS and evolution. Rather, we hope to broaden the view of CPS beyond a purely mechanistic perspective (i.e., a strict functional description of the process and its related tools) by revealing how CPS mirrors operations that are fundamental to the process of evolution. Moreover, we explore the extent to which CPS leverages creative problem-solving dispositions that are natural to all human beings. We are not the first to draw comparisons between

the creative process and evolution, for example see Campbell's (1960) seminal paper, but do believe we are the first to compare CPS specifically to evolution. Our hope here is to both broaden and deepen how CPS is conceived, and to accomplish this by specifically recasting CPS within the framework of biological evolution.

4.1 Parallels Between Evolution and the Creative Process

Earlier we made the case that humans have long been creative problem solvers. To review, we suggested that, among other attributes, it was the capacity to apply imagination to solve problems that ensured the survival of our species. Humans, more so than most species, have the cognitive capacity to imagine novel ideas and the physical dexterity to manifest what was originally conceived in the mind's eye. Humans are creativity machines. To be sure, the transition from walking on all fours to a bipedal posture freed up our ancestors' hands to create, but it was imagination that gave those hands something to do. While at first the use of imagination was likely limited to the resolution of problems that presented an immediate threat to survival, its use was expanded in a manner that led to a broad array of creative products and behaviors. It is our contention that the evolution of human creativity has helped drive the expansion of our civilization.

Evolution can be viewed as a problem-solving process, the goal being the production of solutions to ensure survival in the face of environmental conditions, to achieve some advantage over one's competition, and to garner the attraction of a mate in order to reproduce. From a metaphorical perspective, the process of evolution achieves the same end as creativity, to produce novelty that proves valuable. Though variously stated, perhaps one of the most widely accepted definitions of creativity is the production of novelty that is useful (Runco & Jaeger, 2012). Evolution seems to embody the same Janusian facets of novelty and value. Variation is the exploration of novelty, while selection and retention preserve the novel variations that are most valuable. The working relationship between novelty and usefulness is inherent in Darwin's (2003) description of the fundamental elements of evolution:

> Owing to this struggle, variations however slight and from whatever cause proceeding, if they be in any degree profitable to the individuals of the species, in their infinitely complex relations to other organic beings and to their physical conditions of life, will tend to the preservation of such individuals, and will generally be inherited by the offspring. The offspring, also, will thus have a better chance of surviving, for, of the many individuals of any species which are periodically born, but a small number can survive. I have called this principle, in which each slight variation, if useful, is preserved by the term Natural Selection, in order to mark its relation to man's power of selection. (p. 61)

While novelty and value work together in evolution, it is the presence of novelty that is the determining factor that distinguishes creative solutions and products from uncreative responses (Puccio et al., 2011). Products and behaviors can survive merely on their usefulness. A standard No. 2 pencil, for example, has been widely used for decades without any significant variation. However, for an idea to be considered

creative it must be novel. It would seem that Darwin believed novelty had a special role in the process of evolution. With respect to natural selection Darwin (2003) explained:

> Consequently, in the course of many thousand generations, the most distinct varieties of any one species of grass would have the best chance of succeeding and of increasing in numbers, and of supplanting the less distinct varieties; and varieties, when rendered very distinct from each other, take the rank of species. (p. 107)

And in terms of the role humans play in the evolutionary process of other species, Darwin offered the following observation in terms of the value of novelty:

> No man would ever try to make a fantail till he saw a pigeon with a tail developed in some slight degree in an unusual manner, or a pouter till he saw a pigeon with a crop of somewhat unusual size; and the more abnormal or unusual any character was when it first appeared, the more likely it would be to catch his attention. (p. 36)

To summarize, as with evolution, the essence of creativity is the production of outcomes that are novel, depart from past ideas, and that are valuable. And as with evolution, creativity is ongoing, a never-ending process in which one idea, like species, is replaced by the emergence of new and valuable innovations. The flake tool referred to earlier was in use for over one million years until a new innovation came along, the hand axe, which enjoyed about an equally long product life cycle before it was replaced. Talbot's (1997) definition of creativity, "making a change that sticks (for a while)" (p. 181), highlights the ephemeral nature of creative ideas and the ongoing need for creativity. All ideas and products, be they tangible or intangible, are merely prototypes that serve as springboards for the next wave of ideas that will either refine or disrupt their predecessors. Perhaps like no other time in history has the pace of creativity been so fast as is the case in our present civilization. The flake tool and hand axe were actively used for over a million years; today manufactured products are subject to fundamental redesign every 5–10 years and high-tech products every 6–12 months (Hunter & Schmidt, 1996). To be sure, creativity, like evolution, is an iterative process. However, unlike biological evolution, the evolution of ideas within the human race is occurring at a significantly faster pace, less like a marathon and more like a sprint.

4.2 The Intentional Breeding of Creative Ideas

The pace of change in the twenty-first century has given rise to the recognition that creativity and innovation are necessary workplace skills and, as such, many educational leaders have challenged schools to consider how their curricula might explicitly develop such skills (National Center on Education and the Economy, 2008; Puccio, 2017; Trilling & Fadel, 2009). The call for creative thinkers in the workplace has underscored the shift away from creativity by chance to creativity on demand. This migration from chance creativity to directed creativity is analogous to the distinction

Darwin made between natural selection, as shared in a previous quote from Darwin, and humans' effect on biological evolution (see Darwin, 2003, p. 36). As Darwin (2003) described:

> Variability is not actually caused by man; he only unintentionally exposes organic beings to new conditions of life, and then nature acts on the organization and causes it to vary. But man can and does select the variations given to him by nature, and thus accumulates them in any desired manner. He thus adapts animals and plants for his own benefit or pleasure. He may do this methodically, or he may do it unconsciously by preserving the individuals most useful or pleasing to him without any intention of altering the breed. It is certain that he can largely influence the character of a breed by selecting, in each successive generation, individual differences so slight as to be inappreciable except by an educated eye. This unconscious process of selection has been the great agency in the formation of the most distinct and useful domestic breeds. (pp. 485–486)

Humans can selectively combine individual plants, as well as animals, to facilitate both the speed and outcome of biological evolution. The same can be said for creativity. Humans can be left to their own innate powers of the mind to produce creative ideas. The artifacts of civilizations across the globe are a testament to our species' capacity to create, and, principally due their metacognitive powers, humans can accelerate the pace of creativity. Since humans have been endowed with the capacity to learn new skills and to direct their thinking, it is conceivable to teach creative-thinking skills so that such abilities can be applied as directed. We refer to this as *deliberate creativity*. While some pioneers in the field of creativity explored the nature of creativity, others, like Osborn (1953a), Parnes (1985), Gordon (1961), and de Bono (1977), were concerned with the nurture of creativity. Their work was focused on improving humans' creative problem-solving capacities.

CPS was designed to help individuals and groups deliberately apply their creative-thinking faculties to develop new and valuable solutions to heuristic problems. CPS is not the only deliberate creative process model, but it is one of the most widely researched (Basadur et al., 1986; Puccio et al., 2006; Rose & Lin, 1984; Scott et al., 2004). In their meta-analytic review of creativity training, Scott et al. (2004) found that programs based on cognitive models, such as CPS, were the most effective at enhancing creative attitude, problem solving, creative performance, and divergent thinking. In describing some of the favorable mechanisms of this approach to creativity training, Scott et al. (2004) commented that, "the Creative Problem-Solving program (e.g., Parnes & Noller, 1972; Treffinger, 1995) begins by describing the key cognitive processes underlying creative thought. Subsequently, strategies for effectively applying these processes are described and illustrations of their applications are provided" (p. 383). The remainder of this chapter describes the key cognitive processes associated with CPS.

4.3 The Thinking Fundamental to CPS Parallels the Process of Evolution

We begin by sharing an illustration of the structure of the CPS process (Puccio et al., 2011). Figure 1 depicts a seven-step process that is organized into three stages, this version of CPS is referred to as the Thinking Skills Model (Puccio et al., 2011). The stages are referred to as Clarification, Transformation and Implementation. There are two steps associated with each of these stages, with the seventh step (Assessing the Situation) located in the center of the model. All graphic images within the overall structure were chosen for specific reasons; of particular note is the diamond shape used for each step.

Figure 2 provides a graphic close-up of the diamond with further elaboration. The diamond shape is intended to reflect the balance between two fundamental modes of thinking that occur in each step of the process (from setting the vision through to developing a plan of action). The top portion of the diamond, where the figure expands from a central point, represents divergent thinking. Divergent thinking refers to the ability to generate many, varied, and original options. The bottom half of the diamond, where the lines move inwards until they reach a single point, is meant to illustrate convergent thinking. Convergent thinking is the ability to select, support, and develop the most promising options. Just as variation and selection

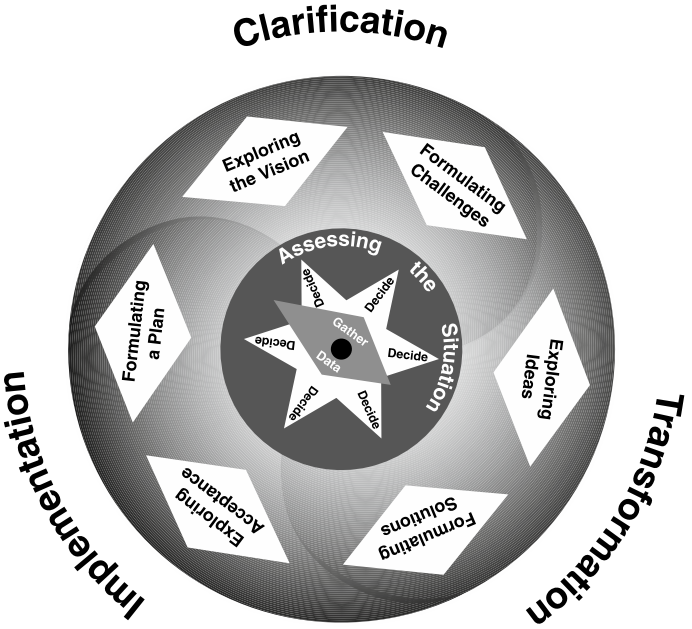

Fig. 1 Creative problem solving: the thinking skills model (Puccio et al. [2011]. Reprinted with permission)

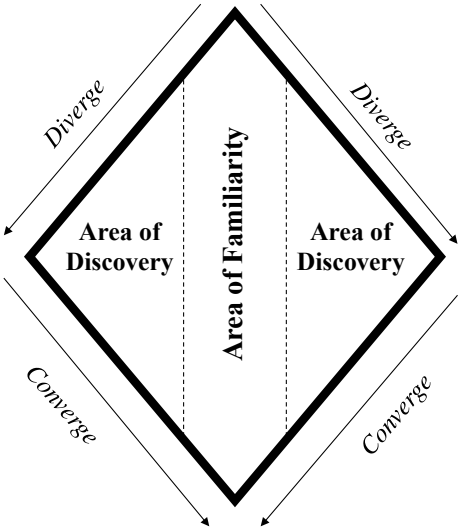

Fig. 2 The dynamic balance between divergent and convergent thinking (Puccio et al. [2011]. Reprinted with permission)

are basic properties of evolution, so are divergent and convergent thinking basic properties of CPS. Here, as also suggested by Campbell (1960), it is possible to see a parallel process between evolution and creativity. Divergence can be thought of as the production of variation, while convergence can be thought of as the selection of the most promising options. These options are then retained as a starting point for the subsequent step in the process. Just as this dynamic balance is inherent in biological evolution, we believe it is equally essential to the evolution of ideas. This dynamic balance, inherent in nature, was summed up by Darwin (2003) when he said, "In one sense the conditions of life may be said, not only to cause variability, either directly or indirectly, but likewise to include natural selection, for the conditions determine whether this or that variety shall survive" (p. 130).

While the ability to transition between divergent and convergent thinking has been a core feature of CPS since its introduction more than 60 years ago, the crucial role these modes of thinking played relative to human creativity may go back approximately 60,000 years ago. Even though the brain reached its modern-day cranial capacity roughly 160,000 years ago, the creative explosion in *Homo sapiens'* culture and products lagged behind this physiological milestone by about 100,000 years (i.e., artifacts dating back to around 40,000 years ago illustrate an innovative leap forward in art, tools, and other cultural traditions). After reviewing the various theoretical explanations for the cognitive changes in the brain that might account for the creative explosion, Gabora and Kaufman (2010) suggested that the most likely cognitive evolution was the ability on the part of *Homo sapiens* to engage in contextual focusing. These authors described contextual focus as the "capacity to spontaneously and subconsciously vary the shape of the activation function, flat for divergent thought and spiky for analytical" (p. 285). This cognitive function enabled humans to engage in the mode of thought appropriate to the situation and thus facilitated more effective

thinking. Specifically, divergent thinking could be applied to open-ended tasks that allowed for imagination and convergent thinking to close-ended tasks that required evaluation and development. And, as applied within the CPS process, humans can move back and forth between these modes of thinking as they develop novel solutions to challenges. If this cognitive explanation for the creative explosion is correct, then this would indicate a direct connection between the cognitive evolution of the human brain and the main operating feature of CPS. The interplay of divergent and convergent thinking in each step of the CPS process may indeed leverage the natural functions found in the evolved human brain. The nature and value of this dynamic balance was captured well by Gabora and Kaufman (2010):

> When the individual is fixated or stuck, and progress is not forthcoming, defocusing attention enables the individual to enter a more divergent mode of thought, and working memory expands to include peripherally related elements of the situation. This continues until a potential solution is glimpsed, at which point attention becomes more focused and thought becomes more convergent, as befits the fine-tuning and manifestation of the creative work. (p. 286)

We have referred to CPS as a deliberate creative methodology that naturally engages innate cognitive skills, i.e., divergent thinking, convergent thinking, and metacognition (the ability to think about thinking and to direct one's thinking as appropriate to the situation). As a 'deliberate' creative process, CPS cannot solely rely on innate modes of cognition but must also provide instruction that explicitly facilitates improved creative thought. With respect to divergent and convergent thinking. these modes can be purposefully engaged by applying guidelines, respectively, that are operationalized through problem-solving tools. Guidelines are offered as set of rules that, when adhered to, improve an individual or group's ability to engage in either divergent or convergent thinking. A tool is a "structured strategy to focus, organize, and guide an individual or group's thinking" (Puccio et al., 2011, p. 115). Tools, which can be oriented towards divergent or convergent thinking, are used within specific steps of the CPS process to render the goal of that respective step attainable. For example, Brainstorming is a divergent tool that is primarily associated with the Exploring Ideas step of CPS, Stakeholder Analysis is a divergent tool within the Exploring Acceptance step, and Searching for Success Zones can be used to facilitate convergent thinking in the Exploring the Vision step. Space constraints do not allow us to elaborate on these tools but a description of these and other tools can be found in Puccio et al. (2011). The effective use of creativity tools, such as those found in CPS and other deliberate creative methodologies like design thinking, serve as breeding strategies for creative output.

4.4 Deferral of Judgment and Pretend Play

Returning to the guidelines found in CPS, especially with reference to divergent thinking, we once again offer connections to human evolution. The principal guideline used in CPS to encourage divergent thinking is called *Defer Judgment*. To defer

judgment is to withhold judgment or evaluation temporarily while using one's imagination to generate options. This ability to suspend disbelief may also have contributed to the creative explosion that occurred some 40,000 years ago. Carruthers (2002) provided an eloquent evolutionary argument for the development of pretend play during the gap in time between the acquisition of language, about 100,000 years ago, and the broad application of human creativity to endeavors beyond practical problem solving (i.e., the creative explosion). Among other points in his argument, Carruthers suggested that the young of all species engage in the kind of play that enables them to hone skills necessary for survival as adults. For humans, play is the ability to form suppositions, to be able to believe in the possibility of an object or concept that does not exist in the present moment. Carruthers reasoned that the ability to engage in pretense improved survival in two ways: through enhanced creative problem-solving skills and increased attractiveness, with respect to reproductive pressures. The potentially crucial catalytic role the attitude of suspending judgment had with respect to pretense is found in the following summary offered by Carruthers (2002):

> In any case, the *supposer* need not be an additional cognitive faculty, with any distinct neural realization. It just has to be the possibility of taking a distinct (non-judgmental, non-evaluative) *attitude* towards contents–namely, the attitude of *supposing*. But, arguably, we get this attitude for free with imagery and language. What these faculties give us is the capacity to frame and then consider a possibility (represented by a visual image, say, or by a sentence), without yet endorsing, or desiring it. Once we have this, we effectively have the capacity to suppose. (p. 242)

With respect to CPS, an ability to engage in the deferral of judgment enables individuals and groups to generate more possibilities and higher-quality solutions to challenges (Firestien & McCowan, 1988; Parnes & Meadow, 1959). Returning to Fig. 2, the two parallel broken lines down the center of the diamond graphically represent the narrow path of possibilities often explored by individuals when engaged in problem-solving tasks. When judgment is used while simultaneously searching for alternatives, individuals are less likely to unearth original solutions that depart from what is already familiar and known. Early research established that when individuals follow the CPS guidelines for divergent thinking, especially the concept of deferral of judgment, they are much more likely to generate larger and more novel sets of responses. The production of novel variation is crucial to both evolution and to the realization of creative outcomes. As Darwin (2003) observed with respect to novelty and its relationship to divergence of character and extinction, "If, then, these two varieties be variable, the most divergent of their variations will generally be preserved during the next thousand generations" (p. 111).

4.5 The Role of Cognitive Fluidity

Another key divergent thinking guideline is cognitive fluidity which is a form of thinking that allows an individual to cross-fertilize ideas from one domain with another (Mithen, 2006). Without cognitive fluidity humans would not be able to

make associations, borrow ideas from one context and apply to a second, or to engage in metaphorical thinking. For example, early research into heavier-than-air flying machines benefited from fluid dynamics, and the idea of a boat's propeller was used to enable the airplane to power itself through air. There are abundant examples of creative breakthroughs resulting from ideas being transplanted across domains, and some have argued that such associative thought is fundamental to creative thinking (Benyus, 1997; Hargadon, 2003; Johansson, 2004; Murray, 2009; Nielsen & Thurber, 2016). In CPS associative thinking is deliberately facilitated through a divergent-thinking guideline called *Make Connections.* Here individuals are encouraged to actively examine areas unrelated to the problem at hand in order to produce additional insights and solutions.

Cognitive fluidity may have played a crucial role in *Homo sapiens'* ability to creatively solve problems, thereby enhancing the survival of our species. To underscore this point, Mithen suggested that while *Neanderthals* and *Homo sapiens* possessed similar sized brains, it may have been the absence of this thinking skill that impeded the former's creativity and thus survival. As Mithen (2006) argued:

> They (referring to Neanderthals) possessed the 'domain-specificity' mentality described above, which was highly adaptive because each type of intelligence had been moulded by natural selection to provide ways of thinking and types of knowledge suited for solving problems within its behavioural domain…As I have explained, the *Homo sapiens* mind is also based on multiple intelligences, but has one additional feature: cognitive fluidity. This term describes the capacity to integrate ways of thinking and stores of knowledge from separate intelligences so as to create types of thought that could never have existed within a domain-specific mind. (pp. 263–264)

4.6 Summary: CPS Leverages Innate Creative Problems-Solving Skills

This has been a brief introduction to CPS, with a special focus on evolution as a prism through which the structure and value of CPS could be understood at a deeper level. As a deliberate creative process, CPS is designed to allow individuals and groups to better direct their innate creative minds, for example by applying the guidelines for divergent thinking described above. The divergent thinking guidelines *Defer Judgment* and *Make Connections* seem to align naturally with the innate creative-thinking skills that have evolved through time. Research and practice have consistently demonstrated that learning and applying CPS does much to enhance creative-thinking skills and performance. Humans have evolved to be creative. CPS is designed to take what is a natural and thorough deliberate practice advance the possibility of a creative breakthrough, no matter the nature of the problem, from chance occurrence to on demand production. For a detailed description of the mechanics of this deliberate creative process, as well as the specific skills and tools associated with each step of CPS, see Puccio et al. (2011) or (2012).

5 Conclusion: The Creativity-Conformity Evolutionary Polarity

To conclude, we return to the broader topic of the role of creativity in human evolution. While we make the case that creativity provides the human species with a key competitive advantage, this quality by itself does not explain the rise of our modern society. It is overly simplistic to suggest that creativity singlehandedly resulted in levels of adaptive success achieved by humans. As Kuhn (2012) succinctly summed up his own work, "this paper makes the case that creativity and innovation can have their origins as much in demographic conditions and social dynamics as in individual cognitive processes" (p. 81). Numerous creativity scholars have maintained that creativity is a multi-faceted phenomenon and as such creative outcomes emerge through an interaction of distinct dimensions (MacKinnon, 1962; Murdock & Puccio, 1993; Puccio et al., 2011; Rhodes, 1961). Individuals do not operate in a vacuum; therefore, the social context plays a facilitative role in producing creative outcomes. With this in mind, we close by offering a proposition that the twin evolution of a creative mind, working in conjunction with a behavioral bias towards social conformity, enabled humans to achieve levels of applied imagination and innovation like no other species on the planet (Puccio, 2012, 2017, 2020; Puccio, Cabra, et al., 2018). We refer to this as the creativity-conformity evolutionary polarity (Puccio, 2020).

A polarity is the union of two qualities that appear to be contradictory yet operate together as a crucial dialectic within a system (Johnson, 1996; Jung, 1960; van der Steur, 2018). Each quality is distinct and value neutral, yet one without the other cannot exist (at least not for very long). Elsewhere, Csikszentmihalyi (1996) has pointed out that the creative person is able to develop a complex personality within which contradictory traits work together. This allows the creative person to adopt the full range of human emotions and assets that serve as a reservoir for creative behavior. Previously we described the balance between divergent and convergent thinking within the CPS process. This balance represents a polarity (Puccio, 2020). In fact, Csikszentmihalyi (1996) said as much when he offered the following observation, "people who bring acceptable novelty in a domain seem able to use well two opposite ways of thinking: the convergent and the divergent" (p. 60). Within a polarity each pole has its advantages. Divergent thinking brings about novelty and provides options; while convergent thinking promotes decision making and leads to focused effort. Yet, each pole in a polarity can present disadvantages. These disadvantages come to the fore when one pole is favored to the exclusion of the other. Divergent thinking that is not effectively balanced with convergent thinking can be chaotic and inefficient, while convergent thinking alone can be inflexible and stagnating. For a polarity to operate successfully there must be fluidity between the poles, as flexible, informed, and conscious movement between the poles maximizes the benefits of the two respective qualities and improves the success of the system.

Like the divergent-convergent polarity in the creative process and creative person, we maintain that there is an evolutionary polarity between creativity and conformity.

We would argue that this creativity-conformity polarity is embedded in Wilson's (2017) description of coevolution:

> The exponential growth of brain size launched during the habiline period of prehistory around two million years ago was the most rapid transformation in the complexity of an organism in the history of life. It was driven by a unique mode of evolution, called gene-culture coevolution, in which cultural innovation increased the rate at which genes favoring intelligence and cooperativeness were spread more rapidly; and, acting in reciprocity, the resulting genetic change increased the likelihood of cultural evolution. (p. 107)

Wilson suggested that the process of evolution selected for and retained both intelligence and cooperativeness. It is precisely the interaction between cognition (i.e., intelligence in Wilson's quote) and social conformity (i.e., cooperativeness in Wilson's quote) that we believe formed a crucial evolutionary polarity. Using the infinity loop to depict a polarity, Fig. 3 illustrates how creativity and conformity work together as a system. As argued throughout this chapter, we believe all humans are innately hard-wired to be creative. And, at the same time, humans are profound creatures of habit. Indeed, in their book on evolutionary psychology, Dunbar et al. (2007) persuasively argued that all humans are born with an innate conformity bias. In short, humans are social and cooperative. Human's propensity towards conformity promotes learning, establishes norms, reinforces proven practices, and serves as the foundation for collaboration. Working together creativity and conformity lead to survival and growth. A rigid focus on one pole over the other, at an individual or collective level, yields their own respective disadvantages. In the short term a rigid preoccupation with either pole produces suboptimal output, which then undermines success and survival over the long term. The creativity-conformity polarity, and the dynamic interplay of this polarity between the individual and the collective, was referenced by Dunbar et al. (2007) when they stated:

> If the conformity bias held total sway, new innovative behaviors would never arise. The conformist bias must interact with individual learning and individuals need to be sensitive to

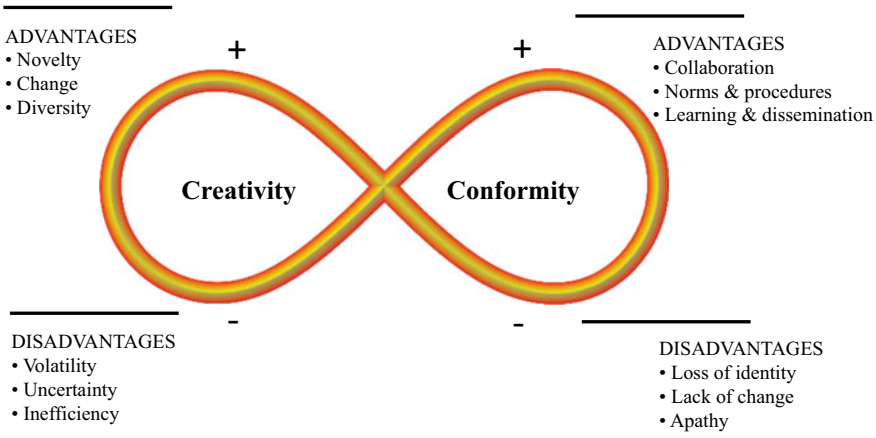

Fig. 3 Creativity-conformity polarity

> environmental change (so that they do not conform to a behavior that is no longer successful) before significant cultural change can occur. This is why cultures can and do change. Some individual learning always takes place and some individuals are less likely to conform than others. Sensitivity to changes in the environment allows such individuals to respond adaptively bringing in new behaviors that spread through the population by a combination of imitation, forms of social learning and, once the behavior becomes widespread, conformity bias. (p. 152)

Within the field of creativity, Sternberg and Lubart's (1995) investment theory of creativity parallels Dunbar and his colleagues' description of the interaction, and potential struggles, between individual creative expression and established societal norms and practices. The essence of Sternberg and Lubart's theory is that creative individuals, like financial investors, buy into novel ideas that hold promise (i.e., buy low). For creative individuals to realize the fullest potential of these creative ideas, they must then convince others of the value of these ideas (i.e., sell high). In pursuit of their creative ideas, creative individuals must be willing to defy the crowd and persist in the face of pressures to conform. Like gravitational pull, unseen yet dramatic, the innate dynamics of the creativity-conformity evolutionary polarity play out in a manner akin to Lewin's (1951) forced-field analysis, in which forces that promote change are pitted against forces that threaten change. Recognition of the creativity-conformity polarity could potentially assist creative individuals as they attempt to buy low and sell high. As it has always been, the same forces of conformity that at first resist creative ideas give way and become the very force that establishes creative ideas as the new normal.

Like other species on our planet, humans have evolved in response to conditions found in the environment. However, unlike other species, the very same competitive advantage, namely creativity, that has contributed to the evolution of humans has also reshaped the conditions of the environment in which we live (Puccio, 2017). To be sure, our creativity has enabled us to survive but it has also fundamentally changed our living conditions, which now impacts us and other species with which we share this planet. To ensure survival and success, individually and as a collective, humans will continue to need to be creative problem solvers. Our species has an innate capacity to generate novel solutions to complex problems, as well as the skills to expand and more effectively direct the gift bestowed upon us through evolution. To ignore creative thinking in schools and organizations, or worse to cling to practices and systems that undermine creativity, is to deny individuals a primal aspect of their humanity, that is the possibility to apply their imaginations to manifest new behaviors and solutions to everyday challenges and opportunities found in life. To suppress creativity is to inhibit our individual and cultural evolution.

References

Allman, W. F. (1996). The dawn of creativity. *U.S. News & World Report*, *120*(20), 53–58.

Ansary, T. (2019). *The invention of yesterday: A 50,000—Year history of human culture, conflict, and connection.* Hachette Book Group.

Basadur, M., Graen, G. B., & Scandura, T. A. (1986). Training effects on attitudes toward divergent thinking among manufacturing engineers. *Journal of Applied Psychology, 71*(4), 612–617. https://doi.org/10.1037/0021-9010.71.4.612

Benyus, J. M. (1997). *Biomimicry: Innovation inspired by nature.* William Morrow and Company.

Campbell, D. T. (1960). Blind variation and selective retention in creative thought as in other knowledge processes. *Psychological Review, 67*, 380–400. https://doi.org/10.1037/h0040373

Carruthers, P. (2002). Human creativity: Its cognitive basis, its evolution, and its connections with childhood pretence. *The British Journal for the Philosophy of Science, 53*(2), 225–249. https://doi.org/10.1093/bjps/53.2.225

Chmielińska, A., & Modrzejewska-Świgulska, M. (2020). Women's life (re)decisions: Report from biographical narrations. *Przegląd Badań Edukacyjnych, 30*, 87–105.

Craft, A. (2001). Little c creativity. In A. Craft, B. Jeffrey, & M. Leibling (Eds.), *Creativity in education* (pp. 45–61). Continuum.

Csikszentmihalyi, M. (1996). *Creativity: Flow and the psychology of discovery and invention.* HarperCollins.

Darwin, C. (2003). *The origin of species: By means of natural selection of the preservation of favoured races in the struggle for life.* Signet Classics.

de Bono, E. (1977). *Lateral thinking*. Penguin Books.

Dunbar, R., Barrett, L., & Lycett, J. (2007). *Evolutionary psychology: A beginners' guide*. Oneworld Publications.

Firestien, R. L., & McCowan, R. J. (1988). Creative problem solving and communication behaviors in small groups. *Creativity Research Journal, 1*, 106–114. https://doi.org/10.1080/10400418809534292

Gabora, L., & Kaufman, S. C. (2010). Evolutionary approaches to creativity. In J. C. Kaufman & R. J. Sternberg (Eds.), *Cambridge handbook of creativity* (pp. 279–300). Cambridge University Press.

Gordon, W. J. J. (1961). *Synectics*. Harper & Row.

Gould, S. J. (1996, October). Creating the creators. *Discover*, *17*(10), 42–54.

Hargadon, A. (2003). *How breakthroughs happen: The surprising truth about how companies innovate.* Harvard Business School Press.

Hunter, J. E., & Schmidt, F. L. (1996). Intelligence and job performance: Economic and social implications. *Psychology, Public Policy, and Law, 2*, 447–472. https://doi.org/10.1037/1076-8971.2.3-4.447

Isaksen, S. G., Dorval, K. B., & Treffinger, D. J. (1994). *Creative approaches to problem solving.* Kendall/Hunt.

Isaksen, S. G., & Treffinger, D. J. (2004). Celebrating 50 years of reflective practice: Versions of creative problem solving. *The Journal of Creative Behavior, 38*(2), 75–101. https://doi.org/10.1002/j.2162-6057.2004.tb01234.x

Johansson, F. (2004). *The Medici effect: Breakthrough insights at the intersection of ideas, concepts and cultures*. Harvard Business School Press.

Johnson, B. (1996). *Polarity management: Identifying and managing unsolvable problems.* HRD Press.

Jung, C. G. (1960). The transcendent function In R. F. C. Hull (Trans.), *The Collected works of C. G. Jung* (Vol. 8). Princeton University Press (original work published in 1947).

Kaufman, J. C. (2016). *Creativity 101*. Springer Publishing.

Kuhn, S. L. (2012). Emergent patterns of creativity and innovation in early technologies. In S. Elias (Ed.), *Origins of human innovation and creativity* (pp. 69–87). Elsevier.

Lewin, K. (1951). *Field theory in social science: Selected theoretical papers*. Harper.

MacKinnon, D. W. (1962). The nature of nurture of creative talent. *The American Psychologist, 17*, 484–495. https://doi.org/10.1037/h0046541

Meadow, A., & Parnes, S. J. (1959). Evaluation of training in creative problem solving. *Journal of Applied Psychology, 43*(3), 189–194. https://doi.org/10.1037/h0046040

Mithen, S. (2006). *The singing Neanderthals: The origins of music, language, mind, and body.* Harvard University Press.

Modrzejewska-Świgulska, M. (2013). Twórczość codzienna jako zasób wspierający dobrostan ludzi [Everyday creativity as a resource supporting people's well-being]. In K. J. Szmidt, & M. Modrzejewska-Świgulska (Eds.), *Zasoby twórcze człowieka. Wprowadzenie do pedagogiki pozytywnej* (pp. 83–107). Wydawnictwo Uniwersytet Łódzkiego.

Modrzejewska-Świgulska, M. (2014). *Twórczość codzienna w narracjach pedagogów* [Everyday creativity in educator's narrations]. Wydawnictwo Uniwersytet Łódzkiego.

Modrzejewska-Świgulska, M. (2015). *Twórczość codzienna w praktyce i teorii.* [Everyday creativity in practice and theory]. In J. Uszynska-Jarmoc & B. Kunat (Eds.), *Twórczość codzienna jako aktywność całożyciowa człowieka* (pp. 23–36). Trans Humana.

Morriss-Kay, G. M. (2010). The evolution of human artistic creativity. *Journal of Anatomy, 216*(2), 158–176. https://doi.org/10.1111/j.1469-7580.2009.01160.x

Murdock, M. C., & Puccio, G. J. (1993). A contextual organizer for conducting creativity research. In S. G. Isaksen, M. C. Murdock, R. L. Firestien, & D. J. Treffinger (Eds.), *Understanding and recognizing creativity: The emergence of a discipline* (pp. 249–280). Ablex.

Murray, D. K. (2009). *Borrowing brilliance: The six steps to business innovation by building on the ideas of others.* Gotham Books.

National Center on Education and the Economy. (2008). *Tough choices or tough times: The report on the new commission on the skills of the American workforce.* Wiley.

Nielsen, D., & Thurber, S. (2016). *The secrets of the highly creative thinker: How to make connections others don't.* BIS Publishing.

Osborn, A. F. (1953a). *Applied imagination: Principles and procedures of creative problem-solving.* Scribner's Sons.

Osborn, A. F. (1953b, November 11). *This I Believe* [Interview]. Edward R. Murrow Papers; Tufts Digital Archive. https://dl.tufts.edu/concern/audios/nv935c52m

Palmer, D. (2010). *Origins: Human evolution revealed*. Mitchell Beazley.

Parnes, S. J. (1985). The creative studies project. In S. G. Isaksen (Ed.), *Frontiers of creativity research* (pp. 156–188). Bearly Limited.

Parnes, S. J., & Meadow, A. (1959). Effects of "brainstorming" instructions on creative problem solving by trained and untrained subjects. *Journal of Educational Psychology, 50*(4), 171–176. https://doi.org/10.1037/h0047223

Parnes, S. J., & Noller, R. B. (1972). Applied creativity: The creative studies project: Part II—Results of the two-year program. *The Journal of Creative Behavior, 6*, 164–186.

Puccio, G. J. (2012, December). *Creativity as a life skill*. TEDx Gramercy. https://www.youtube.com/watch?v=ltPAsp71rmI

Puccio, G. J. (2017). From the dawn of humanity to the 21st century: Creativity as an enduring survival skill. *The Journal of Creative Behavior, 51*, 330–334. https://doi.org/10.1002/jocb.203

Puccio, G. J. (2020). Polarities in creativity: Revisiting Amabile's componential model. In R. Reiter-Palmon, C. Fisher, & J. S. Mueller (Eds.), *Creativity at work: A Festschrift in honor of Teresa Amabile* (pp. 143–156). Palgrave Macmillan.

Puccio, G. J., Burnett, C., Acar, S., Yudess, J. A., Holinger, M., & Cabra, J. F., (2018). Creative problem solving in small groups: The effects of creativity training on idea generation, solution creativity, and leadership effectiveness. *The Journal of Creative Behavior*. Advance online publication. https://doi.org/10.1002/jocb.381

Puccio, G. J., & Cabra, J. F. (2009). Creative problem solving: Past, present, and future. In T. Rickards, H. A. Runco, & S. Moger (Eds.), *The Routledge companion to creativity* (pp. 327–337). Routledge.

Puccio, G. J., & Cabra, J. F. (2010). Organizational creativity: A systems perspective. In J. Kaufmann & R. J. Sternberg (Eds.), *The cambridge handbook of creativity* (pp. 145–173). Cambridge University Press.

Puccio, G. J., Cabra, J. F., & Schwagler, N. (2018). *Organizational creativity: A practical guide for innovators and entrepreneurs*. Sage.

Puccio, G. J., Firestien, R. L., Coyle, C., & Masucci, C. (2006). A review of the effectiveness of CPS training: A focus on workplace issues. *Creativity and Innovation Management, 15*, 19–33. https://doi.org/10.1111/j.1467-8691.2006.00366.x

Puccio, G. J., Mance, M., Barbero-Switalski, L., & Reali, P. D. (2012). *Creativity rising: Creative thinking and creative problem solving in the 21st century*. ICSC Press.

Puccio, G. J., Mance, M., & Murdock, M. C. (2011). *Creative leadership: Skills that drive change* (2nd ed.). Sage.

Puccio, G. J., Murdock, M. C., & Mance, M. (2005). Current developments in creative problem solving for organizations. *The Korean Journal of Thinking & Problem Solving, 15*, 43–76.

Rhodes, M. (1961). An analysis of creativity. *Phi Delta Kappan, 42,* 305–310. https://www.jstor.org/stable/20342603

Richards, R. (1999). Everyday creativity. In M. A. Runco & S. R. Pritzker (Eds.), *Encyclopedia of creativity* (Vol. 1, pp. 683–687). Academic Press.

Rose, L. H., & Lin, H. T. (1984). A meta-analysis of long-term creativity training programs. *The Journal of Creative Behavior, 18*, 11–22. https://doi.org/10.1002/j.2162-6057.1984.tb00985.x

Richards, R. (2010). Everyday creativity: Process and way of life—Four key issues. In J. C. Kaufman & R. J. Sternberg (Eds.), *The Cambridge handbook of creativity* (pp. 189–215). Cambridge University Press.

Roth, G., & Dicke, U. (2005). Evolution of the brain and intelligence. *Trends in Cognitive Sciences, 9*, 250–257. https://doi.org/10.1016/j.tics.2005.03.005

Roth, G., & Dicke, U. (2017). Evolution of cognitive brains: Mammals. In S. Watanabe, M. a. Hofman, & T. Shimizu (Eds.), *Evolution of the brain, cognition, and emotion in vertebrates* (pp. 125–146). Springer. https://doi.org/10.1007/978-4-431-56559-8_6

Runco, M. A. (2006). Reasoning and personal creativity. In J. C. Kaufman & J. Bear (Eds.), *Creativity and reason in cognitive development* (pp. 99–116). University Press Cambridge.

Runco, M. A., & Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal, 24*, 92–96. https://doi.org/10.1080/10400419.2012.650092

Scott, G., Leritz, L., & Mumford, M. (2004). The effectiveness of creativity training: A quantitative review. *Creativity Research Journal, 16*(4), 361–388. https://doi.org/10.1080/10400410409534549

Spivey, N. (2005). *How art made the world: A journey to the origins of human creativity*. Basic Books.

Sternberg, R. J., & Lubart, T. I. (1995). *Defying the crowd: Cultivating creativity in a culture of conformity*. The Free Press.

Szmidt, K. J. (2018). Teoretyczno-badawcze nurty w polskiej kreatologii [Theoretic-research trends in Polish creatology]. *Nauki o Wychowaniu, Studia Interdyscypliarne, 7*(2), 8–43.

Talbot, R. J. (1997). Taking style on board (or how to get used to the idea of creative adaptors and uncreative innovators). *Creativity and Innovation Management, 6*(3), 177–184. https://doi.org/10.1111/1467-8691.00066

Treffinger, D. J. (1995). Creative problem solving: Overview and educational implications. *Educational Psychology Review, 7*, 191–205. https://doi.org/10.1007/BF02213375

Trilling, B., & Fadel, C. (2009). *21st century skills: Learning for life in our times.* Jossey-Bass.

van der Steur, J. (2018). *The power of polarities: An innovative method to transform individuals, teams, and organizations. Based on Carl Jung's theory of the personality.* Polarity Institute.

Wilson, E. O. (2017). *The origins of creativity.* Liveright Publishing.

Conclusion: Interlocking the 7Cs

Samira Bourgeois-Bougrine

Poetry is the lens we use to interrogate the history we stand on and the future we stand for[1]

At just 22 years old, Amanda Gorman, the U.S.'s first-ever youth poet laureate, stole the show at President Joe Biden's inauguration ceremony on January 20, 2021. She recited a poem, "*The Hill We Climb*",[2] that she wrote for the inauguration day. As an activist, she started writing poems, at an early age, that commented on social justice issues such as oppression, race, feminism, and marginalization. She drew inspiration from black women such as Chloe Anthony Wofford Morrison, Maya Angelou, Audre Lorde and Phillis Wheatley. She performed at many prominent venues, including the Obama White House, the Library of Congress, Lincoln Center, and on CBS This Morning.[3] Her account of how she crafted her powerful poem highlights several interconnections between diverse topics within the 7C's framework (Fig. 1). Using as common thread Amanda Gorman's narrative about her craft, the aim of this chapter is to (1) offer a holistic synthesis of the previous chapters to illustrate the intricacy of the various relationships among the 7C and (2) highlight, once again, the need for more dynamic and systemic approaches in future creativity research. This echoes the call of many authors in the previous sections to put more emphasis on the complex and interconnected nature of creativity, thereby challenging existing psychology research approaches that oversimplify the problem by looking at the 7Cs in isolation.

[1] Amanda Gorman's quote—Interview with Michelle Obama: https://time.com/5933596/amanda-gorman-michelle-obama-interview/.

[2] For the poem's transcript, please visit: https://news.harvard.edu/gazette/story/2021/01/amanda-gormans-inauguration-poem-the-hill-we-climb/.

[3] https://www.poetryfoundation.org/poets/amanda-gorman.

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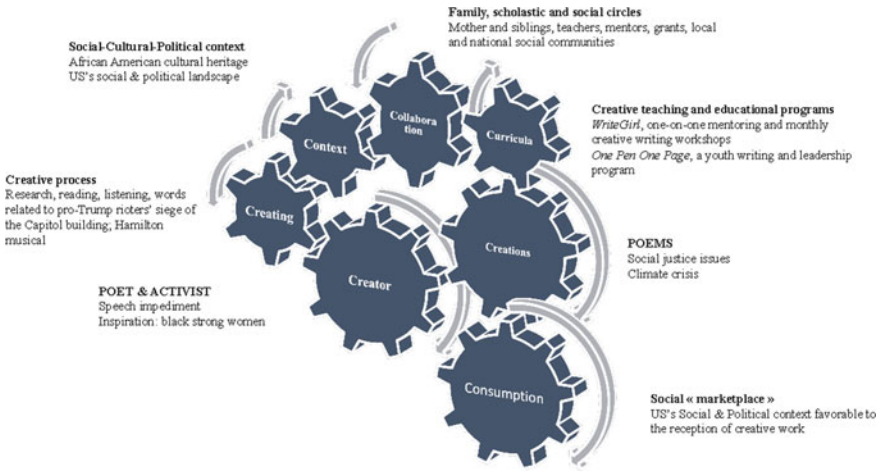

Fig. 1 Systemic and dynamic approach to Amanda Gorman creative work

1 7C's Framework: A Holistic Approach

To consider the mutual dependencies between the 7Cs we will address first some background information about Amanda Gorman that reflect the interactions between the Cs of *Creator, Collaboration, Curricula and Context* and second the act of *creating* and its links with the *Context, Creation and Consumption.*

1.1 Background Information: Creator, Collaboration, Curricula, Context

Reflecting on the how and the why of her craft, Amanda Gorman mentioned several contributors such as her family, her African American cultural heritage and her speech impediment. As highlighted by Mouchiroud et al. (chapter The Social Environment of Creativity), her family, scholastic and social circles played an important role in her creativity. She was born in Los Angeles and raised by a single mother, an English teacher. Her twin sister is an activist and filmmaker. She describes her mother as "*a strong Black woman who taught us to value our ideas and our voices*" (see Footnote 1) and highlighted the huge impact of her mother on her:

When I was really young my mother would read me my Miranda Rights[4] *and make sure I knew them...My mom wanted to make sure I was prepared to grow up with Black skin in America, and that was my first awakening to the political climate I was stepping into...*[5]

Moreover, the US's social and political context had a great influence on her creative process and poems. This echoes the idea defended by Vlad Glăveanu (chapter Creativity and Culture: Four (Mis)Understandings) that creativity is "*simultaneously psychological and socio-cultural phenomenon…(and that) the social and cultural environment is not an outside element imposing its own 'press' on the individual but a constitutive part of both mind and action*". This mutual dependency between the creator and the socio-cultural environment shine through her inaugural poem:

…"We the successors of a country and a time
where a skinny Black girl
descended from slaves and raised by a single mother
can dream of becoming president
only to find herself reciting for one…
We are striving to forge a union with purpose,
to compose a country committed to all cultures, colors, characters and conditions of man"…

Born early, she had an auditory processing disorder and speech impediment that led to an auditory learning struggle. Specifically, she had trouble learning certain sounds, such as "*sh*" or "*r*" and her difficulties lasted till 20 years of age. She considered these obstacles as strengths that reinforced her reading and writing abilities:

I'm really grateful for that experience because it informs my poetry. I think it made me all that much stronger of a writer when you have to teach yourself how to say words from scratch. When you are learning through poetry how to speak English, it lends to a great understanding of sound, of pitch, of pronunciation, so I think of my speech impediment not as a weakness or a disability, but as one of my greatest strengths.

She used songs as a form of speech therapy, and explained that one of her favourite songs to practice was "Aaron Burr, Sir" from Hamilton musical "*because it is jam-packed with R's.*[6]

The more that I recited out loud, the more in which I practiced spoken word and that tradition, the more I was able to teach myself how to pronounce these letters which for so long had been my greatest impediment,

[4] ***Miranda*** **warning**: You have the right to remain silent. Anything you say can be used against you in court. You have the right to talk to a lawyer for advice before we ask you any questions. You have the right to have a lawyer with you during questioning. If you cannot afford a lawyer, one will be appointed for you before any questioning if you wish. If you decide to answer questions now without a lawyer present, you have the right to stop answering at any time. https://en.wikipedia.org/wiki/Miranda_warning.

[5] https://www.romper.com/life/amanda-gorman-mom-family.

[6] https://en.wikipedia.org/wiki/Amanda_Gorman.

At the age of 14, she joined an organization called, *WriteGi*rl, that provided one-on-one mentoring and monthly creative writing workshops where she used to go on stage to read her poetry. Very anxious at the beginning she gained confidence in reading her work aloud:

> *I learned that writing wasn't about pronunciation, but about style and the author's voice. This lesson helped me grow on endless occasions in my life — during school, conferences, competitions, etc., convincing me that poetry can possess astonishing influence when taught to teens.*[7]

Moreover, she benefited from a great deal of emotional and material support and cognitive stimulations, from social and cultural circles. For instance, while studying at Harvard University, she won in 2017, a $10,000 grant from OZY Genius Award[8] for a project called "Generation Empathy". With the help of her mentor, John Fitzgerald, the co-founder of Sensorium, a creative studio that specializes in virtual reality, her project aimed to create a virtual-reality museum with digital portraits of selected social justice activists to inspire teens and students. Interestingly, when addressing *cybercreativity*, Nelson and Guegan (chapter Creative Collaboration in Groups) reported several empirical evidence regarding the impact of virtual reality environments on creativity that could inform the relevance of the "Generation Empathy" program. For instance, they argue that avatars can serve as a means of introducing visually perceptible social cues and that the visual characteristics of avatars have been found to modulate user behaviors. They also explored the impact of factors such as virtual behavioral priming, virtual social identity cues (group membership) and contextual cues in the virtual environment.

1.2 The Act of Creating: Creations, Context, Consumption

Amanda Gorman's creative process relates to compositional creativity that was formalized by Wallas in 1926 in his 4-stage model (Bourgeois-Bougrine, 2020; Fisher & Amabile, 2008). In compositional creativity, the first stage, called preparation, can include information gathering, preliminary analysis to define the problem and the development of specific skills if necessary (Corazza & Agnoli, chapter The DA VINCI Model for the Creative Thinking Process; Botella et al., chapter Creative Processes in Five Domains: Art,Design, Scriptwriting, Music and Engineering). It's worth noticing that in improvisational creativity, such preparation cannot occur because immediate action is needed. Instead, individuals must accumulate a store of knowledge and routines that must be both readily accessible and flexibly organized to meet diverse situational demands. The difference between composing and improvising is well established in music and theater. Regarding Gorman's creative process, she had 3–4 weeks to come up with the poem as she found out that she would be

[7] https://www.huffpost.com/entry/poetrys-relevance-to-yout_b_6000384.

[8] https://www.ozy.com/true-and-stories/how-a-young-poet-is-nurturing-empathy-with-virtual-reality/77355/.

the inaugural poet late in December 2020. The first stage was, indeed, a deep dive in information gathering intensive research, reading, and listening:

> *I did a lot of research.…I read all the previous inaugural poems, really doing a deep literature dive of other orators who I looked up to, whether it be Frederick Douglass and Abraham Lincoln and how they speak to a nation that could feel very divided...*[9]

> *I was also listening to the composers who I feel are great storytellers, but they don't use words so I try to fill in that rhetoric myself. A lot of Hans Zimmer, Dario Marianelli, Michael Giacchino…*[10]

To quote Getzels (1979, p. 167), ideas do not present themselves as "problems capable of resolution or even sensible contemplation. They must be posed and formulated in fruitful and often radical ways if they are to be moved toward solution. The way the problem is posed is the way the dilemma will be resolved". As Einstein (in Getzels, 1979) put it: "The formulation of a problem is often more essential than its solution". Botella et al. (chapter Creative Processes in Five Domains: Art,Design, Scriptwriting, Music and Engineering), who explored the creative process in various domains such as visual art, design, scriptwriting, music and engineering, suggested that the stages of reflection and documentation frequently lead to definition in almost all domains, and the definition stage interacts with the documentation stage. They reported that in the domain of scriptwriting, writing a script for a film often involves a long period of preparation before scriptwriters engage in the actual writing. Indeed, scriptwriters collect, in general, a massive and usually disproportional amount of information, reading books, magazines, newspapers, consulting archives and photos, watching movies, etc. (Bourgeois-Bougrine et al., 2014). As Botella et al. (chapter Creative Processes in Five Domains: Art,Design, Scriptwriting, Music and Engineering) showed, the preparation phase leads commonly to the following stages: associative thinking, convergent thinking, implementation, judgment (To be self-critical, to stand back, to analyze, check the quality of a result) and finalization (To edit, develop, complete, justify, etc.). As described below, these various stages benefit from interactions with the environments.

Indeed, one of the most prominent interactions among the 7C's is between "Creating" and "Context" (Ceylan & Dul, chapter The Place to Be: Organizational Culture and Organizational Climate for Creativity), Glăveanu (chapter Creativity and Culture: Four (Mis)Understandings) and Hennessey (chapter Waste Creatively: The Intersection of Creativity and Consumerism). As you might expect, the US's socio-political *environment* had a huge influence on Gorman's creative process. For instance, during the Trump presidency she witnessed how the "*power of words has been violated and misappropriated*" which probably contributed to her psychological preparation and determination to write a hopeful inauguration poem several years earlier. She revealed to Michelle Obama (see Footnote 10) in an interview for *Time Magazine* that:

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[9] https://www.youtube.com/watch?v=qHhut5nhI8g.

[10] https://time.com/5933596/amanda-gorman-michelle-obama-interview/.

for the past six years whenever I've written a poem that I knew was going to be public or performed, I told myself, write the Inauguration poem. And what that meant for me is not necessarily write a poem that's about a President. It was: write a poem that is worthy of a new chapter in the country. In everything you write, write something that is brave enough to be hopeful. In everything that you write, write something that is larger than yourself. I don't think I would have been able to write that Inauguration poem if I hadn't lived every day of my life as if that was the place I was going to get.

Moreover, the US's social and political landscape in the wake of the 2020 US election and the siege of the Capitol Building on January 6, 2021 had also a great influence on her writing of the inaugural poem. As mentioned in her interviews (see Footnotes 9 and 10), she did not turn a blind eye on what happened at the Capitol or write a poem about some sort of perfect America or surrender to horror or cynicism. Instead of derailing her craft, the last event energized her even more:

what I wanted to do is to kind of re-claim poetry as that site in which we can re-purify, re-sanctify not only the capitol building that we saw violated but the power of words and to invest that in kind of the highest office of the land. (see Footnote 9)

This led her to weave it into her poem words from the tweets, messages and articles she read about the January 6th event. She emphasized the fact that, as a poet, she is more sensitive to words than images:

I'm a poet so often I don't work in images. I work in words and texts. And so, what I was actually doing is while keeping mental sanity looking through the tweets and the messages and articles and seeing what stood out. There's a line in the poem that you might have heard, which is "we've seen a force that would shatter our nation rather than share it". And I got that actually from looking through a few tweets and a lot of people being like, wow, this is what happens when people don't want to share the country with the rest of us. And so, I took that which often became a meme on Twitter and I put that in the poem.

She drew inspiration from American cultural productions as well. Indeed, her poem referred explicitly[11] to two songs from Lin-Manuel Miranda's musical, "Hamilton", that received critical acclaim from its opening in 2014. The first song was "*One Last Time*"[12] where Washington asked Hamilton to pen his farewell address and the second song was "History Has Its Eyes on You"[13] which is another reference to George Washington. She considered "Hamilton" as "a great American cultural piece of what it means to be a better country" and couldn't resist making reference to it in her poem.

While finishing her poem, she was concerned and hesitant about including the closing lines[14] but decided that the country needed to hear the full message of hope:

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[11] https://bookstr.com/article/amanda-gorman-references-hamilton-in-the-hill-we-climb/.

[12] *…"Scripture tells us to envision*
that everyone shall sit under their own vine and fig tree
and no one shall make them afraid…"

[13] *"for while we have our eyes on the future,*
history has its eyes on us."…

[14] *… "When day comes we step out of the shade,*
aflame and unafraid,

I was kind of deliberating between ***see it, be it, free it****. And then I said you know what, we need all of these things at once…we need to realize that hope isn't something that we ask of others, it's something that we have to demand from ourselves.*

The smart way she combined the above inspirational sources illustrate that many forms of creativity are "*ultimately combinatorial and that new ideas or responses are generated as combinations of previous ideas or responses…(however) each generated combination must undergo a selection process or procedure to determine its actual usefulness or effectiveness*" (Simonton, 2019, p. 668). Lévy-Garboua and Gazel (chapter Creativity and Consumer Behavior:An Economic Analysis), offered a perspective from economics when they extended creativity to "*creative consumers who adapt, modify and transform market goods … to produce utility increments…-consumer creativity doesn't stop there because creative works need to be discovered and widely adopted. If they were not socially profitable, they would never become efficient innovations*." From an economic point of view Amanda Gorman could be considered as the "ultimate creative consumer". This antipoetic characterisation provides a perfect transition to the last interaction we will address: the Cs of "Creation" and "Consumption".

As mentioned by Beth Hennessey (chapter Waste Creatively: The Intersection of Creativity and Consumerism), Louis Lévy-Garboua and Marco Gazel (chapter Creativity and Consumer Behavior: An Economic Analysis), the social "marketplace" was favorable to the reception of Gorman's creative work: a divided and shattered nation in a need of healing and mourning. She believed that her message is exactly what the public needed and wanted: hope, unity, community, and healing. And indeed, the press, the politics, laypeople, and domain-specific experts consensually welcomed her poem. It is worth noticing the shift from *personal* creativity, where the creator, alone, decides and assess his or her ideas, to consensual creativity where there is a sociocultural consensual validation. To quote Simonton (chapter From Everyday Creativity to Eminent Cases of Creative Achievement in Professional Domains), "*consensual creativity is no longer a purely psychological phenomenon but rather has acquired an interpersonal and even sociocultural aspect. It should be emphasized that consensual creativity introduces numerous complexities not found in personal creativity.*" The last lines of her poem have been repeated by a lot of people including Barack Obama on Twitter: "*On a day for the history books, Amanda Gorman delivered a poem that more than met the moment. People like her are proof that "there is always light, if only we're brave enough to see it; if only we're brave enough to be it*." Finally, her poem reshaped the contours of her life: she become a role model, a public figure, fashion icon, first poet to recite at the Super Bowl; her publisher ordered a printing of one million copies for her first three books due to overwhelming demand, etc.

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the new dawn blooms as we free it.
For there is always light,
if only we're brave enough to see it.
If only we're brave enough to be it."

2 Perspectives on Creativity

Puccio and Modrzejewska-Świgulska (chapter Creative Problem Solving: From Evolutionary and Everyday Perspectives) suggested that many people believe that they are not creative, probably, because "*our society celebrates and makes legends out of those who achieve eminence as a result of their creative acts*". However, the above-mentioned example of Gorman's achievement is a message of hope to shift the perception of creativity by many lay people and how it can be nurtured. This case emphasizes, indeed, the important role played by her family, teachers, mentors, and social circles in nurturing her creativity:

> *it takes all of us being present and lifting me up to climb this mountain… I have so many supporters, so many organizations that have supported me whether it be urban or the National Poet Laureate program…*

Moreover, it highlights her hard work, openness, and determination to transform her auditory processing disorder and speech impediment into strength. The key question is how can we provide that type of support and care to help the creative growth of so many young people out there? Cotter, Beghetto and Kaufman (chapter Creativity in the Classroom: Advice for Best Practices) provided valuable best practices to foster creative micromoments and creative metacognition and avoid creative mortification in the classroom. The role of teachers in nurturing students' creative thinking is undoubtedly fundamental but schools are not the only channel to empower young generations. Many programs dedicated to fostering creativity exist around the world and their practices have great impact. For instance, one of the organizations that helped Gorman, *WriteGi*rl, has considerable impact on teen mentees as she mentioned in one of her interviews[15]:

> *Although WriteGirl doesn't only focus on poetry, the organization still utilizes poetry to teach, inspire and empower girls all across Los Angeles. And it works! While the high school graduation rate in Los Angeles is only 80 percent (with a 78 percent rate for Latino students and 68 percent for black students), every year 100 percent of WriteGirl teen mentees not only graduate from high school, but move on to college. WriteGirl's success through creative writing mediums like poetry suggest that even if poetry isn't prevalent among all teens, it can be extremely relevant to their lives and aspirations.*

Cognizant of the importance of creative emancipation at youth, Gorman became the founder, in 2016, of a non-profit organization One Pen One Page. It promotes literacy through free creative writing and leadership programs for underserved youth. Other programs dedicated to adults exist as well. However, these creativity programs are rarely explored and studied in the scientific literature and their best practices are unshared.

To conclude this chapter, we would like to emphasize once again that creativity is a context-embedded and complex phenomenon (Corazza & Lubart, 2021). The context of creativity is conceptualized as the "*Press*" factor, within the four P categorisation, as "*Audience & Affordance*" in the five A's model and simply as "*Context*" in the 7Cs

[15] https://www.huffpost.com/entry/poetrys-relevance-to-yout_b_6000384.

framework. As described in the previous section, the context played a pivotal role in the craft of the poem. However, despite the relevance of studying the creativity context, the literature review by Mouchiroud et al. (chapter The Social Environment of Creativity) showed that the environmental or contextual perspective is not given much attention. With less than 5% of articles recorded with "environment" as a keyword and less than 1% on "social environment", these authors lamented the dichotomy between the relevance of the context and the actual research effort. They argued that this lack of effort toward gaining increased knowledge about the environment is detrimental to an exhaustive comprehension of the creative process. This echoes the appeal of Vlad Glăveanu (chapter Creativity and Culture: Four (Mis)Understandings) to extend "*creativity into the cultural world by emphasizing processes of exchange, interaction, communication, resistance, and so on,"* this will give the *"theories a new ground above and beyond what is traditionally a study of internal thinking processes*".

As a complex phenomenon, creativity involves three major properties: (1) the multiplicity of its determinants (the number of potentially interacting Cs), (2) their interdependence (relates to how connected those Cs are), and (3) diversity (has to do with the degree of their heterogeneity). Sargut and McGrath (2011) suggested that these three properties (multiplicity, interdependence, diversity) are what determine complexity and offered a distinction between complicated and complex problem:

> *A complicated problem is one that is ultimately predictable with sufficient analysis and modeling. They are linear, with some identifiable beginning, middle and end and while they may have many parts, it can be understood how the parts create a whole…Complex problems on the other hand are inherently unpredictable… it is difficult to assess the true nature of the problem and therefore how to manage it…Rather than having discrete parts bound together in linear relationships, complex problems are emergent: they are greater than the sum of their parts.* (in Kamensky, 2011, p. 66)

It turns out that complexity is difficult to study and to manage, when using traditional approaches. For instance, Mouchiroud et al. (chapter The Social Environment of Creativity) described how the individual/psychological approach alone is unable to fully grasp the complexity of the creative process. They suggested the integration of additional viewpoints provided by social perspectives to be able to benefit from a larger and more heuristic/comprehensive science of creativity. Moreover, Ceylan and Dul (chapter The Place to Be: Organizational Culture and Organizational Climate for Creativity) emphasized that employee creativity occurs in a complex environment and cannot be explained by direct effects of single elements only. They expressed the need for systems or holistic approaches to address the organizational complexity of employee creativity (i.e., structural models, multilevel models, person-environment fit, overall creativity-supporting climates, global climates, etc.). They argued that if properly applied, these modern data analysis techniques will allow a better understanding of the above-mentioned complexities. These approaches could benefit the study of all types of creativity, from commonplace "little-c" to eminent "Big-C" creativity, from personal creativity to consensual creativity. We believe that, for greater impact, systemic approaches that interlock the 7Cs are required.

References

Bourgeois-Bougrine, S. (2020). What does creativity mean in safety-critical environments? *Frontiers in Psychology, 11*, 2518.

Bourgeois-Bougrine, S., Glăveanu, V., Botella, M., Guillou, K., De Biasi, P. M., & Lubart, T. (2014). The creativity maze: Exploring creativity in screenplay writing. *Psychology of Aesthetics, Creativity, and the Arts, 8*, 384–399.

Corazza, G. E., & Lubart, T. (2021). Intelligence and creativity: Mapping constructs on the space-time continuum. *Journal of Intelligence, 9*(1), 1.

Fisher, C. M., & Amabile, T. (2008). Creativity, improvisation and organizations. In *The Routledge companion to creativity* (pp. 27–38). Routledge.

Getzels, J. W. (1979). Problem finding: A theoretical note. *Cognitive Science, 3*(2), 167–172.

Kamensky, J. M. (2011). Managing the complicated vs. the complex. *The Business of Government Magazine*, 66–67.

Sargut, G., & McGrath, R. G. (2011). Learning to live with complexity. *Harvard Business Review, 89*(9), 68–76.

Simonton, D. K. (2019). Creative genius. In J. C. Kaufman & R. J. Sternberg (Eds.), *The Cambridge handbook of creativity* (pp. 655–670). Cambridge University Press.