The Cambridge Handbook of Creativity and Personality Research

As individual subjects, creativity and personality have been the focus of much research and many publications. This *Cambridge Handbook* is the first to bring together these two topics, and it explores how personality and behavior affect creativity. Contributors from around the globe present cutting-edge research on how personality traits and motives make creative behavior more likely. Many aspects of personality and behavior are examined, including genius, emotions, psychopathology, entrepreneurship, and multiculturalism, to analyze their impact on creativity. *The Cambridge Handbook of Creativity and Research* will be the definitive resource for researchers, students, and academics who study psychology, personality, and creativity.

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The Cambridge Handbook of Creativity and Personality Research

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To my two talented sons, Jerry and Evan.

– GJF

To my parents, Miki Reiter and Avia Reiter, who paved the way and showed me it was all possible.

– RRP

For the late John L. Horn, my undergraduate mentor, a brilliant and generous man who will always be an inspiration.

– JCK

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1 Introduction: The Personal Side of Creativity

Individual Differences and the Creative Process

Gregory J. Feist, Roni Reiter-Palmon, and James C. Kaufman

The study of creativity is full of paradoxes. On the one hand, it is a topic of almost universal fascination and interest, and yet within academic circles it remains on the periphery of mainstream research programs and grant funding. Additionally, most people believe that creativity is original or novel thought and behavior, but in truth, the consensus among researchers is that it involves not only original/novel thought but also meaningful and useful thought and behavior. Finally, many people outside the field, especially those in the arts, would claim that creativity is inherently mysterious and beyond the purview of the scientific method, and yet there is a nearly 70-year history of scientific investigations into the creative person, process, and product. This *Handbook* is evidence of the most current part of this history. Indeed, the history of the scientific study of creativity has gained momentum over the last decade or two, and as with psychology in general, much of this work has recently focused on neural structure and function behind insight, imagination, and the creative brain (e.g., Vartanian, Bristol, & J.C. Kaufman 2013).

Truth be told, the fundamental question on researchers' minds is: what is creativity, and why do some people consistently see novel and meaningful solutions unseen by most? The basic assumption of the contributors to this book is that personality is one of the important answers to the "why" question of creativity. That is, individual differences in personality traits – especially openness to experience – provide important clues as to why some people consistently "think outside the box" in art, science, business, and industry. In short, particular traits of personality lower the threshold for creative thought and behavior.

It's always a good idea to define the main concepts of a book, especially a handbook that aims to be the definitive source of scholarly material on a given topic, in this case creativity and personality. So let us be clear by what we mean by *creativity* and *personality*. First, to foreshadow what you will read in many contributions to this book, there is a nearly unanimous consensual definition of creativity: creative thought or behavior must be both novel/original and meaningful (useful/adaptive) (e.g., Amabile 1996; Runco 2004; Sternberg 1988). It is easy to see why originality per se is not sufficient – there would be no way to distinguish eccentric or schizophrenic from creative thought. Both are original. But, to be classified as creative, thought or behavior must also have meaning to

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other people. Being weird or different just to be weird or different is not creative. It is worth noting that Simonton (2013) has added a third dimension to these two criteria of creativity, namely, surprisingness. Creative thought and behavior must be not only original and meaningful but also surprising and nonobvious.

Next, personality consists of the unique behavioral dispositions of each individual (Feist, Feist, & Roberts 2013). More specifically, personality is the unique behavior of an individual over time and across situations. If a person has the personality trait of *friendly*, this means she behaves in a friendly way more frequently than most people (uniqueness), that she has behaved more friendly than most over a long period of time (temporal consistency), and that she is likely to behave in a uniquely friendly way in many different situations (situational consistency). Personality researchers, like many psychologists, argue that the primary overall cause of behavior is the interaction between personal (internal) qualities of the individual and his or her environment or situation (external). In this sense, they are more likely to look for internal (trait, motivation) explanations of behavior than social psychologists or sociologists, who focus on external, situational forces that shape behavior. Traits are the most common "internal" cause of behavior in personality. More important, we concur with Gordon Allport, who almost 80 years ago wrote: "Personality *is* something and personality *does* something" (Allport 1937, p. 43). We believe that what personality does is lower thresholds for trait-consistent behaviors–one of these being creative behavior as defined above. That is, particular traits raise the odds that someone will think and/or behave in a creative (original and meaningful) way. This book is an exploration of which traits do that and how.

Personality is all about the uniqueness of the person, and creativity at its core is about unique and meaningful behavior. Given this state of affairs, one would think that an authoritative handbook on the topic of creativity and personality would already exist. And one would be wrong. Over the last decade, many books – both popular and scholarly – have been published on creativity. These books have explored many important perspectives on creative thought and behavior, from intelligence, values, and emotion to genius, cognition, and domain-specific versus domain-general abilities. The field of personality, however, has not been neglected by researchers, as the chapters in this book will attest to. Yet there is no one single source that gathers the most current and cutting-edge research on how personality affects creative behavior. The purpose of this book is to fill that gap and be the first (and only) resource of its kind.

A few years back at a conference, the three editors wondered why it was that there was no definitive handbook examining how personality and creativity interact and influence each other. But where to begin? Given that we each had published on the topic of creativity and personality and were familiar with the literature, we first had to come up with a list of others who best exemplify current research on the topic. Fortunately, most scholars we contacted agreed to contribute. The next task at hand was how to organize and structure this

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coherent but diverse set of chapters. After reading through the contributions, we opted to organize the chapters into the following three parts: I – Process and Structure of the Creative Personality; II – Emotion, Motivation, and Psychopathology; and III – Measurement and Social Influences. The general sequence of these parts tends to move from the most general and individualistic to the more specific and social.

The topics in Part I are broad explorations of the creative personality and its processes and structures. The part begins with a contribution by Oleynick and colleagues (Chapter 2) that sets the stage for much of the rest of the book. They lay out the main personality dimension involved in all forms of creativity, openness to experience, and argue for its division into two dimensions: openness (being imaginative and preferring aesthetic engagement) and intellect (preference to explore and understand abstract and intellectual information). In Chapter 3, Jung and Meadows build on this idea and examine the specific brain networks involved with both dimensions of openness to experience and creativity. Particularly exciting is their discussion of how the openness component maps more on to the brain's default mode network, whereas the intellect component maps more on to the cognitive control network. In Chapter 4, Woo and colleagues propose a working model of how openness to experience has different effects on creative achievement depending on whether the creativity is domain general or domain specific.

In Chapter 5, Feist reviews the past and present research on the association between all five of the major personality dimensions of creative scientists. He proposes a functional model of personality and creativity that attempts to integrate and explain the dynamic relationship between personality and creative achievement. Traits function to make behavior (including creative behavior) more likely. In Chapter 6, Karwowski and Lebuda explore the impact that creative self-concepts and beliefs have on creative potential and achievements across the spectrum from mini-c to Big-C creative achievement. In Chapters 7 and 8 we have contributions that discuss how diversifying experiences affect creative accomplishment. In Chapter 7, Damian reviews evidence that having unusual and unexpected experiences (outside cultural norms, e.g., death of a parent or belonging to a cultural minority) early in life have great impact on later lifetime creative achievement. In Chapter 8, Chang, Su, and Chen continue this theme by examining the impact that having multicultural life experiences has on opening a person up to ways to thinking and new kinds of knowledge that are both novel and adaptive, that is, creative. Given the overall importance of the Big Five model of personality in many of these chapters, it is only appropriate that in the final chapter of the part (Chapter 9), Fürst and Lubart provide some challenges to the model and propose a model that moves "beyond the Big Five paradigm." In particular, they propose a more specific theoretical framework that more parsimoniously organizes the known relationships between personality and creativity than the broad traits found in the Big Five.

Part II concerns the interaction between creative personality and emotional and motivational traits. In addition, certain pathological traits can be

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associated with the creative process, especially in literature and the arts. The part begins with a contribution by Taylor, McKay, and J.C. Kaufman on the topic of mood, creativity, and personality (Chapter 10). They argue that mood and personality affect creativity differently depending on the type of mood and the domain of creative achievement (e.g., art versus science). Ivcevic and Hoffman (Chapter 11) continue the theme of affect and creativity by developing a model that integrates emotion-related personality traits and emotion abilities such as emotional intelligence and emotional creativity. These abilities, in turn, facilitate creative achievement. In Chapter 12, and coming from a social-learning-model perspective, Joy examines how the drive and motivation to perform novel and innovative behaviors predicts creative achievement such as divergent thinking, self-reported creative achievement, and rated originality in art and writing tasks. The last two chapters in Part II both concern the connection between psychopathology and creativity. First, Simonton (Chapter 13) reviews the evidence that tends to support a positive relationship between artistic genius and psychopathology. Furnham closes the part with a chapter that explores how both the "dark" (pathological) and "bright" (normal personality) traits correlate with creativity (Chapter 14).

In Part III, contributions cover topics involved with either measuring the creative personality or determining how it operates in a social and organizational context. Beginning this part, Hornberg and Reiter-Palmon examine how different measures and criteria of creativity lead to somewhat different findings in the personality–creativity relationship (Chapter 15). In Chapter 16, Nusbaum and Silvia review whether and to what extent personality traits (the Big Five) predict individual differences in humor – a specific and yet understudied form of creativity. As with many of the chapters in this book, they reveal the strong association between openness to experience and humorous creativity. Next, Dollinger discusses how creative people tell richer and more individualistic stories about their lives using 20 self-photographs (Chapter 17). He also finds that those who are high in openness and low in extraversion tell the most creative and individualistic autophotographic life stories.

The last four chapters of Part III focus on the group, social, and cultural forces behind the creative process. Litchfield, Gilson, and Shalley discuss how personality exists at the team level in addition to the individual level (Chapter 18). From that they examine the association between team-level personality (as operationalized using the Big Five) and creativity. One interesting and surprising finding is that variation (standard deviation) in openness among team members is a stronger predictor of team creativity than the average (mean) openness scores of the teams. In Chapter 19, Akhtara, Ahmetoglua, and Chamorro-Premuzic address the question of whether entrepreneurial personality (at both the individual and the group levels) affects work-related innovation. After answering affirmatively, they discuss how social capital can be leveraged to develop entrepreneurial personality traits. Among the findings reviewed, Akhtara and colleagues report that entrepreneurs tend to have lower levels of agreeableness and neuroticism along with higher levels of openness and conscientiousness.

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In Chapter 20, Fleith reviews the past few decades of educational interventions that have attempted to facilitate and improve creative thinking in students, with a special focus on Brazilian students. The final chapter (Chapter 21) provides a brief history of where the field has been, synthesizes some of the ideas presented throughout this book, and offers suggestions for future directions.

We are very pleased – proud even – with how this book came out, and we believe that it will offer students and scholars of both creativity and personality research the definitive go-to source for the most current and extensive research on how personality influences creative thought, behavior, and achievement. Certain personality traits (especially openness to experience) do make creativity more likely, but there is a lot more to it than that. Enjoy reading the rest of the book to find out how personality and creativity are a match made in heaven.

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PART I

Process and Structure of the Creative Personality

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2 Openness/Intellect

The Core of the Creative Personality

Victoria C. Oleynick, Colin G. DeYoung, Elizabeth Hyde, Scott Barry Kaufman, Roger E. Beaty, and Paul J. Silvia

Openness/intellect is perhaps the broadest, most contentious, and most quintessentially human of the Big Five personality traits. Capacity for imagination and artistic and intellectual curiosity, central components of the openness/intellect dimension, are part of what defines and advances our species. In terms of breadth, the openness/intellect domain encompasses traits ranging from intellectual abilities to aesthetic interests to potentially maladaptive cognitive tendencies related to psychosis (DeYoung, Grazioplene, & Peterson 2012). This remarkable breadth has driven a long-standing debate over how to best interpret and label this dimension.

The Big Five dimensions of personality, including openness/intellect, were empirically (i.e., atheoretically) derived using factor analysis, meaning that they were identified as patterns of covariation among a wide variety of more specific traits. Researchers then had to interpret these patterns, and this was particularly challenging with the openness/intellect factor. Various labels have been proposed over time, with *openness to experience* being the most prominent currently and *intellect* a distant second. We refer to this dimension with the compound label *openness/intellect* because it conveys that each of these two labels reflects a distinct but equally important aspect of the trait.

Though the labeling and characterization of openness/intellect have been a long and contentious process (described in more detail later), what is not disputed is the clear and robust relationship between this dimension of personality and creativity. More so than any other Big Five trait, openness/intellect is consistently related to measures of creativity, including creative thinking, creative achievement, creative professions, creative hobbies, and creative personality generally (Batey & Furnham 2006; Carson, Peterson, & Higgins 2003; Feist 1998; Feist & Barron 2003; S.B. Kaufman 2013; S.B. Kaufman et al. 2015; King, Walker & Broyles 1996; McCrae 1987; Silvia et al. 2008, 2009). In this chapter we review the history of the openness/intellect construct and summarize the empirical findings regarding the relation of creativity to the openness/intellect trait domain as a whole. Additionally, we differentiate openness/intellect into its two major subdimensions, openness and intellect, and discuss research regarding the specific relation of each to creativity. Finally, given that the link of openness/intellect to creativity is well established, we review specific motivational, cognitive, and neurobiological processes that may help to explain this link. In so

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doing, we hope to paint a clearer picture of the creative person and the mechanisms underlying the creative process.

History, Interpretation, and Measurement of Openness/Intellect

Openness/intellect was discovered in conjunction with the other four Big Five traits: extraversion, agreeableness, conscientiousness, and neuroticism. The field of personality psychology has achieved a relatively high degree of consensus on this general taxonomy of personality traits (John, Naumann, & Soto 2008), though, of course, some disagreements remain, such as whether a six-factor model might be better (Saucier 2009). Even in the alternative six-factor model, however, the openness/intellect factor remains the same, so we will not go into detail on that debate. The Big Five dimensions were ultimately derived from analysis of the natural-language terms people use to describe themselves and others (Allport & Odbert 1936; John 1990). Thus they were born out of the lexical hypothesis, which asserts that most important attributes of people have become encoded as single words in natural language. This hypothesis posits that the personality vocabulary in dictionaries constitutes a comprehensive content universe of personality traits from which to sample. In the early lexical studies, researchers scoured the dictionary for all the terms that could describe people, and the resulting list of over 17,000 English words included 4,500 trait terms, which formed the basis of the research that eventually led to the Big Five (Allport & Odbert 1936).

The first discoveries of the Big Five (Fiske 1949; Norman 1963; Tupes & Christal 1961) were all made using a greatly reduced list of 35 variables culled by Cattell from the 4,500 trait terms in order to have a manageable number of variables for factor analysis in the days before computers. Later studies found that the same five factors were evident even in much larger lists of trait terms (Goldberg 1990). Two of the three early studies labeled the openness/intellect dimension *culture* because it was marked by attributes such as *cultured* and *polished*, but this is now typically viewed as a historical accident stemming from the idiosyncrasies of Cattell's short list, and *culture* is not considered a good label for this broad, basic dimension of personality (Peabody & Goldberg 1989).

The most commonly used label in lexical research had been *intellect* due to high loadings from adjectives such as *intelligent*, *insightful*, and *clever* (John 1990), but the label *openness to experience* has supplanted it in popularity (John et al. 2008). The latter label stems from the work of Costa and McCrae (1985), who found that measures of imagination, intelligence, openness to change, and emotional and aesthetic sensitivity tended to covary. They interpreted this factor based on previous work positing openness to experience as a construct (Coan 1972; Fitzgerald 1966; Tellegen & Atkinson 1974). After they created a widely used measure of the Big Five (the NEO Personality Inventory, Revised

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[NEO PI-R]) (Costa & McCrae 1992), openness came to provide the *O* in *OCEAN*, a popular acronym for the Big Five dimensions.

Saucier (1992, 1994) observed that *imaginative*, *creative*, and *original* are three of the best and most specific markers of openness/intellect in lexical research, and he proposed the label "imagination" for this dimension. Using a slightly different method, Johnson and Ostendorf (1993) identified *artistic*, *creative*, and *imaginative* as three of the purest indicators of openness/intellect, leading Johnson (1994) to suggest that this dimension might best be labeled *creativity* or *creative mentality*. Although these labels have not caught on with psychologists, they serve to highlight that, from a descriptive standpoint, creativity is at the core of openness/intellect.

We believe that this assertion can also usefully be inverted: openness/intellect is the core of the creative personality. This means that the best route to understanding why some people are more creative than others is likely to be through research on openness/intellect. If we can understand why openness/intellect is one of the major dimensions of personality, we may better understand the significance of creativity in human functioning. And if we can understand the various components of openness/intellect and their sources in psychological and biological processes, we will be well on our way to understanding what it is about creative people that enables them to create.

The Hierarchy of Traits within Openness/Intellect

Personality is organized hierarchically, and the Big Five personality traits represent dimensions of individual differences at a very general level, each encompassing many more specific traits that covary (John et al. 2008). These more specific traits are typically described as *facets*, and there may be many facets within each of the Big Five. There is no consensus on how many facets exist or are important. Evidence does exist, however, for a level of personality structure in between the facets and the Big Five in which each of the Big Five traits has two major subfactors (i.e., *aspects*), which are likely to represent the most important distinctions for discriminant validity (DeYoung, Quilty, & Peterson 2007; Jang et al. 2002).

Perhaps unsurprisingly, the two aspects of openness/intellect can be well characterized as *openness* and *intellect*. Openness reflects the tendency toward engagement with aesthetic and sensory information (in both perception and imagination), whereas intellect reflects the tendency toward engagement with abstract and intellectual information. The correlation between openness and intellect is typically in the range of .3 to .5 (e.g., DeYoung et al. 2007), so it is possible to find individuals who are high in openness but not intellect or who are high in intellect but not openness. Figure 2.1 illustrates the structure of the openness/intellect domain. At the highest level of the diagram is the Big Five trait. (Note that there is evidence for a level of personality above the Big Five containing two dimensions representing the shared variance of openness/intellect and extraversion and of conscientiousness, agreeableness, and low

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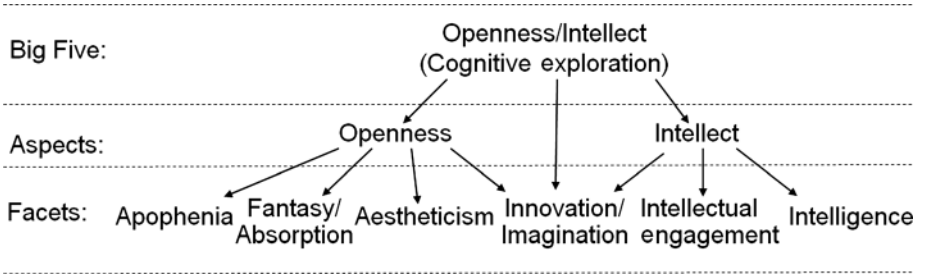

Figure 2.1 *Hierarchical structure of the openness/intellect trait domain. Levels of the hierarchy are labeled at left. Facets are arranged such that those closest together are most strongly related and those farthest apart are least related (DeYoung et al. 2012). Facet labels represent categories of facets and are not indivisible entities. No consensus exists as to the exact number and identity of facets, and this list is necessarily somewhat speculative.* Apophenia *is the tendency to detect patterns or causal connections where none exist. (Source: From DeYoung 2015.)*

neuroticism (Chang, Connelly, & Geeza 2011; DeYoung, 2006). This level of personality is not depicted in Figure 2.1.)

Various instruments are available to psychologists who wish to measure openness/intellect, many of which are free and publicly available. Any instrument designed to measure the Big Five personality traits – such as the Big Five Inventory (BFI) (John et al. 2008), the NEO-PI-R (Costa & McCrae 1992), the International Personality Item Pool (IPIP) Big Five scales (Goldberg 1999), the Mini-Markers (Saucier 1994), the HEXACO-PI (Lee & Ashton 2004), or the Big Five Aspect Scales (BFAS) (DeYoung et al. 2007) – includes a measure of openness/intellect at the level of the Big Five, and most of these will measure a blend of its two aspects regardless of their labels. The BFAS is the only instrument specifically designed to assess the openness and intellect aspects separately, but the aspects can also be assessed using a combination of lower-level facet scales. For example, the openness-to-ideas facet of the NEO-PI-R measures intellect reasonably well, and the openness-to-fantasy, aesthetics, and feelings facets of the NEO PI-R together assess openness reasonably well.

Notwithstanding the historical debate over how to best characterize the openness/intellect factor, reasonable consensus now exists that openness/intellect is a dimension reflecting a general tendency toward complexity and flexibility in information processing. Its core psychological function can be described as *cognitive exploration* (DeYoung 2015). People high in openness/intellect have both the desire and the ability to explore the world cognitively through both perception and reasoning. Openness reflects the tendency to explore sensory and aesthetic information through fantasy, perception, and artistic endeavor, whereas intellect reflects the tendency to explore abstract and semantic information through reasoning. Creativity, which manifests both artistically/aesthetically and intellectually, is thus straightforwardly related to either one or both of

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the aspects of openness/intellect depending on the form of creativity in question. In the following sections we discuss the empirical findings on the relation of creativity and openness/intellect at the level of the Big Five, as well as unique relationships between openness, intellect, and creativity.

Facets of Openness/Intellect

A number of different lists and measures of facets of openness/intellect have been published, highlighting the lack of consensus on the number of facets of openness/intellect. For example, Saucier and Ostendorf (1999) analyzed lexical ratings and identified three facets: intellect, imagination/creativity, and perceptiveness. Connelly et al. (2014) categorized and meta-analyzed 85 personality scales conceptually related to the openness/intellect domain and identified four facets purely related to openness/intellect (aestheticism, openness to sensations, nontraditionalism, and introspection) and three additional facets with strong secondary loadings on other Big Five factors (variety seeking, innovation, and fantasy). Woo et al. (2014) factor analyzed 36 scales related to openness/intellect and identified six facets: intellectual efficiency, ingenuity, curiosity, aesthetics, tolerance, and depth. S.B. Kaufman (2013) used factor analysis of both questionnaires and cognitive tests to provide evidence for four facets: explicit cognitive ability, intellectual engagement, aesthetic engagement, and affective engagement (though the last of these was more strongly correlated with agreeableness than with openness/intellect).

Though it is unclear exactly how many traits exist at the facet level, it is evident that some facets are more central to the domain as a whole than others. This phenomenon appears most straightforwardly in the finding that some facets have higher factor loadings on openness/intellect than others and that some facets have strong loadings only on openness/intellect without cross-loadings on other factors (Connelly et al. 2014; DeYoung et al. 2012; Johnson 1994). Another way in which some facets are more central than others can be seen using a multidimensional scaling procedure to show that the relations among various openness/intellect facets are well described by a single scaling dimension, called a *simplex* (DeYoung et al. 2012). The simplex entails mapping the correlations among the facets by placing them all on a single line, with the distance between them representing the strength of their correlation. The facet level of Figure 2.1 is arranged to correspond to this simplex. Note that Figure 2.1 is not intended to assert that there are exactly six facets in openness/intellect; rather, these can be considered six categories of facets that we feel capture the range of facets reasonably well. Creativity would fall in the central category labeled *innovation/imagination*.

Two of the facets in Figure 2.1, intelligence and apophenia, bear additional comment. Apophenia is the tendency to detect patterns (either sensory or causal) where none objectively exist, manifested in phenomena such as superstition, magical ideation (e.g., belief in telepathy), and unusual perceptual experiences (e.g., hallucinations). The inclusion of intelligence and apophenia as facets within

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openness and intellect is controversial, but they do typically have their primary loadings on openness/intellect when factor analyzed together with other Big Five facets (DeYoung et al. 2012). Still, their loadings are weaker than those of other facets, and they tend to be unrelated or even weakly negatively related to each other despite both loading positively on the same factor. Hence they can be viewed as peripheral (noncentral) facets of openness/intellect. With the rest of openness/intellect, they share the property that they are modes of cognitive exploration. This common feature explains how apophenia and intelligence may be nearly uncorrelated yet still part of the same trait domain.

Of particular interest here is that both IQ and apophenia are related to creativity (Benedek et al. 2014; Nettle 2006). The relation of creativity to IQ is less controversial than its relation to apophenia. Because apophenia is a core feature of symptoms of psychosis and characterizes the trait of schizotypy that represents normal-range variation in risk for psychosis (DeYoung et al. 2012), this association ties into the common tropes of the mad genius and the mentally ill artist. Although full-blown mental illness is rarely conducive to creativity, considerable evidence has accumulated to show that both questionnaire measures of apophenia and genetic risk for psychosis (as indicated by the presence of relatives with psychotic illness) are indeed associated with artistic creativity (Carson 2011; DeYoung et al. 2012; S.B. Kaufman et al., 2015; Kozbelt et al. 2014; Kyaga et al. 2013; Nelson & Rawlings 2010). A more thorough understanding of the openness/intellect domain as a whole, therefore, may lead to better theories of the link between creativity and risk for psychosis.

Openness/Intellect and Creativity

Creativity is typically defined as the generation of products that are simultaneously both novel and useful (J.C. Kaufman & Sternberg 2010). The second criterion is essential because it allows us to differentiate creative thought and behavior from thought and behavior that is merely eccentric or odd (Feist 1998) Usefulness is not limited to practical utility; creative works can also be deemed useful on intellectual or aesthetic grounds, which is why we prefer the terms *appropriate* or *meaningful* for this criterion. We note as well that creative products can be either material or abstract.

Based on the preceding definition, it is possible to conceive of creativity as a personality trait (the tendency to engage in creative activity and generate creative products), a process (the process by which a person generates creative products), or an appraisal of a product itself (Simonton 2003). Further, stable individual differences in creativity can take a variety of forms, and thus, when discussing creativity as a personality trait, it is useful to assess a broad range of constructs (e.g., Silvia et al. 2009). Examples include viewing oneself as a creative person, having creative hobbies, working on creative goals in everyday life, coming up with creative ideas in structured laboratory tasks, and attaining public markers of real-world creative achievement (Batey & Furnham 2006;

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Carson et al. 2005; Feist 1998; Feist & Barron 2003; King et al. 1996; McCrae 1987; Silvia, J.C. Kaufman, & Pretz 2009; Silvia et al. 2008, 2009, 2012).

Regardless of how creativity is conceptualized and assessed, openness/intellect, more so than any other Big Five domain, is consistently and strongly related to it (DeYoung 2015; Feist 1998; J.C. Kaufman et al. 2010; S.B. Kaufman et al. 2015). This is true whether creativity is measured by performance on laboratory tasks or by real-life creative engagement and achievement. Further, creativity can be considered either a facet of or an outcome of openness/intellect depending on how it is conceptualized. Generally, if creativity is conceptualized as a trait (i.e., as individual differences in the tendency to be creative), then it can be considered a facet of the openness/intellect domain itself. Alternatively, if creativity is conceptualized as a characteristic of a product, then it can be considered an outcome of openness/intellect. For example, openness to aesthetics (a good marker of the openness aspect) predicted the creativity of fictional stories written in the laboratory and evaluated by expert judges using a consensual assessment technique (CAT) (Thrash & Elliot 2003). Another study found that openness/intellect correlated with the creativity of Thematic Apperception Test (TAT) stories and drawings (Dollinger, Urban, & James 2004). In these and similar cases, creativity, conceptualized as an appraisal of a product, can be viewed as an outcome of openness/intellect.

The relation of openness/intellect to creativity transcends domains. This is in contrast to the other four Big Five personality traits, which tend to relate to creativity inconsistently, weakly, or in a domain-dependent manner. For example, a study of the relations between the Big Five and creativity in five domains (general, math/science, drama, interaction, and arts) found that openness/intellect was the only Big Five trait to correlate positively with all domains of creativity (J.C. Kaufman et al. 2010). Similarly, Dollinger et al. (2004) assessed the relationship between the Big Five traits and creativity in the visual arts, literature, crafts, performances, music, and math/science and found a significant positive correlation between openness/intellect and every domain except music. (The correlation between openness/intellect and musical creativity was positive ($r = 0.14$), but it did not reach statistical significance. Other studies have found correlations between openness/intellect and musical ability and creativity [see Greenberg et al. 2015; S.B. Kaufman et al. 2015].)

Extraversion is the only other Big Five trait to reliably show positive correlations with creativity (see S.B. Kaufman et al. [2015] for a correlation with artistic creativity), but the patterns of correlation between creativity and extraversion tend to be weaker and less consistent than those of creativity and openness/intellect. In a latent class analysis of creative achievements (Silvia et al. 2009), people with creative achievements in any domain of creativity (visual arts or performing arts in this sample) were higher in openness/intellect than people with no creative achievements. People with achievements in performing arts, however, were higher in extraversion than the visual artists and people with no achievements. The effect of openness/intellect thus

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was general, differentiating creative samples from noncreative ones, whereas extraversion's effect was specific, differentiating the kinds of creative domains people found appealing.

Additionally, a recent meta-analysis assessed the relation of the Big Five traits and creative self-beliefs, a broad set of characteristics including creative self-efficacy, creative personal identity, and self-rated creativity, in a number of domains (Karwowski & Lebuda 2015). Openness/intellect was consistently the strongest Big Five predictor of creative self-beliefs, and these relationships were strongest for domain general measures of creative self-beliefs. Consistent with this finding, Silvia et al. (2009) documented a strong relationship between openness/intellect and global creativity (assessed using the Creativity Scale for Different Domains) (J.C. Kaufman & Baer 2004). We do not attempt to solve the ongoing debate over whether there is a general creativity factor (analogous to a general intelligence factor) (e.g., Baer 1998, 2010; Silvia et al. 2009), but it is clear from the literature that the relation of openness/intellect to creativity pervades most, if not all, domains of creativity.

Given that creativity is central to the openness/intellect domain as a whole, and given that openness/intellect predicts creativity in nearly all domains, one might wonder about the utility in differentiating openness from intellect or in considering different domains of creativity. Until recently, little had been established regarding the discriminant validity of openness and intellect in the context of creativity, but recent work has provided evidence that openness and intellect differentially predict creative achievement. Specifically, in four demographically diverse samples (total N = 1,035), openness was found to independently predict creative achievement in the arts (but not the sciences), and intellect was found to independently predict creative achievement in the sciences (but not the arts) (S.B. Kaufman et al. 2015).[1] On a more fine-grained level, openness (but not intellect) correlated with creative achievement in music and film/theater, and intellect (but not openness) correlated with inventions and scientific discovery. Similarly, an earlier study using the NEO PI-R found that aesthetics, a facet of openness, related to artistic creativity and that ideas, a facet of intellect, related to scientific creativity (Perrine & Brodersen 2005).

This pattern of results for openness and intellect can be placed within a dual-process theoretical framework that differentiates type I processes that operate automatically from type II processes that require voluntary attentional resources (S.B. Kaufman 2011, 2013; J.C. Kaufman et al. 2010, 2015; Kahneman 2011). Artistic creativity seems likely to draw more heavily on type I processes associated with openness, such as implicit learning and pattern detection, whereas scientific creativity seems likely to draw more heavily on type II processes associated with intellect, such as reasoning and working memory. Thus it is useful to consider the different aspects of openness/intellect as well as different domains of creativity when examining relations among personality and creativity.

Regardless of how creativity is conceptualized and measured, it is consistently and robustly related to openness/intellect more so than to any other Big

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Five trait. An obvious question raised by the research establishing this relation is why or how this relation comes about. In the following section we discuss cognitive, motivational, and neurobiological processes that may account for the link between openness/intellect and creativity.

Sources of the Link between Openness/Intellect and Creativity

Cognitive Processes

Openness/intellect is the Big Five personality trait most associated with cognition (Zillig, Hemenover, & Dienstbier 2002). There are several cognitive processes common to both creativity and openness/intellect, and these processes may help explain the strong association between them. Latent inhibition, for example, is an automatic process by which stimuli previously categorized as irrelevant are prevented from entering conscious awareness (Lubow 1989; Lubow et al. 1992). Although decreased latent inhibition is potentially maladaptive, being a common feature of psychosis (Baruch, Hemsely, & Gray 1988a, 1988b; Lubow et al. 1992), it can also benefit creativity and original thinking (Carson 2011). There is evidence that reduced latent inhibition is associated with both openness/intellect and creative achievement in high-functioning individuals (Carson et al. 2003; Peterson, Smith, & Carson 2002). Reduced latent inhibition may allow high-functioning individuals to consider more stimuli as potentially relevant, thus allowing for the novel and original associations important for creativity. Edgar Allen Poe (1899) once remarked, "Experience has shown, and a true philosophy will always show, that a vast, perhaps the larger portion of the truth arises from the seemingly irrelevant." This quotation highlights the idea that with adequate intellect, openness to the plausibility of seemingly irrelevant connections may help a person to discover new and useful ideas.

Implicit learning is another cognitive process that may allow those high in openness to detect associations and patterns in noisy and complex environments, thus contributing to their creativity. Much like latent inhibition, implicit learning is an automatic cognitive process, distinguished from more deliberate and conscious processes, such as working memory (S.B. Kaufman et al. 2010). Traditionally, individual differences in implicit learning were considered error or noise (e.g., Zacks, Hasher, & Sanft 1982), but more recent work has begun to treat implicit learning as an ability with meaningful individual differences (see Reber, Walkenfeld, & Hernstadt 1991; S.B. Kaufman et al. 2010). One study showed a double dissociation in which openness was independently associated with implicit learning but not with working memory, and intellect was independently associated with working memory but not with implicit learning (S.B. Kaufman et al. 2010). This finding is consistent with studies in which intellect (but not openness) was associated with working memory and with the hypotheses outlined earlier regarding the association of type I and type II processes

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with openness/artistic creativity and intellect/scientific creativity, respectively (DeYoung et al. 2009; J.C. Kaufman et al. 2010).

Another cognitive process common to both creativity and openness/intellect is divergent thinking (McCrae 1987). Unlike intelligence or reasoning tasks that require people to *converge* on the one correct answer, divergent-thinking tasks invite participants to generate multiple clever, interesting, and creative responses (Plucker & Makel 2010). For example, participants might be asked to think of as many uses for a brick as they can. Responses can be algorithmically scored according to several criteria, such as the total number of responses made (fluency), the number of times participants switched between different categories (flexibility), and, for a given response, the portion of participants who also give that response (originality), with relatively infrequent responses earning more points for originality. The creativity of participants' responses can also be rated subjectively by others, and this approach appears to yield a better measure of creative potential than the more traditional algorithmic approaches (Benedek et al. 2013; Silvia et al. 2008). Creative thinking in the laboratory does not necessarily translate to creative outcomes elsewhere, and it is thus useful to know whether divergent thinking, as assessed in the laboratory, leads to real-life creativity (Jauk, Benedek, & Neubauer 2014).

Scores on traditional divergent-thinking tasks do indeed predict creativity outside the laboratory. For example, divergent thinking is related to creative achievement (Barron & Harrington 1981; S.B. Kaufman et al. 2015), the creativity of writing projects (Alpaugh et al. 1982), and the creativity of writing and art among academically advanced children (Runco 1986). Thus the ability of individuals high in openness/intellect to come up with original ideas is captured in their high performance on divergent-thinking tests (S.B. Kaufman et al. 2015; McCrae 1987).

Motivational Processes

For the abilities measured by laboratory tests of creativity to translate into real-life creative productions, a person must possess not only the potential to think creatively but also the *inclination* to be creative (McCrae 1987). Along with its cognitive components, openness/intellect encompasses a motivational component having to do with interest in novelty and complexity (DeYoung, Peterson, & Higgins 2005). This is consistent with our conceptualization of openness/intellect as involving a tendency or motivation to explore the world cognitively through perception and reason. At the core of openness/intellect is curiosity about information. This motivation to explore and tendency to find information rewarding may ultimately lead to novel ideas, the key to creativity.

In addition to the desire to explore novel ideas, one must be motivated to transform those ideas into creative products. Studies have found that inspiration, an approach-oriented motivational state, is associated with openness and creativity (Oleynick et al. 2014; Thrash & Elliot 2003; Thrash et al. 2010). Specifically, inspiration is posited to serve a transmission function such that an open

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person is inspired by creative ideas and is subsequently motivated to transmit or actualize these ideas by turning them into creative products (Thrash et al. 2010).

One way to discern the motivational component of openness/intellect is to observe how people choose to spend time in their everyday lives. Cross-sectional research has found that people higher in openness/intellect have hobbies that involve making and creating as opposed to observing or participating (Wolfradt & Pretz 2001). Recent experience sampling and daily diary studies have shown that people higher in openness/intellect are substantially more likely to be doing something creative when signaled during a normal day (Silvia et al. 2014) and to report that they spent time on creative pursuits (Conner & Silvia 2015). Thus people's preferences for novel, creative activities are revealed by their spontaneous and voluntary activities in their real-world environments.

Shared Neurobiological Underpinnings of Openness/Intellect and Creativity

A number of findings suggest a similarity between openness/intellect and creativity at the neural level. Important evidence for this similarity has emerged from studies of resting-state functional connectivity, which assess patterns of synchrony in activation throughout the brain while people relax in a magnetic resonance imaging (MRI) scanner without working on a particular task. This method has allowed mapping of the major functional networks in the brain (Yeo et al. 2011). One of the most important of these has come to be known as the *default network*, a set of midline, temporal, and inferior parietal brain regions that tend to be active when people are awake but not engaged in externally directed tasks (see Chapter 3). The default network has been implicated in a range of cognitive processes that involve spontaneous and self-referential thought, such as mind wandering, day dreaming, autobiographical memory, future simulation, mental scene construction, and theory of mind reasoning (Andrews-Hanna, Smallwood, & Spreng 2014; Buckner, Andrews-Hanna, & Schacter 2008). Moreover, a growing literature suggests that the default network plays a critical role in creative cognition (Beaty et al. in press a; Jung et al. 2010; Spreng, Mar, & Kim, 2009; Takeuchi et al. 2012). Critically, the cognitive abilities noted earlier all draw on the capacity for imagination, which is central to openness/intellect.

In light of the apparent conceptual overlap between openness/intellect and the default network, DeYoung (2015) suggested that openness/intellect may be related to variation in default network functioning. This notion received support from neuroimaging research reporting increased functional connectivity between hubs of the default network and brain regions associated with cognitive control in individuals high in openness to experience (Adelstein et al. 2011). Beaty et al. (in press b) provided further evidence by examining the relation between openness/intellect and global functioning of the default mode network. Across two studies, the authors found that openness/intellect predicted

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increased global efficiency of the default mode network, pointing to increased information processing within this network in people high in openness/intellect. Beaty and colleagues hypothesized that efficient access to the neurocognitive resources of the default network may partially account for the ability of people high in openness/intellect to generate creative ideas. Thus variation in the default mode network may be important for the link between openness/intellect and creativity.

In addition to similarities in brain function, parameters of brain structure have also been linked to both openness/intellect and creativity. Using diffusion tensor imaging, Jung et al. (2010) found that creativity (assessed using CAT with responses to a divergent-thinking task) and openness/intellect were both associated with decreased white matter integrity in the frontal lobes. A more recent study showed that this negative association was specific to the openness aspect and was not present for intellect (Grazioplene et al. 2016). This is consistent with findings that IQ is *positively* associated with frontal white matter integrity (Jung et al. 2010; Navas-Sánchez et al. 2014; Penke et al. 2012). Although decreased white matter integrity has been associated with reduced intelligence and risk for schizophrenia, it may also be associated with a more diffuse pattern of connectivity that facilitates divergent thinking and creativity.

Finally, openness/intellect and creativity appear to share a relationship with the neurotransmitter dopamine. The general function of the dopaminergic system is to promote exploration by facilitating engagement with reward or cues of reward (DeYoung 2013), which includes cognitive exploration prompted by the incentive reward value of information. There is behavioral, genetic, and neuroimaging evidence suggesting that variation in dopaminergic function is associated with variation in openness/intellect (DeYoung 2013; Passamonti et al. 2015).

In addition to its association with openness/intellect, dopamine also appears to be involved in many of the cognitive processes described earlier (i.e., reduced latent inhibition, working memory, and divergent thinking), which are related to both creativity and openness and/or intellect. Turning to creativity, neuroimaging studies have linked dopamine to performance on divergent thinking tasks (De Manzano et al. 2010). Studies have also found that creativity is predicted by eye-blink rate, which is a marker of dopaminergic activity (Chermahini & Hommel 2010; Depue et al. 1994). Thus the neurotransmitter dopamine appears to be common to both openness/intellect and creativity, and it may ultimately facilitate the cognitive processes that we have argued explain the openness/intellect–creativity link.

There is also evidence that dopamine influences the motivational processes described earlier. Dopamine facilitates exploration, and recent work suggests that dopamine plays a role in the incentive reward value of information and in the desire to explore cognitively (DeYoung 2013). Additionally, dopamine is hypothesized to influence the higher-order personality trait plasticity, which represents the shared variance between openness/intellect and extraversion (DeYoung 2013). In a study examining the factor structure of an integrative

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model of creativity, inspiration was found to load highly (in fact, higher than openness/intellect or extraversion) on the plasticity factor (Ghisletta & Lubart 2014). Though this study did not directly examine whether dopamine is implicated in inspiration, theories regarding the role of dopamine in plasticity imply that this would be the case.

Conclusion

Openness/intellect is at the core of the creative personality. Despite historical disagreements over the interpretation of the openness/intellect dimension, its association with creativity is reliable and strong. This association is evident regardless of how creativity is assessed, and openness/intellect predicts creativity in nearly all domains of creative activity. By differentiating the two aspects, openness and intellect, one begins to see more fine-grained patterns of association. At the aspect level, openness is primarily associated with artistic creativity, and intellect is primarily associated with scientific creativity. This pattern of results points to the importance of attending to different traits within the openness/intellect trait domain as well as to the different domains in which creativity manifests.

Having established these relationships, researchers have begun to uncover the specific cognitive, motivational, and neurobiological mechanisms that may account for the link between creativity and openness/intellect. The cognitive processes divergent thinking, working memory, reduced latent inhibition, and implicit learning all share an association with both creativity and openness/intellect. Motivational processes linking openness/intellect include cognitive exploration, the reward value of information, and inspiration. At the neural level, diffuse white matter connectivity in the prefrontal cortex and functional connectivity within the default network may underlie both openness/intellect and creativity. Finally, dopamine, a neurotransmitter responsible for exploration and reward, is implicated in both openness/intellect and creativity. An integrated understanding of the basic neurobiological processes that underlie individual differences in openness/intellect and creativity can shed light on the purpose and function of these traits for our species.

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Note

1 Both openness and intellect exhibited significant positive zero-order correlations with creative achievement in the arts and the sciences, but the only significant unique relationships (controlling for the other aspect) were between intellect and scientific creative achievement and between openness and artistic creative achievement.

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3 Sweet Dreams Are Made of This

The Role of Openness in Creativity and Brain Networks

Rex E. Jung and Christine Meadows

Sweet dreams are made of this
Who am I to disagree?
I travel the world
And the seven seas,
Everybody's looking for something.
—Eurythmics

The quest to find connections between human cognitive complexity and the success of our species has been long and arduous. The success of the human species is inexorably linked to our ability to successfully colonize novel and complex environments (Wren et al. 2014). Today there are several competing hypotheses attempting to explain this success, such as improved technology (Mellars 2004, 2006), behavioral adaptability and flexibility (Potts 2002), complex language (Wynn & Coolidge 2010), and sophisticated social networks (Grove, Pearce, & Dunbar 2012). While offering important *extrinsic* information about human behavior, these hypotheses tend to neglect perspectives that incorporate more *intrinsic* factors such as major personality variables and their organization within the human brain. Here we focus on one personality variable particularly relevant to human innovation and creativity – openness to new experience – and the emerging literature that links this personality variable to regional brain structure and function.

This chapter is divided into several sections. In the first section we will introduce the personality variable of openness to experience and highlight its importance to the manifestation of creativity. We next outline the neuroimaging research linking the personality variable *openness to new experiences* (here forward simply *openness*) to specific brain features. We briefly highlight our own work in the arena of personality neuroscience and then broaden the discussion to note the significant overlap between regions identified to correspond with openness and those corresponding to the so-called default-mode network (DMN). Finally, we will attempt to map the two main personality facets openness/intellect (O/I) onto broad brain networks including the DMN and the cognitive control network (CCN).

Personality Factors and Creativity

The structure of personality has been of great interest to psychologists, with early theorists separating main features along a continuum such as

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extraversion–introversion (Jung 1921). Numerous theoretical models emerged, including Eysenck's three-factor model (Eysenck & Eysenck 1976), Cattell's 16 factor model (Cattell & Drevdahl 1955), and finally, the more parsimonious five-factor model of personality (Big Five), which persists to the present day (McCrae & John 1992). Early researchers were invariably drawn to the correlations between personality variables and constructs including intelligence and creativity, for reasons having to do with both the *Zeitgeist* and the personal interests of the researchers who, working in the fields of individual differences, were at the center of such inquires (e.g., Eysenck and Cattell). Thus it was most natural for the makers of the most reliable and valid measure of human personality (i.e., the Big Five) to assess correlations between its main factors and those of intelligence and creativity, the latter of which was (and is) most often measured by performance on tests of divergent thinking ability – taking a common item and extrapolating as many uses as possible for it (e.g., a brick). Of the five personality factors, only openness was significantly correlated with creativity (as measured by various aspects of divergent thinking) – r range (self, peer, spouse ratings) = 0.29 – 0.41, with the author concluding that "openness to experience is a common characteristic of creative individuals" (McCrae & Ingraham 1987, p. 1264).

In a subsequent tour de force meta-analysis, this suspicion was supported by findings that openness was the largest predictor of creative achievement in both artists (effect size $d = 0.47$) and scientists (effect size $d = 0.31$) (Feist 1998). Feist noted that the empirical consensus provided by this meta-analysis – particularly around openness – allows for "future researchers (to) make educated guesses as to where to begin their search for the potential underlying physiological and psychological mechanisms of highly creative behavior" (Feist 1998). These "educated guesses" are where we turn our attention to next.

Neuroimaging Studies of Openness to Experience

Surprisingly little neuroimaging research has been undertaken regarding the personality variable of openness to new experiences, one of the Big Five personality factors characterized by such adjectives as *artistic*, *curious*, *imaginative*, *insightful*, *original*, and *having wide interests* (McCrae & John 1992). While openness was previously treated conceptually as a rather cohesive factor, it has more recently been parsed into two major domains representing intellect, dealing with variables having to do more with *reasoning and intelligence*, and openness, having to do with more *imaginative and creativity* variables (DeYoung et al. 2009). This bifurcation of openness has been empirically supported by the development of the Big Five Aspect Scale (BFAS), comprised of 100 items validated across two independent samples and splitting each of the five main factors into two independent facets (DeYoung, Quilty, & Peterson 2007). Thus the understanding, validation, and replication of the construct of openness are sufficient, from a

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psychometric perspective, to warrant exploration of neural correlates that might give rise to this complex human behavior.

The first neuroimaging study of openness makes note that the intellectual history on which it is founded draws heavily on the thinking of Hans Eysenck, who posited three main dimensions of personality – psychoticism, extraversion/introversion, and neuroticism (i.e., PEN) – each of which was hypothesized to have distinct physiological bases (Eysenck 1990). For example extraversion–introversion was hypothesized to be determined by activity in the reticular formation and neuroticism with the limbic system (Stough et al. 2001). Thus these authors go about searching for biological markers of the major factors of personality using the techniques available to them, namely, electroencephalography (EEG), undertaken in 5 male and 11 female subjects. Subjects kept their eyes closed throughout the experiment and were exposed to photic series comprised of 30-second bursts of flickering lights (8–40 Hz) interspersed with 90-second breaks. Several correlations between personality variables and light frequencies were found; most notably, these researchers found that openness was "moderately and positively correlated with photic driving at a frequency in the theta band across all cortical regions." These authors make note of previous research showing theta activity being associated with age (Maulsby 1971) and pleasure-seeking behavior (Kugler & Laub 1971), leading them to speculate that "adults who are more open, may have retained a somewhat childlike wonderment and open mindedness about their world with a willingness to explore alternative views about issues" (Stough et al. 2001).

It was eight long years before any brave soul ventured back into the thicket of personality neuroscience, but those who ventured forth came to the arena with a well-developed theory based on the burgeoning field of cognitive neuroscience (DeYoung et al. 2009). Noting that intellect was distinct from openness, and given the well-established relationship between intelligence and working memory (Kane & Engle 2002), these authors used functional magnetic resonance imaging (fMRI) applied to 104 individuals who performed a difficult working memory task. They hypothesized that intellect (but not openness) would be associated with both working memory performance and the posteromedial prefrontal cortex (pMPFC) regions subserving said working memory performance. The pMPFC was noted to be reliably engaged during performance of working memory tasks (Cabeza & Nyberg 2000) and engaged while monitoring performance associated with goal-directed activity (Ridderinkhof et al. 2004), making this region ideal in isolating the neural correlates of intellect. Rather unsurprisingly, intellect was correlated with activity in the left lateral anterior prefrontal cortex (aPFC) and pMFC. More interestingly to this chapter, none of the openness facets (including fantasy, aesthetics, and feelings) were significantly correlated with activation of any brain region (superior parietal or frontal), or with a measure or general intelligence (*g*), or with working memory ability, suggesting that openness might be associated with brain regions and cognitive constructs beyond the purview of this particular research. What could these brain regions be?

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It was another six years before this foundational question would be answered. Much like the researchers (earlier) who were interested in the intersection between intellect and working memory/intelligence, researchers from China became interested in the intersection between creativity and openness, given that an increasingly sophisticated research literature was emerging showing specific brain regions associated with creative cognition (Jung et al. 2013). Two-hundred and fifty-two healthy college students underwent structural magnetic resonance imaging (sMRI), tests of creative cognition (i.e., divergent thinking), the Revised NEO Personality Inventory, and a measure of general intelligence (Raven's Advance Progressive Matrices) (Li et al. 2015). Voxel-based morphometry was used to determine gray matter volume associated with both creativity and openness. Based on previous studies (DeYoung and colleagues [2010] had found a nonsignificant cluster to be associated with volume of a cluster within the right parietal cortex, albeit nonsignificant), they hypothesized that right posterosuperior temporal sulcus volume would be implicated in curiosity and imagination (Krain et al. 2006). When they specifically focused on brain regions where identified creative cognition was correlated with volume, they found that openness was positively correlated with right posteromedial temporal gyrus (pMTG) volume and negatively correlated with the volume of a cluster within the orbitofrontal cortex (OFC). This relationship was specific to openness because no other personality variable showed any significant correlation with any cluster associated with creative cognition. Subsequent analysis confirmed that openness partially mediated the correlation between the right pMTG volume and trait creativity, suggesting that "openness to experience might induce some particular patterns of cognitive processing associated with intuition, imagination, curiosity and fantasy through 'semantic processing' functions related to the right pMTG" (Li et al. 2015). These authors appear to suggest that the capacity for openness *precedes* the development of creative cognition, although this supposition is speculative given the correlational nature of their findings.

The most recent study, by our group, attempts to bring the research of openness together within a framework of complex brain networks (Beaty et al. 2015). These brain networks will be discussed more fully in the next section; suffice it to say here that the cognitive neurosciences have evolved away from the "bits and pieces" approach of discrete brain regions associated with individual cognitive processes (e.g., Broca's area as the *seat* of expressive language) to more sophisticated appreciation of the interplay between different regions of the brain (i.e., networks) working in concert to facilitate complex cognitive processes (e.g., language networks). One large-scale brain network – the DMN – has engendered significant attention in the cognitive neurosciences because it has been linked with "spontaneous and self-generated cognitive processes, such as autobiographical memory retrieval, episodic future thinking, theory of mind reasoning, mental scene construction, moral decision making, creative cognition, daydreaming, and mind wandering" (Andrews-Hanna et al. 2010; Beaty et al. 2015; Fox et al. 2015; Stawarczyk & D'Argembeau 2015).

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While the DMN had been implicated in creative cognition across several studies (Beaty et al. 2015; Jung et al. 2013), its specific role in personality (i.e., openness) was largely unexplored. In two independent samples ($N = 68$ and $N = 86$) using resting-state fMRI, structural equation modeling, and a measure of network efficiency, we found strong support that openness is related to global efficiency within the DMN ($B = 0.42–0.43$, $p < 0.002$). We hypothesized that this relationship was due to imaginative characteristics linking openness with the DMN.

Our Efforts in Personality Neuroscience

Our group has ventured (some would say stumbled) into the arena of personality neuroscience, often by virtue of the broad net that we cast to capture the elusive nature of creative cognition in the human brain (Jung et al. 2009, 2010a, 2010b). In these studies, we always administer a broad battery of tests designed to measure various aspects of a given construct, being rather agnostic regarding the "true nature" of the individual difference in question and wary of the various factions that become increasingly ossified through exposure to only their own ideas and influences. As a neuropsychologist by training, one of us (RJ) has learned that any single test can be influenced by any number of factors, both intrinsic and extrinsic (e.g., I have seen physicists from Los Alamos National Laboratory crippled on an IQ test for lack of breakfast) and that by observing a pattern of findings one can draw much stronger inferences than can be found by relying on a single measure, no matter how reliable or valid that measure might be (in the abstract). To that end, we generally administer no more than three hours of tests – this we found to be the upper limit of tolerable for normal subjects – sampling intelligence, creativity, personality, achievement, and the like. All these individual attributes, in various combinations, have been found to be important to creative ability.

Magnetic resonance spectroscopy (MRS) is a neuroimaging technique allowing for the assay of brain biochemistry in vivo (Ross & Sachdev 2004). While this technique has been well demonstrated to be sensitive to biochemical alterations associated with neurological disorders including traumatic brain injury (Friedman et al. 1998, 1999) and various neuropsychiatric disorders (Jung et al. 2001; Rowland et al. 2003), our group has demonstrated its efficacy in elucidating individual differences in normal cognition, particularly intelligence and creativity (Jung et al. 1999a, 1999b, 1999c, 1999d, 2005, 2009a, 2009b). This has led to a renaissance in spectroscopic approaches to understanding cognitive functioning – given the high reliability (intraclass correlation [ICC] $\geq .90$) of obtaining *N*-acetylaspartate measures (a neuronal marker) from the human brain (Gasparovic et al. 2010). Indeed, a recent review ($N = 628$) and prospective study ($N = 40$) supports *moderate* associations between *N*-acetylaspartate and IQ in healthy adult subjects (Patel & Talcott 2014), similar to what we found in the first study reporting such associations some 15 years prior (Jung et al. 1999b).

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With this in mind, we undertook to determine the association between *N*-acetylaspartate (NAA) and various other metabolites (e.g., choline, creatine, and inositol) and personality in a cohort of 60 subjects (27 females), who took the NEO Five-Factor Inventory. While most of our previous studies had focused on one or two large (~8 cm^3) spectroscopic *voxels* (i.e., cubes of tissue) in frontal or parietal white matter, the technology had sufficiently advanced to allow us to sample from a spectroscopic *grid* comprised of 100 smaller voxels of roughly ~1 cm^3 and spanning regions from the anterior cingulate through the posterior cingulate gyri and bilateral frontal and posterior white matter.

In short, many of the relationships between brain biochemistry and personality variables overlapped within brain regions overlapping the DMN – not particularly surprising given that the regions within which our voxels were placed (within medial and posterior brain regions). Most interesting, we found that openness had a positive relationship with NAA within the right parietal white matter and a negative (i.e., inverse) relationship with NAA within the left frontal white matter. At this point, we should note that we did not separate out openness from intellect and that the findings corresponded well with those from our intelligence work, namely, lower frontal NAA and higher parietal NAA being associated with higher IQ (Jung et al. 1999b). This finding gets at the fundamental importance of separating out openness from intellect: if you do not, you might be getting results similar to those found in intelligence neuroscience (Jung & Haier 2007) as opposed to the more subtle and important distinctions to be learned regarding the interaction of personality with creative cognition (Jung 2014).

Our second foray into personality neuroscience used diffusion tensor imaging (DTI), again a technique with high reliability (ICC $\geq$ .77) with respect to fiber tracking measurements (Danielian et al. 2010). We focused on the reliability of these structural measures given the recent focus on the low reliability of (and overreliance on) fMRI measures in all of neuroscience (particularly creativity). DTI measures white matter microstructure by means of water diffusion through cellular compartments (i.e., myelinated axons) in vivo (Le Bihan 2003). Water moves preferentially down the length of axons, like water through a straw, allowing for measurement of the integrity of the neuron–axon system, reflecting some combination of increased axonal thickness, increased myelin thickness, or increased coherence (i.e., directionality) of fibers in a given direction (Cohen et al. 2009). We studied white matter integrity in 72 young adults (32 females) and found that openness/intellect was significantly inversely correlated with white matter integrity of the right anterior thalamic radiation. Subsequent analyses suggested lower levels of myelination (i.e., higher radial diffusivity) to be driving the results, brain organization that was noted to be similar in kind and location to that found in patients diagnosed with schizophrenia and bipolar disorder (McIntosh et al. 2008). Again, our measure confounded openness with intellect, although our two studies generally painted a picture of "less is more" with respect to both creative cognition (i.e., lower volume, DTI, and NAA in

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frontal regions) and personality in the dynamic interplay of frontal lobe interactions with more posterior brain regions.

> A picture begins to emerge regarding the manifestation of complex cognitive processes in the brain, including the interplay of intelligence and creativity. Whereas more neural resources are often associated with higher intellectual capacity in a parieto-frontal network of brain regions (Jung & Haier 2007), studies in DT appear to suggest that less is often better in a different network of brain regions, particularly fronto-cingulate subcortical networks linked via white matter loops. (Jung et al. 2010a, p. 4)

A Default Mode of Brain Functioning

The neuroimaging research just reviewed increasingly points to significant overlap between the personality variable of openness and both behavioral characteristics and neural mechanisms associated with the DMN. Stough's early EEG work points to theta-band correlates, suggesting a less mature, sensation-seeking neural organization (Stough et al. 2001). DeYoung and colleagues' fMRI study looking at working memory, intelligence, and intellect showed no (significant) overlap between regions commonly associated with these variables of *cognitive control* and measures of openness, suggesting a clear neural distinction between openness and intellect (DeYoung et al. 2009). Li's group (Li et al. 2015) was the first to find significant overlap between volume within a key node within the DMN – namely, the pMTG – and measures of openness, which they interpreted as reflecting "intuition, imagination, curiosity and fantasy." Finally, our recent study rather definitively links the personality trait of openness to the network efficiency of the DMN, with the *imaginative characteristics* of both openness and the DMN being hypothesized to be the common thread (Beaty et al. 2015b). What is it about this DMN that makes it such a strong player in the expression of openness and (as we will see) creative cognition?

The DMN was discovered in 1997, rather by accident, when researchers noticed that a broad swath of brain region consistently reduced activity levels when subjects were engaged in cognitive tasks, including visual search, spatial attention, reading nouns, and memory for words (Shulman et al. 1997). These regions classically include the posterior cingulate/precuneus, bilateral inferior parietal cortex, medial prefrontal cortex, and bilateral medial temporal cortex. Subsequent studies showed that this set of brain regions, comprising "a default mode of brain function," became less metabolically active during activities that involved attention demands, planning, and goal formulation (Raichle et al. 2001). In fact, these brain regions were "always on" but less so when attentional demands from the external environment dictated that resources be diverted away from the brain's *default mode*. Since discovery of the DMN in 1997 and its explicit naming in 2001, there have been 673 papers focused on this topic (Scopus: Default Mode in Article Title; Brain in All Fields). The DMN has

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since been identified in the monkey (Vincent et al. 2007), cat (Popa, Popescu, & Pare 2009), rat (Lu et al. 2012), and mouse (Stafford et al. 2014), suggesting that this brain network organization is a consistent feature across mammalian species (although some differences exist; e.g., monkeys lack parietal component; rats' parietal component is within the primary sensory cortex).

Thus, if we know what the DMN does not do (i.e., it is not active during externally directed cognition), what is its function? As it happens, the various nodes within the network serve discrete functions associated with more internal, self-directed cognitive processes. Three main subdivisions of the DMN have been described: (1) ventromedial prefrontal cortex (VMPC), (2) dorsal medial prefrontal cortex (DMPC), and (3) posterior cingulate/precuneus/lateral parietal (PcPP). It is always rather problematic to discuss particular brain regions as being "responsible for" and/or "associated with" particular cognitive functions; that being said, extensive lesion work and work with nonhuman primates allow researchers to set up rather broad boundaries within the brain (think of them as low fences between friendly neighbors) associated with rather discrete cognitive capacities. For example, the ventromedial prefrontal cortex has long been associated with personality integrity and deviant social behavior, first uncovered by the rather unfortunate case of Phineas Gage. More recently, researchers have implicated this triad of regions with more specific aspects of emotional processing (VMPC), self-referential mental activity (DMPC), and recollection of prior experiences (PcPP), with particular DMN activation patterns depending on particular task demands (e.g., emotional valence versus self-reference) (Raichle 2015). It is common to associate the DMN with daydreaming, mind wandering, thinking about the past or future, and mental simulation, the importance of which will become evident in subsequent sections (Beaty et al. 2015; Jung et al. 2013). One of the most recent, and striking, developments regarding the DMN is the notion of balance between the so-called task-positive network (also called the *cognitive control network* [CCN]) and DMN in the brain. While these networks are often in dynamic opposition (i.e., anticorrelated), they also can be observed to cooperate during cognition, suggesting a dynamic, interactive relationship between these two main brain networks. Dr. Raichle suggests that the DMN plays a critical role in organizing and expressing preplanned, reflexive behaviors that would be considered to be essential to adaptive functioning in a complex world (Raichle 2015).

Mapping Personality Constructs of Plasticity and Stability on Brain Networks

DeYoung and colleagues have formulated a general theory of normal personality functioning wherein the five factors conform to two broad domains, namely, plasticity and stability (Hirsh, Deyoung, & Peterson 2009). These so-called metatraits were discovered through factor analysis, with one

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factor – stability – containing elements of agreeableness, conscientiousness, and neuroticism (the last being reversed) and the other factor – plasticity – containing extraversion and O/I (DeYoung 2006; Digman 1997). Stability is hypothesized to relate to "the need to maintain a stable organization of behavioral and psychological function," while plasticity is hypothesized to relate to "an individual's basic need to incorporate novel information from the environment" (DeYoung 2006). These metatraits have been further hypothesized to be *theoretically* related to serotonergic and dopaminergic systems (respectively) (DeYoung 2006), based on prior work on approach and avoidance behaviors in lower animals (Depue & Collins 1999). When these authors looked at a broad range of behaviors in the real world (e.g., drinking alcohol/using other drugs, telling a joke, and staying up all night), they found a "remarkable" consistency between these two metatraits and behaviors associated with restraint (i.e., stability) and engagement (i.e., plasticity) with the environment (Hirsh et al. 2009).

Allen and DeYoung (2016) attempt to move the field of personality neuroscience into a broader perspective encompassing "thought, cognition, motivation, and emotion (that is, personality)" in an ambitious and recent paper. While we would agree that motivation and emotion are clearly within the purview of the personality neurosciences, once one delves into *thoughts* and more so for *cognition*, one has moved more firmly toward the *cognitive* neurosciences proper, which have customarily been the purview of such subdomains as intelligence/reasoning (Deary, Penke, & Johnson 2010; Gray, Chabris, & Braver 2003; Green et al. 2010; Jung & Haier 2007; Prabhakaran et al. 1997) and creativity/aesthetics (Abraham et al. 2012; Dietrich 2004; Ishizu & Zeki 2013; Jung et al. 2013; Vessel, Starr, & Rubin 2013) to name two. DeYoung and colleagues have linked O/I specifically to the dopaminergic system of the human brain, although this line of evidence is admittedly indirect (DeYoung, Peterson, & Higgins 2005; 2002) and relies on the association of O/I with working memory ability (DeYoung et al. 2005, 2009). This highlights both the problem and the promise of combining and deconvolving O/I, respectively, as was reviewed earlier. To be sure, it is likely that the neurological processes underlying openness would be different from those of intellect given the well-established neuronal differences between creativity (Jung et al. 2013) and intelligence (Jung & Haier 2007), respectively.

The review by Allen and DeYoung (2016) notes that intellect, more specifically, has been demonstrated to be associated with both working memory performance and brain activity associated with such performance in an fMRI paradigm (DeYoung et al. 2009). They note associations between the left (lateral) frontal pole and posteromedial prefrontal cortices, regions that have been implicated previously in making abstract analogies (Green et al. 2006), cognitive control (Ridderinkhof et al. 2004), and, when combined with a positron emission tomographic (PET) study, showed additional recruitment of the anterior cingulate (Sutin et al. 2009) – a structure associated with error detection (Swick & Turken 2002). On the openness side of the equation, there are two functional connectivity studies showing increased connectivity between

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the medial prefrontal cortex (MPFC) and the precuneus (Adelstein et al. 2011) – two main hubs of the DMN – and a second study showing increased connectivity in parietal components of the DMN (Sampaio et al. 2014). Both studies combined openness and intellect, so the specificity of these findings to openness versus intellect is nonspecific.

While Allen and DeYoung (2016) rightly focused on possible neurotransmitter correlates of the Big Five personality variables, we make note of the growing likelihood that the major facets of openness and intellect map to the major brain networks of the DMN and CCN, respectively. The evidence for this bifurcation is as follows:

1. One of the first studies to separate openness and intellect (DeYoung et al. 2009) found that intellect was clearly associated with working memory performance and pMPFC activation, the cognitive constructs (i.e., intelligence and working memory) and regions (i.e., dorsal and lateral frontoparietal) of which are clearly association with the CCN (Niendam et al. 2012).
2. Openness facets, in this same study, were not correlated with activation of any brain region, or with a measure of general intelligence (*g*), or with working memory ability. Openness is clearly measuring behavioral and brain characteristics that are different from intellect, although these variables are rarely measured separately (DeYoung et al. 2009).
3. Openness was positively correlated with right pMTG volume and negatively correlated with the volume of a cluster within the orbitofrontal cortex (OFC) – nodes within the DMN (Li et al. 2015). Importantly, these authors control for IQ in their analysis: thus, while they did not explicitly separate openness from intellect, they controlled for the effects of the latter, making the results more likely to be specific to openness.
4. Finally, in two independent samples, openness was strongly related to network efficiency within the DMN, hypothesized to be due to imaginative characteristics of both openness and the DMN (Beaty et al. 2015).
5. All other studies to date have either convolved openness and intellect or not controlled for IQ, or the brain regions identified have not been specific enough to articulate regions that would map onto the CCN or DMN with any specificity (DeYoung et al. 2010; Jung et al. 2010a; Ryman et al. 2011; Stough et al. 2001; Taki et al. 2013; Xu & Potenza 2012).

It is difficult to make strong inferences when the studies that have separated openness from intellect are so few. That being said, there appears to be compelling evidence that when openness and intellect are separated, intellect tends to map to brain networks associated with intelligence, working memory, and the CCN, while openness maps to networks associated with schizotypy, imagination, and the DMN. Indeed, openness has been associated with "they who dream by day," with DeYoung and Grazioplene noting that dreaming (like openness) engages the brain's DMN. Indeed, they note that the DMN is similar to dreaming – in sleep, the brain is engaged in hyperassociative encoding, whereas during wakefulness, the exploratory aspects of the DMN are mediated

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by openness (DeYoung & Grazioplene 2013). We hypothesize that exploration of openness and intellect separately, with attention to their independent contribution to brain network structure and function (e.g., DMN and CCN), will produce much the same clarity within the personality neurosciences that separation of creativity from intelligence has had in the cognitive neurosciences (Beaty et al. 2015; Deary et al. 2010).

Concluding Remarks and Paths Forward

There is really no good reason that such massive creativity would have emerged in anatomically modern humans (AMHs) some 50,000 years ago given the incredible stability (~1.5 million years) of our previous intellectual achievement (the Acheulean hand axe), leading to the main artifact of creativity in the modern world, ironically also hand held (i.e., the iPhone). One possibility is that while humans (and other species) share intellect, which can be measured as the general factor *g* (Deary 2012), humans have more recently evolved the capacity to "dream by day," to imagine, to be open to new experiences within a mental template that allows behaviors to be simulated within cognitive space (at relatively low cost) before being implemented in the external world (at relatively high cost). The capacity to simulate possible behaviors, within the DMN, can be seen as a compelling leveraging capacity, unique to anatomically modern humans, leading to increased openness (i.e., plasticity), exploration of both territory and ideas, and perhaps even to the creation of the modern technologies such as the iPhone. Being able to let the mind wander and let the default mode take over seems to be a crucial part of human creativity. Indeed, sweet dreams are made of this.

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4 The Curious Dynamic between Openness and Interests in Creativity

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Creativity research has long sought to answer the following question: what are the common attributes of creative persons? In this chapter we pose a slightly different (and more nuanced) theoretical question: *how* and *when* do personality traits contribute to one's pursuit of creative work? Do different psychological attributes of individuals play differential roles in creative achievement and development over time? Our core argument in this chapter is that addressing these questions requires a further conceptual refinement of the domain-specificity-versus-generality debate in creativity research (Baer 2010) as well as a careful delineation of two personal attributes (i.e., openness and interests) in *manifesting* and *developing* one's creativity over the course of one's career.

We organize this chapter into four sections. We begin with a brief presentation of our broad theoretical perspectives on the issue of domain specificity versus generality in creativity research. Building on these foundations, we then propose a working model that delineates how openness and interests may differentially influence one's creative achievement in various forms through their unique contributions to domain-specific versus general determinants of creative performance. Next, we further discuss how openness and interests may influence each other, how this relationship may evolve over the course of one's career, and how it may affect the outcome of one's creative pursuits in various domains. Last, we conclude by discussing an agenda for future research that takes into account these nuanced roles that openness and interests play in the creative process and the development of creativity.

Domain Specificity and Domain Generality in Creativity Research

The issue of domain specificity (i.e., whether one's creativity in a given domain may be generalized to other domains) has been widely debated among creativity scholars. While some have suggested that a person's creativity is similar to a stable trait (much like *g*) and is predictive across multiple domains (Hocevar 1976; Plucker 1998, 1999), contemporary creativity research seems to emphasize the domain-specific nature of creativity. Most notably, a great deal

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of theoretical and empirical evidence suggests that creative performance in one domain is not necessarily predictive of creative performance in other domains (Baer 2012; Ford 1996; Gardner 1988; Reiter-Palmon et al. 2009; Sullivan & Ford 2010; Zeng, Proctor, & Salvendy 2011). There is, however, less consensus concerning whether the process in which one's creative potential is manifested and translated into tangible outcomes is domain general or domain specific in nature (Baer 1991).

Reviewing and discussing the full range of scholarly debates around domain specificity versus generality of the creativity phenomenon as a whole are well beyond the scope of this chapter. Instead, for the purpose of this chapter, we briefly present our theoretical viewpoint on this issue in three parts. First, we are in full agreement with the argument that creative performance and outcomes are best evaluated within a specific domain. Creativity researchers often argue that the evaluation of creative outcomes should be embedded within a context or domain (Csikzentmihalyi 1988; Ford & Gioia 2000). That is, we should not try to judge creativity in one domain against creativity in another domain because what makes an artistic outcome creative may differ significantly from what makes a scientific outcome creative (Baer 2010; Feist 2006; Runco 2004). Additionally, we champion the consensual definition of creativity, which posits that "[a] product or response is creative to the extent that appropriate observers agree it is creative. Appropriate observers are those familiar with the domain in which the product was created or the response was articulated" (Amabile 1982, p. 1001). Individuals unfamiliar with a domain may not have knowledge of what is novel and appropriate for the domain in question. For example, an undergraduate student in psychology is not expected to possess the required skills or expertise to judge whether or not a submitted article makes a novel and useful contribution to the field of psychology. Not only would the undergraduate be unfamiliar with past research on the topic, but he or she also would be unlikely to know whether the methods and theory are sound. J.C. Kaufman, Pumaccahua, and Holt (2013) explored nonexperts, quasi-experts, and experts differing in their ability to judge creative outcomes. Their results suggested that these groups do differ in the ability to judge creative outcomes. Specifically, nonexperts were deemed inappropriate judges of creativity, and quasi-experts were acceptable when the outcome was not particularly specialized (J.C. Kaufman et al. 2013). Thus we maintain that creativity should be judged within a domain, that is, against other outcomes in that domain, and by individuals appropriately familiar with the domain.

Second, we contend that the direct determinants of creative performance and outcomes are neither wholly domain general nor specific (cf. Simonton 2014; Sternberg 2005). In other words, addressing the question of whether, when, and how one is likely to achieve creative outcomes requires a careful consideration of both domain-general *and* domain-specific factors. This argument is in part inspired by Amabile's (1983) componential model of creativity, which suggests that creativity requires three theoretically distinct

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components: domain-relevant skills, creativity-relevant skills, and intrinsic task motivation. According to Amabile's model, domain-relevant skills (i.e., knowledge and skills required for creative performance in a given domain) and task motivation are largely domain specific, whereas creativity-relevant skills (e.g., cognitive style, working style, and divergent thinking abilities) are considered more domain general (Conti, Coon, & Amabile 1996). To illustrate these points, consider a scientific researcher. Producing a creative outcome that is both novel and useful in a scientific field requires extensive knowledge in the specific content domain and the ability to write in a manner that is appropriate to the target audience within the field (domain-relevant skills). The researcher must also be highly motivated to conduct his or her research in order to persist on a particular project until it comes to fruition, such as publishing an article or getting a patent (task motivation). The research will require the ability to connect ideas, generate new ideas, gather pertinent information, and so on in the first place (creativity-relevant skills).

Third and most pertinent to our ultimate argument in this chapter, we propose that delineating the complex nature of domain-specific versus general components of creativity is critical for better understanding how personal attributes such as openness and interests may differentially affect various aspects of one's creative pursuit. On the one hand, we argue that creativity-relevant skills (domain general) are closely linked to the underlying psychological construct of openness. The ingenuity facet of openness (Woo et al. 2014) is particularly relevant to the notion of domain-general creativity skills. Ingenuity describes individuals who have a general tendency and ability to gather, combine/connect, and generate new ideas. Domain-specific knowledge and task motivation also may be influenced in part by one's openness – especially the *curiosity* facet: those who are curious and open to new ideas are likely to have the ability and motivation to acquire new knowledge and to engage in creative activities. At the same time, as we discuss in the following sections, the degree to which curiosity contributes to the development of such domain-specific components of creativity is likely limited; in fact, having "too much curiosity without a specific focus" may result in suboptimal results for one's creative achievement in the long run.

On the other hand, we suggest that one's interest in a particular domain plays a major role in determining how much domain-specific knowledge one is likely to accumulate over time and how motivated one stays "on course" with the creative process within a given domain. Put differently, a person is most likely to develop and manifest his or her creative potential to the fullest degree – *within a given career field* and *over an extended period of time* – when the person's interests, values, and personality are well aligned with the field's norms and requirements. As such, we argue that one's domain-specific interest uniquely contributes to one's creative pursuit within the specific domain above and beyond one's general inclination for creative activities and curiosity for new knowledge.

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How Do Openness and Interests Contribute to Creative Achievement?

In this section we articulate how openness and interests uniquely contribute to one's creative achievement in various forms. We begin by reviewing the literature around openness and interests in relation to creative achievement, followed by proposing a working model that delineates how openness (focusing on the curiosity and ingenuity facets) and interests may differentially influence various forms of creative achievements.

Openness

As a broad personality dimension, openness has received a great deal of recognition as a (fairly) consistent predictor of creativity (Batey & Furnham 2006; Brophy 1998; Feist 1998, 2006; S.B. Kaufman 2013; McCrae 1987; Silvia et al. 2009b) and its many forms, including creative accomplishments (Dollinger, Urban, & James 2004; J.C. Kaufman et al. 2009–10; King, Walker, & Broyles 1996), creative behaviors (George & Zhou 2001; Perrine & Brodersen 2005), creative performance (Baer & Oldham 2006; Batey & Furnham 2006), self-ratings of creativity (Mussel et al. 2015; Silvia, J.C. Kaufman, & Pretz 2009a; Silvia et al. 2009b), and scientific and artistic creativity (Feist 1998). However, because of the breadth and heterogeneity of openness, we must look at lower-level openness to determine what is driving these relationships and how it contributes to creative outcomes in different domains.

In this chapter we define *openness to experience* (or, in short, *openness*) as "a multifaceted, hierarchically organized construct representing ways in which an individual typically deals with novel stimuli" (Woo et al. 2014, p. 29). Those with high levels of openness are often said to have a "preference for variety and novelty," where the novel stimuli may take on either intellectual or experiential form. Based on a factor analysis of 36 existing openness-related measures, Woo and colleagues (2014) found that the broad dimension of openness could be broken down to two intermediate-level constructs called *aspects* (consistent with works by DeYoung and colleagues, e.g., DeYoung, Quilty, & Peterson 2007): intellect and culture. Research suggests that the intellect aspect of openness may be particularly relevant to creativity because it is correlated with performance on fluid intelligence tests (Nusbaum & Silvia 2011) and tasks involving problem solving, thinking, information search, learning, and creativity (Berlyne 1960; Litman 2005; Mussel 2013). In the empirically derived hierarchical model of openness of Woo and colleagues (2014), the intellectual and cultural aspects of openness are further divided into six *facets* at the most specific level: intellectual efficiency, curiosity, ingenuity, aesthetics, tolerance, and depth. The first three facets are subsumed under the *intellect* aspect, and the other three are under the *culture* aspect.

Building from this model, we propose that at least two distinct intellectual facets of openness have unique implications for creativity: *ingenuity* and

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curiosity. The ingenuity facet of openness captures one's general ability and inclination for engaging in creative behavior (e.g., divergent thinking), which is largely tautological and does not offer much substantial insight beyond the overall assessment of one's creative potential. The curiosity facet of openness, however, captures one's openness to new ideas and general inclination for acquiring new knowledge, which often facilitates the initial idea-generation stage in the creative process. As such, curiosity speaks primarily to short-term outcomes or ordinary achievements.

Additionally, a number of further insights into intellect's relationship with creativity can be gleaned from Mussel's (2013) theoretical framework for intellect, which proposes a two-dimensional structure of the intellect aspect of openness: the *process* dimension and the *operational* dimension. The operational dimension describes the psychological mechanisms that enable intellectual achievements and is separated into three operations: *think*, reflecting cognitive motivation; *learn*, referring to motivation to acquire crystallized intelligence; and *create*, referring "to a person's ability [or motivation] to produce creative outcomes" (Mussel 2013, p. 887). The think and learn operations should motivate one to gain the domain-relevant skills necessary for creativity, while the create operation, as implied by its name, suggests the basic domain-general skills required for creativity. Mussel and colleagues (2015) suggested that these operations of intellect are related to various indicators of creative achievement, with the think operation uniquely and strongly associated with creative achievements requiring higher working memory capacity, cognitive load, or divergent thinking (Taft & Rossiter 1966) and the create operation related to self-reported general and domain-specific creativity.

Past research on openness and creativity is highly dependent on measures of divergent thinking (e.g., Batey, Chamorro-Premuzic, & Furnham 2009, 2010a; Bender et al. 2013; Chamorro-Premuzic & Reichenbacher 2008; Furnham et al. 2008; Furnham, Crump, & Swami 2008–9; Scratchley & Hakstian 2000–1; Walker & Jackson 2014). These studies use divergent thinking as a proxy for creativity, suggesting that openness is a significant predictor of creativity, with correlations typically ranging from .16 to .66. By examining research on openness and divergent thinking, we can conclude that openness is predictive of ideational behavior; however, ideational behavior is an insufficient (albeit necessary) determinant of creativity (Runco, Illies, & Eisenman 2005; Zeng et al. 2011). Further, divergent thinking tests are often measured by fluency and originality, which give no indication of how useful the idea is (Runco & Charles 1993; Zeng et al. 2011).

Other research on openness and creativity has used self-reports of creativity (e.g., Batey, Furnham, & Safiullina 2010b; Furnham & Bachtiar 2008; Furnham, Hughes, & Marshall 2013; Hughes, Furnham, & Batey 2013; J.C. Kaufman et al. 2009–10; Sung & Choi 2009) or supervisor ratings of creativity (e.g., George & Zhou 2001; Gong et al. 2012; Madjar 2008; Moneta et al. 2010; Raja & Johns 2010; Strickland & Towler 2011). While self-reports of creativity are sometimes necessary, they are also likely to be contaminated by an individual's creative role identity and creative self-efficacy (Karwowski et al. 2013).

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Common method bias is also a valid concern when using self-report measures of creativity and personality (Ng & Feldman 2012). In terms of supervisor ratings, research examining openness has typically found small or null results with creativity.

Research examining openness with subjective measures of the novelty and usefulness of the outcome are incredibly rare. Grosul and Feist (2014) did examine the relationship between openness and publications and citations in academic scientists and found a significant positive relationship between openness and citations ($r = 0.21$) but a nonsignificant relationship between openness and publications ($r = 0.16$). Simmons (2011) measured creativity using a consensual assessment technique (Amabile 1982) with an in-basket exercise and found that openness was significantly correlated with creativity ($r = 0.175$).

In summary, research on openness and divergent thinking is overrepresented in relation to the research on openness and creativity, as measured by novelty and usefulness criteria. The lack of empirical research examining openness and creativity using proper measurement of creativity severely hinders our ability to draw conclusions about the relationship between the two constructs. Research clearly suggests that openness is a fairly consistent predictor of divergent thinking abilities (e.g., Batey et al. 2010a; Furnham et al. 2008). Yet we think that such an empirical correlation between measures of openness and divergent thinking ability does not afford us much insight beyond the obvious (and nonperfect) relationship between self-reported creativity (or the *ingenuity* facet of openness) and actual measures of creativity (or *creative potential*, to be more precise). The *curiosity* facet of openness, however, may add something more theoretically useful: those who are curious and are inclined toward seeking new knowledge in general are likely to be exposed to a wide array of information across multiple domains that would serve as a "raw ingredient" for one's divergent thinking. However, a question remains: is curiosity for general knowledge enough to bring the person's creativity to fruition in a specific domain?

Interests

Interests, as defined by Rounds and Su (2014, p. 98), are "trait-like preferences for activities, contexts in which activities occur, or outcomes associated with preferred activities that motivate goal-oriented behaviors and orient individuals toward certain environments." Such preferences are not necessarily characterized by a sense of pleasure but are more strongly associated with increased levels of curiosity and prolonged engagement in tasks and experiences, even when they are complex and perplexing (Silvia 2008). For example, Turner & Silvia (2006) studied the association between individuals' level of interest and enjoyment and their appraisal of paintings by a variety of artists with different styles, such as Claude Monet and Francis Bacon. While level of enjoyment tended to be higher with paintings appraised as simple, positive, and calming, level of interest tended to be higher with paintings appraised as complex, unfamiliar,

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negative, and disturbing. As such, interests promote the sense of curiosity and drive individuals to learn more about what intrigues them.

How interests influence creativity is perhaps the least developed area of the creative person literature. While some researchers have alluded to the potential role of interests (e.g., Simonton 2014), there are only a handful of studies that we are aware of looking directly at interests with creativity as a dependent variable. For example, Perrine and Brodersen (2005) proposed that artistic and investigative interests mediated the relationship between personality and creative behavior in the arts and sciences. They found that openness to ideas was significantly related to scientific creativity, while openness to aesthetics and fantasy was significantly related to artistic creativity. Further, artistic interest mediated the relationship between openness to aesthetics and fantasy and artistic creativity, while investigative interest mediated the relationship between openness to ideas and scientific creativity. Other research has examined the association between self-perceptions of interests and creativity (e.g., J.C. Kaufman, et al. 2013). In a sample of 3,295 undergraduates, J.C. Kaufman and colleagues (2013) found that individuals with higher investigative and artistic interests had higher self-reported creativity than individuals with higher realistic and social interests. These findings are consistent with Holland's (1985) assertion that creativity is related to interests in the following order: artistic, investigative, social, enterprising, realistic, and conventional.

When it comes to the roles of psychological attributes in manifesting and developing one's creativity, interests may account for certain components of creativity that are not be fully explained by openness (and its facets) alone – namely, task motivation and domain-relevant skills. The motivational properties of interests are threefold. Interests can motivate behaviors by (1) steering the *direction* of behaviors and driving activities and goals toward specific domains. For example, individuals with strong artistic interests may seek out learning opportunities in painting, obtain advanced education in creative arts, and eventually pursue a career in a relevant field. Additionally, interests can also influence (2) the *vigor* of behaviors, by energizing goal-striving efforts, and can influence (3) the *persistence* of behaviors, by providing a context that helps to sustain efforts on a goal until the objective is achieved (Nye et al. 2012; Su & Nye in press). For example, when interested in mathematics, individuals tend to be more engaged in math activities and persist longer in solving a challenging math problem. In summary, interest in a particular activity serves as a source of intrinsic motivation that drives individuals to explore and learn more about it.

The relationship between interests and task motivation promotes the development of domain-specific knowledge and skills. Interested individuals are more likely to initiate activities and seek out experiences relevant to the domain that best fits their interests, actively acquire both declarative knowledge (i.e., knowledge of facts) and procedural knowledge (i.e., knowledge of processes or how to do things) in that domain, and spend more efforts in developing skills needed for performing tasks well in that domain. A large volume of educational psychology literature has shown that interested students "persist longer at

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learning tasks, spend more time studying, read more deeply, remember more of what they read, and get better grades in their classes" (Silvia 2008, p. 58; also see Hidi & Harackiewicz 2000; Silvia 2006). In a longitudinal study of approximately 1,000 students between grades 1 and 12 (ages 6–17), Denissen, Zarrett, and Eccles (2007) found that interests were positively associated with students' domain-specific knowledge and ability; moreover, the within-person correlations among interests and ability increased across time. In the adult intelligence-development literature, Ackerman (1996; also see Ackerman & Heggestad 1997) proposed the *process, personality, interests, and knowledge (PPIK) theory* and presented meta-analytic findings that demonstrated that interests are critically related to the development of domain-specific knowledge and adult intelligence across the life span.

Importantly, the relationships among interests, motivation, and knowledge acquisition and skill development are dynamic and reciprocal. While interests enhance motivation and drive knowledge acquisition and skill development, the accumulation of knowledge, skills, and abilities increases individuals' probability of success in a particular domain and, in turn, motivates individuals, reinforces individual interests, and contributes to interest development in that domain. In the *theory of vocational personalities and work environments*, Holland (1959, 1997) proposed that the degree of similarity between a person's interest type and his or her work environment (also referred to as *interest congruence*) affects a person's work attitudes and behaviors; higher levels of interest congruence lead to greater satisfaction, persistence, and success in a field. A recent meta-analysis with 60 studies spanning 70 years of research on the relationship between interests and performance (Nye et al. 2012) has shown that interests are particularly strong predictors for persistence in both academic and work settings. When an individual's interests are well matched with an educational environment or a job environment, he or she is more likely to persist in that pursuit (meta-analytic $r = 0.34$ and 0.36, respectively). More important, interests have also been shown to predict the continuity of careers in the long run (meta-analytic $r = 0.15$) (Assouline & Meir 1987). Interested individuals tend to persist in a job and, even when they move among jobs, stay within the same occupational category (e.g., Gottfredson 1977; Holland et al. 1973).

Putting It All Together

Creativity research can be broadly divided into studies on the creative person, process, product (outcome), or press (environment) (Rhodes 1961). Importantly, the creative person, process, and press are all thought to contribute to producing the creative outcome (Batey 2012). As discussed earlier, openness is a personality characteristic most often associated with the creative person (or creative potential), whereas the connection between interests and creativity has not been well articulated in the literature. Our overall perspective is that openness and interests are uniquely linked with different stages of the creative process, as well as with different levels of creative achievement.

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Openness and Interests Facilitate Different Stages of the Creative Process

Individuals can engage in the creative process by perceiving opportunities (problem construction) (Mumford et al. 1996b; Reiter-Palmon et al. 1997), seeking and organizing information (information gathering) (Mumford et al. 1996a, 1996c), combining information (conceptual combination) (Scott, Lonergan, & Mumford 2005), generating ideas (idea generation) (Guilford 1956), and evaluating these ideas (idea evaluation) (Puccio & Cabra 2010). We argue here that the creative process is differentially affected by openness and interests to yield creative outcomes. The remainder of this section will detail the ways in which openness, as part of the creative person, and interests, as part of the creative press, result in creative achievement.

We propose that openness and interests play unique roles in the creative process. As highlighted earlier, the creative process broadly includes problem identification, information gathering, idea generation, and idea evaluation. As a caveat, these processes are not necessarily linear (Mumford, Medeiros, & Partlow 2012). For example, during idea generation, individuals may seek additional information on finding their working knowledge insufficient for solving the problem.

Before the creative process can begin, however, there must be an opportunity for creative action (Ford 1996). It is likely that individuals with interests in artistic and investigative domains may be presented with more opportunity for creativity; however, opportunity alone is not sufficient. Rather, individuals must also *choose* to engage in creative action rather than habitual action (Ford 1996). Individuals high in openness are more likely to choose novelty over the habitual action (Woo et al. 2014) and thus will be more likely to identify opportunities for creativity and view a problem in a novel way.

Assuming that the individual identifies a creative opportunity, he or she may engage in information gathering. Importantly, information gathering may be internal or external. Someone with sufficient levels of cognitive ability and openness to new ideas (e.g., curiosity) is likely to have a broad range of knowledge that cuts across multiple content areas. Ziegler and colleagues (2012) suggested that open individuals are likely to enhance their general knowledge of the world due to their tendency to seek out novel and challenging environments. This is consistent with the *environment-enrichment hypothesis* (Raine et al. 2002, p. 669): a tendency to explore one's environment allows individuals to "create for themselves an enriched, stimulating, varied, and challenging environment." In support, research has found that openness significantly predicts knowledge across diverse domains, including physical science, biology/psychology, humanities, and civics (Ackerman et al. 2001).

Researchers debate whether having a diverse knowledge base or having expertise in related domains is more beneficial to creativity (Mumford, et al. 2012; Mumford et al. 1996a; Sternberg 1989); however, it appears to depend on the level of creativity. For example, eminent creators will require a great deal of expertise, while everyday creativity will require much less. Taking into account

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both perspectives, we argue that having a diverse knowledge base will aid the creative process, especially with respect to information gathering and idea generation.

After generating ideas (whether formally or informally), the individual will need to evaluate and fine-tune those ideas. Idea evaluation is the least researched aspect of the creative process, and researchers typically stop at the idea-generation phase. As a result, openness has been heavily studied in relation to divergent thinking (e.g., Batey et al. 2009, 2010a), and research has generally supported the idea that openness is positively related to idea generation. What we do not know is whether open individuals are more effective at evaluating ideas. We propose that open individuals are better at generating ideas than evaluating and expanding on those ideas, and interests play a larger role in idea evaluation. Idea evaluation requires a certain level of expertise and persistence that other phases of the creative process may or may not require. For an individual to develop an idea into an outcome, he or she must persist at the task, which often requires the right fit with the environment.

To summarize, those who are intelligent and curious are likely to have a sufficient level of knowledge and motivation to initiate a creative process. However, one must remain motivated to follow through with the creative process and produce creative outcomes. While dispositional persistence certainly contributes to this continued motivation (Colquitt & Simmering 1998; Hart et al. 2007), we argue that the prolonged, continual commitment to the field of one's career over the course of a lifetime usually comes with the person's interest in the specific content domain. It may be understood as a three-step process. First, initial inspirations come from being open to new ideas and the ability to gather information from various sources and combine them in a novel and useful way (e.g., the ingenuity facet of openness to experience, divergent thinking ability), which may be collectively characterized as creative potential (Runco et al. 2005; Zeng et al. 2011). Second, further cultivating the creative ideas and executing the complete production of creative outcomes often require task-specific motivation, which is partially influenced by dispositional persistence (also referred to as *grit*, *perseverance*, *self-control*, and *tenacity*) but also strongly by how much one finds the task interesting and engaging. Third, the most significant, eminent form of creative achievement requires a long-term (often lifelong) commitment to one's career field, which stems from the fit between personal interests and environmental characteristics.

These ideas may be further articulated through a gardening metaphor: a gardener (i.e., a creative person) who has many seeds of various plant species has the potential of growing lots of different plants in his or her garden (i.e., openness and divergent thinking ability associated with creative potential across multiple content domains). Yet, in order for a seed to sprout and grow its roots, it needs proper care, such as watering, sunlight, and pruning (i.e., cultivation of ideas). Lastly, in order for the plant to flourish in the long run, the gardener must make a concerted effort to take good care of the plant; if the gardener is particularly interested in cultivating this particular breed of flower,

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he or she will exert a lot of effort to learn about the right type of environment for the plant and spend long hours completely absorbed in gardening these plants.

Openness and Interests Lead to Different Levels of Creative Achievement

Another way of conceptualizing the differential roles of openness and interests in creativity is to consider the *level* of creative achievement. J.C. Kaufman and Beghetto (2009) cite four levels of creative magnitude an individual may achieve and that researchers might measure or focus on. The lowest level is *mini-c creativity*, which concerns the development of creativity (e.g., Getzels & Csikszentmihalyi 1976). Individuals expressing mini-c creativity may be experimenting and developing creativity-relevant skills such as information gathering and idea generation. The next level is *little-c creativity*, which is akin to everyday creativity. In essence, little-c creativity is the application of mini-c once creativity-relevant skills have been more fully developed (J.C. Kaufman & Beghetto 2013). Mini-c and little-c creativity do not require high levels of domain expertise or task motivation; rather, the focus is on creativity-relevant skills (e.g., divergent thinking). Little-c becomes *Pro-c creativity* once domain-relevant knowledge is attained through effort and a moderate level of motivation. To obtain *Big-C* (or *eminent*) *creativity*, the individual must be recognized as an expert in a particular domain (Simonton 2014). Receiving recognition and being renowned as an eminent creator require a great deal of creativity-relevant skill, domain-relevant skill, and motivation. Eminent creators are typically great thinkers, experts in their fields, and are highly motivated to persist for years, if not decades.

The differences between mini-c, little-c, Pro-c, and Big-C become important when we consider the role of openness and interests in creative achievement. If we are concerned mostly with predicting mini-c and little-c creativity, considering high levels of openness may be more important than domain-specific interests. If, however, the focus is on predicting and explaining psychological attributes required for Pro-c or Big-C creativity, interests may be far more important to consider because they directly determine one's motivation to engage in long-term knowledge and skill acquisition within a specific domain.

To illustrate our claim, consider a child who might be characterized as a "creative individual," who is curious and enjoys novelty. During class, the child may learn to seek out novel information and come up with ideas for projects in class (mini-c), and if his or her teachers adequately foster creative development, the child may build off of existing concepts and knowledge to form his or her own ideas and work that may be considered creative in relation to peers (little-c). Once the child becomes a young adult, he or she may pursue interests and seek out environments that fit his or her preferences. With the aid of a proper environmental fit, the individual will continue to grow in domain knowledge and achieve higher levels of creativity in the work force (Pro-c). Assuming that the individual possesses a high level of focus, drive, and intensity, he or she may

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even reach the level of eminence and be recognized for his or her outstanding contributions to a field (Big-C).

As the preceding illustrates, individuals may achieve different levels of creativity depending on the presence or absence of both openness and interests. Openness begins the process toward creativity, but interests are needed to fulfill creative achievement beyond little-c and mini-c creativity. Researchers focusing on openness and other individual differences tend to focus on mini-c and little-c creativity (e.g., Batey et al. 2010a), and not surprisingly, measures of mini-c and little-c creativity are where we find the largest relationships with openness and creativity. However, if we expand our measurement to Pro-c or Big-C creativity, the relationship between openness and creativity becomes less consistent (Grosul & Feist 2014), suggesting there are other variables (e.g., interest) that are required to achieve an exceptional level of creativity.

The Dynamic Interplay between Openness and Interests

Now we move on to further theoretical suppositions around how one's level of openness (especially curiosity) and interests may relate to each other and how the dynamic interplay between openness and interests may affect the outcome of one's creative pursuits in various domains. First, drawing from Holland's (1959, 1997) *theory of vocational personalities and work environments*, one may argue that highly open individuals would be most successful in a field that particularly calls for creativity – namely, investigative and artistic domains (e.g., Barrick, Mount, & Gupta 2003; Larson, Rottinghaus, & Borgen 2002). Interestingly, it also has been shown that scientists are generally lower on openness compared to nonscientists (Feist 1998). We speculate that this may be explained in part by the multifaceted nature of the openness construct: people high on openness and intellectual curiosity also tend to value aesthetics, cultural experiences, and deeper emotional experience (Woo et al. 2014). Therefore, it is possible that highly open people, despite their general interests in math and science, will eventually move away from these fields because of their broader interests in other topics that are more cultural, aesthetic, or artistic in nature.

We might also consider how one's openness affects creative interest and achievement *within a chosen field/domain of career.* From a longitudinal study of 579 college students tracked over 10 weeks, Hambrick and colleagues (2008) found that the intellectual aspect of openness significantly predicted interest in current events, which then predicted engagement in news-seeking behaviors and, ultimately, the acquisition of new knowledge in current events. These findings suggest that people high in openness may, by virtue of their disposition toward intellectual exploration, find it interesting to expose themselves to various topic areas ("general interest in learning") and eventually become more knowledgeable in general. At the same time, this general intellectual curiosity may not be sufficient for the person to thrive in a specific career field because

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highly curious individuals without a focused, domain-specific interest may not be motivated to exert concentrated efforts to gain extensive expertise in the domain. Although little empirical work has been conducted on this, our theory is that those high on openness (especially curiosity) are likely to have interests in a broad range of domains (and are thus knowledgeable in a variety of different areas) and that such breadth of interests may have some negative implications for one's creative pursuits in a specific domain.

In a sense, openness may be construed as a double-edged sword. On one hand, it may facilitate initial exposure to (or basic-level knowledge in) a variety of different content domains, which may facilitate the process of exploring and identifying one's true interests (Ziegler et al. 2012), and also contribute to one's interest in pursuing a career in creative (scientific or artistic) domains (Perrine & Brodersen 2005). On the other hand, high openness also may hinder one's pursuit of eminent creativity within a given domain if the initial breadth of interests and subsequent knowledge acquisition outcomes do not result in a clear identification of one's domain-specific interest over time. Individuals who continually pursue a variety of interests may fail to perceive a fit within a particular domain, are less likely to develop domain-specific knowledge and expertise, and will not likely achieve a high level of creativity in any particular domain.

Future Research Agenda for Creative Person Research

Defining creativity has always been a tricky business. Guilford (1950, p. 444) once suggested that *creativity* may be broadly defined as "patterns of traits that are characteristic of creative persons." This notion of *creative personality* has sparked an extensive boom in empirical and theoretical work attempting to define, describe, and explain the phenomenon of creativity from a personological perspective (e.g., Feist 1998; Puccio & Cabra 2010). As a result, the current creativity literature abounds with numerous insights on how various traits of individuals may be associated with creative performance and outcomes. Yet contemporary creativity research seems to favor a definition of creativity that focuses on the product rather than the person: creativity is now more commonly conceptualized and assessed as an *outcome* that is judged as both novel and useful in the context of a specific domain (e.g., Amabile 1982; Ford 1996; Montag, Maertz, & Baer 2012; Mumford 2003; Zhou & Hoever 2014). This shift from a person-based to a product-based definition of creativity has been both the cause and the result of criticisms concerning the *trait* approach to defining creativity (e.g., Amabile 1983, 1988; Csikszentmihalyi 1988) and a push toward a more interactionist view that takes into account the roles of environmental contexts in the creative process (e.g., Amabile et al. 1996; Oldham & Cummings 1996; Zhou & Hoever 2014) and an emphasis on the actual behaviors and their effectiveness (Montag et al. 2012). We fully acknowledge that creativity is a multicomponent, multilayered phenomenon

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that is best explicated through both personal and situational perspectives and that focusing exclusively on personal traits as a definition of one's creativity provides a largely incomplete picture. More important, however, we argue that the existing research on the *creative person* needs to be further refined and expanded so as to capture the entire scope of individual psychological attributes that likely play differential roles in the creativity phenomenon as a whole.

We see at least three broad, interrelated directions in which further theoretical expositions may be beneficial with regard to the creative person literature: (1) taking into account the temporally dynamic nature of creativity by recognizing the full spectrum of creative achievement processes ranging from the short-term process of engaging in creative behaviors in a given moment to the long-term process of achieving creative outcomes over the course of one's career, (2) delineating domain-specific versus domain-general factors influencing creative behaviors and outcomes, and (3) identifying additional factors that may uniquely influence creative behaviors and outcomes within a given domain that have not been fully recognized in the literature. This chapter illustrates these future directions by discussing how two particular individual traits – openness and interests – may exert different influences on momentary creative activities and subsequent achievement over time.

In relation to this chapter, we encourage empirical research that systematically investigates how one's general curiosity and domain-specific interest influence the level of creative achievement in multiple, rather than one, domains over time. It may be worthwhile to investigate how one's initial involvement in a career field with a high demand for (domain-general) divergent thinking versus extensive (domain-specific) expertise may lead to changes in the creative individuals' interests and occupational choices and how the choice of one's career influences subsequent development of one's creative personality and achievements over time. Taking into account the dynamic reciprocity between personal characteristics and environmental features would be critical to advancing our understandings on this topic. Lastly, future research also may investigate how the level of curiosity interacts with the level of interest (e.g., if curiosity is high and interest is low, then the person will not focus attention in one domain, but if curiosity high and interest high, then the person will persist in one domain).

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5 Personality, Behavioral Thresholds, and the Creative Scientist

Gregory J. Feist

Why is creativity – the creative process, person, product, and environment – so fascinating to so many people? Origins are inherently fascinating because they suggest how something came to be. Our curiosity is especially peaked over the big things in life and how they came into existence: the Universe, life, species, humans, individual people, and ideas. And in doing so, origins suggest why they came to be. Mysteries of the unknown capture our imagination. Indeed, curiosity about the mysterious, as Einstein said, is the cradle of all art and science. I would add religion to this list. It is not a coincidence that the Bible, like many religious texts, starts with genesis – the creation of the Universe. The act of creation is mysterious, and anyone with curiosity cannot help but wonder "why and how" when trying to understand ideas that were so unique, original, meaningful, and powerful that they changed history.

Psychologists too have long tried to understand the mysterious and at times hard-to-comprehend mechanisms behind the ideas of people such as Einstein, Darwin, Woolf, Picasso, Van Gogh, Watson and Crick, Bell, and Edison who came up with ideas that changed art, literature, science, engineering, and technology forever and in the process changed the course of civilization. How did Einstein conjure up the image of riding on an elevator at the speed of light and then ask, "What is the speed of a light beam being emitted from this elevator already traveling at 300,000 kilometers per second?" From that image and idea came the theory of relativity? But could anyone have had this idea and have developed the theory of relativity, or was there something truly special about Einstein's mind and personality that only he was likely to ever come up with those ideas? Of course, creative ideas happen to all of us at some time, and psychologists are interested not only in Big-C creativity (world class) but also little-c creativity (everyday) (J. C. Kaufman & Beghetto 2009).

The fundamental assumption of this chapter is that the "who" in creative thought and behavior is not equally distributed in the population and that certain people are more likely than others to have truly creative ideas. And one of the mechanisms that make these ideas more likely in some than in others is certain traits and qualities of personality. To be sure, there are many biological, cognitive, and environmental mechanisms that also make creative ideas more likely in one person than another (Karwowski & Lebuda 2016; Selby, Shaw, & Houtz 2005). In this chapter I propose a general model that attempts to integrate many of these mechanisms. The primary mechanism explored in my

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research program, however, has been personality traits, both normal and clinical. The former involve individual differences in openness to experience, extraversion, agreeableness, conscientiousness, and neuroticism, whereas the latter involve high-functioning autism and psychoticism. In this chapter I build on my functional model of personality that argues that traits change behavioral thresholds and thereby make certain behaviors more likely and others less likely. One of the behaviors – and the one of focus in this chapter – is creative thought and behavior.

As defined in Chapter 1, *creativity* is thought and behavior that is both original/novel and meaningful/useful. And *personality* consists of the unique traits of an individual that provide relative stability to his or her behavior over time and across situations (Feist, Feist, & Roberts 2013). Science, however, is the one organizing construct of this chapter that has not yet been defined. Above all else, *science* is a method of acquiring knowledge about our world in general and our physical, biological, and social worlds in particular. The methods of all sciences share some basic similarities, which we dub the *scientific method*: observe, predict, test, interpret, and communicate. Elsewhere I call this the *OPTIC (observe, predict, test, interpret, and communicate) method* (Feist & Rosenberg 2015). Science consists of observing the world, making testable predictions, carrying out empirical tests of those predictions, and then interpreting and communicating the results.

Because it is important in what comes later in this chapter, I must be clear on how I distinguish the main branches of science – physical, biological, and social (Feist 2006b). As I argued in *The Psychology of Science and the Origins of the Scientific Mind*, the three forms of science stem from and are built on domains of mind or distinct multiple intelligences. I argue that humans posses at least seven distinct forms of intelligence, namely, folk or implicit physics, mathematics, psychology, biology, language, art, and music. The evidence for this claim comes from developmental, comparative, archeological, universality, precocity, neuroscientific, and genetic criteria (Feist 2006b; Gardner 1983, 1999). These intelligences are implicit or folk forms of knowledge – that is, knowledge systems are based on unexamined and often nonverbal assumptions about how things work. In a few people, however, these skills and understandings become more and more explicit and the focus of their interests and careers – they often go on to become professional physicists, biologists, or psychologists, for example. The progression from implicit to explicit knowledge in these domains is the hallmark of development at both the species and individual levels (Feist 2006b; Karmiloff-Smith 1992).

I give this brief overview of the broader context in which science evolved and unfolded to set the stage for my review of the creative scientist around two domains of intelligence most intimately involved in science: physical and social intelligence. These correspond to the physical and social sciences in the broadest sense of the words. I chose these two (and omit biological) because they offer the sharpest contrast in psychological profiles.

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Physical knowledge concerns understanding the inanimate world of physical objects – their motion and causal relations in space. The inanimate world can be created by nature or by humans. Rocks, solar systems, atoms, and chemical compounds are prime examples of the former, whereas machines, computers, and engines are prime examples of the latter. Understanding and grasping the principles of how inanimate objects work and behave are the essence of *implicit* or *folk* physics. Implicit physical knowledge is also seen in children's automatic sense that physical objects obey different rules than living things (inanimate versus animate rules). Physicists, chemists, geologists, technologists, and cosmologists are examples of those whose profession it is to explicitly understand the physical world.

Social knowledge, however, concerns understanding the thoughts, motives, and behaviors of oneself and others, either individually or collectively. Social and emotional intelligences are central skill sets of *implicit* or *folk* psychology. Interacting with and understanding other people are absolutely critical for our survival, as seen in sexual relationships, parenting, teaching, economic relationships, political and friendship alliances, emotion recognition, deception detection, and understanding *theory of mind*, to name but a few of the applications of folk psychology. As with other domains of intelligence, people vary on this skill in a normally distributed way, with most people being average and only a few being extremely bad or extremely good at it. Most human conflict and violence stem from an inability to appreciate and understand beliefs, values, and ideologies of other individuals or groups of people. Psychologists, anthropologists, sociologists, and economists are examples of those whose profession it is to explicitly understand the social world.

Now is neither the time nor the place to delve deeply into the nature of science and the distinction between "hard" (physical) and "soft" (social) sciences. A few words, however, are in order concerning the differences between the physical and social sciences because the organizational differences make it all the more clear why people with different personality and cognitive skills would gravitate toward one form of science or the other. Dean Keith Simonton (2009) has quantified these heretofore conceptual differences between the physical and social sciences. Compared to the social sciences, the physical sciences do indeed have more agreement on what a contribution is and have greater consensus as to what the most important work is. In fact, compared to social scientists, physical scientists are less likely to consult with colleagues and garner feedback before submitting their manuscripts (Suls & Fletcher 1983). Moreover, physical scientists have contributions made by younger scientists and are more likely to use visual/graphical means of communicating findings. Finally, the physical sciences have more laws than theories.

There is empirical evidence showing that personality differences influence preference for hard or soft science. Babbage and Ronan (2000), for example, studied professors of physical and social sciences and found distinct personality differences – more specifically, social scientists compared to physical scientists were higher on empathy, dominance, tolerance, and intuition. Similarly,

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physicists were less emotionally expressive and more masculine than social scientists (Wood 2011). Even within the social sciences, personality traits influence how quantitative scientists are as well as their theoretical orientation (Conway 1988; Hart 1982; Johnson et al. 1988; Royalty & Magoon 1985; Zachar & Leong 1992).

Behavioral Thresholds and a Functional Model of Personality

I developed a model of personality and creativity that proposes that personality facilitates creativity by lowering behavioral thresholds to make creative thought and behavior more likely (Feist 1998, 2010). In this model, genetic differences influence brain structures and temperamental differences, which lead to personality variability (social, cognitive, and motivational-affective and clinical traits), and these personality traits affect creative thought and behavior. The idea was and still is that a particular constellation of personality traits functions to lower the thresholds of creative behavior, making it more rather than less likely. The part of the model that has been investigated most intensively over the last decade since the model was first proposed is the biological foundations component, especially genetic and neuroscientific. However, one component of the model is completely new, reflecting significant growth in research, namely, the clinical personality traits of psychoticism, schizotypy, latent inhibition, and negative priming. Hence this chapter will give more weight to these components than to the others.

My functional model builds ties between biology and personality and argues for the causal primacy of biological factors in personality in general and the creative personality in particular (Feist 2010). To be clear, the updated model of the creative personality proposes the following order of causal priority:

Genetic and epigenetic influences
➔ *Brain structure and function*
➔ *Personality traits*
➔ *Creative thought and behavior*

By combining the biological and the functional arguments, I am proposing a model for the causal path starting with specific biological processes and mechanisms and going to psychological dispositions to creative thought and behavior. The basic idea is that causal influence generally flows from left to right, with genetic and epigenetic influences affecting brain structure and function. Brain-based influences, in turn, causally influence the four categories of personality influence: cognitive, social, motivational, and clinical. The first three are *normal* traits of personality, conceptualized differently than the Big Five dimensions. These traits individually and collectively lower thresholds for creative thought and behavior, making them more likely in individuals who possess particular clusters of traits. For example, the trait of being open to new and varied experiences, ideas, and values seems to make having novel and meaningful ideas more likely.

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It is important to point out, however, that the causal direction is not always unidirectional but in fact also could be bidirectional. Creative thought and behavior can also influence personality and personality traits – insofar as they shape experience – and can even affect gene expression through the process of epigenetics. It is best to see this model as being somewhat simplistic but a first step toward a model of how personality and creativity affect each other.

In the model, I categorize personality traits into four categories (cognitive, social, motivational, and clinical). I still find this categorization useful, but here I simplify it into just two categories: *normal* and *clinical* personality traits. That is, some personality traits are part of everyday life and do not interfere with functioning (cognitive, social, and motivational), whereas other traits are found only in subsets of the population and do interfere with everyday functioning. The level of dysfunction, to be sure, also exists on a continuum from mild to severe. In general, the connection between clinical traits and creativity is strongest when the traits are mildly rather than severely experienced.

I operationalize *normal* personality traits primarily around the Big Five typology, which posits that human personality consists of five major dimensions or traits that exist on a continuum from really low to really high: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (OCEAN) (John & Srivastava 1999; McCrae & Costa 1999). Briefly, *openness* is the tendency to use your imagination and to seek out novel situations, experiences, and ideas, and *conscientiousness* is the disposition to be organized, orderly, punctual, and detail oriented. *Extraversion* is the tendency to seek out social situations and thrilling experiences and to be generally happy. *Agreeableness* is the disposition to be warm, friendly, and trusting, whereas *neuroticism* is the tendency to experience negative emotions, such as anxiety, fear, sadness, and depression. Each of these personality dimensions exists on a continuum from low to high, so they each have an opposite pole (such as closed, disorganized, introverted, hostile, and calm and stable). The one category of traits that does not map cleanly onto the Big Five is motivational, which includes intrinsic motivation, drive, ambition, and achievement-oriented.

Clinical traits will be those for which there is evidence of an association with interest in and talent for science, namely, high-functioning autism (formerly known as *Asperger's syndrome*), and psychoticism/schizotypy. Autism is a pervasive developmental disorder with impaired social interaction and communication deficits (APA 2013). In addition, there often are repetitive behaviors, sensory sensitivities, restricted interests, and a focus on and fascination with patterns. One of main scholars of autism, Simon Baron-Cohen, has long argued that autism consists of an orientation and interest in things over people. In general, thing-oriented individuals tend to be more introverted and interested in molecules, numbers, and other inanimate objects, whereas those who are people-oriented, not surprisingly, are drawn toward social stimuli and tend to be more extraverted (Feist 2006a, 2006b; Lippa 1998; Mount et al. 2005; Prediger 1982).

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Psychoticism, one of the three dimensions of Eysenck's model of personality (i.e., psychoticism, extraversion, and neuroticism), is a dispositional trait that increases the susceptibility of developing psychotic symptoms but should not be confused with full-blown psychosis (i.e., a psychopathological state) (Eysenck 1993; Eysenck, White, & Eysenck 1976). Elevated levels of psychoticism tend to be characterized by social isolation, impulsivity, aloofness, hostility, unusual thoughts and behaviors, and creativity (Eysenck 1995).

Lastly, I will examine research on whether schizotypy (and some of its components) has an association with some forms of scientific creativity. Rado (1953) first abbreviated the phrase *schizophrenic genotype* to *schizotype* and described it as the eccentric behaviors that predispose a person to schizophrenia. Current conceptualizations consider schizotypy to exist on a continuum in the general population and define it as consisting of the following core traits: unusual experiences (i.e., hallucinatory and/or magical thinking), cognitive disorganization (i.e., difficulty concentrating, feelings of worthlessness, and social anxiety), introvertive anhedonia (i.e., lack of enjoyment), and impulsive nonconformity (i.e., violent and self-abusive behaviors) (Mason, Claridge, & Jackson 1995).

Now that I have defined creativity, personality, and science, I can review the empirical literature examining the association between personality and the creative scientist. Since the 1950s and 1960s, creativity researchers have examined empirically the association between creative thought and behavior and personality traits (Barron 1955, 1963; MacKinnon 1978). By the 1990s, enough literature on the topic had accumulated for the first meta-analysis to be conducted (Feist 1998). Since then, other reviews and meta-analyses on creativity and personality have followed (Karwowski & Lebuda 2016; Selby et al. 2005). This chapter is an expanded and updated review of the literature on personality and creativity.

Psychological Profiles of Creative Scientists

One of my major claims is that distinct psychological profiles exist for people who gravitate toward science in general and different domains of science in particular. Another way to put this is in the form of a question: which traits make interest in and talent for science more likely? More specifically, which traits make interest in the physical sciences more likely, and do these traits differ from those which make interest in and talent for social science more likely?

Normal Personality Traits

The science of personality and creativity has advanced to the point where there is meta-analytic research suggesting that the direction and magnitude of each of the five personality domains correlate with creativity in general and creativity in science in particular (Feist 1998; Karwowski & Lebuda 2016).

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Openness

Open people tend to be imaginative and curious, so it is not surprising that open people are more creative. This is not just a theoretical connection but also an empirical one (Agnoli et al. 2015; Batey, Chamorro-Premuzic, & Furnham 2010; Chang et al. 2014; Dollinger, Urban, & James 2004; Feist 1998; Harris 2004; Ivcevic & Brackett 2015; Karwowski & Leduba 2016; S. B., Kaufman 2013; S. B., Kaufman et al. 2015; Tang & J. C. Kaufman 2015; van Tilburg, Sedikides, & Wildschut 2015). One of the more interesting recent studies on openness and creativity reported that its relationship is moderated by an inability to filter out irrelevant visual information (Agnoli et al. 2015). That is, creativity was highest in those who were highest on openness and who paid attention to irrelevant information in a visual eye-tracking task. Openness can also moderate the relationship between creativity and other psychological processes, such as emotion regulation (Ivcevic & Brackett 2015). Being able to regulate one's emotions predicted levels of creativity, but only in highly open participants.

Openness to experience predicts interest and creative achievement in science (Feist 2012; Lounsbury et al. 2012; Tang & J. C. Kaufman 2015). Grosul and I (Grosul and Feist 2014) found openness to be the strongest associated personality trait with overall creativity (as measured by aggregated and standardized scores on publications, citations, h-index, and Soler's creativity index) in a sample of biological, social, and physical scientists. One of the largest effect sizes from the meta-analysis showed that creative scientists were more than three-fourths of a standard deviation higher on the tolerance scale of the California Psychological Inventory than less creative scientists (Feist 1998). Tolerance assesses open-mindedness, flexibility of attitudes, and tolerance of diversity.

Some researchers, however, have demonstrated that openness is not completely a unitary construct but rather has two distinct subcomponents: being open to novel experiences (openness) and engaging in cognitive and intellectual activity (intellect) (DeYoung, Grazioplene, & Peterson 2012) (see also Chapter 2). Recent research suggests that the openness component of personality is strongly associated with artistic creativity, whereas the intellect component is more strongly associated with scientific creativity (S. B., Kaufman et al. 2015).

Conscientiousness

The dimension of conscientiousness has a complex relationship with creativity in general and with scientific creativity in particular (King et al. 1996; Tang & J. C. Kaufman 2015). Wilson and Jackson (1994) reported strong effect size differences between physicists and the general population. Physicists were more than one standard deviation higher and are controlled, careful, and cautious compared to the population. McCrae (1987) found a positive relationship between conscientiousness and creativity, whereas others have found either a negative relationship (Gelade 2002) or some facets that are positive

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(competence) and others that are negative (deliberation) (Batey et al. 2010). Moreover, as I reported in my meta-analysis (Feist 1998), scientists in general were moderately higher on conscientiousness than nonscientists, but creative scientists were only slightly higher than less creative scientists. In a sample of academic scientists, Grosul and I (Grosul and Feist 2014) found no relationship between conscientiousness and overall creativity. King et al. (1996) found an interaction between conscientiousness and creativity among college students. With creative accomplishments as the outcome, these authors had three groups of conscientious students (low, medium, and high) and three groups with verbal creativity (low, medium, and high). The regression slopes between conscientiousness and achievement were negative for the medium- and high-creativity (verbally) groups but positive for the low-creative group. So conscientiousness seems to facilitate creative achievement in less creative people but hinders it in more creative people. Finally, Chamorro-Premuzic (2006) found no direct relationship between conscientiousness and creativity, but conscientiousness did predict a form of academic performance (dissertation project) that was strongly correlated with creative thinking. Yet Pavitra, Chandrashekar, and Choudhury (2007) reported that creative musicians were more conscientious than control participants.

As Haller and Courvoiser (2010) pointed out, many creativity researchers (e.g., Barron, Cropley, Csikszentmihalyi, and McMullen) have argued that creative people are often a "bundle of paradoxes" or possess a complex set of contrasting personality traits such that they have a wider latitude of personality dimensions or strength to go from one pole to the other. Barron (1963) referred to this wide latitude as "ego-strength." Conscientiousness appears to be one of these paradoxes of the creative personality, with highly creative people preferring disorder and chaos so that they can make their own sense and order from it, with more mundane levels of creativity being associated with high levels of conscientiousness.

Extraversion

In a classic study of more than 200 physicists, Wilson and Jackson (1994) reported large effect sizes showing that compared to the general population, physicists were more introverted, unsociable, and inhibited. Similarly, in a more recent study of over 2,000 scientists compared to more than 78,000 nonscientists, scientists were slightly more introverted (Lounsbury et al. 2012). In a meta-analysis (Feist 1998), I reported that scientists are not very different from nonscientists on extraversion but are somewhat more introverted.

Additionally, creative scientists are more extraverted than less creative ones, but this mostly comes from the confidence component rather than the sociability component of extraversion. In support of this, the effect size on the dominance scale from the California Psychological Inventory was more than a half standard deviation higher for creative than for less creative scientists.

Type of work environment, however, may moderate the relationship between extraversion and creativity in science and technology. For example, in a sample

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of Taiwanese research and development engineers, extraversion is positively related to high information exchange and creative work performance (Chiang, Hsu, & Shih 2015).

Agreeableness

One general trend in the literature on agreeableness and creativity is the finding that highly creative people are often relatively low in agreeableness or high in hostility and aloofness (Feist 1993, 1998; Silvia et al. 2011). This seems to be especially true of creative and eminent scientists. Meta-analytic results suggest that creative scientists compared to less creative scientists are modestly higher in hostility and lack of warmth (cf. Chambers 1964; Helmreich, Spence, & Pred 1988; Helson & Crutchfield 1970; Rushton, Murray, & Paunonen 1987; Van Zelst & Kerr 1954). For example, in a classic study from the 1950s, Van Zelst and Kerr (1954) collected personality self-descriptions from 514 technical and scientific personnel from a research foundation and a university. Holding age constant, they reported significant partial correlations between productivity and the self-ratings of "argumentative," "assertive," and "self-confident." Additionally, Feist (1993) interviewed creative and eminent physicists, chemists, and biologists, and these interviews were blindly rated on personality qualities using the California Q-Sort (Block 1978). This research found that the most creative scientists were not only more self-confident but also more arrogant and hostile than their less creative peers.

Interestingly, scientists compared to nonscientists also seem to be a bit less agreeable. For example, from multiple studies using Cattell's personality measure, the 16 Personality Factor, scientists were a fifth of a standard deviation lower than nonscientists on "Warmth" (Feist 1998).

Neuroticism

The disposition to experience negative affect (i.e., anxiety, sadness, fear, depression, guilt, and shame) is perhaps the weakest association between normal personality traits and creative science. To be sure, historical anecdotes of famous scientists such as Tesla, Turing, and Galton suggest strong anxious and compulsive tendencies and even depression (Darwin) (Pickover 1998). Yet there is scare systematic empirical evidence for this general association. For instance, the meta-analysis of neuroticism as measured in 30 different samples of creative and less creative scientists found effect sizes of around a tenth of a standard deviation in favor of creative scientists.

There are other non–Big Five traits of personality that are consistently associated with creative scientists. For instance, creative scientists tend to be more driven, intrinsically motivated, ambitious, achievement-oriented, and independent than less creative scientists (Busse & Mansfield 1984; Chambers 1964; Helmreich et al. 1988; Feist 1993, 1998; Gough & Woodworth 1960; Heller 2007; Rushton et al. 1987). That is, creative scientists are driven more than most

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to understand and solve complex problems and get intrinsic pleasure out of the process. Interestingly, recent research suggests that intrinsic motivation is a mediator between the openness–creativity relationship because openness to experience is related to both creativity and intrinsic motivation, and intrinsic motivation is related to creativity; thus intrinsic motivation mediates the relationship between openness and creativity (Prabhu, Sutton, & Suaser 2008).

Clinical Personality Traits

When children or adults are asked to describe a scientist, they typically use such terms as *smart*, *quirky*, *asocial*, *nerd*, and the British term *boffin* – a disheveled, brilliant, but socially isolated and clueless egghead or scientist (Francis, Skelton, & Read 2012; Jones 1997). Scientists have even been depicted in literature and film over the decades in ways often suggesting social isolation and awkwardness, mental instability, and "madness" (Frayling 2005; Haynes 1994; Jones 1997). One only has to think of Faust and Frankenstein or Jekyll and Strangelove to see how common such views are in popular culture.

To be sure, the history of science is scattered with examples of personality quirks and even disorders among famous and highly creative scientists. Tesla, in addition to his various phobias, would probably have been diagnosed as being on the high-functioning end of the autism spectrum disorder, as would have Einstein, Newton, Paul Dirac, Henry Cavendish, and Turing (James 2003; Muir 2003; O'Connell & Fitzgerald 2003; Pickover 1998; Sacks 2001). For example, Alan Turing had extreme difficulty with social interaction much of his life; made notoriously little eye contact; and often had long, awkward silences during conversation; and finally, he had an incredible facility with patterns, numbers, and codes to the exclusion of much else (O'Connell & Fitzgerald 2003). Francis Galton compulsively quantified most of his experiences and observations (Pickover 1998). These cases are historical anecdotes and hence were not officially diagnosed, and the fictional cases may have been little more than stereotypes.

A more systematic but general study on psychopathology and scientific genius reported that scientists without psychopathology and who made paradigm-preserving (normal science) contributions were most eminent, whereas those with psychopathology who made paradigm-rejecting (revolutionary) contributions were most eminent (Ko & Kim 2008). In short, psychopathology moderates the relationship between type of creative contribution (normal versus revolutionary) and eminence. The most likely clinical dimensions associated with scientific interest and talent in general appear to be high-functioning autism and high psychoticism (including schizophrenia and schizotypy).

Asperger's/High-Functioning Autism

Given that science comes in at least three primary forms – physical, biological, and social – there should be a noncausal association between those who develop

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interest in the physical sciences (things) and those who have high-functioning autism. And indeed, research bears out this theoretical assumption (Austin 2005; Baron-Cohen et al. 1997, 2007, 1998; Billington, Baron-Cohen, & Wheelwright 2007; Feist 2006a, 2006b; Focquaert et al. 2007; Rawlings & Locarnini 2008; Thomson, Wurtzburg, & Centifanti 2015). For instance, not only those in math, science, and engineering but also their first-degree relatives are more likely to score mildly higher than normal on the autism spectrum (Baron-Cohen et al. 1998). Science compared to humanities majors scored higher on not only self-reported measures of autism spectrum and lower on social skills but also on various tasks, such as lower on eye reading (for emotion and state of mind) and social skills and higher on block design and mechanical reasoning (Carroll & Yung 2006). Similarly, Focquaert and colleagues (2007) studied thing (systematizing) and people orientation (empathizing) in more than 350 science and humanities majors and reported not only high systemizing styles in science majors but also that this effect interacted with gender. That is, male humanities majors were just as empathizing as female science majors. Male science majors were the most systematizing, and female humanities majors were the most empathizing. Finally, chemistry and math majors were more systemizing than physics and engineering majors.

Although sparse in number, recent neuroscientific studies have examined the brain structure and function of those with autism and mathematical and scientific ability compared to control individuals and have uncovered systematic differences between the two groups (Casanova et al. 2007; Iuculano et al. 2014). For example, Casanova et al. (2007) reported that compared to control individuals, the brains of distinguished scientists and those on the autism spectrum have smaller minicolumns, in particular, in Brodman's regions (4, 9, 17, 21, 22, and 40). Some researchers argue that these smaller minicolumns favor discrimination of information and focused attention, traits that are seen most extremely in those with *savant syndrome* (Gustafsson 1997; Treffert 2006). Similarly, Iuculano and colleagues (2014) compared brain organization and function during mathematical problem solving of typical children to those of children on the autism spectrum. They found that in general children on the autism spectrum had higher mathematical ability and performed more sophisticated decomposition strategies and surprisingly used brain regions typically used in face recognition during math problem solving. This last finding is fascinating and partially explains the inferior face-recognition ability as well as the superior mathematical ability commonly found in those on the high end of the spectrum.

Psychoticism/Schizophrenia/Schizotypy

Historically, research has demonstrated a link between psychoticism and creativity, especially in artists and the general population (Barron 1963; Eysenck 1995; Feist 1998; Kokosh 1969; Ludwig 1995, 1998; Post 1994; Simonton 1999). The cognitive element of psychoticism most closely associated with creativity is

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overinclusive thinking/associations. A few studies report that very high levels of psychoticism (as expressed in clinical or subclinical forms of schizophrenia) are less debilitating than mood disorders to scientific geniuses (Ko & Kim 2008; Post 1994). Of course, the well-known Nobel laureate John Nash suffered full-blown schizophrenia after his ground-breaking contributions to game theory (Nasar 1998).

Results connecting psychoticism in general to creativity, however, have been mixed, and these inconsistent results have lead some researchers to propose that psychoticism is too broad and general, and in fact, its relationship to scientific creativity would be better understood if it were broken down into specific components, such as latent inhibition and schizotypy (Batey & Furnham 2008; Mason et al. 1995).

One proposed cognitive mechanism connecting psychoticism and creativity is the lack of cognitive inhibition or latent inhibition (Carson 2014; Eysenck 1995). *Latent inhibition* (LI) is the ability to filter irrelevant stimuli (Eysenck 1995; Lloyd-Evans, Batey, & Furnham 2006; Lubow 1989), and research suggests that LI may be a key link between psychoticism and scientific creativity (Eysenck 1995). If an individual has low LI, he or she is incapable of or has a lessened ability to filter out irrelevant stimuli (Lubow 1989). Whereas in those with mental disorders, a bombardment of irrelevant stimuli can lead to intense sporadic thoughts, excessive speech, and distractibility (Kusumakar, Bond, & Yatham 2002), this same bombardment can lead to an increase in creative thought and achievement in individuals who are mentally stable (Eysenck 1995; Feist 2006a). However, having low LI as an underlying factor in creative achievement also leaves open the possibility of residual psychotic characteristics in one's personality.

Both low latent inhibition and the residual psychotic features are not dispersed evenly throughout the scientific domains, however. Research shows that fields of science for which subjectivity, meaning, and value are emphasized (e.g., social sciences) tend to have a higher lifetime prevalence of psychopathology than fields that rely on mathematics, precision, and objectivity (physical science) (Ludwig 1998).

A second specific psychoticism link to creativity is *schizotypy*. The core quality of schizotypy is eccentric ideas and behavior, and the history of science, both at its core and in the fringes, is filled with thinkers who have proposed unusual, eccentric, and even bizarre theories. For instance, the famed inventor/technologist Nikola Tesla had various unusual phobias (pigeons, germs, and round objects), and yet he had a compulsive love of the dark (Pickover 1998). The inventor of the transistor radio and Nobel laureate, William Shockley, was a hoarder (Shurkin 2006). At the periphery of science and technology, Wertheim (2011) has gathered many insightful examples of "fringe" or "quack" science in physics that claim to explain basic physical phenomena such as matter, energy, and gravity without using any current standard models of physics. What is most intriguing is that often these "fringe scientists" are without any formal training in science. Many fringe scientists may well be on

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the borders of schizophrenia as well (i.e., schizotypic), and yet it is important to keep in mind that Einstein himself was such an outsider and his ideas were very much on the fringe as he worked in a Swiss patent office.

Although a growing body of empirical literature is revealing a connection between schizotypy and creativity, this finding seems to hold more for artistic than for scientific creativity (Acar & Sen 2013; Batey & Furnham 2008; Claridge, Pryor, & Watkins 1990; Nettle 2006; Rawlings & Locarnini 2008; Wuthrich & Bates 2001). This is not to say that there is no relationship between schizoptypy and scientific creativity but rather that overall the association is not a large one (Ko & Kim 2008; Nasar 1998; Pickover 1998).

The general association between various clinical traits and high levels of creativity can be placed into a broader theoretical framework as put forth by Shelley Carson, namely, the *shared-vulnerability model* (Carson 2011, 2014). The general model consists of two overlapping Venn diagram circles, one for creativity and one for psychopathology. The unique qualities for creativity are high IQ, working memory skills, and cognitive flexibility. These are protective factors. The unique qualities for psychopathology are low IQ, working memory deficits, and perseveration. These traits are risk factors. Finally, the overlapping qualities shared by both creativity and psychopathology are attenuated latent inhibition, preference for novelty (openness), and hyperconnectivity. These are the shared vulnerability factors. Creative people, especially scientists, are likely to possess the shared vulnerability and protective factors, and hence Carson's model is quite consistent with the evidence presented here that creative scientists are likely to have only mild levels of vulnerability.

Summary/Conclusions

The basic and fundamental assumption I make is that personality functions to change behavioral thresholds, making some behaviors more likely and others less likely. This chapter has focused on which personality traits make creative behavior more likely in the sciences. More specifically, I have organized the chapter around two major forms of personality traits, namely, *normal* and *clinical*. The former consists of the of the well-known Big Five trait dimensions, whereas the latter consists of traits most associated with scientific interest, talent, and creativity, that is, high-functioning autism and nonpathological forms of psychoticism. All five of the Big Five dimensions of personality play a role in lowering thresholds of creative behavior, with high openness to experience and low agreeableness playing the strongest roles. Moreover, the low sociability component of introversion is robustly associated with creative achievement in science. Similarly, the social skills element of high-functioning autism seems to be consistently associated with scientific creativity, as too are the social isolation and aloofness of psychoticism elements.

The science of personality and creativity has made tremendous strides over the past 50 years. The research trends and principles uncovered during this time

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have answered some important questions. And yet, as is true of all science, answered questions simply give rise to new questions. Perhaps one of the biggest unanswered questions is the direction of causal influence between personality and creativity. Do these personality qualities make creativity more likely (as I have assumed and argued), or perhaps does creative achievement change personality? Or, as is most likely, is there some kind of complex, bidirectional relationship between personality and creativity in which personality lowers thresholds but then, over the course of a creative career, personality traits evolve and change? It is exciting to know that these questions are still open for the next generation of personality and creativity scientists.

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6 Creative Self-Concept

A Surface Characteristic of Creative Personality

Maciej Karwowski and Izabela Lebuda

> Innovativeness requires an unshakable sense of efficacy to persist in creative endeavors when they demand prolonged investment of time and effort, progress is discouragingly slow, the outcome is highly uncertain, and creations are socially devalued when they are too incongruent with pre-existing ways.
>
> —Bandura (1997), p. 239

Convictions about oneself and one's abilities influence how much effort a given person is able to invest when performing a task (Bandura 1997; Haimovitz, Wormington, & Corpus 2011). Classic theories of self-concept (general self-concept, global self-worth, and self-esteem) have assumed that self-concept is a general construct (Coopersmith 1967; James 1890/1963). However, in contemporary theorizing, multidimensional and hierarchical models of self-concept are indeed more influential in the field of psychology (Marsh & Hattie 1996; Marsh et al. 2006). These models conceive of self-concept as a phenomenon diversifying with age (Karwowski & Barbot 2016) and, aside from treating it as a global characteristic, refer to different self-concepts tied to several domains of human functioning.

Convictions about one's own creative abilities and the perceived nature of creativity are known as *creative self-beliefs* (CSBs) (Karwowski & Barbot 2016). Such beliefs, most frequently analyzed in the creativity literature, include, among others, self-rated creativity, creative self-efficacy, creative personal identity, creative role identity, and creative metacognition. Creative metacognition (J.C. Kaufman & Beghetto 2013) combines self-perception and knowledge about the context of creativity – strategies for action, situations, or how worthwhile it is to present or mask one's creative abilities. Creative role identity and creative personal identity refer to the weight the subject ascribes to creativity within one's self-image. Creative personal identity refers to the significance of creativity for the entire *I*, and role identity refers to the significance a person ascribes to creativity in a particular role one plays (Jaussi, Randel, & Dionne 2007; Tierney & Farmer 2002). Hence creative role identity depends more on external factors, such as convictions about social roles shared across one's environment. Self-rated creativity and creative self-efficacy refer to how one assesses one's abilities and potential for creative activities: self-rated creativity mainly encompasses convictions about the extent of one's creative abilities and possession or not of particular characteristics associated with creativity (Furnham et al. 2008;

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Hughes, Furnham, & Batey 2013). Both self-rated creativity and creative self-efficacy may refer to domain-general creative abilities as well as domain-specific self-perceptions (e.g., science, social, sports, visual art, and verbal art) (J.C. Kaufman 2006) or areas of life (creative self-perception general, at work, at school, or in a hobby) (Reiter-Palmon et al. 2012). Creative self-efficacy describes the extent to which the subject assesses his or her chances of managing creative challenges (Beghetto, J.C. Kaufman, & Baxter 2011; Karwowski 2011; Tierney & Farmer 2002) and dealing with a specific task (see Beghetto & Karwowski in press). As opposed to self-rated creativity or creative self-concept in general, creative self-efficacy does not just refer to the assessment of current abilities but rather to the assessed potential for solving a specific task creatively (Beghetto 2006; Karwowski 2011; Pretz & McCollum 2014).

In this chapter we analyze the role of a wide category of *creative self-concept* (CSC) beliefs (therefore, we interchangeably use the category of *creative self-beliefs* [CSBs]) (Karwowski & Barbot 2016, see also Beghetto & Karwowski in press, for a more detailed discussion) as it relates to creative potential but also to creative activity and achievements – including Pro-c and Big-C (J.C. Kaufman & Beghetto 2009). We devote special attention to three issues: (1) relations between CSBs and personality, namely, the extent to which hard-core (personality) and surface characteristics (CSBs) differ from each other; (2) the question of CSBs' incremental validity when explaining creative activity and creative achievements, namely, whether and to what extent CSBs "tell" us something about creative activity and creative achievement in addition to what personality "tells" us; and finally, (3) hypothetical mechanisms and the role CSBs play in creativity on various dimensions, forms, and levels: starting with mini-c and ending with Big-C (J.C. Kaufman & Beghetto 2009). To meet the first objective, we will discuss results of a recent meta-analysis of the relations between the Big Five personality characteristics and the Huge Two personality traits: plasticity (comprising openness and extraversion) and stability (comprising conscientiousness, agreeableness, and emotional stability) (DeYoung, Peterson, & Higgins 2002) and CSBs (Karwowski & Lebuda 2016). This will allow us to determine whether and to what extent these constructs are discriminatively valid. To achieve the second objective, we will briefly discuss the results of two studies that investigated psychological conditions for creative activity and creative achievements. Finally, to achieve the third objective, we will draw on results from our own studies as well as a review of the creativity literature while building a hypothetical model of the relations between CSBs and creativity. We devote less attention to developmental and educational conditions of CSBs, which we discussed elsewhere (Karwowski & J.C. Kaufman in press; Karwowski & Barbot 2016). However, before we examine the functions played by CSBs on various stages of creativity, it is important to ask whether and to what extent CSB dimensions are independent from personality.

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CSB and Personality

Although reciprocal relations between personality and self-concept variables are hypothesized in the literature (Marsh et al. 2006), there are plausible theoretical arguments for expecting personality to influence CSBs rather than the other way around (Asendorpf & Aken 2003). The strength of the relation between personality and CSBs largely depends on the measures applied, and frequently the results obtained are likely to be underestimated (Karwowski et al. 2013), especially when researchers use short and consequently less reliable personality scales. Systematically, openness to experience is the strongest and most consistent predictor of CSBs – to the point where is not just unsurprising (Martindale 1989) but is actually considered to be a key test for measuring CSB validity. Similarly, extraversion is also a positive predictor of CSBs, which indicates the stronger relation of CSBs with plasticity as opposed to stability (Silvia et al. 2009). This might be quite surprising considering the frequently cited relation between introversion and creative achievement in some domains (Feist 1998). This pattern of relations suggests that CSBs and creative abilities are not the same concept; they are characterized by different personality correlates, and CSBs themselves do not always have to be accurate; that is, they do not always have to render one's creative abilities. Relations with the remaining personality factors and CSBs are definitely less stable across studies and are clearly weaker.

Although the relations between self-rated creativity and personality have been occasionally studied (Batey, Chamorro-Premuzic, & Furnham 2010; Furnham et al. 2009; Silvia et al. 2009, among others), the question of the relationships between creative self-efficacy and creative personal identity with personality has not been explored extensively. Separate studies showed positive associations between creative self-efficacy and intrinsic motivation (Choi 2004; Karwowski 2011a), optimism (Hsu, Hou, & Fan 2011; Li & Wu 2011), and some aspects of creative personality (Choi 2004) or substantial correlations between creative self-efficacy and creative personal identity with the trait curiosity (Karwowski 2012).

Silvia and colleagues (2009) searched for the relationship between Huge 2 personality traits, namely, plasticity and stability, as well as their interaction with widely operationalized creativity. Aside from measuring divergent thinking, creative activity, and creative achievement, Silvia and colleagues (2009) also measured CSBs in different domains. In their study, plasticity was a consistent, positive predictor of creativity, including CSBs. Specifically, plasticity was substantially related to the global creative self-concept (β = 0.74), hands-on creativity (β = 0.59), and emphatic-interpersonal creativity (β = 0.55) and unrelated to math–science creativity (β = 0.05). Interestingly, however, stability also predicted CSBs in the domain of emphatic-interpersonal creativity (β = 0.30) and math–science creativity (β = 0.31). No significant interaction between plasticity and stability explaining creativity was found.

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More recently, the relationships between the Big Five personality traits, creative self-efficacy, and creative personal identity were reported using a large and diverse sample of Poles (Karwowski et al. 2013). Personality traits were measured with the use of the 10-Item Big Five Inventory (BFI-10) (Rammstedt 2007), a short and valid but modestly reliable (due to its length) scale. Creative self-efficacy correlated significantly and substantially with openness (r = 0.34) and neuroticism (r = –0.33), conscientiousness (r = 0.19), and extraversion (r = 0.14) and weakly yet significantly with agreeableness (r = –0.09). The pattern of correlations between creative personal identity and personality was similar. A robust correlation with openness was obtained (r = 0.37), and a lower one was found with neuroticism (r = –0.20), extraversion (r = 0.17), conscientiousness (r = 0.16), and agreeableness (r = –0.07). Given the moderate reliability of the personality measurement, it may be assumed that the true correlations between these constructs are higher. Interestingly, Karwowski and colleagues (2013) demonstrated gender differences in the predictive role of personality for creative self-concept variables. Although openness and neuroticism were consistently significant predictors (positive and negative, respectively) among both males and females, extraversion and agreeableness predicted (positively and negatively, respectively) creative self-efficacy only among females. Although tentative, this finding may show gender-moderated mechanisms of the relationships between personality and CSBs.

To provide a more reliable response to the issue of the strength of the relation between personality and CSBs, a recent meta-analysis may be useful (Karwowski & Lebuda 2016). After a systematic overview of 25 independent studies conducted on a total sample of about 20,000 people, five personality traits were correlated with CSBs, and the effect size of this association was consistent with the findings of individual studies. A strong correlation between openness and CSBs (r = 0.47) was followed by correlations between CSBs and extraversion (r = 0.26), conscientiousness (r = 0.13), neuroticism (r = –0.12), and agreeableness (r = 0.07). Thus the discriminant validity of CSBs was visible based on the meta-analytical findings; even after correcting for attenuation, personality and CSBs were not one and the same, even though they shared a significant portion of variance.

Consistently larger correlations were noted between CSBs and both openness and extraversion than between the remaining personality dimensions, suggesting that plasticity comprises the personality meta-factor particularly important for CSBs. So far, however, this reasoning was tested in only one study (Silvia et al. 2009). Karwowski and Lebuda (2016), using meta-analytically obtained correlations between personality and CSBs, as well as correlations between the Big Five traits from a different meta-analysis (van der Linden, de Nijenhuis, & Bakker 2010), demonstrated that a structural equation model was well fitted in which Huge Two personality metatraits predicted CSBs, and plasticity was a very strong and positive predictor of CSBs (β = 0.71), while stability negatively predicted CSBs (β = –0.23). Whereas the first result was expected, the second may be surprising. Neuroticism negatively

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correlated with CSBs, whereas conscientiousness did so positively, which could enable one to expect weak but positive correlations with stability (see Silvia et al. 2009). This significant and negative correlation suggested suppression (Paulhus et al. 2004): the part of stability that was relatively independent of plasticity correlated negatively with CSBs.

In conclusion, although relations of CSBs with personality – especially with plasticity – were unquestionable and substantial, CSBs should not be considered just an epiphenomenon of personality. As a *hard-core* trait, personality most likely shapes CSBs (Asendorpf & Aken 2003), but meta-analysis suggested that it was responsible for only approximately 37 percent of the variance in CSBs. Demonstrating discriminant validity is important for the status of CSBs. There is, however, still a question about the role played by CSBs in creativity on each level – starting with mini-c and little-c all the way to Pro-c and Big-C. The next section attempts to answer this question.

CSBs, Mini-c, and Little-c Creativity

Previous studies provided evidence of correlations between CSBs and creative potential, although analyses frequently remained at a correlational level and rarely proposed the mechanisms in which CSBs would be engaged. These mechanisms were formulated rather indirectly – for instance, Lee (2011) proposed that self-talk in children (a precursor of self-reflection and self-regulation, two components of metacognition) was an important component of creative problem solving. Hence, according to this reasoning, higher CSBs could be the result of metacognition (J.C. Kaufman & Beghetto 2013), resulting in higher effectiveness when dealing with problems. This metacognitive line of reasoning was supported by results that showed that people who produced more original responses were also better at rating their most original responses in a divergent thinking task (Runco & Dow 2004; Silvia 2008).

Self-rated creativity was found to be significantly and positively related to several measures of creative potential, such as divergent thinking performance or engagement in everyday creative activities (Furnham et al. 2008; and others). Indeed, Silvia and colleagues (2012) found that self-reported creativity and the Creativity Domain Questionnaire (CDQ) were as strongly related to the other measures of creative activity and achievement as the measures were to one another, demonstrating the correspondence between self-perceptions and performance. However, Karwowski (2011) obtained positive but weak relationships between creative self-efficacy and creative abilities (measured by the figural test), although in another study (Karwowski, Lebuda, & Wiśniewska in press), creative self-efficacy and creative personal identity were quite strongly related to measures of divergent thinking. Recently, an attempt was made to examine whether self-perceptions were accurate when participants were asked about their performance on a specific task they had just completed. When the question was posed in a general manner, participants' responses seemed

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unrelated to their actual performance on current tasks (J.C. Kaufman, Beghetto, & Watson 2015; Pretz & McCollum 2014).

Even though a substantial collection of studies found positive correlations between CSBs and creative potential measures, three issues deserve emphasis. First of all, correlations were usually weak or moderate; they rarely exceeded $r = 0.30$. Second, much indicated that domain-specific CSBs generated higher correlations with measures of creative abilities than domain-general measures, which may provide a further argument in the classic discussion of the domain-generality/specificity of creativity (Baer 2015). Third and finally, the correlations obtained did not provide much information about the mechanisms underlying these relations. Arguably, one can hypothetically interpret this result in (at least) one of two ways. First, higher CSBs may also mean developed creative metacognition and, consequently, greater awareness of one's creative abilities. Second, it was also possible that at least some CSBs – especially creative self-efficacy and self-rated creativity – developed under the influence of creative abilities. If a person had an opportunity in the past to demonstrate creative abilities, that person is likely to believe in himself or herself, so his or her creative potential translates into CSBs. Both of these mechanisms are feasible, yet both require well-planned research that could shed some light on the mechanisms of CSBs.

CSBs, Pro-c, and Big-C Creativity

The significance of CSBs was also manifest in the case of Pro-c and Big-C creativity. In organizational settings, Tierney and Farmer (2002) showed that self-reported creative self-efficacy predicted supervisor ratings of creative performance at work, especially for white-collar employees who had high job self-efficacy (see also Tierney & Farmer 2011). Similarly, Jaussi and colleagues (2007) demonstrated that creativity in the workplace and creative self-efficacy were positively related (see also Carmeli & Schaubroeck 2007).

High creative self-concept was typical for eminent creators (Albert & Runco 1986; Barron & Harrington 1981, Ochse 1990, and others), who already at a young age were characterized by a high level of self-confidence and were able to accurately assess their traits, especially in the domain of their abilities (Cox 1926). In a classic study (MacKinnon, 1983), the most creative architects ascribed to themselves more traits associated with creativity, such as independence, individualism, or innovativeness, whereas less creative architects described themselves mainly using characteristics desired by their employers, such as being reliable and hard-working. Creative architects also demonstrated more effective methods of handling barriers in creativity (when encountering problems in solving a task, they changed their activity), while their less creative peers stuck with the same challenge despite lack of effect. Classic studies on creative writers (Barron 1983) found very similar results: renowned writers demonstrated a much greater sense of self-efficacy, describing themselves using

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the categories of intellectual and verbal abilities, the ability to think in original and unconventional ways, and independence but also productiveness and effectiveness.

Thus creative self-concept seemed to play an important role for both artistic and scientific creativity (Wolpert & Richards 1997). High CSBs distinguished creators who were more or less successful in their domains (Barron & Harrington 1981; Feist 2014) and is probably of special significance for the creative achievements of women: female artists and scientists who achieved success at work were characterized by a self-confidence level that exceeded that of average women in society (Bachtold & Werner 1972; Csikszentmihalyi 1996; Mockros & Csikszentmihalyi 1999). The significance of these convictions may be noted, among others, in a statement by Vera Rubin, an accomplished astronomer:

> I think I was terribly naive all along and when I come upon obstacles I don't think I took them very seriously. I just felt that the people who presented obstacles really did not understand that I really wanted to be an astronomer. And I tended to ignore them or dismiss them, so I don't think the obstacles have been severe. In general, I think they were just a lack of support. I always met Teachers who told me – in college, in graduate school – to go and find something else to study … they didn't need astronomers … I wouldn't get a job … I shouldn't be doing this. And I really just dismissed all that. I just never took it seriously. I wanted to be an astronomer and I didn't care whether they thought I should or should not. So, somehow or other I just had the self-confidence to ignore all these bits of advice.
> (Cited in Csikszentmihalyi 1996, p. 209)

Eminent artists and scientists are usually heavily independent when assessing their own works. Confident with regard to the high quality of their product, they continue working even if they feel that they lack support from others (Ochse 1990). For instance, Beethoven's assessments of his own work indicated a high level of accuracy and self-awareness (Kozbelt 2007). Kozbelt (2008) also demonstrated that artists who created work rated as more creative were more likely to rework, revise, and erase their drawings than those whose work was rated as less creative (see also Ivcevic & Nusbaum in press).

Eminent creativity requires time, a considerable amount of work, and dedication. Additionally, in the case of eminent creativity, it is probably impossible to demonstrate a single fixed career path. The way professional roles are played is associated, among others, with perceptions of social expectations and one's own notions of being an artist, scientist, or inventor (Freeman 1993; Helson 1990). As a result of interactions between a creator and his or her environment, the sense of identity takes shape – both identity of (creative) self and identity in a (creative) role (Glaveanu & Tanggaard 2013). In the case of creators, the borderline between personal and professional identity is fluid (McRobbie 1998), and the role of a creator is superior to other roles played; independently from time and place, a creator predominantly perceives himself or herself through the lens of being an artist or scientist (Lebuda 2013; Roe 1953; Whitbourne 1996). From early to late adulthood, a cohesive identity enables one to predict the

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extent to which creative potential would become realized. It was also associated with increased productivity, and consequently, it increased the chances of creative achievement (Helson & Pals 2000). It is also arguable that creative activities are a source of confirming one's *I* as a creator (Helson & Pals 2000). Creativity itself may result from searching for one's identity and making attempts to streamline it (Albert 1990).

Incremental Validity and Hypothetical Mechanisms of the CSBs

The arguments presented thus far show that CSBs are related to personality but are not synonymous with it and that they correlate with creative abilities, creative activity, and creative achievements. However, two questions still require attention. The first is the question of the incremental validity of CSBs in explaining creative activity and achievement. The second relates to the mechanisms of CSBs.

Incremental Validity

The strong relation of CSBs with plasticity begs the question of whether CSBs are able to tell us anything about the chances of creative activity or creative achievements when we control for the role of personality. So far this problem has not been considered frequently, even in studies that jointly analyzed CSBs, personality, and creative abilities or achievements (e.g., Silvia et al. 2009). However, confirming CSBs as scientific constructs that play a significant role for creativity is especially important. This role would be demonstrated if CSBs were able to explain a unique (thus not explained by personality) variance in creative activity and creative achievements. To answer this question, we analyzed results of two yet unpublished studies: the first was conducted on a sample of 500 Polish adults and the second on a sample of more than 3,500 Polish adolescents. Both studies used the same personality measurement – the 50-Item Big Five Inventory (BFI-50), based on the International Personality Item Pool (Goldberg 1992). To measure creative self-efficacy and creative personal identity, we used the Short Scale of Creative Self (SSCS) (Karwowski 2012, 2014; Karwowski et al. 2013; Karwowski, Lebuda, & Wiśniewska in press), as well as the Kaufman Domains of Creativity Scale (K-DOCS) (J.C. Kaufman 2012; McKay, Karwowski, & J.C. Kaufman in press). Creative achievements as measured with Creative Achievement Questionnaire (CAQ) (Carson, Peterson, & Higgins 2005) served as a dependent variable. In the case of adolescents, the modified creative activity scale (Benedek et al. 2012; Jauk, Benedek, & Neubauer 2013) was used for the dependent variable.

In both studies, the procedure to assess the incremental validity of CSB measures (SSCS and K-DOCS) was identical and executed through regression models. In the first step, achievements (in the case of adults) and activity (in the case of adolescents) were explained by the five personality factors. In the second

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step, creative self-efficacy and creative personal identity were added to the model, and the third step added the K-DOCS dimensions. Our focus was on the significance of R^2 change. Key results (Figure 6.1) enabled us to state that in a clear majority of cases, the variables introduced in each consecutive step increased the percentage of explained variance in creative achievements and creative activity. In the case of creative achievements (general CAQ result log-transformed in advance), personality was responsible for 20 percent of the variance, but adding domain-general CSBs (creative self-efficacy and creative personal identity) as well as domain-specific CSBs (K-DOCS) triggered a significant increase in the percentage of explained variance – to 29 percent. It is worth noting that the significance of creative self-efficacy and creative personal identity was relatively low (R^2 = 3 percent), as opposed to domain-specific K-DOCS factors, which were responsible for 6 percent. Regarding the distinguished CAQ factors creative achievements in everyday creativity (e.g., humor or cuisine), science, and art, the significance of creative self-efficacy and creative personal identity was visible only for science, but the R^2 change was very low (1.4 percent). Yet, of importance is the fact that examining the level of specific domains of creativity revealed that CSBs, as measured by the K-DOCS, were more predictive of creative achievements than personality.

Regarding creative activity measured among adolescents – on both general and domain-specific levels – we can also see the incremental validity of CSBs. Similar to the preceding case, the role of domain-general creative self-efficacy and

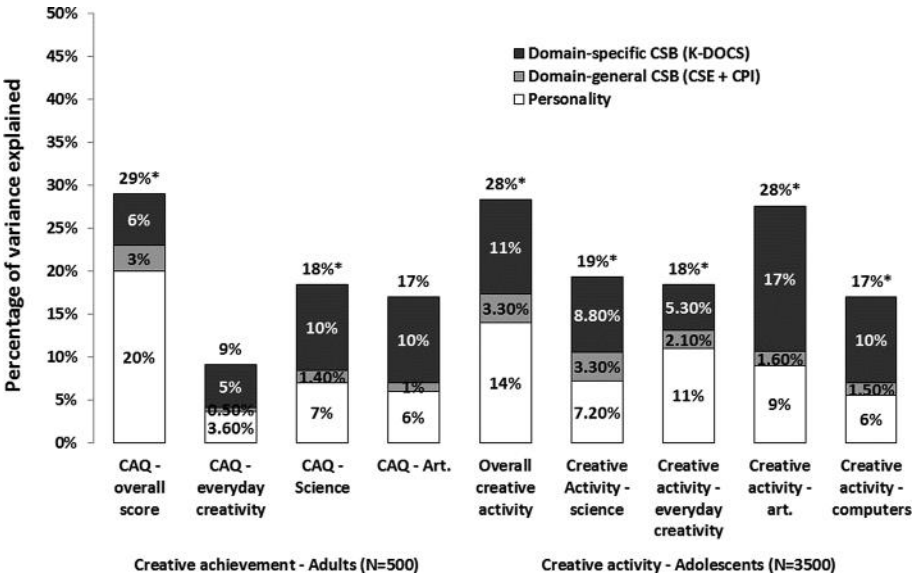

Figure 6.1 *Incremental validity of CSBs when explaining creative activity and creative achievement. Note that the asterisk denotes a situation in which all steps bring a statistically significant increment in R^2 change. Otherwise, creative self-efficacy and creative personal identity did not alter the model significantly.*

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creative personal identity was relatively small – explaining 3.3 percent of the variance separately for both general activity and science, 2.1 percent for everyday activity, 1.6 percent for art, and 1.5 percent for creativity in web development and programming. However, each time-obtained increment was statistically significant. Similar to the preceding case, domain-specific K-DOCS scales were highly predictive of activity and explained a similar or sometimes greater percentage of activity variance than did personality. Therefore, the rule was very clear: in the case of everyday activity (by definition, quite general), personality was of relatively greater importance, but when descending to the level of specific domains, the significance of CSBs measured by K-DOCS increased.

The results obtained confirmed the incremental validity of CSBs: CSBs were not only able to tell us something about the conditions of creative achievements and creative activity, but their contribution was something that personality alone could not provide. Thus, in the case of such domain-general CSBs, such as creative self-efficacy and creative personal identity, the explained variance above personality was small, resulting from stronger relations between creative self-efficacy, creative personal identity, and personality. However, even in this case they provided information beyond that of personality. In the case of domain-specific K-DOCS, the explanatory power was significant: it doubled the variance explained by personality itself and hence significantly increased the chances of understanding the conditions of creative achievement or creative activity. This finding makes it possible for CSBs to gain recognition as a predictor of creative activity and achievements, in addition to personality. In order for this to happen, however, we need to better understand the mechanisms under which they operate. Further on we devote attention to a different role creative self-efficacy and creative personal identity play in the relations between creative potential and creative achievement.

Hypothesized Mechanisms

As already known (Bandura 1997; Karwowski & Barbot 2016), general self-efficacy and creative self-efficacy take shape to a great extent under the influence of social factors and experience. We previously argued that personality (and plasticity especially) played a special role explaining the variability of CSBs. In this understanding, creative self-efficacy would develop as a result of previous creative successes, environmental support and the role of mentors, and personality and creative abilities (see Karwowski & Barbot 2016). We also reported that creative self-efficacy was usually a significant and quite strong predictor of creative activity and creative achievements. Creative self-efficacy made it possible to deal with failure and increased motivation for creative activities and perseverance when realizing them. Hence we have reasons to think that creative self-efficacy may mediate the relation between creative potential – especially creative abilities and personality – and creative activity and achievement.

The situation was slightly different for creative personal identity. Though it was associated with creative self-efficacy, personality, creative activity, and

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creative achievement, this psychological characteristic seems to play a different role. Because creative personal identity indicated the importance of creativity in self-description as well as its general high valuation, one may assume that a high level of creative personal identity increases the chances for undertaking activities considered creative. In this understanding, creative personal identity would be a factor closely tied to the "decision" (Sternberg 2002) to engage in creative activity. It is easy to imagine people characterized by high creative potential who do not achieve anything creative because they do not consider creativity as a significant element of self-description or as an activity worth undertaking. Indeed, previous studies showed that the relations between creative abilities and creative achievements of young scientists were particularly strong among those who valued creativity (high creative personal identity) (Szen-Ziemiańska & Karwowski 2015). Hence we consider creative personal identity to be a moderator of the relations between potential and achievement. The relation between creative self-efficacy (CSE) and creative personal identity (CPI) was discussed elsewhere (Karwowski & Barbot 2016; Tierney & Farmer 2011) and thus not included here.

To test the preceding hypotheses, we used one of the aforementioned studies (N = 500 adults) to examine whether creative self-efficacy mediated the relation between personality (especially openness) and creative achievements, as well as creative personal identity moderating this relation (Figure 6.2).

The results confirmed our reasoning. Personality together with CSE and CPI explained 23 percent of the variance in creative achievements – thus their

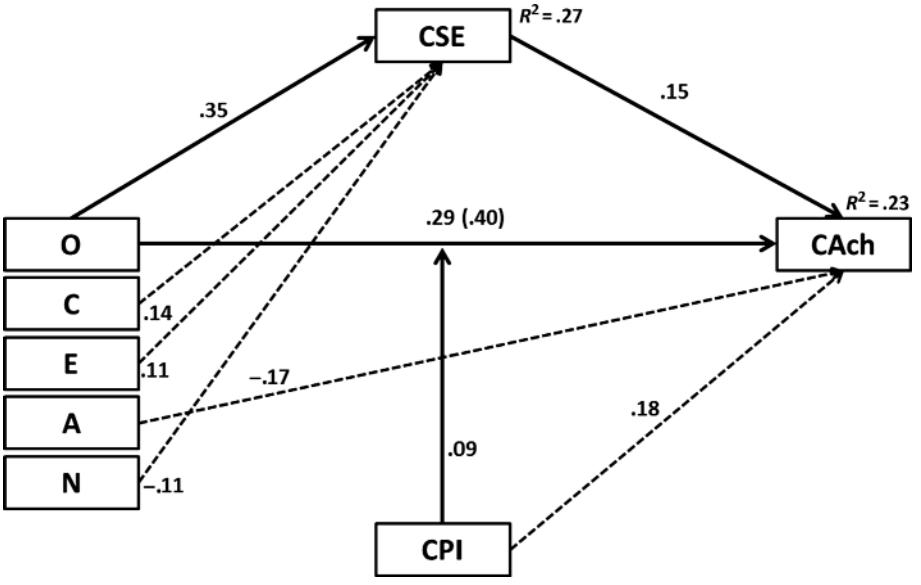

Figure 6.2 *CSE as a mediator and CPI as a moderator of the relations between personality and creative achievements. Note that all coefficients presented in the figure were statistically significant at least at* $p < 0.05$.

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contribution was considerable. However, the effect of openness to achievements was partially mediated by CSE (statistically significant indirect effect assessed by the Hayes process [2008]: $B = 0.05$, SE = 0.02, 95% CI: 0.017, 0.098). Of equal importance, the theorized role of CPI was confirmed. Openness translated into creative achievements clearly more strongly among people who not only valued creativity but also considered it to be a significant element of their own characteristics and self-description.

Conclusion

Although studies on self-efficacy have already become an important output of sociocognitive theories, studies examining CSBs in the psychology of creativity are still relatively new. Whereas in the classic works of psychology of creativity – especially the humanistic psychologists (Maslow 1958; Rogers 1956) – we find interest in human identity in combination with creativity, sociocognitive models of creative self-efficacy or creative personal identity have appeared only within the last two decades. The overview and analyses presented in this chapter enabled us to conclude that CSBs comprise important explanatory variables that hold high significance for the contemporary psychology of creativity. By defining them as surface characteristics and by distinguishing them from hard-core personality traits, we wished to emphasize two issues. First, they are changeable under the influence of socializing influences, training, and personal activity. Second, at least to some extent, personality as a more stable and natural characteristic exerts influence on them. Meta-analyses presented in this chapter revealed that although the relations of CSBs with personality factors (in particular, Huge 2 traits: plasticity and stability) were substantial, we were simultaneously dealing with strong arguments in favor of considering CSBs as constructs separate from personality – constructs that cannot be solely tied to personality. Furthermore, we showed that CSBs were characterized by incremental validity when explaining creative activity and creative achievements. The fact that these dimensions were able to predict activity and achievement above personality indicated their importance for the theory and practice of creativity studies. Last, but not least, we devoted attention to hypothetical mechanisms played by creative self-efficacy and creative personal identity, assuming that creative self-efficacy mediated the relationship between creative potential and creative achievement and that creative personal identity moderated this relation. This finding was also confirmed by suggesting that CSBs were not just static characteristics of an individual but also able to fulfill significant functions that may cause this potential to be or not be creatively applied.

We believe that consequences that stem from these findings may provide potentially important contributions to the creativity literature, on the one hand, and practice, on the other. After all, they showed that CSBs were theoretically and practically meaningful. They showed that they were malleable (e.g.,

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Mathisen & Bronick 2009) and predictive of creative successes. Creativity scholars, but potentially also parents and teachers, probably should consider this important. Of course, many questions regarding CSBs still remain open and might be considered a relatively new research field within creativity studies, one that could soon attract much more attention and be revitalized by new findings.

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7 Where Do Diversifying Experiences Fit in the Study of Personality, Creativity, and Career Success?

Rodica Ioana Damian

The bookstore window stares at me defiantly. Lined up like soldiers are hardcover copies of Malcom Gladwell's *David and Goliath: Underdogs, Misfits, and the Art of Battling Giants* (2013), one of our nation's number one bestsellers. Is it surprising that a book extolling the beneficial powers of unusual and even traumatic experiences is widely popular? Truth be told, we love underdog stories, and we want to believe that by prevailing over the difficult experiences life may throw at us, we can become better people, more creative, and more successful. This implies that nonnormative or even traumatic experiences should have a positive influence on personality development, creativity, and life success, above and beyond other contextual and individual factors. But is there any scientific evidence to support this hopeful claim?

Despite wide popular interest and centuries-old fascination with the kinds of life experiences that might be relevant to creativity and career success, there is little empirical evidence available. One branch of psychology that has shed some light on the issue is research on creative genius. A *creative genius* is someone who has produced a highly impactful *creative* contribution, that is, an *original*, *useful*, and *surprising* body of work that has left a mark on history (Simonton 2012, 1994). Creative geniuses can belong to any domain of achievement, and examples include Marie Curie (scientific genius), Salvador Dali (artistic genius), and Napoleon (military genius). As it turns out, there is a specific group of life experiences that is particularly characteristic of creative geniuses, namely, *diversifying experiences* (Damian & Simonton 2014; Simonton 1999).

Diversifying experiences are unusual and unexpected events or situations that push people outside the realm of "normality." Examples include both positive and negative experiences, such as extensive travel and early parental death, respectively. As it turns out, diversifying experiences have very high occurrence rates in the childhoods of creative geniuses. Thus researchers have proposed that such experiences might be relevant for the development of creativity and career success. As mentioned earlier, a product qualifies as *creative* if it can be considered to be original, useful, and surprising (Simonton 2012). To meet the criteria of originality and surprise, one must be able to see things in

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unconventional ways and go against traditional ways of viewing the world. Thus the person must learn to relax the constraints posed by society on the thought process and imagine the impossible. In this context, unusual and unexpected events might provide the experience necessary to break boundaries. They push people outside the realm of "normality" and help them to see the world in multiple ways, which might give them the cognitive flexibility necessary for coming up with creative ideas. These experiences should have both short- and long-term effects, and the greater the number and severity of these childhood events and circumstances, the more divergent is the developmental track and hence the greater are the cognitive freedom and flexibility of the adult. In other words, unconventional developmental experiences might foster unconventional ideas (Damian & Simonton 2014; Ritter et al. 2012; Simonton 1999). In recent years, experimental work has brought some support to the idea that diversifying experiences may be related to increased cognitive flexibility and originality in laboratory tasks (e.g., Ritter et al. 2012; Saad et al. 2013). That being said, do we have the necessary empirical evidence to conclude that diversifying experiences have a positive influence on real-world creative achievement and life success in the general population? In other words, are underdogs and misfits generally destined to emerge victorious from their battles with giants, or is that just wishful thinking?

Research Traditions in the Study of Diversifying Experiences

Research on diversifying experiences and creativity is scattered across (1) different methodologies (e.g., historiometric and psychometric), (2) different areas of psychology (e.g., personality psychology, social psychology, cultural psychology, and clinical psychology), (3) different types of creativity (e.g., creative thinking measured via laboratory tasks versus real-world creative achievement), and (4) differed types of diversifying experiences (e.g., mental illness, multiculturalism, and traumatic events). The findings are generally siloed in their respective areas, and very little integrative work is available (Damian & Simonton 2014). One of the goals of this chapter is to review the available literature in a way that facilitates integration and that fosters more systematic research on diversifying experiences and their role on personality development, creativity, and career success. Thus I will begin by characterizing the different types of research available, after which I will review the existing empirical evidence.

In the historiometric method, biographical and historical information is first quantified and then subjected to statistical analysis (Simonton 2009). This method is ideal for the study of genius-level creative achievement because geniuses are often dead or otherwise unavailable to visit psychological laboratories for psychometric measures. At the individual level, genius-level creative achievement can be measured by counting the total number of publications or artworks of a particular scientist or artist. Furthermore, biographical and

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historical information can be coded to identify developmental influences in the lives of the great, and thus measures of diversifying experiences can be obtained and correlated with the level of creative achievement of each subject. This method results in correlational studies only; it is mainly used by social-personality psychologists; and it focuses on genius-level creative achievement rather than creative achievement or creative thinking in the general population.

Unlike historiometric research, psychometric research collects direct individual measures from the participants. The advantage of such research is that it allows us to delve more deeply into the processes underlying creativity, and it allows us to study the role of diversifying experiences in the general population. The disadvantage is that most of this research so far has focused on creative thinking as measured by laboratory tasks rather than on real-world creative achievement (but see Carson 2014). However, these findings still represent a valuable source of knowledge about creativity because creative thinking is a necessary but not sufficient component of creative achievement; specifically, creative achievement is presumed to require motivation and expertise in addition to creative thinking (i.e., the ability to come up with original, useful, and surprising ideas) (Simonton & Damian 2013). Furthermore, the psychometric method can result in both correlational studies and experiments; it is used across many different fields of psychology; and experimental data are vital in establishing causal links between diversifying experiences and creativity.

In what follows, I will review the research available, which cuts across different methodologies and areas of research. Importantly, the vast majority of historiometric and psychometric studies conducted so far have focused on only one type of diversifying experience at a time (e.g., mental illness, parental death, or multiculturalism) rather than measuring all the diversifying experiences in the subject's developmental history (Damian & Simonton 2014). If we are to study systematically the developmental role of diversifying experiences on creativity and life success, then we ought to move beyond the study of specific experiences, take a broader view, and integrate the different types of diversifying experiences. Thus, based on my reading of the literature, I have extracted several types of diversifying experiences, and I have organized the literature review around these types.

Types of Diversifying Experiences and Empirical Evidence

Familial Instability and Trauma

Historiometric research has found that family economic difficulties, instability, and periods of outright poverty are very common in the childhoods of future creative geniuses, much more common than in the general population (Berry 1981; Goertzel & Goertzel 1962). Another, even more extreme form of familial experience that is overrepresented among eminent creators is an early traumatic experience consisting of a loved one's death or departure from the child's life.

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Several studies have suggested that orphanhood rates are particularly high among eminent personalities, with rates ranging between 25 and 50 percent (Albert 1971; Eisenstadt 1978; Illingworth & Illingworth 1969). In Roe's (1953) collection of great scientists, 15 percent had lost a parent before the age of 10. Among mathematicians, 25 percent had lost a parent before the age of 10 and 30 percent before the age of 14. The results for creative writers are even more dramatic, showing that 55 percent had lost a parent before the age of 15. Another study found that orphanhood rates among recipients of the Nobel Prize for Literature were eight times higher than those found among Nobel Prize winners in physics (Berry 1981). Of course, the main concern here is whether these rates exceed normal expectations. Some studies suggest this is the case, finding, for example, that only 6 percent of college students had lost a parent before age 10. However, others have argued that the effect disappears when choosing appropriate comparison groups (e.g., Woodward 1974), that is, groups that match in terms of birth year, birthplace, and socioeconomic status.

Psychometric research on posttraumatic growth in the field of positive psychology has also suggested that some level of developmental stress and trauma might be beneficial for creativity in the general population. Specifically, Forgeard (2013) showed that self-reported posttraumatic growth (i.e., the retrospective perception of positive psychological changes resulting from adverse experiences) was correlated with more self-reported creativity in a cross-sectional sample. Importantly, this study relied on retrospective self-reports regarding life experiences, which is a major criticism that applies to most current research available on posttraumatic growth (Damian & Roberts 2014).

Contrary to these findings, one historiometric study on 499 scientists showed that early adversity was related to lower, not higher, career performance, though the authors pointed out that the obituaries they used to extract biographical data might not have been the best source for coding early adversity given their "celebratory" nature (Mumford et al. 2005). In addition, several psychometric studies on the general population have shown that familial instability and trauma, especially economic difficulties, experienced during childhood are related to a plethora of negative career outcomes, including lower academic achievement, educational attainment, and occupational prestige (e.g., Damian et al. 2015; Shonk & Chicchetti 2001). Given these findings, we might predict that familial instability and trauma are related to lower, not higher, levels of real-world creative achievement inasmuch as creative achievement is related to career success. However, this is an issue that remains to be investigated because, to my knowledge, no studies to date have looked at the prospective link between familial instability and trauma and creative achievement in the general population.

Physical Illness

Other common developmental experiences among creative geniuses are physical illness or disability. Eminent examples come to mind, such as Ray Charles, who

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was blind; Thomas Edison, who was partially deaf; and Toulouse-Lautrec, who was partially disabled. Indeed, research showed that highly eminent people frequently suffer from some serious physical ailment (Ellis 1926; Goertzel & Goertzel 1962). Though this is a common finding in the context of creative geniuses, it is unclear how physical illness plays out in the context of long-term career outcomes in the general population. In the short term, we know from psychometric studies that a lack of physical fitness is associated with lower academic achievement among students (Castelli et al. 2007) and that transient physical illness is related to lower job performance and productivity among adults in the workplace (Pransky et al. 2005). However, these data are cross-sectional, so it is possible that physical illness may have a negative effect on work and achievement outcomes in the short term but a positive effect in the long term once the person has had a chance to overcome the illness and experience growth or a change in perspective. Furthermore, the effects of physical illness may be different for creativity and career success compared to academic achievement and temporary job performance. Long-term longitudinal studies on general population samples are needed to assess the link between serious physical illness experienced early on and later creative achievement and career success.

Psychopathology

Another kind of experience that positively predicts eminent creativity is psychopathology. The "mad genius" hypothesis is an ancient idea that goes back to Plato and Aristotle, and research continues today (J.C. Kaufman 2014). However, research on this topic is controversial and highly polarized. On one side are humanistic and positive psychologists who argue that creativity is a sign of superior mental health, self-actualization, and subjective well-being as opposed to psychopathology (Maslow 1970; Bacon 2005; Cassandro & Simonton 2002). Indeed, some researchers believe that the mad genius idea does not have any empirical support and that previous findings are due to unresolved methodological issues (Sawyer 2012; Schlesinger 2009). On the other side are those who believe that there is some connection between creativity and psychopathology, although few would claim that mental illness is a prerequisite for being a creative genius. The more commonly accepted idea is that mental illness and creativity share some cognitive and dispositional traits, such as a cognitive disinhibition and a schizotypal personality (Carson 2014).

Researchers have long known that highly creative people are more likely to come from families that have an above-average tendency toward psychopathology (e.g., Karlsson 1970). Furthermore, an extensive study (Ludwig 1992) investigated a sample of 1,005 eminent creative people, both artists and scientists, and concluded that psychopathology (including both mood and cognitive disorders) has extremely high rates among eminent people, with artists showing even higher rates (68 percent of all artists had one or more incidences of mental illness across their lifespan) than scientists (39 percent). The level of mental

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illness also predicted positively achieved eminence, as long as it was moderate and not extreme. Importantly, extreme levels of mental illness (or specific episodes) were actually found to be detrimental to creativity. A more recent historiometric study (Simonton 2014a) has suggested that the mad genius controversy (whereby some researchers claim that psychopathology is positively and others claim it's negatively related to creativity) may be resolved by using more sophisticated methods. According to Simonton (2014a), it is important to recognize that both psychopathology and eminent creativity are quantitative rather than qualitative variables, that they should be measured independently, and that the relation between the two variables may be either linear or curvilinear depending on the domain of creative achievement. Indeed, this author showed in a study of 204 eminent scientists, thinkers, writers, artists, and composers that positive monotonic functions were found for writers and artists, whereas nonmonotonic single-peak functions were found for scientists, composers, and thinkers.

Mirroring some of the findings from historiometric research, a psychometric study of highly creative novelists who took the Minnesota Multiphasic Personality Inventory (Barron 1963; cf. Nettle 2006) showed that tendencies toward psychopathology are indeed present at a high rate among these people, but it is, on average, subclinical. These findings are in line with a study by Richards and colleagues (1988), who showed that the highest levels of creativity were found among people with mild bipolar symptoms or people who had a relative with bipolar disorder as opposed to people who had full-blown bipolar disorder or a control group. This inverted-U relation between mental illness and creativity was replicated in a study by Kinney and colleagues (2001), who showed that people with schizotypal symptoms scored higher in creativity than both a control group and people with full-blown schizophrenia. To explain these findings, researchers have proposed the shared vulnerability model of creativity and psychopathology (Carson 2014). According to this model, inhibitory processes should be detrimental to creativity because creativity requires the ability to come up with original and useful ideas, and that presumably requires a large pool of information and unusual connections. Thus many researchers have suggested that a *broad attention focus*, *defocused attention*, *cognitive disinhibition*, and *reduced latent inhibition* are characteristic of creativity (Carson, Peterson, & Higgins 2003; Keri 2011; but see Benedek et al. [2012] for some evidence that *increased* inhibition is related to creativity in some situations). Interestingly enough, disinhibited thinking is also typical of some forms of psychopathology (Carson 2011; Eysenck 1995), which would explain why tendencies toward psychopathology are positively linked to creativity and which led researchers to propose that creativity and psychopathology may share genetic components that can manifest as either creativity or psychopathology depending on the presence of other moderating factors (Berenbaum & Fujita 1994; Carson 2011). The idea that psychopathology and creativity may share some genetic components is supported by one study that identified a unique gene found in both the highly creative and the mentally ill (Keri 2009). It is likely, however,

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that in the highly eminent, the gene is inherited along with other traits that turn a potential cognitive liability into a cognitive asset. One of these buffering factors is intelligence. Studies have shown that cognitive traits typical of psychopathology are only related to more creativity in people who also have high IQ scores (Carson 2011; Carson et al. 2003; Eysenck 1995).

Finally, a recent mathematical simulation (Simonton 2014b) showed that some of the conflicting evidence present in the field may be due to the *mad genius paradox*. Specifically, it is possible that two apparently conflicting propositions may be simultaneously true. Namely, it is possible that (1) among creative people, the most creative show more psychopathology than the less creative and (2) among all people, creative people show better mental health than do noncreative individuals. The simulation supported the mad genius paradox and showed that the phenomenon follows logically from the fact that creative productivity is approximated by an inverse power function called *Lotka's law*, where an extremely small number of people are responsible for the highest number of creative products. Thus any future research should carefully consider the creative achievement distribution present in the sample at hand.

Enrichment

Another category of experiences that seem to be related to creativity consists of those that can be considered enriching with regard to knowledge and ideas. Examples include schooling, mentoring, hobbies, reading, and peripheral training.

Highly creative people have been historically presumed to dislike traditional schooling (Galton 1874). However, a closer examination of the empirical evidence suggests that schooling is an important factor in creative achievement, but there are some differences across domains of creativity (i.e., sciences versus arts). Specifically, scientific creativity requires much more formal training than artistic creativity (Simonton 1986; Terman 1954). For example, eminent scientists are more likely to have university training compared with eminent writers (Raskin 1936; Simonton 1986), and highly productive scientists are more likely to have obtained doctoral degrees (Simonton 1983). Furthermore, high-achieving scientists (as opposed to low-achieving scientists) are more likely to have experienced a high educational intensity, such as being in a doctoral program with thesis and dissertation requirements, a high reputation, and an emphasis on modes of thought (Mumford et al. 2005). In contrast, the link between education and artistic creativity follows an inverted-U-shaped curve, suggesting that doctoral degrees are associated with less artistic creativity, whereas some college degree is associated with the highest level. Scientists also tend to be much better students than artists, as indicated by their grades in school and college (Schaefer & Anastasi 1968).

In addition to traditional schooling, highly creative people tend to have other types of enrichment experiences. One of them is studying under a great mentor

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and under a diverse array of mentors (Simonton 1984a, 1992; Mumford et al. 2005). Another is engaging in extensive self-education. Highly creative people often display independent learning, extracurricular activities, and hobbies (Roe 1953; Mumford et al. 2005). Often these "side activities" may distract from schoolwork (which could be the reason so many eminent people, Einstein included, had such poor school records), and they often provide the basis for later discoveries (Simonton 2004). Another form of self-education characteristic of creative geniuses is early, voracious, wide, and omnivorous reading (McCurdy 1960; Simonton 1984b). Reading represents a very cheap and convenient source of ideological diversity that can broaden one's horizons and increase creativity.

Finally, some evidence suggests that highly creative people often tend to have peripheral training to the discipline in which they later make their contributions (Hudson & Jacot 1986; Simonton 1984b), and this might be more characteristic of scientific revolutionaries. Eminent examples of professional marginality in the history of psychology include Sigmund Freud (medicine), Jean Piaget (natural history), and B. F. Skinner (literature).

Psychometric studies, coming mostly from the social cognitive experimental tradition, support the idea that ideological enrichment might be conducive to creativity. In this literature, diversifying experiences from the enrichment category are simulated in the experimental context. They are defined as *schema violations*, that is, violations of schematic representations or expectations. For example, one study showed that preparing breakfast in a way that violated a well-learned cognitive schema led to more creativity (Ritter et al. 2012). Another study showed that being exposed to counterstereotypes, that is, targets that violate peoples' expectations, led to more creative ideas (Gocłowska, Crisp, & Labuchagne 2013). In line with these findings, other research showed that adopting paradoxical frames (i.e., mental templates that help people recognize and embrace contradictions) increased creativity (Miron-Spektor, Gino, & Argote 2011).

Although these studies support the idea that enrichment may be related to more creativity, I am not aware of any studies to date where general population samples that experienced ideological enrichment during their development were tracked over time and evaluated on their creative achievement and career success.

Diversity

Historiometric research suggests that cultural and religious diversity is highly characteristic of creative geniuses. One study of twentieth-century eminent personalities found that one-fifth were either first- or second-generation immigrants (Goertzel, Goertzel, & Goertzel 1978). Another study found that 25 percent of highly eminent scientists were second-generation immigrants (Eiduson 1962). Among distinguished mathematicians, 32 percent were foreign born (Visher 1947), and 52 percent were either foreign born or second-generation

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Americans (Helson & Crutchfield 1970). Moreover, a recent economic study conducted in the United States over a 10-year period, from 2000 to 2010 (Peri 2012), showed that foreign-born immigrants stimulate economic growth with their disproportionate degrees of eminent creativity and innovation. Although foreign-born immigrants represent only 13 percent of the US population, they account for 30 percent of all the patents granted and 25 percent of all the US Nobel laureates. Further supporting the idea that cultural diversity is relevant for creativity, historiometric research has shown that highly creative people tend to have experienced extensive traveling (including traveling and living abroad) and that their families show high geographical mobility (Simonton 2004).

With regard to religious diversity, Galton (1874) found that the Fellows of the Royal Society of London did not tend to belong to the Church of England but belonged to a variety of obscure sects. Other studies have replicated this finding, showing that the less widespread religions (such as Unitarians and Quakers) tend to produce more eminent geniuses than their more widespread counterparts (such as Roman Catholics and Baptists). Furthermore, distinguished scientists are more likely to arise from Jewish families (Berry 1999; Feist 1993; Roe 1953). Additionally, Jews claim a disproportionate share of the Nobel Prizes in sciences (Berry 1981).

Psychometric research also shows a positive link between cultural diversity and creativity and provides us with some insight into the underlying cognitive processes. For example, Tadmor and colleagues (2012) showed that bicultural people (i.e., people who identify as pertaining to two different cultures) achieve higher levels of creativity and professional success. Moreover, they found that this effect was driven by the higher level of integrative complexity of biculturals (i.e., the information-processing capacity that involves considering and combining multiple perspectives). In other words, biculturals who are creative are only so to the extent to which they can benefit from the ideological and cultural diversity they are exposed to by integrating it in their thinking. A recent experiment by Saad and colleagues (2013) supports the idea that biculturalism can predict higher levels of creativity under certain circumstances. Specifically, the authors found that Chinese Americans were more creative when they were reminded of both their identities (i.e., bicultural context) as opposed to just one of their identities (i.e., monocultural context), but this was only the case when the participants were high in bicultural identity integration; that is, they chronically experienced their two cultural identities as compatible (or blended) versus oppositional (or in conflict). In addition to showing that a bicultural background may be conducive to more creativity, research has also shown that living in a foreign country for a significant amount of time (but not brief travels abroad) is linked to more creative thinking and cognitive flexibility, as measured in the laboratory (Lee et al. 2012; Leung et al. 2008; Maddux, Adam, & Galinsky 2010). Furthermore, Fee and Grey (2012) showed in a longitudinal study that people who had lived abroad had increased cognitive flexibility and creativity relative to both other people who had not lived abroad and to their own predeparture scores.

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Studies have also shown that fully functional bilingualism and multilingualism are positively associated with creative cognition (Carringer 1974; Lopez, Esquivel, & Houtz 1993; Simonton 2008), which is not surprising given that bilingualism and multilingualism usually co-occur with cultural diversity and immigration. Most researchers in this area assume that acquiring a new language must increase creative cognition because it allows the bilingual individual to easily encode any given thought or image in two distinct languages, and this, in turn, will likely result in more cognitive flexibility (Hamers & Blanc 2000; Ricciardelli 1992). This account, of course, fits with the diversifying experience hypothesis of creativity. However, the problem is that bilingualism cannot be manipulated in the laboratory, and most studies available to date introduce many confounds, such as intelligence, socioeconomic status, age, and cultural experiences. Of particular concern is the frequent co-occurrence of bilingualism with exposure to different cultures (for a review on problems with research on bilingualism and cognitive function, see Paap, Johnson, & Sawi [2015]).

Beyond research on diversity and creativity at the individual level, there is also extensive psychometric research looking at the role of diversity on team creativity, and this research considers both cultural and ideological diversity. Specifically, some researchers found that group creativity increased significantly when group membership was highly diverse owing to the increased heterogeneity of perspectives and ideas (Nemeth & Nemeth-Brown 2003; Page 2007). Membership diversity can entail gender, ethnicity, training, age, and a host of other demographic and occupational factors. Indeed, a meta-analysis of the role of demographic diversity and team performance found that functional background diversity (e.g., work history) and educational background variety were related to more team creativity (Bell et al. 2010). These findings support the hypothesized link between diversifying experiences and creativity, and they mirror previously presented effects such as the impact of cultural and religious diversity at the individual level, as well as findings that eminent geniuses tend to have studied abroad, under a foreign mentor, or under a multitude of mentors, and tend to have had professional marginality. Other researchers, however, have noted that the literature on group diversity and creativity has produced mixed findings (for a review, see van Knippenberg & Schippers 2007). In an attempt to resolve the inconsistencies in this literature, several studies have proposed moderator effects of the link between group diversity and creativity. One experiment (Homan et al. 2007) showed that diverse groups performed better only when they were persuaded to value group diversity. In other words, diverse groups only performed better when they held pro-diversity rather than pro-similarity beliefs, whereas the performance of homogeneous groups was unaffected by diversity beliefs. Another laboratory experiment (Hoever et al. 2012) showed that the effect of a team's diversity on its creativity was moderated by the degree to which team members were instructed to engage in perspective taking, that is, when people placed themselves in their team members' shoes.

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Limitations of Previous Research

Historiometric studies have greatly advanced our knowledge of diversifying experiences and creative achievement, and without these studies, this chapter would not exist. However, such studies have several limitations. First, they are correlational studies, so they pose the issue of multiple determinants. That is, each eminent creator who is investigated has multiple biographical aspects that are related to creative achievement, and it is almost impossible to completely disentangle their effects. Some of their experiences may have a positive effect, whereas others may have a negative effect. Furthermore, some of the positive effects of these diversifying experiences may occur only in certain circumstances, that is, when someone has a buffer or a protective factor in their lives. In this context, it is worth noting that creative geniuses (in particular, scientists), on average, are fairly privileged. They tend to come from middle-class professional families, where reading, thinking, and studying are encouraged; they tend to be more highly educated than the average population; and they tend to have great mentors (Simonton 2004). Second, historiometric studies measure diversifying experiences using biographical information that was written and collected after the subject became an eminent figure. This is problematic because it is possible that once someone is already famous and successful, their biography is written in a more dramatic fashion, and diversifying experiences are highlighted because of the biographer's own biases (e.g., if the biographer wants to "sell" a great underdog story). This criticism is somewhat attenuated by the fact that many of the diversifying experiences are entirely objective and verifiable via historical records (e.g., parental death). Third, historiometric studies have, on the one hand, the advantage that they measure real-world creative achievement, but on the other hand, they are limited to genius-level creative achievement because only the highest level of creative achievement gets recorded and archived systematically (e.g., as part of encyclopedias and biographies). To put in perspective how rare eminent creative achievement is, consider that only 10 percent of all scientists are responsible for over 50 percent of the published works (Simonton 2004). Now, if you take the handful of works that can be considered historically meaningful, you are left with a very small number of people who are bound to be very different from the general population. Understanding and characterizing geniuses constitute an intrinsically interesting endeavor, but the generalizability of the results is limited because we cannot know whether the same experiences that are related to more creative achievement and career success among geniuses might be relevant for the rest of us (see Simonton 2014b).

Psychometric studies are equipped to address the generalizability issue, but they also pose some issues. First, many psychometric studies are correlational, which means that the multiple-determinants problem still applies. Second, most psychometric studies that have looked at real-world diversifying experiences have used retrospective self-report measures. This is highly problematic,

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especially in studies that ask people how they have grown from their past experiences, because it might lead to demand effects (see Damian & Roberts 2014). Third, when psychometric studies have tried to measure people's creativity levels after the occurrence of a certain diversifying experience (e.g., having lived abroad), they suffered from selection biases (e.g., people choose to live abroad or not, and most studies are generally done on convenience samples of highly intelligent and fairly privileged college or MBA students because they are the ones who can afford exchange programs). Fourth, although most psychometric studies tend to use samples from the general population, these samples are rarely representative and often very small. Finally, psychometric studies often suffer from a lack of ecological validity, especially in the experimental context, where one has to simulate diversifying experiences in the laboratory and measure creativity on specific tasks.

Additionally, most research conducted so far on diversifying experiences and creativity (both historiometric and psychometric) has two major limitations. First, most studies have focused on one type of diversifying experience only (e.g., trauma or cultural diversity) rather than investigating all types systematically and looking at overall indices and their link with creativity. This is essential because certain types of diversifying experiences may not have incremental validity over and above other types. For example, in a recent historiometric study conducted on a sample of eminent African Americans (Damian & Simonton 2015), the authors investigated the effects of psychopathology on creative achievement with and without controlling for familial instability, trauma, and physical illness. Though psychopathology initially predicted more creativity, this effect disappeared when controlling for the other types of diversifying experiences cumulated. A second limitation of most studies conducted so far on diversifying experiences and creativity is that they do not establish the incremental role of diversifying experiences over and above other important predictors of career success and creative achievement, such as intelligence, socioeconomic status, and motivation.

In sum, there is enough empirical evidence so far to suggest that diversifying experiences might represent an important new set of predictors of creative achievement and life success. However, we do not yet know what effects such experiences may have in the general population and how this topic of study may be integrated in the broader context of personality and creativity research.

Integrating Diversifying Experiences in Personality Theory

Traditionally, personality has been conceptualized as traits, and traits have been conceptualized as unchangeable causal forces used to predict outcomes, such as creative achievement or career success. In this context, there is little room for integrating diversifying experiences in the study of personality and creativity. However, in light of extensive recent empirical evidence, the static view of personality is no longer tenable. We now know that personality

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traits are characterized by both continuity and change over time and that they can develop even in adulthood (Roberts et al. 2006). Thus the next big question in the study of personality is how and why personality changes over time. One prominent theory in the field, which addresses this question and which has received substantial empirical support so far, is the *neo-socioanalytic theory* (Roberts 2006; Roberts & Caspi 2003; Roberts & Wood 2006). According to this theory, social roles and pressures, including major life events and experiences, are developmentally meaningful and contribute to personality change over time. I will use this framework to show how we may integrate the study of diversifying experiences in the broader field of personality, creativity, and career success.

The neo-socioanalytic model of personality, as described by Roberts (2006), consists of several components. First, there are the *units of analysis*, of the different aspects of personality that are relevant for important life outcomes, including success and creativity. These units of analysis include personality traits (e.g., openness/intellect, extraversion, neuroticism, agreeableness, and conscientiousness, also known as the *Big Five*), as well as motives and values, abilities, and narratives. These units of analysis are presumably interrelated and influenced by genetics. Furthermore, these four areas of personality are presumably reflected in identity (measured via self-reports) and reputation (measured via observer reports). In turn, identities and reputations are influenced in this model by social roles (e.g., status and belongingness), society, and culture. Major life events and experiences have the potential to affect people's social roles and cause environmental demands or environmental *press*, which can then lead to personality change in reaction to the environment throughout the lifespan (i.e., the *plasticity principle*). Investment in social roles is theorized to be a driving factor for personality development (i.e., the *social investment principle*). Moreover, stability in personality presumably results from commitment to an increasingly developed identity (i.e., the *identity development principle*), which is consistent with social roles (i.e., the *role continuity principle*) and with further experiences that deepen the personality characteristics that led to those experiences in the first place (i.e., the *corresponsive principle*). In sum, the neo-socioanalytic theory provides us with a framework that is ideal for integrating diversifying experiences in the study of personality, where personality is understood as a broad collection of traits, motives, abilities, and narratives. By integrating diversifying experiences in this framework, we gain the following: (1) an understanding of why and how diversifying experiences might be developmentally relevant for important life outcomes, including creativity and career success, and (2) an understanding of how personality can be shaped by diversifying experiences. Next, I briefly explain why each of the units of analysis in this theory is essential for understanding creativity and career success over the lifespan, and I give examples of how diversifying experiences might affect the development of these core aspects of personality.

As mentioned earlier, the neo-socioanalytic theory proposes that personality consists of four *units of analysis* or *domains*: traits, values and motives, abilities,

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and narratives, which are intended to subsume most categories of individual differences (Roberts & Wood 2006). The *trait domain* refers to enduring patterns of thoughts, feelings, and behaviors that people exhibit. There are several trait taxonomies available, the most popular being the Big Five structure (i.e., openness/intellect, agreeableness, conscientiousness, neuroticism, and extraversion). Extensive research across psychological areas has shown that personality traits are highly relevant in predicting both creativity (e.g., Feist 1998) and career success (e.g., Duckworth et al. 2012; Roberts, Caspi, & Moffitt 2003; Damian et al. 2015). The *values and motives domain* refers to all things that people think desirable, that is, what they would like to do or what they would like to have. This category includes motives and needs, as well as values, interests, preferences, and goals. Extensive research has shown that motives and values are important for both creativity and career success (e.g., Amabile 1996; Rounds & Su 2014). The *abilities domain* includes what people are able to do, that is, general intelligence, which subsumes verbal, mathematical, and spatial intelligence. Previous research has shown that intelligence has a strong positive link with creativity and career success (e.g., Cawley, Heckman, & Vytlacil 2001; Damian et al. 2015; Gottfredson 2002; Kuncel, Hezlett, & Ones 2004). Finally, the *narratives domain* focuses on the devices people use to tell the stories they use to understand themselves and their environments (McAdams 1993). Many elements extracted from people's life narratives are essential for understanding adjustment and life success (McAdams 2001).

Diversifying experiences have the potential to be developmentally relevant and affect the lifespan change of each of these different units of analysis, either directly or through their impact on social roles, and that could have downstream consequences for creativity and career success. For example, the openness/intellect personality trait has been shown to be related to cognitive exploration and creativity (for a review, see DeYoung 2014). Moreover, previous research has shown that experiencing more positive life events predicted increases in openness/intellect over time but also that people who had higher levels of openness/intellect to start with tended to experience both more positive and more negative life events over time (Lüdtke et al. 2011). Extending these findings to diversifying experiences, we might predict that people higher in openness/intellect might have more diversifying experiences over their lifespan and that might increase their openness/intellect over time (to the extent to which they experience or reappraise the respective events as positive), which might, in turn, increase their creativity and creative achievement. It is possible, of course, that only some kinds of diversifying experience might have this effect (e.g., cultural diversity and enrichment but not trauma), or it is possible that all have a similar effect to the extent to which the person reappraises the event as a challenge or a "growth opportunity" that changes the way he or she thinks about the world. Moreover, diversifying experiences may affect other aspects of personality, not just personality traits. For instance, if a person experienced early physical illness, he or she might develop an early and strong interest in science (as a way to explain the illness to himself or herself), and that might lead

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the person to become a successful scientist (Rounds & Su 2014). In addition to the possibility that diversifying experiences may affect creativity and career success through their direct role in personality development (i.e., they might change a person's personality traits, motivations, abilities, or life narratives), it is also possible that diversifying experiences might lead to personality development through the impact they have on shaping social roles (i.e., they might change a person's social roles, which may later lead to personality changes). For example, experiencing early parental death might put someone in a caregiver role at an unusually early age (e.g., taking care of a younger sibling), which might speed up the process of personality maturation; specifically, the person might increase in conscientiousness earlier than usual, and that might help his or her later career success, which would be in line with previous research showing that social roles affect personality development (Bleidorn et al. 2013) and that conscientiousness is prospectively related to more career success (Damian et al. 2015).

In sum, integrating the study of diversifying experiences and their impact on creativity and career success with personality research could prove to be a generative field of research. It would allow researchers to explore dynamic bidirectional processes between specific life events, their subjective experience, and social role change as well as personality change over time. The field of creativity would gain because we would be able to better understand the processes and boundary conditions of the diversifying experience–creativity link. That is, perhaps only certain people benefit from these experiences but not others; perhaps people who start as high in openness/intellect are more likely to embrace and grow from these experiences; or perhaps there are other moderating factors (e.g., social support) that influence what kind of personality development trajectory someone might take after a diversifying experience. The field of personality would gain because we would be able to better understand what kinds of experiences might be transformative and encourage growth and who the people are who are likely to experience this growth; this would help us to better understand the patterns of continuity and change in personality, as well as individual differences in patterns of growth and change.

Future Directions

Considering this review, I believe that research on diversifying experiences, creativity, and career success has a number of exciting directions for future research that can be divided into three major categories: measurement, sampling and methods, and modeling. First, with regard to measurement, this research area is in dire need of a good measure of diversifying experiences that can be administered to the general population. As evidenced in the literature review, research so far has not been very systematic, and each individual study has often focused on one type of experience only. Researchers must create appropriate measurements, consisting of all the different types of diversifying

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experiences, to study both the cumulative effects and the effects of individual categories on creativity and career success. Another challenge with respect to measurement in this area will be to find good measures of real-world creativity in the context of the general population. One such example is the Creative Achievement Scale (see Carson 2014).

Second, with regard to sampling, researchers need to be aware of the possibility that the effects of diversifying experiences on creativity and career success might be vastly different for genius versus general population samples. Diversifying experiences might very well follow the pattern of the mad genius paradox described earlier in this chapter (Simonton 2014b), whereby it is possible that diversifying experiences can predict more creativity and career success among highly creative people, but less in the general population. To address this issue, researchers should either ensure that their samples contain a wide range of creativity and career success, with large enough samples at each end, or conduct research using different methodologies and draw appropriate conclusions (i.e., psychometric for the general population and historiometric for highly creative geniuses). With regard to methods, it becomes apparent from this chapter that there are no studies available to date that used a prospective longitudinal design to test the role of diversifying experiences on creativity and career success. More longitudinal designs, especially on large representative samples, should be employed. This would also address the issue with retrospective self-report of diversifying experiences that I mentioned in the limitations section. Furthermore, researchers should consider going beyond linear effects and testing multiplicative effects in case the effects of diversifying experiences are moderated by certain factors (see Damian & Simonton 2014), and they should also test for curvilinear relationships (Simonton 2014a).

Finally, with regard to modeling, researchers should strive to integrate the study of diversifying experiences, creativity, and career success in the broader context of modern personality theory. I think that the neo-socioanalytic model provides a great framework that may generate a large number of research questions. This framework would encourage more longitudinal studies and would provide a model ideally designed to better understand the developmental role of diversifying experiences over the lifespan and the underlying mechanisms of the proposed link between diversifying experiences, creativity, and career success.

Conclusion

In sum, there is a wealth of evidence suggesting that diversifying experiences may play an important developmental role in creativity and career success. Both historiometric and psychometric studies support this conclusion, and there are many exciting possibilities for future directions. Furthermore, integrating the study of diversifying experiences into the broader context of personality theory would benefit not only the study of creativity and career

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success but also the study of personality because researchers could uncover a new source of personality change. Going back to our original question – that is, do we have the necessary empirical evidence to conclude that diversifying experiences have a positive influence on real-world creative achievement and life success in the general population? – the answer so far would have to be negative because there is simply not enough research available. Thus, even if some underdogs and misfits are destined to emerge victorious from their battles with giants, many more are bound to get crushed by these battles, so the interesting question becomes who are the people who can thrive as a result of their diversifying experiences, and how do they do it?

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8 Rethinking the Multicultural Experiences–Creativity Link

The Interactive Perspective on Environmental Variability and Dispositional Plasticity

Jen-Ho Chang, Jenny C. Su, and Hsueh-Chih Chen

Research findings have consistently revealed a notable link between multicultural experiences and creative thinking (for reviews, see Gocłowska & Crisp 2014; Leung et al. 2008). The psychological mechanisms that underlie this link seem intuitive. Not only do multicultural experiences provide individuals with opportunities to learn new concepts and knowledge, but they often call for the construction of innovative frameworks, which can help to resolve incongruities that arise when newly learned ideas are incompatible with individuals' preexisting knowledge structures (Crisp & Turner 2011). Both the learning of new concepts and the construction of innovative frameworks are critical elements of creativity, and they represent two major creative processes, namely, *insight* and *divergent thinking* (Hennessey & Amabile 2010; Runco 2004). Taken together, multicultural experiences may be characterized as contexts with much *environmental variability*, wherein individuals are afforded the opportunity to enhance their creativity.

The effects of multicultural experiences on creativity have been documented using different types of creativity measures across various stages of development. For instance, Chang and colleagues (2014) found that compared with children raised by parents who were from the same country, children raised by parents from different countries performed better on domain-general creativity, which is indexed by multiple dimensions such as fluency, flexibility, and originality. A follow-up study investigated young adolescents growing up in households comprised of parents who were from the same country but belonged to culturally distinct ethnic groups. More specifically, the study focused on children raised by Taiwanese parents. The results revealed that Taiwanese children whose parents belonged to two culturally dissimilar ethnic groups (i.e., one parent was Min-nan Taiwanese and the other was Outside-Province Taiwanese) outperformed children whose parents belonged to culturally similar ethnic groups (i.e., both parents were Min-nan Taiwanese) on both domain-general and domain-specific mathematic creativity (Chang, Su, & Chen 2015). With regard to young adults, Lee, Therriault, and Linderholm's (2012) research showed that undergraduate students with study-abroad experiences performed better on both domain-general and domain-specific creativity tasks than students without such experiences.

Furthermore, this multicultural experience–creativity link has also been demonstrated in studies conducted with adult participants. Specifically, these

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studies show that expatriates demonstrate higher creativity at work than non-expatriates (Fee & Gray 2012). Adults with bicultural or multicultural backgrounds were more innovative and achieved greater success in their jobs than monocultural adults (Godart et al. 2015; Maddux, Adam, & Galinsky 2010; Tadmor, Galinsky, & Maddux 2012). Finally, using experimental manipulation to test the causal effect of multicultural experiences on creativity, Leung and Chiu (2010) primed individuals with different cultural icons. Their results suggest that individuals primed with dual cultural icons (i.e., American and Chinese pictures, music, and videos presented simultaneously) had more innovative ideas compared with those primed with single cultural icons (i.e., either American or Chinese pictures, music, and videos) and those in the control group (i.e., unprimed). In sum, results from past research offer consistent support for the role multicultural experiences play in fostering individuals' creativity.

However, the current literature has largely overlooked the possibility that individuals' disposition could moderate the direct effect of multicultural experiences on creativity. It might be the case that only certain types of multicultural individuals reap the benefits of multicultural experiences. For example, Tadmor and colleagues (2012) revealed that creativity-related outcomes for bicultural individuals can differ depending on the type of acculturation strategies they adopt. More specifically, these researchers found that only biculturals who were high on both home and host cultural identification displayed innovative job performance. This finding suggests a more nuanced picture of how multicultural experiences relate to creativity. Rather than treating individuals from multicultural backgrounds as a simple and unified group, it may be worthwhile to take into account the ways in which individuals perceive their multicultural experiences and how those perceptions, in turn, influence their level of creativity. With this idea in mind, this chapter discusses potential individual differences that could moderate the effect of multicultural experience on creativity. We propose a novel approach for understanding when and why multicultural experiences foster creativity. This approach, which we call the *interactive perspective*, highlights the interaction between environmental variability and intrapersonal plasticity. We used the term *dispositional plasticity* to refer to a basic tendency to accept and include different (or even opposing) kinds of information and stimulation, allowing for the manifestation of variability and malleability pertaining to self and social identities.

Drawing from the cognitive-affective personality system (CAPS) (Mischel 2004; Mischel & Shoda 1995) theory, the term *dispositional plasticity* applies to a cluster of cognitive and affective psychological units or variables. In other words, dispositional plasticity is not restricted to a simple dimension or variable but includes a variety of concepts found across different levels of personality, including traits, beliefs, and social identities (McAdams & Pals 2006). In this chapter we review existing literature on how different levels of dispositional plasticity-related constructs might moderate the association between multicultural experiences and creativity. The dispositional plasticity-related

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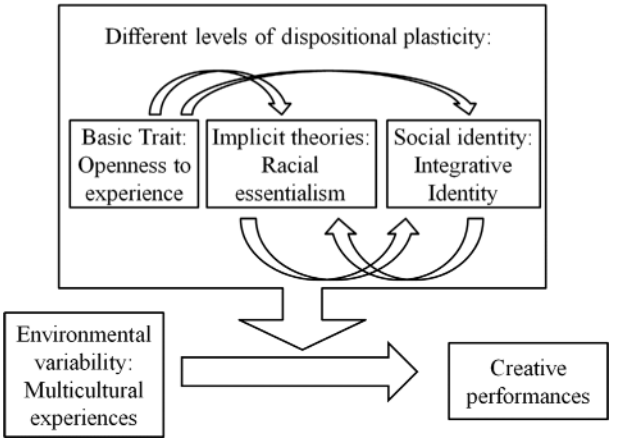

Figure 8.1 *Interactive effects of environmental variability and intrapersonal plasticity on creativity.*

variables covered in this chapter range from (1) basic trait-level variables such as openness to experience (McCrae & Costa 1997; McCrae & John 1992) to (2) the implicit theory level (e.g., individuals' lay theory of race) (Hong, Chao, & No 2009; No et al. 2008) to (3) the global level of social identity integration (Amiot et al. 2007; Tadmor et al. 2012), as indicated in Figure 8.1. We argue that having multicultural experiences is a necessary but insufficient condition for enhancing creativity. Only individuals with high dispositional plasticity are able to consume environmental variability and use it to create successful innovations. In sum, the interactive perspective regards both multicultural experiences and dispositional plasticity as indispensable conditions for the cultivation of creativity.

Basic Trait Level: The Moderating Effect of Openness to Experience

At the trait level of personality, there has been much discussion surrounding the direct relationship between openness to experience and creativity (Feist 1998; McCrae 1987). Why would openness to experience moderate the multicultural experiences–creativity link? When individuals encounter multicultural experiences, those with a higher openness to experience disposition can more easily perceive multicultural information because their mind is more flexible to capturing novel stimuli, thereby increasing their idea pool, whereas the "close-minded" tendency of those with a lower openness to experience disposition could block channels that would allow them to perceive multicultural information in their external environment. Therefore, even when people immerse in different cultural environments, if they are not sufficiently open-minded, those environments may not stimulate their thinking and as a result exert little impact on their creativity. Empirical evidence from Leung and

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Figure 8.2 *Examples of the different sizes and fonts of the Chinese character from the new version of the Chinese Creative Thinking Test.*

Chiu's (2008) study demonstrated the moderating effect of openness to experience on the multicultural experiences–creativity link. In their study, exposure to multicultural experiences predicted better creative performance only among European-American undergraduate students who scored high on openness to experience. Among European-American participants who scored low on openness to experience, exposure to multicultural experiences did not have a positive effect on creativity.

Extending the work of Leung and Chiu (2008), we reanalyzed our recently published data set from Chang et al. (2014) that contained information about creativity and openness to experience among bicultural and monocultural individuals in Taiwan. Specifically, in the original study reported by Chang et al. (2014), there were 290 young adolescents from bicultural families (one Taiwanese parent and one immigrant parent) and 420 young adolescents from monocultural families (two Taiwanese parents). The creativity measure used in the study was the new version of the Chinese Creative Thinking Test (Wu & Albanese 2010; Wu et al. 1999), which included 27 versions of the same Chinese character "人" (meaning "human") in varying sizes and styles (Figure 8.2). The participants were given exactly 10 minutes to complete as many drawings as possible. Three facets of creativity were assessed: (1) fluency (the number of responses given), (2) flexibility (the number of response categories given), and (3) originality (the number of unusual responses given). Finally, in order to capture the trait *openness to experience* from the Big Five personality theory (McCrae & Costa 1997; McCrae & John 1992), we used the Chinese version of the Mini-Marker Scale (Saucier 1994), which included all five basic personality traits (i.e., openness to experience, extroversion, contentiousness, agreeableness, and emotional stability).

Following the analysis procedure suggested by Leung and Chiu (2008), the multicultural background (dummy-coded: monocultural = 0 ; bicultural = 1) $\times$ openness to experience regression model was fitted to fluency, flexibility, and originality scores obtained from the new version of the Chinese Creative Thinking Test. We used the PROCESS 2.10 macro (Hayes 2013) to investigate the moderating effect of openness to experience on the link between multicultural experiences and creativity. The main effects of multicultural background (b = 1.31, p = 0.003) and openness to experience (b = 1.63, $p < 0.001$) were both significantly and positively associated with fluency. In addition, the interaction term, multicultural background $\times$ openness to experience, was also significant (b = .95, p = 0.04). Follow-up simple slopes analysis suggested that among young adolescents low on openness to experience (one standard deviation below the mean), those from bicultural families did not have higher fluency scores

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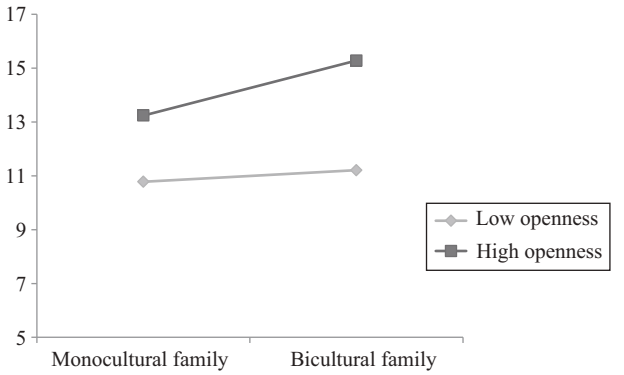

Figure 8.3 *Fluency plotted ± 1 SD from the mean on young adolescents' openness to experience and their multicultural background.*

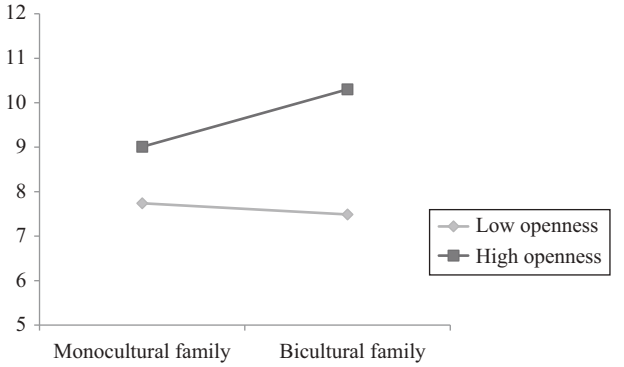

Figure 8.4 *Flexibility plotted ± 1 SD from the mean on young adolescents' openness to experience and their multicultural background.*

than those from monocultural families (b = 0.43, p = 0.48). By contrast, among young adolescents high on openness to experience (one standard deviation above the mean), those from bicultural families significantly outperformed those from monocultural families (b = 2.19, $p < 0.001$; see Figure 8.3).

With regard to flexibility, the main effect of multicultural background was marginally significant (b = 0.52, p = 0.06), and the main effect of openness to experience was significant (b = 1.01, $p < 0.001$). In addition, the interaction term, multicultural background × openness to experience, was also significant (b = 0.83, p = 0.01). Follow-up simple slopes analysis suggested that among young adolescents low on openness to experience (one standard deviation below the mean), those from bicultural families did not have higher flexibility scores than those from monocultural families (b = –0.25, p = 0.55). By contrast, among young adolescents high on openness to experience (one standard deviation above the mean), those from bicultural families significantly outperformed those from monocultural families (b = 1.29, p = 0.003; see Figure 8.4).

Finally, the main effects of multicultural background (b = 0.99, p = 0.03) and openness to experience (b = 1.63, $p < 0.001$) were significantly and positively

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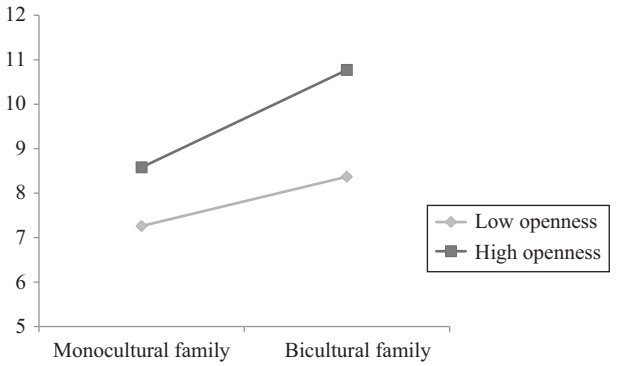

Figure 8.5 *Originality plotted ± 1 SD from the mean on young adolescents' openness to experience and their multicultural background.*

associated with originality. In addition, the interaction term, multicultural background × openness to experience, was marginally significant ($b = 0.71$, $p = 0.08$). Follow-up simple slopes analysis suggested that among young adolescents low on openness to experience (one standard deviation below the mean), those from bicultural families did not have higher originality scores than those from monocultural families ($b = 0.87$, $p = 0.20$). By contrast, among young adolescents high on openness to experience (one standard deviation above the mean), those from bicultural families significantly outperformed those from monocultural families ($b = 1.44$, $p < 0.001$; see Figure 8.5).

Consistent with Leung and Chiu's (2008) findings, our results supported the interactive perspective that the link between multicultural experiences and creativity only appears among individuals who are high on openness to experience. In addition, other personality traits (i.e., extroversion, contentiousness, agreeableness, and emotional stability) did not show this moderating effect in our study ($p > 0.10$), which suggests the uniqueness of openness to experience in its ability to account for the relation of multicultural experiences to creativity. Interestingly, openness to experience relates to neither multicultural background (Chang et al. 2014) nor exposure to multicultural environments (Leung & Chiu 2008). Therefore, multicultural experiences and personality seemed to be independent factors that appear to have important synergistic effects on creativity. In sum, converging evidence based on the existing literature and our reanalysis supports the interactive perspective, which asserts that both environmental variability and dispositional plasticity are necessary conditions for the advent of creativity.

Implicit Theory Level: The Moderating Effect of Racial Essentialism

A second candidate of dispositional plasticity that likely accounts for the moderating effect of multicultural experiences on creativity comes from the

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implicit theory of racial essentialism (Hong et al. 2009; No et al. 2008). *Implicit theories* (or *lay theories*) describe individuals' beliefs about whether a particular concept or trait is fixed or malleable (Molden & Dweck 2006). The original idea was proposed by Carol Dweck and her colleagues, who have conducted a number of compelling studies examining individual differences in the extent to which people perceive their intelligence (Blackwell, Trzesniewski, & Dweck 2007), personality (Yeager & Dweck 2012), and willpower (Job, Dweck, & Walton 2011) as fixed (an *entity* view) or changeable (an *incremental* view). Moreover, recent studies extended the idea of entity versus incremental views to intergroup relationships (Carr, Rattan, & Dweck 2012) and even creative mind-sets (Karwowski 2014). Previous studies (both correlational and experimental) have consistently revealed that the incremental view is associated with indicators of positive psychological adjustment, including better academic achievement (e.g., incremental view of intelligence), interpersonal relationships (e.g., incremental view of personality), and well-being (for reviews, see Burnette et al. 2013; Schleider, Abel, & Weisz 2015).

The role of implicit theories in the link between multicultural experiences and creativity can be best explained using research on *racial essentialism* (Hong et al. 2009; No et al. 2008; Tadmor et al. 2013). Early research on cultural frame switching conducted by Hong and colleagues (2000) revealed that bicultural individuals (i.e., Chinese Americans) exposed to American primes (e.g., Abraham Lincoln's picture) made more internal attributions (fitting with the Western attributional tendency), whereas those exposed to Chinese primes (e.g., Confucius' picture) made more external attributions (fit with the East Asian attributional tendency). By contrast, monocultural individuals could not switch as easily between these two cultural primes. However, later studies did not always replicate the cultural frame-switching effects among bicultural individuals (e.g., Benet-Martnez et al. 2002). For this reason, No and colleagues (2008) extended implicit theories to racial perception in order to explain these inconsistent findings. The basic idea was that bicultural individuals can adopt one of two implicit theories about race: (1) *racial essentialism*, which reflects the belief that race is an inalterable essence, such as biologically or genetically based traits and abilities, and (2) *social constructionist theory*, which reflects the belief that race is socially constructed and malleable across time and space (Hong et al. 2009). Most important, their study revealed that only bicultural individuals who preferred or were primed by the social constructionist theory of race (or lower racial essentialism) displayed the effect of cultural frame switching, whereas bicultural individuals who preferred or were primed by racial essentialism (or lower social constructionist theory) did not.

The distinction between racial essentialism and social constructionist theory of race provides another perspective on the potential influence of multicultural experiences on individuals' creative performance. Specifically, when individuals endorse a racial essentialism mind-set, they are more likely to see multicultural experiences as fixed or stereotypical information that fits with their own inalterable assumptions. In other words, this fixed state may lead to a habitual

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reluctance to consider alternative frameworks or produce new perspectives. This rigid mind-set could prevent the consolidation of new and distant knowledge, impeding processes of creative thinking such as divergent thinking and insight. Research findings from Tadmor and colleagues (2013) confirmed these ideas and showed that primes of racial essentialism hindered the creative performance of bicultural individuals (i.e., Asian Americans). In addition, this effect was mediated by closed-mindedness (Webster & Kruglanski 1994), which refers to an inability to "receive, evaluate, and act on relevant information received from the outside on its own intrinsic merits, unencumbered by irrelevant factors in the situation arising from within the person or from the outside" (Rokeach 1960: 57). Together this research on racial essentialism provides additional evidence in support of the influence dispositional plasticity has on the multicultural experiences–creativity link. Because racial essentialism is beyond the trait level, this perspective highlights the potential of using psychological training or manipulation to enhance bicultural individuals' creativity.

Social Identity Level: The Moderating Effect of Multicultural Identity Integration

The last aspect of dispositional plasticity that is likely to moderate the multicultural experiences–creativity link is multicultural identity integration. Research on multicultural identity integration could be traced back to Berry (1997), who described four types of acculturation strategies individuals may use when they come into contact with a foreign culture. These acculturation strategies can be distinguished by two underlying dimensions: (1) identification with one's heritage culture and (2) identification with one's host culture. A two-by-two matrix with these dimensions yields four acculturation strategies: (1) *separation*, which involves maintaining the traditions of one's heritage culture without participating in the host culture; (2) *assimilation*, which involves maintaining the traditions of one's host culture without participating in the heritage culture; (3) *marginalization*, which involves little or no participation in either the heritage culture or the host culture; and (4) *integration*, which involves maintaining the traditions of one's host culture while participating in the heritage culture. Extending the research on cultural frame switching (Hong et al. 2000) among bicultural individuals, Benet-Martnez and colleagues (2002) found that only bicultural individuals who perceived their dual identities as compatible showed culturally appropriate responses to heritage and host-culture primes, whereas bicultural individuals who perceived their dual identities as incompatible did not.

The relationships among multicultural experiences, creativity, and multicultural identity integration can be further understood through the work from Cheng and colleagues (2008). They found that Asian Americans with high bicultural identity integration (i.e., those who perceive their Asian and American cultural identities as compatible) are more creative than those who with low

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bicultural identity integration in developing new dishes that combined both Asian and American ingredients. In addition, their second study found that women engineers with high gender–professional identity integration (i.e., those who perceive their gender and professional identities as compatible) are more creative than those who with low gender–professional identity integration in developing new technologies for women. Follow-up investigation from Carmit T. Tadmor and her colleagues (Maddux et al. 2014; Tadmor et al. 2012) also demostrated that only bicultural individuals who identified with both host and heritage cultures demonstrated greater innovation and better job performance. However, bicultural individuals who compartmentalized their cultural identity, in which they identified with either the host culture or the heritage culture, did not display this innovative effect.

The psychological mechanism underlying the link between multicultural identity integration and innovation identified in this research was *cognitive complexity*. That is, multicultural identity integration allows individuals to perceive more nuances and subtleties in their environment, which can help them to build the elaborate knowledge structures that are necessary for bringing out creativity. Another study conducted by Saad and colleagues (2013) also supports these notions. Increased level of creativity was only observed among individuals with bicultural identity integration working in bicultural contexts. It appears that multicultural identity integration can help individuals to reorganize dissimilar pieces of cultural information to form new conceptual frameworks. Taken together, these findings also provide evidence suggesting that multicultural exposure alone is not enough to stimulate creativity; how individuals integrate their cultural identities also matters a great deal.

In addition to being a relatively stable individual difference variable, multicultural identity integration has also been treated as a dynamic developmental process. Specifically, Gocłowska and Crisp (2014) built on Amiot and colleagues' (2007) social identity developmental model and described multicultural identity integration as an adaptation process for individuals exposed to multicultural experiences. According to their perspective, there is a series of change processes that individuals may go through on entering a new cultural environment. The first process involves the alternation of conceptual frameworks, in which individuals encounter different cultural information and become adept at switching between different conceptual frameworks. In the second process, individuals are faced with the challenge of resolving conceptual inconsistencies between their "host" cultural experience (or multicultural experience) and their "home" cultural experience; if they succeed in overcoming this challenge, then they become more adept at integrating inconsistent knowledge structures. Finally, in the last process of cultural adaptation, individuals develop a new, inclusive self-definition that draws from a broader range of ideas simultaneously and decrease their reliance on relatively narrow concepts from any single cultural framework. This last process helps to facilitate the creation of novel knowledge structures.

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Table 1 *Moderating Effect of Dispositional Plascitiy-Related Constructs on Multicultural Experience–Creativity Link*

Levels of dispositional plascitiy	Conditions	Could multicultural experiences foster creative performance?	Representative study: Author (year)
Basic trait level: Openness to experience	Low openness to experience	No	Leung and Chiu (2008); reanlysis: Chang et al. (2014)
	High openness to experience	Yes	
Implicit theory level: Racial essentialism and social constructist theory	Racial essentialism	No	Tadmor et al. (2013)
	Social constructist theory	Yes	
Social identity level: Multicultural identity integration	Multicultural identity compartmentalization	No	Cheng et al. (2008) Tadmor et al. (2012); Saad et al. (2013)
	Multicultural identity integration	Yes	

Table 1 summarized the moderated effect of dispositional plasticity on the relationship between multicultural experiences and creativity. We argue that multicultural experiences are a necessary but not sufficient condition for enhancing innovations. The interaction perspective assumes that both multicultural experiences and dispositional plasticity are indispensable factors for increasing creative performance. More specifically, under different levels of dispositional plasticity-related constructs, as bicultural individuals hold higher openness to experience (basic trait level), higher social constructionist theory (or lower racial essentialism; implicit theory level), or higher multicultural identity integration (social identity level), they could benefit from the multicultural exposure and thereby cultivate better creative innovation.

Potential Links among Openness to Experience, Racial Essentialism, and Multicultural Identity Integration

The three facets of dispositional plasticity-related constructs just discussed – that is, openness to experience, racial essentialism, and multicultural identity integration – may have mutual influences on one another via distinct pathways. As indicated in Figure 8.1, openness to experience could be an antecedent to racial essentialism and multicultural identity integration. As addressed by Woo and colleagues (2014), openness to experience is comprised of different dimensions, including curiosity and tolerance for diverse opinions, concepts, and cultural experiences. Moreover, previous research indicates that individuals low on openness to experience are more likely to endorse

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essentialism and to compartmentalize different cultural identities, whereas individuals high on openness to experience are more likely to endorse the social constructionist theory of race and to integrate multiple cultural identities (Benet-Martínez 2012; Benet-Martinez & Haritatos 2005; Fischer 2011). Moreover, openness to experience is at the trait level, which is more biologically based and stable across time and space (McCrae & John 1992). Temporally speaking, it is likely to be a psychological antecedent given its hereditable and static nature. With regard to the relationship between racial essentialism and cultural identities integration, a reciprocal influence tempered by socioeconomic and political factors is likely (Benet-Martinez 2012). Dynamic processes within this dyad need to be examined longitudinally in future research.

Caveats: Possible Confounding of Bilingualism and Engagement in Multiculturalism

Another important line of future research is the investigation of how bilingualism influences biculturalism and creativity. As mentioned by Chen (2015), most bicultural individuals are also bilingual. Despite the substantial overlap between bilingualism and biculturalism, a notable portion of studies focusing on biculturalism did not partial out the effect of bilingualism. Specifically, in the creativity literature, Carringer (1974) found that bilingual (i.e., Spanish-English speaking) individuals outperformed their monolingual (i.e., Spanish-speaking only) counterparts on the Torrance Tests of Creative Thinking. This finding alludes to the possibility that bilingualism moderates the effect of multicultural experiences on creativity. In addition, research has consistently shown that bilingual individuals have better executive functions, such as task switching, inhibition, and working memory capacity, compared to monolingual individuals (for reviews, see Bialystok & Craik 2010; Bialystok, Craik, & Luk 2012). These cognitive functions are also essential to the unfolding of creativity (Kounios & Beeman 2014; Zabelina & Robinson 2010). In order to differentiate and/or integrate the effects of linguistic ability and multicultural experiences on creativity, further work on dispositional plasticity and its link to multicultural experiences and creativity is needed.

Another point of caution with regard to future research on dispositional plasticity, multicultural experiences, and creativity is based on a recent study by Godart and colleagues (2015), who found that both cultural breath (i.e., the number of foreign countries in which individuals had worked) and cultural distance (i.e., the extent to which the culture of one's home country differs from the culture of foreign countries in which the individual had worked) have an inverted-U-shaped relationship with organizational leaders' level of innovation. Their findings indicated that multicultural experiences may be a double-edged sword for creativity. With regard to cultural breadth, when it is too large, individuals' ability to adapt to each of their multicultural experiences may be

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hindered. The same pattern applies to cultural distance: when cultural distance is too great, individuals may feel overwhelmed and unable to absorb and integrate diversity. However, an interesting exception is cultural depth (i.e., the degree to which individuals feel close to a culture and possess a penetrated understanding of that culture), in that great cultural depth still led to higher innovation. The unanswered question is whether dispositional plasticity (e.g., openness to experience and racial essentialism) moderates the curvilinear effects of cultural breadth and cultural distance on creativity. Future studies could examine all these measurements together to obtain a more comprehensive picture of how each aspect of dispositional plasticity influences the relationship between multicultural experiences and creativity.

Conclusion

This chapter dovetails with an emerging literature showing that a complete understanding of the link between multicultural experiences and creativity requires looking beyond the extent of individuals' multicultural experiences. We discussed three aspects of dispositional plasticity – that is, openness to experience, racial essentialism, and multicultural identity integration – and the ways in which each can facilitate the effects of multicultural experiences on creativity. Specifically, bicultural individuals who were high on openness to experience, low on racial essentialism, or high on multicultural identity integration could benefit from their environmental variability, that is, the multicultural experiences, thereby enhancing their creative performance. In addition, we described the need for future studies to investigate the interplay among these dispositional plasticity variables and to study them in combination with important covariates such as bilingualism and multicultural engagement. Further research on integrating multicultural experiences and dispositional plasticity can open up significant new avenues for the enhancement of creativity and uncover important mechanisms responsible for driving successful innovations.

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9 An Integrative Approach to the Creative Personality

Beyond the Big Five Paradigm

Guillaume Fürst and Todd Lubart

Personality has received a great amount of attention in creativity research. Along with cognitive variables, personality traits are central to virtually any description of a creative person. Indeed, personality is at the heart of many theories of creativity (e.g., Eysenck 1993, 1995; Sternberg & Lubart 1995). Although numerous traits relevant to creativity have been identified, a general theoretical framework that organizes them in a meaningful way is lacking. In their review, Barron and Harrington (1981, p. 454) listed the following relevant traits:

> active, alert, ambitious, argumentative, artistic, assertive, capable, clear thinking, clever, complicated, confident, curious, cynical, demanding, egotistical, energetic, enthusiastic, hurried, idealistic, imaginative, impulsive, independent, individualistic, ingenious, insightful, intelligent, interests wide, inventive, original, practical, quick, rebellious, reflective, resourceful, self-confident, sensitive, sharp-witted, spontaneous, unconventional, versatile, and *not* conventional and *not* inhibited.

It has been shown that creative personality inventories based on adjective checklists have good predictive validity (Domino & Giuliani 1997; Gough 1979), but these long enumerations lack theoretical underpinning. In contrast, strong theoretical approaches (e.g., Eysenck 1993, 1995) have promoted thorough empirical research but tend to focus on a relatively small set of variables. To our knowledge, there is no formal model that integrates most of the personality variables known to be relevant to creativity – such as those listed by Barron and Harrington (1981) and those examined in more recent reviews. There have been, however, endeavors for a synthesis based on the Big Five framework (Batey & Furnham 2006; Feist 1998). The problem with these, we suggest, is that the Big Five framework is too general and not particularly relevant for creativity research. Each of the Big Five factors is very broad, with many facets that are at best only vaguely relevant to creativity. In this chapter we propose a model of creativity and personality that focuses on essential features of personality related to creativity. Based on various traditions of research, we introduce a theoretical framework that formally and parsimoniously organizes these traits. This framework builds on past influential theories of personality and creativity but extends and synthesizes them.

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General Definitions and Overall Framework

The creative personality is a complex topic situated in a network of other complex topics. Creativity and personality are already by themselves broad research topics related to other major topics of similar importance, such as cognition and affect. To begin, personality and creativity will be defined, and the general theoretical perspective adopted will be outlined.

Very often *personality* is defined as relatively robust predispositions (i.e., relatively stable traits) that facilitate or hinder the occurrence of various *behaviors*, *thoughts*, and *feelings* (e.g., John, Robins, & Pervin 2008). To give just a few examples, there are personality traits that influence sociability, anxiety, optimism, impulsivity, and also some aspects of cognition (e.g., tolerance of ambiguity and attention to details). The origin of such traits can be genetic as well as learned and influenced by the environment. The field of personality research also often distinguishes between the study of *individual differences* (i.e., the relations between various personality variables at the population level) and the study of the *idiosyncratic organization* of personality traits at the individual level – which makes every person unique.

Concerning *creativity*, in line with Plucker, Beghetto, & Dow (2004), we view it as "the interplay between ability and process by which an individual or group produces an outcome or product that is both novel and useful as defined within some social context" (p. 90). Underlying this definition, it is worth noting that person-related variables enter into the act of creation, which is, in turn, influenced by environmental context and leads to a production (work, idea, outcome).

In this context, the *creative personality* would be defined as follows: a complex array of traits – tendencies toward certain behavior, thoughts, and affect – that are characteristic of individuals who produce novel, appropriate work. In this chapter we consider all key distinctions of personality (i.e., individual differences and idiosyncratic organization of traits and their behavioral, affective, and cognitive implications) in relation to all key distinctions of creativity (person, process, product, and press). Nonetheless we will focus mainly on individual differences that influence the creative process and product. However, we think that research on individual differences should be articulated with research centered on the individual and his or her environment. Hence, although we give more relative importance to individual differences and general laws in this chapter, we propose a model that is compatible with alternative and complementary approaches.

To move toward our final synthetic, integrative, multivariate model of the creative person, we proceed as follows. First, we consider the relations between personality and creativity in the classical framework of the five-factor model of personality (FFM or Big Five). This first step allows us to have a general overview of past research and to understand the key variables at stake. In a second step, we consider some other factors of personality that are of a higher

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order than those of the Big Five, such as psychoticism. This allows us to move progressively toward a possible general model of creativity and personality based on the Big Five and its extensions. At this point, limitations of this approach will be highlighted, and another perspective will be proposed. Following an integrative multilevel approach, we return progressively to important specificities, such as the influence of personality on creativity through cognition, cognitive style, affect, and motivation. Finally, the implications of idiosyncratic personality organization and intraindividual variability are considered. In the discussion, we articulate all these elements together.

Creativity and the Five-Factor Model of Personality

In this section we start by discussing the general relation between creativity and personality within the five-factor model (FFM) (openness, extraversion, neuroticism, agreeableness, and conscientiousness). We base this short review on classic papers that have already discussed the multiple relations between creativity and personality (Batey & Furnham 2006; Feist 1998). These authors distinguish often among different types of creativity (e.g., everyday creativity, artistic creativity, and scientific creativity) and generally use the FFM of personality as a rather consensual framework. Given that all these factors are very broad factors – each of them encompassing many different traits – we use a recent distinction proposed by DeYoung and colleagues (2007), which is a midlevel distinction between broad factors (or domains) and specific traits. Occasionally, we discuss as well the role of very specific traits or facets of the broader factors. Then we discuss the relations between creativity and personality in the framework of other models of personality, namely, the *Gigantic 3* (extraversion, neuroticism, and psychoticism/disinhibition) and the *Huge 2* (plasticity and stability).

Openness

Openness (O) is a factor related to imagination, fantasy, aesthetic sensitivity, attentiveness to inner feelings, preference for variety, intellectual curiosity, and unconventional values (McCrae & Costa 1997). This factor is also sometimes called *intellect* and related to other similar traits, such as artistic imagination, introspective reflection, and intellectual knowledge (Goldberg 1992; Saucier 1994).[1] Other authors (e.g., Caprara & Perugini 1994; De Raad, Hendriks, & Hofstee 1992) also include in openness such traits as independence and nonconformity.

O is definitely the factor of the Big Five that is the most strongly and reliably related to creativity. According to Costa and McCrae (1992), O is the fundamental dimensions related to artistic temperament. Empirically, O is positively related to divergent thinking (McCrae 1987), artistic and scientific creativity (Feist 1998), and everyday creativity (Batey & Furnham

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2006). According to Batey and Furnham (2006), O consists of both an attitudinal openness to new experience and an inability to inhibit irrelevant information (a perceptual openness), which can facilitate access to original, unexpected ideas.

A possible distinction between openness and intellect has often been discussed, especially in recent years. According to DeYoung and colleagues (2007) and Johnson (1994), openness and intellect can be meaningfully distinguished. In this perspective, *openness* represents a heightened sensitivity to aesthetics and beauty, whereas *intellect* represents a strong interest in ideas and the quest for truth. According to Nusbaum and Silvia (2010), openness is more closely related to creativity, whereas intellect is more closely related to intelligence. DeYoung, Grazioplene, and Peterson (2012) have shown that the "ideas" facet of openness is indeed close to intelligence, whereas the "aesthetic and feeling" facet are close to positive schizotypy (a tendency to experience unusual perception experiences and magical ideation), also called *apophenia*. In short, apophenia is a tendency to see patterns and causal connections where none actually exist. These two last traits are at the core of schizotypy, which is also known to be related to creativity (Eysenck 1993). Arguably, this kind of openness can be assimilated to the perceptual openness mentioned by Batey and Furnham (2006).

Extraversion

Extraversion (E) is generally conceptualized as a high-order factor embracing high energy, sociability, warmth, enthusiasm, excitement seeking, dominance, self-confidence, assertiveness, and positive emotion (John & Srivastava 1999; McCrae & Costa 1999). Many of these traits have been found to be positively associated with many measures of creativity. Self-confidence and dominance in particular appear to be characteristic of both scientists and artists (Feist 1998). E is also positively correlated with divergent thinking and everyday creativity (Batey & Furnham 2006). Sociability has shown mixed relationships with artistic and scientific creativity, especially for high creative achievers, who need supposedly a lot of time alone for thinking and elaborating ideas (Feist 1998). Sociability can, however, be positively related to everyday creativity (Batey & Furnham 2006) and to social network size, which can be, in turn, positively related to creativity (Kéri 2011).

According to several authors (e.g., Depue & Collins 1999; DeYoung et al. 2007), the general factor of extraversion can be split into a dimension of *agency* or *assertiveness* and a dimension of *sociability* or *enthusiasm*. It is possible that the agency dimension of extraversion is relevant for virtually any type of creativity, whereas the sociability facet differs from domain to domain (see, e.g., Silvia, J.C. Kaufman, & Pretz 2009). It is also very likely that extraversion has an indirect effect on creativity through positive affect. Indeed, positive affect has long been known to have a positive impact on creativity (e.g., Isen, Daubman, & Nowicki 1987; Vosburg 1998). According to DeDreu, Baas, and

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Nijstad (2008), a positive activating mood (happy, elated) influences creative fluency and originality because of enhanced cognitive flexibility.

Neuroticism

The neuroticism (N) factor encompasses traits such as anxiety, depression, and negative affect in general, as well as self-consciousness, impulsivity, irritability, and vulnerability (John & Srivastava 1999; McCrae & Costa 1999). For N, domain or field specificity appears to be important. According to Feist (1998), artists are more anxious, emotional, and sensitive, whereas scientists are more likely to be affectively stable. However, it is unclear whether N has just an influence on the preference for certain domains of creativity, leading neurotic people to choose an artistic field to express themselves (Eysenck 1993), or N is really a facilitator in art, leading to higher achievement through higher sensitivity to emotional stimuli and communication of emotional ideas in a work of art (Batey & Furnham 2006).

According to DeYoung and colleagues (2007) and Saucier and Goldberg (2001), the N factor can be split into two main subdomains: *withdrawal* (anxiety, negative affect, and fearfulness) and *volatility* (labile affectivity, irritability, and angry hostility). Zuckerman and colleagues (1993) have also shown that the angry hostility facet is negatively related to the agreeability factor, whereas the impulsivity facet is negatively related to the conscientiousness factor. It is likely that volatility has a positive impact on creativity, at least if it is not too high. Some features of volatility (high impulsivity, low agreeableness) are reminiscent of psychoticism (discussed in the next section) as well as subclinical personality traits, such as cyclothymia, which seems to be positively related to creativity (Richards et al. 1988). It is also possible that N has an indirect impact on creativity through negative affect. Indeed, according to De Dreu and colleagues (2008), negative affect can induce higher creativity because of enhanced persistence. (These considerations about personality, affect, and creativity are further elaborated in Section "An Integrative View of the Creative Personality".)

Conscientiousness

Conscientiousness (C) is a factor that regroups traits such as self-discipline, dutifulness, dependability, achievement striving, preference for planned, organized behavior, and deliberation (low impulsivity) (John & Srivastava 1999; McCrae & Costa 1999). Generally speaking, C appears negatively related to artistic creativity and positively related to scientific creativity, but the reality is more subtle. First, whereas scientists are higher on C than the general population or than artists, highly creative scientists, when compared to less creative scientists, are lower on C (Feist 1998). This is consistent with the fact that low C scores are characteristic of people high on psychoticism, which is often seen as an advantage for creativity (see next section for further details). However, because C is also positively related to organization, work efficiency, and need

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for achievement, high C scores also might be favorable to creativity, especially to high creative achievement.

One possible way to make sense of this apparent paradox is to consider the two main subdimensions of conscientiousness suggested by DeYoung and colleagues (2007): *industriousness* and *orderliness*. Orderliness typically refers to traits such as perfectionism, preference for routine, and tidiness. Industriousness is more specific to achievement striving, efficiency, and self-discipline. Hence it is possible that low orderliness and high industriousness are favorable to creativity. In a study by Fürst, Ghisletta, & Lubart (2014), it was indeed found that the variance of the C factor can be split in two parts: one part that is positively related to high nonconformism and high impulsivity and another part that is positively related to high persistence and need for achievement.

Agreeableness

The general **a**greeableness (A) factor is typically defined using traits such as compliance, cooperativeness, modesty, tender-mindedness, altruism, and straightforwardness. A is most often negatively associated with creativity; creative people, especially artists, but also scientists, are more likely to be hostile, asocial, unconventional, and norm rejecting (Feist 1998). Batey and Furnham (2006) reviewed several studies showing that creative people have tendencies toward low A, being less deferent and team oriented, less socialized, self-controlled, tolerant, and concerned with good impressions.

Once again, the broad traits proposed by DeYoung and colleagues (2007) can help to clarify a bit this somewhat dramatic picture. These authors proposed a split of the A factor in the two subdomains of *compassion* (warmth, sympathy, understanding) and *politeness* (cooperation, pleasantness, modesty). It is possible that low politeness – especially low conformism and low concerns for a good impression – is more relevant for creativity than low compassion. Moreover, creative people may not necessarily mean to be impolite or aggressive; maybe it is just that they want to "do things their way," and they are confronted with cooperation issues because their methods are unusual. However, it is also possible that creative people are cold, stubborn, and aggressive because these traits are typical of psychoticism, a factor supposedly central to creativity that we are going to consider now.

Creativity and Higher-Order Factors of Personality

In this section we move up the hierarchy of personality factors and consider higher, second-order traits, namely, plasticity, stability (DeYoung 2006; Digman 1997), and psychoticism (Eysenck 1992b). These *superfactors* have an important synthetic potential, and although they may sometimes appear overly general or excessively multifaceted, they provide an excellent

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bird's-eye view of all the traits and lower-order factors we discussed in the preceding section.

Psychoticism

Eysenck (1993) made interesting suggestions for an integrative theory of personality and creativity based on the concept of psychoticism (P). P is composed of several lower-order traits such as aggressive, cold, antisocial, and impulsive and can be more simply conceived as a combination of the inverse of the A and C factors of the Big Five (Zuckerman et al. 1993), as shown in Figure 9.1. Many details about the conceptualization of P have been vigorously debated (Costa & McCrae 1992; Eysenck 1992a); however, this factor has a long-standing reputation in the personality literature. It has been found to be very close to corresponding factors in other theories based on three superfactors, in particular, from the factor of disinhibition (Clark & Watson 1999; Watson & Clark 1993), which regroups traits such as impulsivity, recklessness, risk taking, and a tendency to focus on the immediate moment rather than carefully planning or considering the long-term implications of behavior – all typical of low-C.

Eysenck (1993) has argued that P constitutes a genetic advantage for creativity, principally through its relation with low cognitive and behavioral inhibition, which consequently leads to higher ideational fluency and originality, as well as to higher independent and norm-challenging behavior. Although probably not sufficient in itself, because it does not take into account other factors

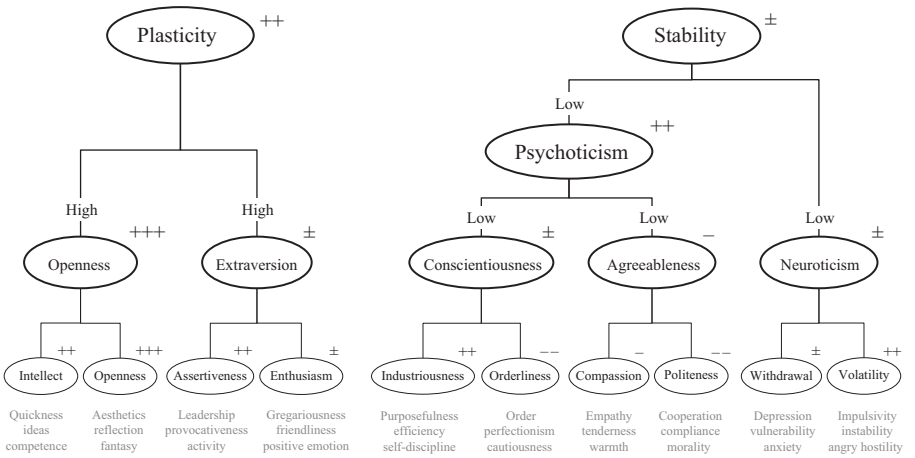

Figure 9.1 *Hierarchical structure of personality traits.* Note: *The + and – signs refer to the positive or negative impact of each factor on creativity; paradoxical effects are symbolized with a ±. The* high *and* low *on the lines connecting two factors indicate the nature of their relationship (high = positive correlation; low = negative correlation). Traits at the very bottom level are samples of representative traits of the 10 subdomain factors. See DeYoung et al. (2007) for further information.*

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such as motivation or affect, this parsimonious theory has, however, provided insightful lines of research and has led to many supporting empirical results. The P factor, or more specific traits defining it, has indeed often been found positively related to artistic and scientific creativity, as well as to divergent thinking (originality in particular) and everyday creativity (Acar & Runco 2012; Batey & Furnham 2006).

These considerations pave the way to further reflection about the relation between inhibition and creativity. Cognitive inhibition and latent inhibition in particular have been the object of increasing attention in creativity research. *Latent* inhibition refers broadly to a tendency to filter or ignore past familiar stimuli (Lubow & Gewirtz 1995). People with low latent inhibition do not forget or ignore easily stimuli previously experienced as irrelevant. More generally, people with low *cognitive* inhibition have trouble filtering information from entering consciousness. Cognitive inhibition and latent inhibition have been found to be negatively related to psychosis and traits characteristic of a proneness to psychosis, such as psychoticism and schizotypy (Lubow et al. 1992). More recently, latent inhibition has been found to be positively related to openness (Peterson & Carson 2000; Peterson, Smith, & Carson 2002) and to real-life creative achievement (Carson, Peterson, & Higgins 2003). Together these results indicate that people with low inhibition (i.e., unable to filter information) are more likely to be more prone to psychosis and have a higher probability to manifest relatively greater creativity.

Stability and Plasticity

Although the factors of the Big Five were originally conceived as independent factors, a growing body of literature suggests that higher-order factors may meaningfully account for the correlations that are actually often observed between some of these five factors (DeYoung 2006; Digman 1997). These two higher-order factors are *plasticity*, characterized by high O and high E, and *stability*, characterized by low N, high A, and high C. More synthetically, stability can also be seen as a composite of low N and low P (see Figure 9.1).

From what we saw in the preceding section, plasticity appears as a powerful predictor of creativity; because E and O are overall positive predictors of different kinds of creativity, it seems reasonable to suppose that the joint contribution of these two factors will have good predictive power. Although empirical studies on plasticity and creativity are still quite rare, recent results have indeed shown that plasticity is highly and positively related to various measures of everyday creativity, with effect sizes ranging from ~.30 to .70 (Silvia et al. 2009). Moreover, Fürst and colleagues (2014) have shown that plasticity can be extended to incorporate the concept of inspiration. A small scale of inspiration was actually the best marker of this factor, whose predictive validity was good; correlations with a measure of idea generation in two studies ranged from ~.30 to .60.

Stability also holds great potential for synthesizing many relations mentioned in the preceding section. More specifically, stability should be negatively related

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to artistic creativity; being "unstable," meaning nervous, not agreeable and not conscientious, should be an advantage in the arts. However, there are several problems with such a simplistic perspective. First, the C factor is not very well explained by the higher-order stability factor; that is, in such a model, most of the variance of C remains specific to C and does not contribute much to the estimation of stability (DeYoung 2006). This could be problematic because the role of C – quite complex but apparently important – could be totally eclipsed behind this very broad stability factor. Second, the predictive validity of this factor is much lower than for plasticity: Silvia and colleagues (2009) found effect sizes in the range of .30 or below, and Fürst and colleagues (2014) found no effect at all.

At this point, the situation could be summarized as follows: as just discussed and represented by the "++" signs in Figure 9.1, plasticity seems to be unambiguously and positively related to creativity. For stability, things are more complicated; it would be a rash simplification to conclude that a low stability is preferable for creativity – hence the sign "±" placed next to it in Figure 9.1. Furthermore, and even for plasticity, such a very high-level synthesis does not account for many relations between creativity and personality. Although the role of O is quite clear, the impact of the broad E factor is not without ambiguity; if we can conclude reasonably that assertiveness is generally favorable for creativity, the role of enthusiasm and its underlying traits is much more ambiguous. For stability, if we go down the hierarchy of subfactors and traits below it, things get critically complicated. The apparent positive effect of psychoticism hides all the difficulties aforementioned with the C factor, whereas the N factor also has its fair share of thorny surprises – volatility may play a positive role, just as negative affect could to a certain extent, but it would be unwise to conclude that withdrawal, anxiety, and depression are good for creativity (Silvia & Kimbrel 2010). In the end, we find paradoxes at almost every level of analysis.

An Integrative View of the Creative Personality

A Metaframework

To try to overcome these difficulties, we propose a slight change of perspective. Instead of a two-factor model of personality and creativity based on plasticity and stability, we would like to consider a more general two-dimension theory of creativity, putting aside for a moment the personality variables. The two general dimensions of this model are *order* and *chaos*. Such a distinction is certainly not a novel idea; rather, it has been omnipresent in an incommensurable number of past theories, as we will soon see. These two dimensions have been proposed by Rea (2003) to account for what can be called *creative intelligence*. In a few words, order corresponds to cold-ordered thinking, and chaos corresponds to hot-chaotic thinking. The general idea of this order and chaos

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Table 9.1 *The Two Dimension of Chaos and Order and Other Theories of Creativity*

Author	Chaos	Order
Guilford (1950)	Divergent thinking	Convergent thinking
Campbell (1960)	Variation	Selection
Simonton (1997)	Ideation rate	Elaboration rate
Suler (1980)	Primary process	Secondary process

model is that creativity lies somewhere between these two dimensions – too much order would lead to dry and unproductive intelligence, whereas too much chaos would lead to messy thinking and nonsense.

In his original chapter, Rea discussed these two dimensions as two extremes of a nonlinear "order-edge-chaos" continuum. It is worth mentioning that this discussion took place in the wider context of complex adaptive systems, with an important place given to nonlinearity and phase transitions. However, we will not go into further detail on this in this chapter.[2] Rather, we will consider how past classical research on creativity could fit in this general order-and-chaos dichotomy. In all cases, the central idea remains the same: creativity is viewed as a point of equilibrium between these two extremes. We believe that this synthetic general approach holds enormous promise for an integrative theory of creativity. It is possible that it has not yet achieved popularity in the field because it is too abstract and remote from more classical theories. Hence our intention here is to place this relatively unknown approach in relation to other mainstream and influential theories of creativity.

Let us start at a very general level. As Table 9.1 shows, the chaos dimension can be seen as analogous to the classical dimension of *divergent* thinking and the order dimension can be seen as analogous to *convergent* thinking (Guilford 1950). This dichotomy is also reminiscent of the model proposed by Campbell (1960). The idea of this approach is that creativity relies on two main mechanisms: *variation* and *selection*. Variation can be seen as a blind, random process that is at the origin of idea production. The selection mechanism is responsible for the selective retention of worthy ideas. This theory has been further developed by Simonton (1997), in which the variation process corresponds to an *ideation rate* and the selection process to an *elaboration rate*. In both models, variation and ideation are considered as quite chaotic and unpredictable, whereas selection and elaboration are somewhat more controlled and ordered processes. In yet a different perspective, the chaotic and uncontrolled nature of variation and ideation rate is arguably analogous to the psychoanalytic notion of *primary processes* (e.g., Suler 1980), which refers to loose, automatic, and illogical ideation. Similarly, selection and elaboration are analogous to *secondary processes*, which refer to conscious elaboration of meaningful ideas or product. In this theory, as in the others mentioned earlier, creativity relies on an interplay or equilibrium between these two types of processes.

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Table 9.2 *Personality Variables and Order and Chaos*

	Chaos	Order
High-order factors (Gigantic 2, Huge 3, Big Five)	*(Low stability, high plasticity)*	*(High plasticity, high stability)*
	High psychoticism (P)	High openness/intellect (O)
	High openness/intellect (O)	
Broad traits (10 subdomains by DeYoung and colleagues)	High openness (O+)	High intellect (O+)
	Low orderliness (C–)	High industriousness (C+)
	High volatility (N+, A–, C–)	High assertiveness (E+)
Specific traits	Inspiration (O+, E+)	Purposefulness (C+, N–)
	Novelty seeking (E+, P+, O+)	Self-discipline (C+, N–)
		Efficiency (C+, E+)
	Risk taking (E+, P+)	Achievement striving (C+, E+)
	Impulsivity (E+, P+)	
	Nonconformism (P+)	Perfectionism (C+, N+)
	Apophenia (O+, P+)	Quickness (O+, N–)

Personality Variables and Order and Chaos

Now that the overall metatheoretical stage is set, we can come back to our personality variables and see how they could possibly fit the scheme. Ideally, it would have been convenient if, for instance, high plasticity corresponded to high order and low stability to high chaos. However, this angle does not really work. To a certain extent, psychoticism can be seen as quite representative of chaos, due to its underlying impulsive and nonconformist traits. By extension, low stability (i.e., high N, low C, and low A) also could be synonymous with chaos. However, high stability also could be considered as the perfect example of order. One could argue that plasticity is more representative of order, for example, because of the openness/intellect factor. All this is very fragile, and inconsistencies multiply as we look at it closer. Stability and plasticity nonetheless figure in the recapitulative Table 9.2 for the sake of exhaustivity, but one should not pay too much attention to it, for it does not hold much promise. Also, the presence of openness in both columns of this first row may appear like an easy solution to a difficult problem – and to a certain extent it is – but this is actually motivated by several reasons. The first is to represent the overwhelming presence and importance of this factor for creativity. Beyond this, there are also other specific reasons for this double presence of O that will be clarified when we consider in more details how the underlying traits of this factor are distributed in the lower rows of the table.

Before we discuss these details, a general point has to be mentioned: not all the factors of the Big Five are present in this table. This is, a deliberate choice because we feel that many of the factors of the Big Five are actually much too broad to be included in a meaningful theory of creativity and personality. This should be clear from the first part of this chapter, replete with the report of

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contradictory findings about the role of N, C, or E in relation to creativity. The use of the Big Five framework has reached a ceiling in terms of understanding the relationship between creativity and personality. The new (or renewed) approach proposed here, based on order and chaos, leads us to shift perspective and look at these personality factors from a different angle. The Big Five literature has provided an interesting synthesis up to now, but we argue that it is time to move to a theory that is more specific and relevant for creativity research.

Given this, we can now consider the second row of Table 9.2. This second row focuses on some of the 10 *subdomains* or *broad traits* proposed by DeYoung and colleagues (2007). First, we can see that the general O (openness/intellect) factor is now split up and distributed in two columns. Consistent with what was discussed earlier, intellect fits in the order column because this factor is close to intelligence (DeYoung et al. 2012; Nusbaum & Silvia 2011) and, by extension, convergent thinking. The openness factor is in the chaos column because it is close to schizotypy or apophenia (DeYoung et al. 2012). Similarly, the two main aspects of C are also distributed in two separate columns. Industriousness is in the order column because it represents traits such as purposefulness and efficiency, essential to performing sustained work allowing the organization and elaboration of creative ideas. The orderliness factor is in the chaos column because people with low scores on this factor tend to be messy, to dislike routine, and to accept things even if everything is not "just right." This is reminiscent of tolerance to ambiguity and psychoticism, both related to creativity (Eysenck 1993; Zenasni, Besançon, & Lubart 2008). This is probably the aspect of the general C factor that is responsible for the positive correlations that have been reported between C and creativity. The last factors of this level of analysis are the broad traits of volatility and assertiveness. Volatility represents traits such as affective instability and a tendency to be easily annoyed, agitated, and angry. This is also close to psychoticism (low C and low A) as well as to the impulsiveness and immoderation facets of N. This is clearly a factor of chaos. However, assertiveness, which is in the order column, represents traits such as leadership and activity (e.g., take charge, influence people). These are seen as relevant for order because observable, manifest creativity needs that kind of motivation so that "things get done" and good ideas do not stay in the mind of a creator or in a drawer of a desk in an embryonic state.

Finally, the last row of the Table 9.2 lists some even more specific traits. In the order column we find many traits that underlie the industriousness and intellect broad factors described earlier. To a certain extent, some of these traits are also positively related to extraversion and emotional stability (see DeYoung et al. [2007, p. 884] for further details). All these traits are relevant to fast, efficient, and purposeful work that allows the development of promising ideas. In the chaos column we find specific traits that underlie mostly the O, E, and P factors. Inspiration has been found to be very close to O and E, or the plasticity factor (Fürst et al. 2014). Variables from the spectrum of novelty seeking, excitement seeking, risk taking, and impulsivity are known to be

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midway between E and P (e.g., Depue & Collins 1999; Zuckerman & Cloninger 1996). These, along with nonconformism, more specific to P, are the variables that push people to try new ways of doing things or new ways to think without worrying too much about "what could go wrong" or "what others could say." Finally, the variable of apephonia (or positive schizotypy) represents attempts at seeing new patterns and relations between ideas, even if there is a high risk that they would be erroneous or unfruitful. All these variables hence represent the adventurous, bold, and even sometimes dangerous explorations without which creativity would not exist in the first place.

One noticeable thing at this point: along with the paradoxical role of certain factors (C in particular), other cells in Table 9.2 imply somewhat incompatible traits or abilities. For example, people high on volatility are less likely to be high on industriousness (the two factors correlated ~ –0.50) (DeYoung et al. 2007). Hence it is likely that creativity relies on a tradeoff or some fragile equilibrium point; certain levels of volatility and psychoticism are useful to a certain extent, but they should not be too high; otherwise, they would have a negative impact on industriousness . This will be further elaborated in the "Discussion" section. For now, we continue to develop this order and chaos approach to other aspects of the creative person.

A System View of the Creative Person

The idea of this section is now to mix the ideas of the preceding section with another classical tradition in psychology: the basic distinction between *cognition*, *personality*, and *affect*. Using a very simple perspective, we posit that *motivation* can be seen as the overlap of affect and personality, *cognitive style* as the overlap of personality and cognition, and *processing depth* as the overlap of cognition and affect. Thus the aim of this section is to review how the two dimensions of order and chaos can be found in all these components. Here we leave progressively the correlational approach to enter the territory of individual functioning. Figure 9.2 proposes a graphical representation of the organization of these components. It is very sketchy, but this should be enough for our purposes. In this figure, the large outmost line represents the whole person. Nothing is represented outside of it only because our central focus here is on the functioning of the person, but one could certainly add other people in the social realm or more abstract systems such as a field or a domain of creativity (see Feldman, Csikszentmihalyi, & Gardner [1994] for an example of such diagrams and integrative system theory).

Table 9.3 summarizes how order and chaos can be found in each of these components. The table starts with cognition and proceeds with each component following a circular clockwise movement. The first row of this table actually is a summary of previous sections: chaos in the domain of cognition is characterized by fast, automatic ideation and the ability to combine and expand knowledge in a new (and sometimes risky) manner; order is represented by much slower processes such as controlled elaboration, evaluation, and verification. This

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Table 9.3 *Order and Chaos in the Various Subsystems of the Creative Person*

	Chaos	Order
Cognitive processes and abilities	Synthesize, combine, expand	Analyze, evaluate, verify
	Fast, automatic ideation	Slow, controlled elaboration
	Divergent thinking, generation, low latent inhibition (LI)	Convergent thinking, selection, general intelligence (*g*)
	See also Table 9.1	See also Table 9.1
Processing depth	Shallow, heuristic processing	Deep, systematic processing
	Quick idea association	In-depth analysis
	Many superficial searches	One methodic search
Affect	Extreme arousal (excitation or sleepiness)	Moderate arousal (calmness, concentration)
	Positive affect (PA)	Negative affect (NA)
	Facilitate loose associations and flexibility	Facilitate effortful work and persistence
Motivation	Enthusiasm	Dissatisfaction
	Challenge, interest, pleasure	Mastery, importance, seriousness
Personality	Extraversion ↔ PA	Neuroticism ↔ NA
	Openness, psychoticism ↔ LI	Intellect ↔ *g*
	Novelty seeking	Industriousness
	See also Table 9.2	See also Table 9.2
Cognitive style	Innovators, finders	Adaptors, seekers
	Preference for holism and broad conceptualization	Preference for analysis and narrow conceptualization

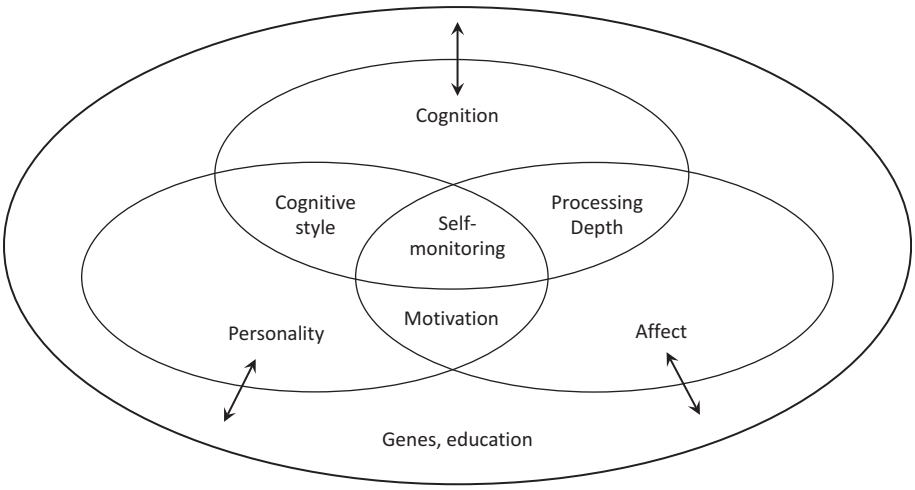

Figure 9.2 *Schematic view of subsystems inside the creative person.*

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proposition is in line with the elements synthesized in Table 9.1, as well as with other syntheses, such as the synthesis on cognitive regularities in creativity by Bink and Marsh (2000), who distinguish between generation (idea production and synthesis) and selection (idea evaluation and elaboration).

The second row, "Processing depth," refers to two main types of information processing: heuristic and systematic. The former is a superficial and relatively automatic mode of processing information; the latter corresponds to a deeper and thorough mode of thinking (e.g., Chaiken & Ledgerwood 2012; Newell & Simon 1972). The real interest here comes when we consider the impact of *affect* on information processing. Specifically, positive affect induces heuristic processing that lacks logical consistency, with little attention paid to details, and fosters unusual associations; conversely, negative mood elicits an analytical mode of processing information, a high degree of logical consistency, and considerable attention to detail (Schwarz & Bless 1991). These theoretical elements are very similar to – and partially at the origin of – the model by DeDreu and colleagues (2008), according to which negative affect fosters persistence and positive mood enhances flexibility. In a different but related perspective, Martindale (1999) has argued that extreme levels of arousal (intense excitation on the one hand and sleepiness on the other) are favorable to loose and remote association, whereas moderate levels of activation are more favorable to elaboration and conscious work[3].

All these considerations about affect show that mood and emotion have long and important ramifications; they are related to both processing depth and motivation variables. Indeed, the notion of motivation is quite inseparable from affect. If we look in the motivation cells of Table 9.3, we can see a distinction between Enthusiasm (related to positive affect) and Dissatisfaction (related to negative affect). These are arguably the two main motivations that are at the origin of all creative endeavors (see also Rea, 2003).

If we now come back to personality, we can synthesize elements discussed in the section "Creativity and the Five-Factor Model of Personality" that did not figure in Table 9.2. First, the "Personality" row of Table 9.3 shows that extraversion may have an impact on creativity through its correlation with positive affect, whereas neuroticism could foster persistence and perfectionism through negative affect. Moreover, volatility also may be relevant in the affect spectrum, for it is related to affect instability; given the advantage of both negative and positive affects, as well as of a variety of levels of arousal, volatility may facilitate access to the whole spectrum of these various affective states. Furthermore, personality is also connected to cognitive factors. Intellect is positively related to general intelligence (*g*), whereas openness and psychoticism are related to latent inhibition. Personality also has important motivational implications, in particular, through variables such as novelty seeking (P, E, and O) and industriousness (C).

Finally, at the crossroads between personality and cognition lie *cognitive styles*. This is again a vast literature that is impossible to review exhaustively here (for such a review, see Kozhevnikov 2007). Quite simply, here our only

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goal is to show that many – but obviously not all – cognitive styles can fit well in Table 9.3. For instance, we believe that Kirton's (1976) *innovators*, who prefer original thinking and norm-challenging behavior, would have their place in the "Chaos" column. Conversely, *adaptors*, who are more concerned with resolving problems and searching for improvement, would fit nicely in the "Order" column. Consistent with this idea, Kwang and Rodriguez (2002) have shown that adaptors are more conscientious and innovators more extraverted. In the same vein, see also convergent and divergent thinkers as described by Brophy (2000) and Cropley (2006). In a different (historical) approach, Galenson (2006) distinguished between *finders*, who innovate quickly and at a young age, and *seekers*, who progress slowly through a long trial-and-error process. We think that finders would go well in the "Chaos" column and seekers in the "Order" column, though it is a bit speculative.

More generally, Table 9.3 is also reminiscent of the distinction between *experiential system* and *rational system* proposed by Epstein (Epstein 1990; Epstein et al. 1996).[4] According to this theory, the rational system is analytic, logical, systematic, intentional, effortful, and conscious – this system has been operationalized through need for cognition, which is very close to intellect (DeYoung et al. 2012). Complementarily, the experiential system is holistic, automatic, fast, effortless, and driven by affect. Both systems fit nicely in Table 9.3, *experiential* in the "Chaos" column and *rational* in the "Order" column.

Discussion

In this chapter we tried to synthesize a various number of approaches that have been of central importance for the study of the creative personality. The general model that we propose here provides a compilation and articulation of past research; it is not a completely new approach that implies any radical change of perspective. Rather, the hopes and efforts underlying the elaboration of this framework were those of unification and synthesis between different traditions. In closing, we now offer some general consideration about this model, how it can shed light on the complex nature of the creative personality, and what are its implications for practical applications and future research.

With its two dimensions, this order-and-chaos model is obviously very general. However, as we hope to have made clear, it can possibly be specified in many various ways. Indeed, the personality traits and factors discussed here have many implications. First, most of these traits have general, direct impact on creativity (i.e., variable listed in Table 9.2). Second, many of these variables have indirect or more specific implications, through the various subsystems represented in Figure 9.2 (cognition, affect, motivation, etc.). For example, openness and intellect are closely connected to intelligence, apophenia, and latent inhibition, which all have an impact on creativity. Similarly, extraversion and neuroticism can have an important influence on creativity through their

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close relations with mood. Further, these mood variables can have a significant influence on cognition (processing depth in particular) that seems quite relevant to creativity. Finally, at the crossroads between personality and cognition lie various cognitive styles, many of them being known to also affect creativity.

Beyond these general considerations, this order-and-chaos framework points out one last very important issue. We have seen that things are not as simple as having one group of variables going in the order category and another group of variables, independent of the first group, going in the chaos category. On the positive side, it seems that several traits in the same category tend to be positively correlated (e.g., in the "Order" column of Table 9.2, intellect, industriousness, and assertiveness are positively correlated, as reported by DeYoung et al. [2007])[5]. However, the whole picture is more complex than that. First, some traits of one category can be relatively independent (e.g., in the "Chaos" column, openness is almost uncorrelated with volatility; again, see DeYoung et al. [2007]). Second, some traits in different categories can be positively correlated (e.g., intellect and openness). Third, some traits in different categories are also sometimes negatively correlated (e.g., industriousness and order). Although this might appear messy, most of these "exceptions" should not be seen as anomalies in an otherwise neat taxonomy. On the contrary, we believe that all these exceptions can be seen as very meaningful.

First, the independence of traits in a given category (column) reveals the cumulative impact of different traits and is consistent with confluence approaches (e.g., Sternberg & Lubart 1995). Second, the positive correlations between traits of different columns suggest that some general factors of the Big Five (openness in particular) have meaningfully distinguishable facets (DeYoung et al. 2012). We believe that the distinction between these facets deserves to be emphasized because some distant traits of the continuum that constitutes the openness factor are virtually uncorrelated, such as need for cognition (intellect) and apophenia (openness). Third, and this is probably the more critical issue, the negative correlation between traits present in different columns of the order-and-chaos tables reveal that creativity might partially rely on some paradoxical abilities. Csikszentmihalyi (1996) proposed a theory including these kinds of findings, referring to the complexity of creative personality. Typical manifestations of complexity are the fact that creative people tend to be playful and serious, humble and proud, and extraverted and introverted. Hence the dual nature of many aspects of the creative personality seems to be essential rather than anomalous. Moreover, there are other theories of creativity based on a similar idea. For example, Rothenberg (1996) has proposed that the janusian and homospatial processes (i.e., integration of opposites) are central to creativity. In a different but related vein, a recent article by Gocłowska and Crisp (2014) shows how the integration of two inconsistent social identities can foster creativity.

As an ultimate synthesis, we would like to propose a last figure (Figure 9.3) that provides a summary of the model discussed throughout this chapter and also integrates the issue of paradoxical abilities or complex personality. This figure is

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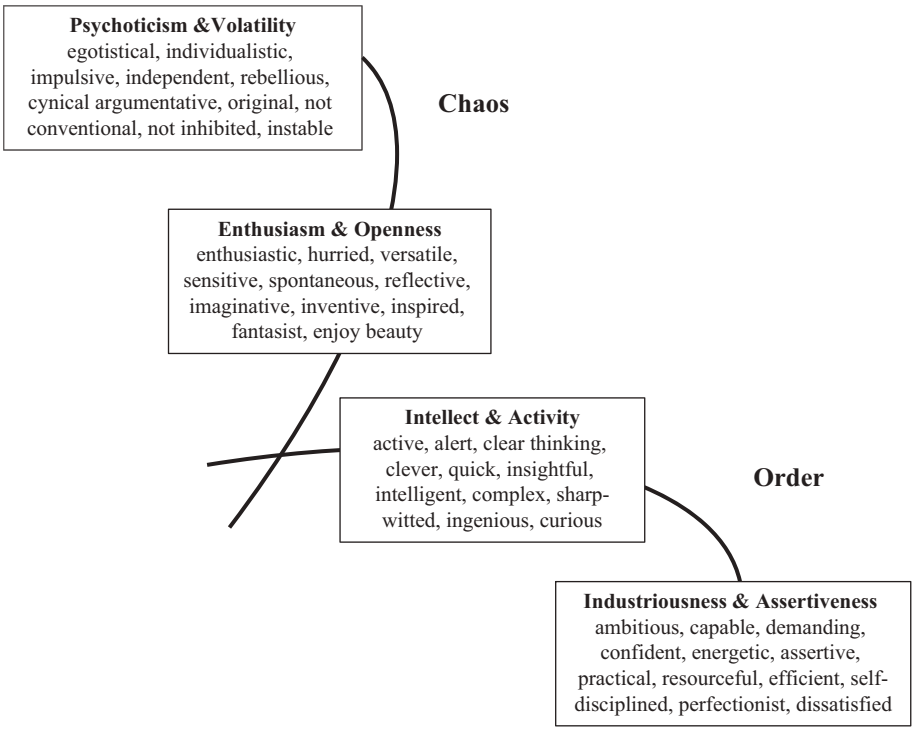

Figure 9.3 *Summary of the order-and-chaos integrative model.*

composed of four main boxes, each of them including various correlated traits – those listed in the preceding tables and most of the traits from Barron and Harrington's (1981) review listed in the opening of this chapter. These boxes are arranged in a nonlinear two-dimensional space of order and chaos. We explain the twisted axis as we describe the four boxes and their relations to each other.

Let's start with the central-most boxes. The "Enthusiasm & Openness" box regroups traits such as sociability, positive emotion, and attitudinal and perceptual openness. According to the position of this box in the diagram, these traits are representative of a moderate level of chaos and relatively neutral level of order; they favor idea production and novelty seeking but do not preclude a high level of order (e.g., high industriousness). The second central box, "Intellect & Activity," represents high intellectual curiosity and high level of energy. This box is considered representative of moderate levels of order and a neutral level of chaos; together these traits are favorable to deep processing and elaboration of ideas, but they do not preclude high level of chaos (e.g., high psychoticism). One thing worth noting at this point: as the axes suggest in this region of the graph, traits of these two boxes are likely to correlate positively – indeed, all of them could be subsumed under the plasticity factor.

The two other boxes are related in a different way. The "Psychoticism & Volatility" box represents typical traits of chaos – impulsivity, instability, recklessness, anticonformism, and so on. These traits can bring very innovative

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ideas and/or quite aggressive ways of defending them. However, unlike traits in the "Enthusiasm & Openness" box, high scores on these traits tend to imply low scores on the typical order traits listed in the "Industriousness and Assertiveness" box. For example, psychoticism is just plain antonymic of "disciplined" or "perfectionist." Hence very high levels of chaos tend to imply a low level of order. And, of course, the reverse is true. Traits typical of very high order, listed in the right-most box, tend to be negatively correlated with typical traits of chaos. For example, volatility is negatively correlated with industriousness (~–.40) (see DeYoung et al. 2007).

Finally, to conclude concerning this diagram in relation to the complex nature of the creative personality, we could say that creative people are able to manage quite high levels on all these factors; they can accommodate high levels of chaos without compromising order. If we exaggerate the idea underlying the twisted axis of this diagram, very creative people would be able to "straighten" the order-and-chaos axis or to "orthogonalize" them (i.e., having high scores of *both* chaos and order), whereas on the other extreme, very uncreative people would be characterized by a flat, one-dimensional axis (i.e., a high level of chaos implying systematically a low level of order).

This perspective of the creative personality has direct relevance for the study of individual functioning. The notion of complexity just mentioned and other specificities of the model – especially those developed in the second half of this chapter – allow a more person-centered approach. For example, Figure 9.2 and Table 9.3 allow the framing of research questions that deal with the individual functioning of a creative person, asking, for instance, specific questions such as "What are the cognitive factors source of chaos in the person?", "What is the nature of his or her motivation?", "How are order and chaos balanced?", "How are affect, personality, and cognition variables articulated?", and so on. By extension, this could have implications for real-life applications such as creativity training. According to this model, successful creativity training should take into consideration the notions of complexity and equilibrium between order and chaos. If a person has already strong divergent thinking abilities, successful training should emphasize convergent thinking. Conversely, for people who have high scores on variables from the order spectrum, successful training would be based on practices that favor chaos (e.g., brainstorming).

Before closing this discussion, it is important to note that the approach developed here remains trait based and provides a general proposal for creative personality. It is likely, as work from the situationist and interactionist perspectives on personality have shown since the 1960s, that there is a situation component that should not be neglected. Hence certain traits may be active or show enhanced impact when they are expressed in a class of relevant situations. This is one approach that can integrate domain specificity in the personality model. Indeed, some traits may be best conceived in domain-specific ways, such as risk taking per domain, rather than a general factor.

A second key caveat is the need to integrate the possibility of idiosyncratic personality structure underlying creativity. Indeed, as creative people

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demonstrate and benefit from their uniqueness, it would be unlikely that they all show the same personality structure in terms of a consistent two-factor model. This fits well with the recent literature on ergodicity (or nonergodicity) of personality trait models. As Molenaar and colleagues (Molenaar 2004; Molenaar & Campbell 2009) have demonstrated, a general personality model (e.g., the two-trait model proposed here) may not represent well all individuals and their personal personality structure. We therefore present a general model that describes creative personality at the population level and accounts for individual variability at the population level. This model is based on correlations and factor analyses calculated at the collective sample level. This model does not preclude that case studies can show that some individuals will be best described by other idiosyncratic structures of personality. This idiosyncratic level of analysis (or case-study level) is worthwhile but complementary to the general, population level that the model proposed here has adopted.

Conclusion

The model developed in this chapter pays allegiance to many approaches and can serve as a consensual framework for future research. To conclude, we feel that researchers in creativity should not have to make the (impossible) choice between two extreme theoretical options to account for the relations between personality and creativity, namely, a very general model, with a wide scope but limited application, and some more specific models, more precise but also more limited in scope. Rather, we hope that an intermediate solution has been offered in this chapter that can accommodate both extremes. In the same vein, we believe that the study of individual differences through covariance structure and the study of individual functioning should also be complementary (rather than mutually exclusive) and, ultimately, integrated. Maybe the model proposed here can be seen as a first step in this direction. Finally, we hope that this framework will allow a flexible articulation between the Big Five and other approaches concerned with more specific personality traits. On the one hand, the Big Five should not obliterate such more specific approaches, but on the other, creativity research should not be detached from this tradition or other classical personality research (e.g., Eysenck and Zuckerman). Hence, in the end, we like to see all these issues as matter of equilibrium or, as Aristotle would have put it, of the golden mean – between order and chaos, generality and specificity, interindividual differences and intraindividual functioning, and between the Big Five framework and other theoretical approaches.

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Notes

1 Throughout this chapter, when we use the abbreviation "O" for openness, it actually refers to the broad openness/intellect factor.

2 For an introduction to these themes, see the book *Creative Intelligence* by Ambrose, Cohen, and Tannenbaum (2003), with the aforementioned chapter by Rea. See also "Chaos Theory and Creativity" by Schuldberg (2010).

3 Interestingly, both these approaches are reminiscent of some models of artificial intelligence, in particular, the ones based on the terraced scan function (Hofstadter 1995). The idea of this function is to perform superficial exploration of many possible solutions to a problem and to devote more and more resources as a path is identified as promising. Without entering into technical details, one of the key features of this function is the temperature. When temperature is high, this means that no good solutions are in view and that, consequently, the algorithm performs a wide and nonspecific search (almost blind), distributing resources to various options. This is reminiscent of hot-cognition and heuristic strategies induced by positive mood and high arousal. When temperature is low, this means that the program has been zeroing in on a potentially good solution. Then it devotes a lot of resources to the specific testing and elaboration of this promising resource. This is similar to the cold cognition and analytical processing induced by negative mood and more moderate levels of arousal, much more adequate for calm elaboration of an idea. Although the analogy is not perfect – the concept of temperature is not completely comparable to affect in general or arousal in particular – it is interesting to see how such different approaches converge on similar key findings.

4 See also Kahneman (2011).

5 On a related note, see also Mussel (2013) and his two-dimensional model of intellectual achievement based on two processes (seek and conquer) and three operations (think, learn, and create).

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PART II

Creativity and Personality

Emotion, Motivation, and Psychopathology

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10 Creativity and Personality

Nuances of Domain and Mood

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The nature of the relationship between creativity and personality is one of the core issues at the heart of creativity research. It is a rare topic that can both inspire a kneejerk, obvious response (such as "Openness to experience is related to creativity," a near-universal finding) (see J.C. Kaufman 2016) yet also present intricacies and debates such that the topic warrants a full handbook. A scan of the table of contents of this book gives a hint of the scope of this issue. In this chapter we tackle two related areas that play into the larger creativity–personality connection: creativity domain and mood.

Creativity Domains: A Brief Prologue

The question of whether creativity is domain general or specific has important implications for how it may or may not relate to a given construct. The domain-general view suggests that creativity is consistent across domains such that an individual who is creative in one domain will be creative in all domains (Plucker 1998). The domain-specific view suggests that creativity in one domain is independent of creativity in another (Baer 1998). These disparate approaches have converged in recent years to recognize the importance of both ends of the spectrum and the role that measurement plays (J.C. Kaufman, Glăveanu, & Baer in press). For example, studies of creative products tend to find domain-specific results, whereas studies using self-assessments tend to yield domain-general interpretations (Plucker & Makel 2010). Several theories (Baer & J.C. Kaufman 2005; Plucker & Beghetto 2004) have been developed to reconcile these views and suggest ways in which creativity contains both domain-general and domain-specific elements.

One such model, the *Amusement Park Theoretical (APT) Model of Creativity* (Baer & J.C. Kaufman 2005; J.C. Kaufman & Baer 2004, 2005, 2006), suggests that there are general requirements for all creative behavior, but creative outcomes require domain-relevant skills and characteristics. The model (which uses the analogy of an amusement park) moves from being very general to very specific across four levels. The first level of the model, *initial requirements*, states that certain criteria in intelligence, motivation, and the environment must be met in order to produce any creative work. For example, a person must be motivated to engage in creative behavior in order to successfully create in any domain.

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The second level of the model, *general thematic area*, relates to the broader areas in which one might be creative (e.g., everyday life, scholarship, performance, math/science, and art) (J.C. Kaufman 2012). Creativity in the arts may require greater emotional intelligence, whereas this may not be true for creativity in the sciences (Baer & J.C. Kaufman 2005; see also Dostál, Plháková, & Záškodná 2015). The third level, *domains*, distinguishes between the diverse applications within a thematic area. Within the general thematic area of the arts there may be many different domains, such as visual arts and music. All forms of visual art rely on skills in composition of form, whereas this would not be required for creativity in music. The final level of the model, *microdomains*, is task specific. Within the visual arts domain, the ability to mix paints would typically be necessary to produce creative oil paintings but not metal sculptures.

Personality and Domain-Specific Creativity

The relationship between personality traits and creative performance in general, as well as in different domains, has received much attention (Amabile 1996). Most research investigating the association between personality and creativity has used one of two major models of personality: *Eysenck's supertraits* (Eysenck & Eysenck 1976, 1985) or the *five-factor model (FFM) of personality* (Costa & McCrae 1992).

Eysenck's Supertraits

According to Eysenck and Eysenck (1985), personality is based on innate genetic factors and can be described in terms of three orthogonal dimensions, or supertraits: extraversion, neuroticism, and psychoticism. The dimension of extraversion (versus introversion) reflects individual differences in cortical arousal, wherein people high in extraversion (opposed to introversion) have a habitually low level of cortical arousal, which makes them less sensitive to sensory stimuli (Gale 1983; Geen 1984; Geen, McCown, & Broyles 1985). In order to maintain an optimal level of stimulation, extroverts will seek out exciting activities, whereas introverts (who have a higher level of cortical arousal and are therefore more sensitive to sensory stimuli) will avoid such activities. Therefore, people high in extraversion have a tendency to be "sociable, lively, active, assertive, sensation seeking, carefree, dominant, surgent, and venturesome" (Eysenck & Eysenck 1985, p. 15). Neuroticism (versus emotional stability) reflects individual differences in the activation threshold of the sympathetic nervous system, which is responsible for the fight-or-flight response to threat. People high in neuroticism have a low activation threshold, which causes them to experience negative affect in the face of minor stressors, whereas highly emotionally stable people, who have a high activation threshold, are able to experience negative affect only in the face of very major stressors. Therefore, high neuroticism is associated with feeling "anxious, depressed, guilt

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feelings, low self-esteem, tense, irrational, shy, moody, and emotional" (Eysenck & Eysenck 1985, p. 15). Psychoticism (versus impulse control) has been attributed to individual differences in gonadal hormones (most often testosterone), but this theory lacks empirical support (see Reuter et al. 2005). People high in psychoticism tend to be "aggressive, cold, egocentric, impersonal, impulsive, antisocial, unempathetic, creative, and tough-minded" (Eysenck, 1993, p. 155). Eysenck (1993, 1995) argues that individual differences in creativity are the result of variation in the trait psychoticism.

Eysenck's (1993, 1995) assertion that psychoticism is the basis for creative thought is based on the notion that the biological foundations of personality also influence cognitive style and is supported by evidence linking creativity to psychopathology. He asserted that the unusual ideation (i.e., originality) characteristic of creative individuals is the result of overinclusive thinking or "loose" associative networks, also commonly found in those with certain types of psychopathology, such as schizophrenia. He further suggested that this is so because psychopathology is not categorical but rather reflects extreme variants of underlying personality traits. Therefore, certain types of psychopathology (e.g., schizophrenia) lie on the extreme end of the personality dimension of psychoticism, and creative individuals close enough on the spectrum experience the same abnormality in thought but do not suffer psychosis (possibly due to protective factors). Indeed, creativity has been found to be associated with schizotypy, which is characterized by a set of symptoms (e.g., unusual perceptual experiences, magical thinking, and impulsive nonconformity) that may be indicative of a predisposition to schizophrenia but does not represent a clinically significant disorder (Carson 2014) in a variety of studies (Batey & Furnham 2008; Nettle 2006; Preti & Vellante 2007).

However, schizotypy scales do not distinguish psychoticism from neuroticism (Eysenck 1993), and studies using the Eysenck Personality Questionnaire (EPQ) (Eysenck & Eysenck 1975) to assess psychoticism directly have been inconclusive, in that psychoticism is not always found to relate to creativity, and inconsistent with Eysenck's (1993) theory, extraversion and neuroticism have also emerged as associates of creativity in some studies (Acar & Runco 2012; Batey & Furnham 2006).

Based on a comprehensive review, Batey and Furnham (2006) suggest that inconsistent results in investigations of creativity and Eysenck's supertraits may be due to domain differences. Although the relation of psychoticism to creativity has been inconclusive, with some studies reporting significant associations (Feist 1998; Merten & Fischer 1999; Stavridou & Furnham 1996; Woody & Claridge 1977) and others reporting mixed results (Kline & Cooper 1986) or no correlation (Martindale & Dailey 1996; Sen & Hagtvet 1993), no domain differences have been reported. A recent meta-analysis (Acar & Runco 2012) of studies investigating psychoticism's relation to creativity demonstrated a small overall effect but not significant heterogeneity in creative domain (arts, science, writing, and general). An earlier meta-analysis of creativity and different personality measures found that both artists and

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scientists exhibited greater psychoticism (as measured by the EPQ) than control individuals (Feist 1998). However, the same study found that scientists were more extraverted (as measured by the EPQ) than nonscientists, whereas this was not true for artists (opposed to nonartists). Batey and Furnham (2006) suggest that although extraversion seems to relate to divergent thinking measures, introversion is likely to be beneficial for artistic creators who need solitary time to reflect. Consistent with a relation between extraversion and divergent thinking, Martindale and Dailey (1996) found significantly positive associations between extraversion and scores on an alternative-uses test (listing as many uses as possible for a brick, a shoe, and a newspaper) and a remote-associates task, wherein the first word that came to mind for a participant when primed with a given word was rated creative if it was not in the top 10 word-association norms provided by Palermo and Jenkins (1964). Neuroticism may be important for artistic creativity because it "provides artists with the emotional sensitivity to appreciate and express ideas with emotional content" (Batey & Furnham 2006, p. 393) but is detrimental to divergent thinking, which requires defocused attention (Martindale 1999). Indeed, fluency scores on two visual creativity tasks (i.e., pattern meanings and line meanings) from the Wallach-Kogan Divergent Thinking Tests (DTs) (Wallach and Kogan 1965) demonstrated a significant inverse relationship with neuroticism in a group of university students (Stavridou & Furnham 1996). Although it is possible that domain differences are responsible for inconsistent results in studies investigating creativity's association with Eysenck's supertraits, the lack of empirical studies exploring this possibility renders it inconclusive; much more evidence for domain differences has been provided in studies using the FFM (McCrae & Costa 1987).

Five-Factor Model

Over the last two decades, most of the studies on creativity and personality have shifted focus toward the FFM of personality. The FFM includes extraversion, agreeableness, emotional stability, conscientiousness, and openness to experience (McCrae & Costa 1987). The primary FFM traits related to creativity include openness to experience, conscientiousness, and extraversion (Feist 1998; Hoff, Carlsson, & Smith 2012; McCrae 1987). Openness to experience has emerged as the strongest predictor of creativity. Agreeableness is typically unrelated or has a weak relationship with creativity. Neuroticism is its own case, as we will discuss later.

In some cases, inconsistencies in what traits predict performance depends on what creative domain is studied. For example, Feist (1998) conducted a meta-analysis examining differences in personality traits that predicted creativity by artists and scientists. He found that both groups were high in openness to experience and low in extroversion (i.e., introversion). Scientists, however, were more conscientious than were nonscientists, regardless of them being classified as creative or less creative scientists. However, artists were less conscientious

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than were nonartists. Subsequent studies have also found a negative connection between arts-related creativity and conscientiousness (e.g., Lievens et al. 2002). There are also microdomain differences in how creativity is related to conscientiousness. For example, creative writers (J.C. Kaufman 2002) and contemporary dancers (Fink & Woschnjak 2011) were less conscientious than, respectively, journalists and ballet dancers.

In another study, Silvia, J.C. Kaufman, and Pretz (2009) examined latent classes of creative achievement among college students and found three classes: visual arts, performing arts, and students without any major achievements. They found that people with achievements in the performing arts were more extraverted than were people in the visual arts or those with no achievements. These studies are only a few examples of FFM traits and their relationship to creativity in specific domains.

The factor openness to experience has previously generated debate over its operationalization. Current research indicates that there are two facets (openness and intellect), with each facet being differentially related to creativity (DeYoung 2015; DeYoung, Peterson, & Higgins 2005; DeYoung, Quilty, & Peterson 2007; Nusbaum & Silvia 2011; Woo et al. 2013). Although openness and intellect are highly correlated, their relationship with creativity, intelligence, and creative domains varies. Nusbaum and Silvia (2011) examined the relationship between openness, intellect, fluid intelligence, and creativity (as measured by self-reported creative activities and accomplishments). Openness (but not intellect) predicted creativity, and intellect (but not openness) predicted fluid intelligence. S.B. Kaufman (2013) built on the openness/intellect split to develop a four-factor model. Two factors were rooted in openness (affective engagement and aesthetic engagement) and positively predicted self-reported accomplishments in the arts, as measured by the Creative Achievement Questionnaire (CAQ). Two factors were rooted in intellect (intellectual engagement and explicit cognitive ability) and were unrelated to arts achievement. The two intellect factors, however, positively predicted performance in the sciences, and affective engagement negatively predicted performance. Aesthetic engagement was unrelated to CAQ science scores.

S.B. Kaufman and colleagues (2015) also examined how intellect and openness as measured by the Big Five Aspects Scale differentially predicted performance on the CAQ. They found that openness to experience was positively related to performance in the arts (as was extraversion) after controlling for age, sex, the other four FFM traits, intelligence, and divergent thinking. Intellect was unrelated to performance in the arts. It was, however, positively related to performance in the sciences, whereas openness was unrelated to performance in the sciences.

Another recent study also examined the relationship between the three theoretical intellect framework facets or operations (think, learn, and create) (Mussel 2013) and different creativity measures, including self-reported domain-specific and behavioral measures. Mussel and colleagues (2015) had participants from two samples (undergraduate students and Amazon

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MTurkers) complete the intellect scale and one of three creativity measures: self-report, the Compound Remote Associates Test (CRAT) (Bowden & Jung-Beeman 2003), or a photograph caption task. They found that create was positively related to a general self-report measure of creativity, whereas think and learn were unrelated, after controlling for general intellect scores. To assess the relationship between scores on the three operations and domain-specific creativity, the Kaufman Domains of Creativity Scale (KDOCS) (J.C. Kaufman 2012) was used. Create was the only facet positively related to artistic domains (performance and artistic) and was positively related to everyday creativity (learn was also positively related, and think was negatively related) and mechanical/science (think was positively related, and learn was negatively related). KDOCS scholarly were positively related to think and unrelated to learn or create. Performance on the two different creativity tasks (CRAT and photograph captions) was related to think and unrelated to learn. For the create facet, there appeared to be a suppressor effect present.

Openness is not the only of the five factors to show different results depending on the facet being analyzed. Reiter-Palmon, Ilies, and Kobe (2009) explored conscientiousness and creativity at a deeper level and found that a facet of being industrious/achievement-focused was positively correlated with creativity, but another facet of orderliness/dependability was negatively correlated. When analyzed simply as the larger factor of conscientiousness, however, a suppression effect occurred, and the relationship appeared to be nonexistent.

In sum, FFM personality traits are differentially related to performance across different domains. The differences between openness and intellect, with openness being related to performance in the arts and intellect being related to performance in the sciences, has indicated that openness to experience might be too general a predictor for creativity. Future research should focus on domain-specific notions of creativity and how they differentially relate to openness/intellect and other FFM traits.

The fifth factor, we have not yet discussed, is emotional stability, or neuroticism. Its relationship to creativity is complex because it closely relates to mental illness. Because this research area is so nuanced and there are edited volumes on this area (cf. J.C. Kaufman 2014; Silvia & J.C. Kaufman 2010), we limit our discussion to studies of mood and mood disorders. When discussing affective behavior, it is important to note whether one is talking about a state (a more temporary moment) versus a trait. Some have argued that the blurring of the line between state and trait in how affect relates to creativity is one reason for the extensive debate on the topic (Feist 2012). Moods and mood disorders can be either state or trait based.

The Influence of Mood on Creativity

Early research on the link between creativity and state level mood[1] focused primarily on the role of positively valenced emotions leading to a large

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body of research demonstrating that positive (relative to neutral) mood states enhance creativity (for review, see Ashby, Isen, & Turken 1999). In a seminal study, Isen, Daubman, and Nowicki (1987) demonstrated that inducing positive affect in participants (by having them watch a blooper reel of old western TV shows or giving them a small bag of candy; experiments 1 and 3) increased their performance on measures of creative insight. In one experiment, a greater number of people in a positive mood state (as opposed to those in a neutral mood state) were able to correctly solve Duncker's Candle Test (Duncker 1945), wherein a person must find the correct solution to use – a match, a box of tacks, or a candle – to affix the candle to a wall. In another experiment, people in a positive mood were able to solve more moderately difficult Remote Associates Test (RAT) problems, wherein participants are asked to provide a fourth word that relates to each of three given words. Similar results have been found in a variety of contexts, including educational (Greene & Noice 1988), medical (Estrada, Isen, & Young 1997; Estrada, Young, & Isen 1994), and organizational settings (Amabile et al. 2005), suggesting that positive mood may directly influence the processes underlying creative thought.

Initially, Isen and colleagues (1985) suggested that this enhanced creativity might be so because positive (as opposed to negative) material is better integrated in memory. According to associative theories of creativity, creative thought and insight are the result of forming new combinations of existing concepts in memory, with combinations of more remote, or conceptually distant, elements resulting in more creative ideas (Mednick 1962). Therefore, in accordance with mood-congruent recall, wherein individuals more easily remember information that is consistent with their current mood state (Matt, Vázquez, & Campbell 1992), more diverse and complex material is activated when a person is in a positive mood state, enhancing one's ability to combine remote concepts.

More recent explanations focus on how mood may affect a person's attentional focus, which then influences a person's ability to simultaneously attend to a larger number of conceptual elements (Fredrickson & Branigan 2005; Kasof 1997). A narrow attentional focus may allow a person to attend to a few concepts at once, limiting the number of combinations possible, whereas a broader attentional focus (i.e., defocused attention) allows for a greater number of concepts to be within the focus of attention at once, increasing the number of possible combinations (Abraham & Windmann 2007; Mendelsohn 1976). Positive moods may broaden the focus of attention, allowing a person to attend to a greater number of concepts, thereby enhancing creativity (Fredrickson 1998). This enhanced cognitive flexibility may be due to increases in dopamine projected into the prefrontal cortex (facilitating working memory) in response to such mood states (Ashby et al. 1999). These explanations, along with studies demonstrating enhanced creativity in response to positive mood, provide a strong foundation for the influence of positive moods on creativity but fail to account for instances of enhanced creativity in response to negative mood.

Studies focusing primarily on the valence factor fail to account for other motivational components of emotions, such as activation and orientation,

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which may help to explain why some studies have found enhanced creativity in response to negative mood (Baas et al. 2008, 2011; Friedman, Förster, & Denzler 2007). For example, Friedman and colleagues (experiments 1 and 2) manipulated mood by asking participants to describe either a positive or negative past personal event. Participants then completed an alternative-uses task, describing as many uses as they could think of for a brick (or as many modes of transportation; experiment 2). These tasks were framed as a fun and silly task or as a serious task that had implications for the participants' cognitive functioning. Participants in a positive mood generated a roughly equivalent number of responses whether the task was framed as fun or serious, but individuals in a negative mood generated significantly greater uses when the task was framed as a serious task (as opposed to fun).

Baas and colleagues (2011) found that negative mood states (e.g., fear; study 4) can be associated with greater creativity when they are related to unsuccessful prevention regulation, that is, a lack of closure regarding a prevention goal. They asked participants to write a short essay about an event that happened to them in the past that made them feel fearful and to indicate how much the story described the successful avoidance of negative outcomes (i.e., successful prevention regulation). Participants then completed a visual-insight task (10 items from the Gestalt Completion Task [GCT]) (Ekstrom et al. 1976). Participants in fearful, angry, and happy moods performed better on the insight task than those in relieved or neutral moods, but this effect was mediated by successful prevention regulation (i.e., those who experienced closure were less creative). These studies demonstrate that the motivational components of emotions play an important part in the influence of affect on creativity.

The *feelings-as-information model* (Schwarz 2012; Schwarz & Clore 1996) offers one account of how motivation may influence the effect of negative mood on creativity. The model suggests that affective states provide people with information regarding their current situation, which helps them to make judgments and influences how they process information. A positive mood signals to the person that there are no threats present, resulting in a processing style with less focused attention and greater reliance on general knowledge structures, which might increase exploratory and risk-taking behavior. A negative mood signals threat to a person, resulting in a processing style with more vigilant attention and a greater focus on problem solving. If an individual realizes that his or her feelings are unrelated to the task at hand, it no longer has informational value and no longer influences the person's processing style (no longer influencing performance on the task). The feelings-as-information model provides a theoretical framework for the role of the motivational implications of certain moods and emotional states in creative performance. The *dual-pathway model of creativity* (DPCM) (Baas, De Dreu, & Nijstad 2008; De Dreu, Baas, & Nijstad 2008) delineates how this may interact with valence to directly influence creativity.

The DPCM suggests that both the valence and activation associated with a mood are important influences on creativity. The model argues that creativity

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can be enhanced through two distinct pathways: the *positive-valence pathway*, which increases cognitive flexibility, or the *negative-valence pathway*, which increases perseverance and effort. Creative outcomes depend on *activation*, which refers to "increased engagement of centrally organized promotion or prevention motivation systems to mobilize energy to sustain attention and effort toward goal related activities" (Baas et al. 2011, p. 795). Therefore, moods with high activation should typically lead to greater creativity whether they are positive (i.e., happy, excited) or negative (i.e., angry, anxious) than both deactivating positive (i.e., serene, calm) and negative (i.e., sad, depressed) moods. Although much research (see Baas et al. 2008) has demonstrated that a promotion focus (attainment of positive outcomes) increases creativity relative to a prevention focus (avoidance of negative outcomes), Baas and colleagues (2011) demonstrated that a prevention focus can result in enhanced creativity when the individual is experiencing a mood state that is activating.

Another dimension of the mood–creativity link that has received less attention is *orientation*. The orientation dimension involves taking the two other dimensions (valence and activation) and combining them on a mood circumplex and then turning the circumplex 45 degrees (Watson & Tellegen 1985). Based on the orientation dimension, some states such as boredom (a negative, deactivating state) can increase creativity because it is an approach-oriented state. The DPCM would predict boredom having no effect on creative performance because it is a deactivating state. Across three studies, Gasper and Middlewood (2014) found that approach-oriented states such as boredom increased creativity – measured by the RAT (study 1) and rating weak exemplars as belonging to a category (studies 2 and 3) – compared to avoidance-oriented states such as distress. They argued that the approach-oriented state increased associative thought because it "encourages the quest for meaning and exploration" (p. 55).

The Effects of Interpersonal Emotions and Creativity

Most of the research on mood and creativity has focused on the intrapersonal effects of emotions on creativity. There are a few studies, however, examining the interpersonal effects of emotions that draw on the *emotions as social information (EASI) model* (Van Kleef, 2009; Van Kleef, Homan, & Cheshin 2012). The EASI model argues that an emotional expression has an effect on an observer's behavior through one of two paths. The observer might infer that the situation requires a behavioral change (inferential path), or the observer's emotions or liking of the expresser changes (affective reactions path). Although both paths might affect the observer's behavior, one path is typically dominant, and the strength of the path depends on two moderators (information processing and social-relational factors), which might function alone or together.

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Across multiple studies, expressions of anger have been found to increase an observer's creativity depending on the observer's ability to process information. In one study, Van Kleef, Anastasopoulou, and Nijstad (2010) had participants complete an alternative-uses task, and then they were given feedback on their performance. This feedback was presented in either an angry or a neutral emotional tone. After receiving feedback, participants completed a second alternative-uses task, which was scored for fluency, originality, and flexibility. Prior to completing the first task, participants completed the Personal Need for Structure Scale (Neuberg & Newsom, 1993), which assesses information-processing ability. In support of their predictions, Van Kleef and colleagues (2010) found that when participants received feedback in an angry tone, those high in need for structure compared with those low in need for structure had higher fluency, originality, and flexibility scores, and this effect was mediated by task engagement (time spend on task and self-reported motivation). People high in need of structure have a greater desire to process knowledge and emotional information to which they are exposed in order to understand the situation. Thus the authors inferred that the performance of the participants on the first creativity task was suboptimal, and they needed to expend greater effort on the second task.

In another set of studies, Visser and colleagues (2013) examined the effects of feedback presented in a happy or sad emotional tone on an observer's creative and analytic performance. Participants first completed two tasks: a divergent thinking task to measure creativity and a Sudoku puzzle to measure analytical thinking. After completing the first task, participants were given feedback on their performance in either a happy or sad tone. Participants then completed a second unusual-uses task and another Sudoku puzzle. Participants who received feedback in a happy emotional tone performed better on the second creativity task (more original responses), whereas people who received feedback in a sad emotional tone performed better on the second Sudoku puzzle (proportion of correct responses compared to total response). In a second study, the authors replicated the results and found that the increase in performance on the respective tasks was due to emotional contagion. That is, participants reported feeling more happiness in the happy condition and more sadness in the sad condition.

The studies just reported indicate that the mood–creativity link is complex and includes an interpersonal dimension. The EASI model and the corresponding studies are another intersection of mood and personality on creative performance that have a number of implications for certain domains, such as education and the workplace. A teacher or manager should consider how he or she presents feedback to a student or subordinate. This presentation strategy should be based on a number of contextual factors and the observer's personality traits. If feedback on a person's creative performance is presented in a manner that is perceived negatively, an observer might become averse to future interest in creativity (Beghetto 2014).

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Mood and Domain-Specific Creativity

Mood Disorder and Creative Domains

A negative mood can easily be a passing moment – here and gone in an instant. When someone is in a poor mood as a natural trait, it can be considered a clinical or subclinical issue and be called a *mood disorder*. Mood disorders and their relationship to creativity are often studied in the context of unipolar depressive and/or bipolar disorders. Although the method of diagnosis used in studies investigating a potential relationship between creativity and mood disorders varies, most closely align with the criteria set by the *Diagnostic and Statistical Manual of Mental Disorders (DSM)*. The fourth edition of the *DSM* (*DSM IV*) (American Psychiatric Association 1994) is the most recent version used in published studies investigating this relationship.[2] According to the *DSM IV*, *depressive disorders* (major depressive disorder and dysthymic disorder) are characterized by the occurrence of major depressive episodes, which include symptoms of depressed mood, anhedonia, weight loss or gain, loss of appetite, fatigue or loss of energy, daily sleep disturbance (hypersomnia or insomnia), and reduced ability to concentrate or think clearly. *Bipolar disorders* (bipolar disorder I and II and cyclothymic disorder) are characterized by the occurrence of manic episodes or hypomanic and major depressive episodes. Manic and hypomanic episodes include symptoms such as abnormally and persistently elevated, expansive, or irritable mood; inflated self-esteem or grandiosity; decreased need for sleep; distractibility; pressured speech; and impulsive behavior. Manic and hypomanic episodes are distinguished by severity, wherein hypomanic (opposed to manic) episodes are not severe enough to impair functioning or require hospitalization and do not have psychotic features. Although research investigating the relation of mood disorder and creativity is highly controversial (Schlesinger 2009, 2014; Silvia & J.C. Kaufman 2010), the relation of mood disorder and creativity has been found to differ by creative domain in studies investigating creativity in individuals with mood disorder and in studies investigating the prevalence of mood disorder in creative individuals.

Although relatively few studies have assessed different creative domains when investigating creativity in individuals with (as opposed to without) mood disorder, some studies have noted differential results across domains. Rybakowski and Klonowska (2011) administered the inventiveness battery of the Berlin Intelligence Structure (BIS) Test (Jäger 1982, as cited in Rybakowski & Klonowska 2011), which assesses numeric, figural, and verbal creativity, to a Spanish sample of patients with bipolar disorder and healthy control individuals. Individuals with bipolar disorder scored significantly higher than controls on the verbal subscale but not on the numeric or figural subscales of the BIS Test. Kyaga and colleagues (2011) found that individuals with bipolar disorder were overrepresented in scientific (i.e., university teachers) and particularly in

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artistic (i.e., visual artists, performing artists, authors, etc.) occupations. In a subsequent study, with an extended sample, Kyaga and colleagues (2012) found that those with bipolar and unipolar disorders were overrepresented in artistic occupations (particularly as authors) but not scientific occupations.

A recent meta-analysis (Taylor 2015) of studies comparing creativity in individuals with and without mood disorder suggests that the influence of mood disorder on creativity may differ by domain. Twelve studies were included in the analysis, which assessed creativity in six domains: everyday, performance, quantitative, verbal, visual, and a composite category consisting mostly of general divergent thinking tasks. The overall effect size for the analysis was not significant, suggesting that those with mood disorder are not more (or less) creative than those without. However, follow-up analyses of the differences between creative domains demonstrated small but significant effect sizes for verbal, visual, and quantitative creativity, wherein individuals with mood disorder exhibited greater verbal and visual creativity but lesser quantitative creativity than healthy control individuals. A related line of inquiry suggests that the prevalence of mood disorder in individuals identified as creative (opposed to not) differs across creative domains.

Studies comparing creative individuals in the sciences and the arts suggest that mood disorder may be more prevalent in individuals exhibiting creativity in the arts[3] (Ludwig 1992, 1995; McKay & J.C. Kaufman 2014; Simonton, 2014; Simonton & Song 2009). Papworth and colleagues (Papworth & James 2003; Papworth et al. 2008) employed self-report measures of mood disorder symptoms in order to compare university students studying art with those studying science. Those studying art scored significantly higher on measures of creativity, as well as on mood disorder symptoms (although these did not reach clinical levels).

Several historiometric studies have found evidence of mental illness (often speculated to be mood disorder or depression) in poets compared with other writers (J.C. Kaufman 2001, 2003, 2005, J.C. Kaufman & Baer 2002; J.C. Kaufman & Sexton 2006) and writers compared with both other artistic professions and nonartistic professions (J.C. Kaufman 2001; Ludwig 1995; Post 1994).

One explanation for these differences in relation to creative achievement relates back to the issue of domain-relevant skills. In order to contribute creatively to a specific domain, a certain level of knowledge in that domain is necessary. However, some domains require greater mastery than others (Simonton 2010). The creative arts (i.e., visual arts, creative writing, performance) require less formal knowledge and education than the sciences to contribute creatively. Domain-relevant knowledge has been found to be a better predictor of creativity in mathematics than divergent thinking (which requires no formal training), whereas this relationship was reversed for artistic creativity (Jeon, Moon, & French 2011). So creative achievement in the arts would require less stability (than in the sciences) and therefore may be more accessible to those with mood disorder. Poets have been found to be the least likely of creators to have formal training (Simonton 1986), and Simonton and Song

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(2009) found that although early mental health was positively correlated with achieved eminence in a sample of geniuses, eminent poets, dramatists, and novelists were the most likely to have mental health issues in childhood and adolescence.

Conclusion

It is tempting to give sweeping answers that aim to simplify difficult concepts, whether writing a paper, teaching a class, or talking to a reporter. Yet much of the truth boils down to "what do we mean by this concept?" If we talk about how creativity and personality relate, what do we mean by creativity? Do we mean creativity in a domain-general sense or across different domains? Do we refer to Eysenck's supertraits, the FFM, or subfacets of the FFM such as openness/intellect? If personality traits represent consistent and innate patterns of behavior and preferences, what do we do with the state-based construct of mood?

Many natural conclusions become less clear when analyzed in different ways. The question, for example, of how creativity may be associated with a positive or negative mood state may actually depend less on the mood's valence and more on whether it is activated or deactivated. At the trait level, the relationship between creativity and mood disorders may depend greatly on which creative domain is being studied.

Sometimes it is important to point out nuances, exceptions, and considerations that should be noted when analyzing a field. The connection between creativity and personality can at times feel remarkably straightforward (there are countless studies that in essence consist of a particular population taking a personality measure and a creativity measure). Moving into the details, however, one sees how patterns change by domain, how definitions of creativity and personality can shift findings, and how mood plays its own role. There is a tremendous amount of research that has been done – yet much more that awaits.

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Notes

1 Although affect, mood, and emotion can be distinguished on several factors (e.g., duration, intensity, and function), many empirical studies do not explicitly define the constructs and/or use the terms interchangeably (Beedie, Terry, & Lane 2005). Therefore, this chapter uses the terms interchangeably to describe feeling states in general.

2 The *DSM* is currently in its 5th edition. The *DSM-5* has yet to be used in studies of creativity and thus was not referenced here.

3 Taylor's (2015) meta-analysis did not detect significant heterogeneity due to the creative domain in analyses of mood disorder in creative versus noncreative individuals or dimensional measures of creativity and mood disorder.

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11 Emotions and Creativity

From States to Traits and Emotion Abilities

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Imagine sitting in front of a blank computer screen. What are you feeling? How will these feelings influence your creative process, whether you are about to write a short story or a scientific paper or create digital art? Will your personality traits affect the more transient emotion states? And what can you do to exert agency over how your emotions affect the creative process?

Emotions are central to the creative process, from the emotion-filled decision whether to be creative (Will people think my original ideas are silly?), to positive emotions broadening thinking, and to inevitable frustrations on the way to creative achievement. We address research on emotions and creativity in three distinct but related areas. First, we review the research on emotion states and creativity, which asks what temporary states affect creative thinking. Then we review the research on personality traits, both Big Five and other, more specific emotion-related traits. This research is concerned with aspects of individual differences that are relatively stable through time and across situations. These first two areas have been reviewed previously by others with different emphases. For instance, Feist (2013) discussed mental illness alongside affective states and traits, and Hoffmann (2013) reviewed the role of emotional awareness and intensity in the differential benefits of pleasant and unpleasant feelings. In this chapter we consider research on affective states and traits alongside an emerging area of research on emotion abilities and creativity, specifically focusing on the emotional intelligence abilities of using emotions to aid thinking and regulating emotions. Finally, we propose a model that integrates these three areas of research and delineates the joint influence of emotion states, traits, and abilities on creativity.

Like most other scholars, we feel compelled to define creativity. Plucker, Beghetto, and Dow (2004, p. 90) stated that *creativity* is "the interaction among aptitude, process and environment by which an individual or group produces a perceptible product that is both novel and useful as defined within a social context." This definition includes key building blocks of creativity (i.e., aptitude, process, and environment), as well as an emphasis on the end product that is both original and appropriate or useful. This definition would suggest that the ideal criteria for creativity would lie at the end of the creative process – in the creative products. However, researchers often use criteria for creativity that are closer to the creative process or aptitude than real-life creative products, with the most prominent example being divergent thinking or creative idea

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generation (e.g., Baas, De Dreu, & Nijstad 2008). Divergent thinking tests measure originality, flexibility, and fluency in thinking and predict criteria of creative behavior in both concurrent and longitudinal studies (e.g., King, Walker, & Broyles 1996; Torrance 1988; Wolfradt & Pretz 2001). However, we believe that the distinction between divergent thinking tasks in the laboratory and measures of real-world creative achievement is an important one, especially at the levels of professional and eminent creators. Whenever possible, we review research on both sets of criteria for creativity.[1]

Emotion States and Creativity

Historically, research on creativity and emotion has focused on how different emotion states impact the creative process. The first question examined the effects of positive versus negative emotions on creativity. The creativity-enhancing effects of positive affect have been well documented. In these studies, positive mood induction through techniques such as receiving a gift or watching a comedy clip led participants to use broader cognitive categories and to display greater cognitive flexibility than participants in neutral and negative mood conditions (Abele 1992; Greene & Noice 1988; Isen & Daubman 1984; Isen, Daubman, & Nowicki 1987; Isen et al. 1985). Moreover, these findings appear to generalize outside the laboratory. Amabile and colleagues (2005) found a linear positive relationship between positive affect and creativity in the workplace, studying employees from chemical, high-tech, and consumer products companies. The study collected multiple measures of affect and creativity using daily questionnaires, monthly peer ratings, and worker narratives. Results not only showed a significant correlation between positive affect and creativity but time-lagged analyses also indicated that positive affect was an antecedent of creativity, as well as a consequence of creativity at work.

A meta-analysis of studies from a quarter century of research on the effects of positive and negative mood states on creativity attests to the beneficial effect of positive moods on originality and flexibility in idea generation tasks (Baas et al. 2008) but also offers some cautionary notes on interpreting these results. The analysis included 66 studies using a mood manipulation procedure (e.g., imagery techniques, emotion-inducing materials, and emotional treatment, such as success or failure on a task) and including a measure of creative thinking (i.e., flexibility, fluency, or originality; insight tasks; and composite measures of creative performance in idea-generation tasks). Individuals induced to feel positive moods had higher originality and fluency than those in negative moods, but no overall differences were found between negative and neutral moods. When specifically looking at divergent thinking criteria, the effects of positive mood declined as the time on task increased. Furthermore, effect sizes were small, suggesting that research should take a more nuanced view of creativity and emotion states. Indeed, Baas and colleagues (2008, p. 796) concluded that "to make a difference in creative performance,

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manipulating mood states is not very effective and is unlikely to produce clear and visible changes in creativity."

While the meta-analysis of Baas and colleagues (2008) found benefits of positive moods on creative thinking, it did not rule out possible effects of negative moods on creativity. For example, Akinola and Mendes (2008) found that intense negative emotions positively influenced artistic creativity. The authors induced emotions by randomly assigning participants to social rejection, social approval, or a nonsocial situation and then asked them to complete collages. Social rejection led to higher expert-rated creativity than the other conditions. Furthermore, there was an interaction between affective vulnerability (measured by levels of an adrenal steroid linked to depression) and experimental condition such that induced negative affect had the strongest effect on creativity among those with high affective vulnerability.

When looking at the creative process beyond divergent thinking or idea generation in short, timed tasks, the possible benefits of negative affect for creativity become clearer. Kaufmann and Vosburg (2002) found that while positive mood, induced through film clips, led to the highest scores in early idea generation, neutral and negative mood led to superior task performance during later stages of ideation. Moreover, in a review of innovation research, Anderson, De Dreu, and Nijstad (2004) argued that distress-related variables at the individual, group, and organizational levels, such as job dissatisfaction, small group conflicts, or budget deficiencies, could act as triggers for innovation. Some level of tension or dissatisfaction may be needed to prompt problem finding, which is an important part of the creative process (Csikszentmihalyi & Getzels 1971; Runco 1994).

Social psychological theories at the intersection of emotion and cognition offer clues about the mechanisms behind mood and creativity links. Fredrickson's (2001) broaden-and-build theory describes how positive moods broaden thinking, attention, and action and thus enhance people's intellectual and psychological resources. When positive emotions such as joy or happiness, broaden attention, they increase the likelihood of noticing peripheral cues and accessing a larger network of mental representations, which, in turn, increase one's chances of generating novel ideas. Another group of cognition and emotion researchers proposed a model that describes the kinds of information or input offered by different emotional states (Martin et al. 1993; Schwarz 1990). The model indicates that negative moods provide a cue that something is wrong in one's environment, while positive moods signal that a goal has been reached. Negative moods thus can provide information useful for problem finding or lead to more persistence and effort during the creative process. Positive affect, however, indicates that one has been successful and can stop working on a task. This signaling process may be the basis for the declining benefits of positive moods on creative thinking with longer time spent on the task (Baas et al. 2008).

It is likely that both positive and negative moods contribute to creativity under different circumstances and for different aspects of the creative process.

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The case in point is a study showing that the benefits of mood on creativity in the workplace depend on the social context and how clearly people experience their feelings (George & Zhou 2002). Employee and supervisor pairs completed measures of positive and negative mood at work, perceived recognition for creative performance, clarity of feelings, and creative performance. Negative mood was positively associated with creativity when both perceived recognition and clarity of feelings were high. Positive mood was positively related to creativity when recognition was low and clarity of feelings was high or when recognition was high and clarity was low.

Emotion states also may be thought of in terms of how activating they are; activating moods include anger, fear, and happiness, while deactivating moods include calmness, relaxation, and sadness (De Dreu, Baas, & Nijstad 2008). The *dual-pathway model* of creativity posits that activating moods, whether positive or negative, should enhance creativity. A positive activating mood should enhance cognitive flexibility, while a negative activating mood should enhance perseverance. In a series of studies, De Dreu and colleagues (2008) used mood manipulations and assessed creative thinking using a brainstorming task, a measure of cognitive inclusiveness and breadth of categories, and an insight problem. The positive activating mood (happy) led to most fluency and originality, but the negative activating mood (angry) had the greatest within-category fluency, an indication of persistence (De Dreu et al. 2008).

Personality Traits and Creativity

Big Five Traits

The Big Five model offers a convenient way to review research on personality traits and creativity. Openness to experience is the trait most consistently related to creativity across different criteria, domains and levels of creative achievement (e.g., Feist 1998; Ivcevic & Mayer 2009; McCrae 1987; Nusbaum & Silvia 2011). However, the remaining Big Five traits – extraversion, neuroticism, conscientiousness, and agreeableness – have also been related to creativity, although in more complex ways depending on specific aspects of these traits, as well as the domain and level of creativity.

The Big Five traits are broad personality dispositions that cross functional areas within personality, such as emotionality and motivation, social expression, cognition, and self-regulation (Feist 1998; Mayer 2003). *Extraversion* concerns traits of positive emotionality and traits of social expression such as gregariousness and dominance (Costa & McCrae 1992). *Neuroticism* pertains to negative emotionality, irrational thinking, and difficulty in self-regulation. *Conscientiousness* includes high level of achievement motivation, intellectual efficiency, and restrained emotionality and self-control. *Agreeableness* is described by caring and warm emotional disposition and cooperative and friendly social relationships. Finally, *openness to experience* refers to emotional

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and motivational traits such as seeking new experiences and feeling a wide range of emotions, cognitive traits of intellectuality and imaginative thinking, social expression through nonconformity and liberal attitudes, and self-regulation traits of absorption and tolerance of ambiguity (McCrae 1994, 1996). Each of the Big Five traits is comprised of at least two distinct aspects or facets (DeYoung, Quilty, & Peterson 2007).

Openness to Experience

Openness to experience is at the core of creative personality, predicting diverse outcomes from divergent thinking test scores (e.g., McCrae 1987; Silvia, Martin, & Nusbaum 2009), laboratory writing and art tasks (e.g., Ivcevic, Brackett, & Mayer 2007; Wolfradt & Pretz 2001), self-reported creative behavior (e.g., Carson, Peterson, & Higgins 2005; Ivcevic & Mayer 2009), and professional creative achievement (e.g., Feist & Barron 2003; Helson, Roberts, & Agronick 1995), leading personality theorists to define it as a personality disposition for creativity (McCrae 1994, 1996). Importantly, King and colleagues (1996) found that individuals high in divergent thinking ability but low in openness reported fewer creative accomplishments. Furthermore, openness is related to creative behavior across domains, from everyday self-expression, arts and crafts, music and science, to digital creativity (Carson et al. 2005, Hoffmann, Ivcevic, & Brackett 2016; Ivcevic & Mayer 2009). When both openness and intellect facet are assessed, artistic creativity tends to be predicted by openness and scientific creativity by intellect (S.B. Kaufman 2013).

Most impressive are longitudinal studies showing that openness to experience is an important measure of potential for creative achievement across the life span. One study followed a sample of women graduating from Mills College in 1958 and 1960, with other assessments when women were 27, 43, 52, and 61 years old (George, Helson, & John 2011; Helson et al. 1995). Personality measures of originality, openness, and unconventionality at age 21 predicted other measures of creative potential at age 27 (e.g., Creative Personality Scale for the Adjective Check List), as well as occupational creativity at age 52 (Helson et al. 1995). Similarly, in a study of male graduate students, observer ratings of originality at age 27 predicted lifetime awards for creative achievement measured at age 72 (Feist & Barron 2003). In another study, Soldz and Vaillant (1999) found that openness, measured in college, remained the best predictor of creative achievement 45 years later.

Extraversion and Neuroticism: Traits of Positive and Negative Emotionality

Personality trait dispositions toward experiencing positive or negative emotions – extraversion and neuroticism – are not reliably related to creativity across different criteria. When divergent thinking tests are used as criteria, neuroticism is largely unrelated to creativity, while the results for extraversion are mixed (positive correlations: Batey, Chamorro-Premuzic, & Furnham 2009;

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Furnham & Bachtiar 2008; Furnham et al. 2008, 2009; Martindale 2007; nonsignificant correlations: Batey, Furnham, & Safiullina 2010; Burch et al. 2006; Ivcevic et al. 2007; Silvia, Martin, & Nusbaum 2009; Silvia et al. 2009).

Research focusing on behavioral criteria suggests that the relationship between extraversion and neuroticism and creativity depends on specific trait facets, as well as the creativity domain. Neuroticism predicts creativity in artistic domains. Feist (1998) conducted a meta-analysis of several decades of research on personality traits in artists and scientists. Compared to nonartists, artists can be described as less emotionally stable; they are less likely to be adjusted, guilt free, or happy. Similarly, visual arts students have higher neuroticism when compared with music and psychology students (Haller & Courvoisier 2010), advanced art students have higher negative emotionality and anxiety than science students (Sheldon 1994), and dancers have higher shame proneness than athletes (Thomson & Jaque 2013).

Neuroticism also moderates the relationship between emotion states and creative idea generation. Tamir (2005) suggested that unpleasant but trait-consistent negative states such as worry might benefit performance on demanding tasks for those high in neuroticism. Tamir, Robinson, and Clore (2002) showed that individuals high in neuroticism were more likely to choose to increase their level of worry when expecting to perform demanding tasks measuring intelligence and creativity, such as preparing a short speech than individuals low in neuroticism. Similarly, Leung et al. (2013) found that those higher in neuroticism not only chose to recall worrisome (as opposed to happy) memories before a creativity task, but also were more creative when induced to feel worry. These studies demonstrate the benefit of studying the interaction between emotion states and traits to understand inconsistent findings in past research (e.g., the role of negative emotion states in creativity).

In contrast to the findings about the beneficial effects of positive moods for creative idea generation (Baas et al. 2008), the relationship between extraversion – personality trait of positive emotionality – and creativity is more tenuous. Extraversion is associated with creative behavior in a limited set of domains, such as everyday creativity (e.g., self-expressive creativity, interpersonal creativity, and arts and crafts) (Ivcevic 2007; Ivcevic & Mayer 2009) and entrepreneurial creativity (Lee & Tsang 2001; Marcati, Guido, & Peluso 2008; Zhao, Seiberg, & Lumpkiin 2010). In an act-frequency study, many of the behaviors rated as most typical of everyday creativity had a prominent social component, which can benefit from higher extraversion (e.g., telling a joke and making people laugh, coming up with a funny nickname for someone) (Ivcevic 2007). Similarly, entrepreneurial creativity is social and dynamic in nature, requiring building relationships with business partners and employees, as well as communicating and negotiating with funders and backers. Because of this, it is not surprising that extraversion predicts both intentions to be entrepreneurial and adopting innovations in a specific field, as well as entrepreneurial firm performance (Marcati et al. 2008; meta-analysis: Zhao et al. 2010). Extraversion

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contributes to the greater number and frequency of contacts with external business associates, which, in turn, plays a role in venture growth (Lee & Tsang 2001).

Other studies point to the importance of examining specific facets of extraversion and different aspects of the creative process. For instance, Feist (1998) found that the confidence/dominance facet of extraversion distinguished creative versus less creative scientists, but the sociability facet did not. It is also likely that extraversion is beneficial for those stages of the creative process that involve convincing the field about the value of one's ideas or products (Csikszentmihalyi 1999). Supporting this idea, research points to the important role of entrepreneurs' enthusiasm for securing "angel" investing (Cardon, Sudek, & Mitteness 2009).

Conscientiousness

Conscientiousness is not related to measures of divergent thinking (e.g., Batey et al. 2009; Furnham et al. 2008; Ivcevic et al. 2007; McCrae 1987; Silvia et al. 2009). However, conscientiousness involves traits such as persistence, achievement striving, and competence, which are positively related to creativity defined in terms of achievement. For instance, women described by observers as not giving up under conditions of adversity in college, those with higher grade point averages (GPAs), and those whose education was paid for by scholarship and employment (all correlates of conscientiousness) achieved higher occupational creativity at age 52 (Helson et al. 1995). When separate facets of conscientiousness are examined, achievement striving (including goal orientation, industriousness, and competence) is positively correlated with both creative accomplishments and creative problem solving; dependability (involving orderliness and restraint) is negatively related to creativity; (Reiter-Palmon, Illies, & Kobe-Cross 2009).

Research in organizational and social psychology addresses conditions under which conscientiousness is related to creativity. George and Zhou (2001) examined how several workplace characteristics can bring out conformity, following rules, and preserving the status quo, especially in those higher in conscientiousness. Individuals high in conscientiousness are likely to show low creativity when their supervisors monitor their performance closely and their co-workers are not supportive of creativity. These situational characteristics in the workplace encourage self-restraint and meeting predetermined expectations – and thus greater conformity.

Agreeableness

Overall agreeableness is largely not related to creativity. Some research suggests that the role of agreeableness in creativity might be domain specific and dependent on lower-level facets. Agreeableness may be associated with everyday creativity, such as creative hobbies (Ivcevic & Mayer 2009). Silvia and

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colleagues (2011) found no relationship between overall agreeableness and creativity but a significant negative relationship between honesty/humility and creativity measured by several scales of self-reported creative activities, achievement, and self-perceptions. Similarly, facet traits of low agreeableness, such as arrogance and hostility, have been shown to predict achievement in scientists and artists (Feist 1993, 1998).

Other Emotion-Related Traits

In addition to the Big Five personality traits, creativity has been related to a number of other emotion-related traits. In this section we review four such traits: intrinsic motivation, harmonious passion, hypomanic mood, and emotional creativity.

Intrinsic Motivation

Intrinsic motivation exists when a person both enjoys an activity and finds it challenging (Amabile 1996). Amabile's (1996) componential theory of creativity stresses the key role of intrinsic motivation: individuals may have traits and abilities that constitute creative potential, but whether that potential is transformed into creative achievement depends on intrinsic motivation – whether people want to engage in an activity for its own sake.

Intrinsic motivation predicts extent of involvement in creative activities, as well as in rated creativity of products. For example, as a trait, intrinsic motivation predicted current involvement in creative writing, hours of work per week doing art, number of artworks produced, and instructor ratings of student commitment to art and potential as an artist (Amabile et al. 1994). Further support for the role of intrinsic motivation in creativity comes from biographical studies of eminent creators in multiple domains who identified enjoyment in work as a major motivator for sustained activity (Csikszentmihalyi 1996). Studies following Amabile's foundational work support the important role of intrinsic motivation for creative performance and expand it by addressing mechanisms by which intrinsic motivation affects creativity. For example, in a study of research and development personnel, Dewett (2007) found that intrinsic motivation is predicted by antecedent variables such as supervisor support for creativity and self-efficacy and that it affects supervisor-rated creativity by increasing employees' willingness to take risks.

Grant and Berry (2011) found that intrinsic motivation was related to creativity in the workplace when pro-social motivation was high but not when it was low, indicating that pro-social motivation strengthened the association between intrinsic motivation and creativity. When people had high intrinsic and pro-social motivation, they were likely to consider others' perspectives, which, in turn, increased creativity. The importance of pro-social motivation for creativity is likely specific to domains for which interactions with and understanding of customers are important; two studies pertained to service

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work, surveying security force officers on a military base and water treatment plant employees, and one study on college students used an industry problem-solving task as criterion – coming up with ideas about how a local band could generate revenue (Grant & Berry 2011). Nevertheless, studies reported by Grant and Berry (2011) demonstrated that intrinsic motivation can interact with other domain-relevant emotion traits to enhance creativity.

Harmonious Passion

Harmonious passion is defined as autonomous internalization of an activity; that is, a certain activity is both enjoyable and becomes integrated into one's identity (i.e., a person who enjoys painting defines himself or herself as a painter) (Vallerand et al. 2003). Although research on harmonious passion and creativity is only in its initial stages, we include it here as a promising area of inquiry. Field studies of employees at a porous metal company and a large commercial bank have shown that harmonious passion mediates the effects of autonomy in the workplace on individual creativity, measured by employees' team-leader ratings (Liu, Chen, & Yao 2011). Harmonious passion also predicted deliberate practice, which, in turn, increased creativity in performing arts students, assessed by instructors and program directors (Vallerand et al. 2007).

Hypomanic Mood

Hypomanic mood,[2] similar to positive emotion states, is hypothesized to be associated with creative production through increased risk-taking and greater access to unusual thoughts or associations (Lloyd-Evans, Batey, & Furnham 2006). Hypomanic mood, characterized by breadth and fluency of thinking and high energy level, is correlated with both measures of creative potential (i.e., divergent thinking and self-perceived creativity) and creative activities (Eckblad & Chapman 1986; Schuldberg 1990, 1999).

von Stumm, Chung, and Furnham (2011) examined hypomania, Big Five personality traits, and creativity in a student sample. A latent class analysis of responses on the Biographical Inventory of Creative Behaviors (Batey 2007) identified three distinct groups: noncreative, average creative achievers, and high creative achievers. The high creative achievers had highest scores on divergent thinking fluency and originality, openness to experience, neuroticism, extraversion, and hypomania.

Furnham and colleagues (2008) found that hypomanic traits significantly correlated with three creativity criteria: a divergent thinking task, self-perception of creativity, and an inventory of creative behavior. Hypomania showed incremental validity over fluid intelligence for all three creativity criteria. However, when the Big Five personality traits were entered into the regression, hypomania was only predictive for self-ratings of creativity (openness and extraversion had the highest predictive validity). Additional research will need to address incremental predictive power of hypomania beyond Big

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Five personality traits for different criteria for creativity, especially considering that both hypomania and extraversion describe positive and exuberant mood and high activity.

Emotional Creativity

Emotional creativity is the ability to experience original and effective combinations of emotions (Averill & Thomas-Knowles 1991). A test of emotional triads asks people to describe a situation in which at the same time they experienced disparate emotions, such as affection, disgust, and hope or loneliness, anger, and joy (Averill & Thomas-Knowles 1991). Averill (1999a, 1999b) described three criteria for emotional creativity: novelty (i.e., experiencing variations and combinations of common emotions that result in new, individual-specific emotions), effectiveness (i.e., appropriateness or usefulness for a given situation), and authenticity (i.e., whether the new emotions reflect one's experiences and values). Emotional creativity may provide subject matter for creative work, as well as enrich people's thinking and associations, and thus enhance creative expression.

While emotional creativity has not received as much attention as some of the other emotion-related traits reviewed here, there is evidence that it might predict creativity when expression and richness of emotions are crucial for the work. Emotional creativity might be especially important in the arts. S.B. Kaufman (2013), for example, found that affective and aesthetic engagement was associated with creative achievement in the arts but not in the sciences. A self-report measure of emotional creativity predicts creativity criteria from self-perceived creative capacity and self-reported childhood fantasy and play (Fuchs, Kumar, & Porter 2007) to creativity ratings of poems written in the laboratory, self-reported involvement in artistic creativity and art appreciation activities (Ivcevic et al. 2007), and creativity of stories about emotionally ambiguous situations and expressionistic quality in pictures of specific emotions (e.g., creative use of color and space) (Gutbezahl & Averill 1996). It remains unclear, however, whether emotional creativity is a significant predictor of creativity after controlling for openness to experience (e.g., inconsistent results in studies 1 and 2) (Ivcevic et al. 2007).

Emotion Abilities and Creativity

Research at the intersection of emotion and cognition gave life to a distinct area of inquiry – *emotion abilities*. These abilities collectively refer to capacities to reason with and about emotions (Mayer, Roberts, & Barsade 2008). Unlike emotion-related personality traits that describe people's tendency to experience positive or negative emotions, emotion abilities involve processing of emotion-laden information, such as accurately identifying causes and consequences of emotion states or recognizing emotions in others' faces or nonverbal

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behavior (Elfenbein & Ambady 2003; Izard et al. 2007). The "theory of emotional intelligence" (Mayer & Salovey 1997) offers a broad framework to discuss emotion abilities and defines four related abilities: perception of emotion, using emotions to aid thinking, understanding emotions, and managing or regulating emotions. While the importance of emotion abilities has been amply established in relation to a host of social and achievement outcomes (e.g., Brackett, Rivers, & Salovey 2011; Eisenberg, Sadovsky, & Spinard 2005), their role in creativity remains less well understood. In this section we bring together research from disparate lines of work – from child development to studies of leadership and organizational behavior – and start painting a picture of the role emotion abilities play in creativity. We focus on two emotion abilities: using emotions to aid thinking and emotion regulation.

Ability to Use Emotions to Help Thinking

The ability to use emotions to help thinking involves a capacity to apply knowledge about emotion-cognition links to improve thinking and task performance (Salovey, Mayer, & Caruso 2002). For instance, this ability can involve choosing tasks that are best suited to one's emotion state or redirecting and prioritizing thinking based on experienced emotions. Individuals who are aware that low activation negative emotion states are associated with more successful critical thinking and that high activation positive emotion states are associated with more original and flexible thinking in short brainstorming sessions (Baas et al. 2008; Palfai & Salovey 1993) can apply this knowledge when deciding on which tasks to work at different times (e.g., they can choose to work on generating title ideas for a story or article when in a happy, playful mood). The ability to use emotions to help thinking can also aid one in prioritizing different tasks. This ability can make it possible to follow the advice of B. F. Skinner (1982), who famously said that when one runs into something interesting, everything else should be dropped – the ability to use emotions can allow an individual to recognize when excitement indicates that the new idea is indeed worth pursuing, even at some cost. Finally, using emotions to help thinking involves an ability to generate emotions at will, such as when actors draw on personal memories to portray others' emotions.

What do people with an ability to use emotions do when facing a problem requiring creative idea generation? Cohen and Andrade (2004) demonstrated that some people consciously choose to generate moods that will benefit the tasks they face – positive and high arousal moods in the case of creative idea generation tasks. They used video clips to induce either positive or negative emotions. Next, participants were told that they would be performing either a task requiring precise analytic thinking or a task generating creative and imaginative ideas. Before the tasks, participants were given a choice to listen to happy or sad music and in this way make their mood either more positive or more negative. People tended to listen to upbeat music when they expected to work on a brainstorming task and sad music when they expected to work on an analytic task, thus

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deliberately putting themselves into the mood that can facilitate performance on particular tasks. The study showed that people do not manage their moods only to make them more positive but that they also consider how useful different emotions are for a task at hand. Some people decided to make their mood more negative because negative moods are helpful for critical thinking, while others chose to make their mood more positive because happy moods help original thinking. However, not all people matched their emotions to the tasks awaiting them, pointing to the importance of individual differences.

The process of using emotions to aid thinking and performance is clear in method acting. An actor intentionally generates emotions and associated thoughts based on personal experiences and recalled memories and conducts an in-depth study of the social context, life circumstances, and motivations of the character in order to create a realistic portrayal of a role (Strasberg 1988). This ability to generate emotions to create a character is predicated on the ability to imagine others' emotions and thoughts, which is higher in both adolescent and adult actors when compared with those without acting experience (Goldstein, Wu, & Winner 2009).

The ability to use emotions to stimulate creativity is also evident in processes of interpersonal influence. Leaders and supervisors can choose to strategically share positive emotions to stimulate creative and entrepreneurial thinking, as well as to encourage persistence in striving for challenging goals (Cote & Hideg 2011; Vallerand et al. 2003). At other times, leaders can choose to convey negative emotions in order to promote critical thinking and increased task effort. This ability can be playing a role in creativity in teams or when presenting creative ideas, such as when communicated entrepreneurial passion influences evaluation of funding potential (Cardon et al. 2009).

Similarly, using emotions to help thinking is evident when feedback affects subsequent creativity. Van Kleef, Anastasopoulou, and Nijstad (2010) asked participants to complete a divergent thinking test (unusual uses for a potato) and presented them with either neutral or angry feedback before working on another divergent thinking task (unusual uses for a brick). After receiving angry feedback, originality on the second divergent thinking task was higher in individuals motivated to develop a rich understanding of the situation (high epistemic motivation). When receiving angry feedback, these individuals were able to interpret it as diagnostic of their poor performance and use this information to motivate performance on the following task.

Emotion Regulation Ability and Creativity

Emotion regulation involves influencing and changing emotions and emotional reactions in order to reach a goal (Gross 1998, 2008). Creative achievement in any domain, from the arts to scientific research to technology, is filled with emotions, including the excitement of inspiration, frustration in the face of obstacles, disappointment at rejections or failures, and the elation of positive reception by the field. Such emotions have to be managed and regulated

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effectively in order for people to maintain interest and persist in their work. Effective emotion regulation requires understanding the consequences of one's potential reactions, having knowledge of what strategies are generally more or less helpful, and an ability to evaluate what strategies would be most useful for a particular situation (Brackett et al. 2011). Emotion regulation is necessary to change negative or distressing emotions (e.g., when anxiety inhibits problem finding and creates a writer's block) and also positive but distracting or overwhelming emotions (e.g., when one cannot focus on revising a manuscript because of a recent joy of success).

The importance of emotion regulation ability for creativity is supported by studies with preschool and elementary school children (Russ 2014). Parental reports of successful emotion regulation are correlated with both imagination in pretend play and divergent thinking test scores (Hoffmann & Russ 2012). Similarly, Butcher and Niec (2005) found that poor emotion regulation mediated the relationship between greater frequency of disruptive behavior and lower creativity measured both by parent reports and divergent thinking in elementary school children.

Emotion regulation ability can affect the creative process in two distinct ways: by influencing emotions outside the creative process (e.g., stemming from personal or family life) and by enabling people to manage emotions that are integral to the creative process (e.g., stemming from poor reception or evaluation of one's work). Emotions experienced in one context (e.g., family life) can spill into another context (e.g., work) and influence thinking and performance (Van Dyne, Jehn, & Cummings 2002). Freud (1958/1925) was the first to describe how regulating potentially overwhelming emotions can lead to creativity. He posited the defense mechanism of sublimation as the basis of artistic and other creation. In the process of sublimation, inappropriate impulses and associated emotions are managed by being expressed through socially desirable behavior, such as when everyday sexual or aggressive motives are expressed through art. Freud's idea of sublimation received empirical support in a series of studies in which experimental priming of guilt with damnation words, inducing unacceptable sexual desire, or requiring participants to suppress anger resulted in higher creativity of sculptures, collages, poems, and cartoon captions in the laboratory (Kim, Zeppenfeld, & Cohen 2013).

Kris (1952) elaborated on Freud's theory by describing a regulatory mechanism of regression in the service of the ego – the ability to access repressed impulses, emotions, and images while at the same time maintaining control and not getting overwhelmed by these impulses. Regression in the service of the ego assessed by the Rorschach inkblot test can distinguish between experienced and inexperienced artists and children scoring high or low on the Torrance Tests of Creative Thinking (Dudek & Chamberland-Bouhadana 1982; Dudek & Verreault 1989). Considering that affective and aesthetic experiences predict artistic creativity (S.B. Kaufman 2013), regulating strong or unacceptable emotions by expressing them in creative work might be especially relevant in the arts.

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Regulation of specific emotions, such as boredom, can be directly beneficial to creativity. When people are bored during an activity, they are not likely to be creative (Nakamura & Csikszentmihalyi 2002). However, research shows that people differ in the ability to transform or cope with boredom, and effective coping with boredom is usually accomplished through seeking novelty (Hamilton, Haier, & Buchssbaum 1984). Moreover, susceptibility to boredom appears to be largely due to a lack of emotional awareness, a component of *alexithymia*, an inability to identify and understand emotions and a tendency to minimize emotional experiences (Eastwood et al. 2007).

Emotion regulation ability is also necessary for managing emotions that arise during or as by-products of creation, such as feelings associated with challenges or obstacles, poor reception or evaluation of one's work, and potentially overwhelming emotions associated with great success. An inability to successfully regulate emotions can have dire consequences, demonstrated by research on creative mortification – loss of willingness to engage in a particular creative activity as a result of negative feedback and associated strong self-conscious emotions (Beghetto 2014). Creative mortification is more likely at younger ages, probably because children did not acquire mature strategies for regulating their emotions in ways that can lead to long-term success and well-being. Furthermore, emotion regulation ability is key to successfully negotiating the social aspects of creativity when presenting one's work to the domain gatekeepers (e.g., pitching a business idea to potential investors) or a broader audience (e.g., coping with stage fright).

There is also evidence that the act of emotion regulation, may be relevant for creativity. Bledow, Rosing, and Frese (2013) demonstrated that a change in emotions characterized by decreasing negative and increasing positive mood predicts creativity and that this process (termed *affective shift*) is more important for creativity than the simple presence of positive mood. In Study 1 (diary study), naturally occurring affect was assessed in the beginning and at the end of a workday for five days. People who started their workdays in a negative mood and shifted to positive mood rated their days as more creative than those who did not show such affective shift. In Study 2, participants' mood was induced to shift either from neutral to positive or from negative to positive through recall of two autobiographical memories (first, neutral: activities from a previous day, or negative induction: something that made them feel "afraid, distressed, or nervous"; second, something that made them feel "happy, inspired, or enthusiastic"). Participants in the negative-to-positive-shift group had higher flexibility and originality scores on an idea-generation task (how to improve quality of teaching in their department) than participants in the neutral-to-positive-affect group. This study suggests that positive or negative moods by themselves are not key for creativity, but rather point to the importance of a change in mood, such as evident in the process of emotion regulation.

How does the affective shift impact creativity? First, negative mood facilitates problem finding, critical analysis, and evaluation of the situation and

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conveys information that effort is needed to address the problem (Foo, Uy, & Baron 2009; Gasper 2003; Martin et al. 1993). An increase in positive mood boosts cognitive flexibility and originality, which can aid creative idea generation (Bass et al. 2008). The affective shift offers an opportunity to use information available from both the negative and positive phases. This is an example in which two emotion abilities – managing emotions to decrease negative and increase positive mood and extracting and using information gained from different emotional states – work together to facilitate creativity. An individual who regulated his or her mood from negative to positive can use knowledge about limitations and pitfalls in a project (gained in a negative mood) as well as new ideas and remote associations (gained in a positive mood) to create new solutions.

Ivcevic and Brackett (2015) explicitly examined the role of emotion regulation ability in predicting creative behavior. High school students completed a test of emotion regulation ability that asked them to evaluate usefulness of various strategies aimed at producing a desired regulation outcome (e.g., making someone regret insulting you in front of others), as well as self-reported openness to experience (personality disposition toward creativity). Creativity was measured via peer nominations, and teacher nominations of passion for one's interests and persistence in the face of obstacles also were obtained. A significant emotion regulation ability by openness to experience interaction was observed such that emotion regulation predicted creativity in those with medium or high levels of openness, but not in those low in openness. Furthermore, the relationship between emotion regulation ability and creativity was mediated by persistence and passion. Thus, emotion regulation ability helped individuals to transform their creative potential (personality disposition toward creativity) into behavior by enabling them to maintain interest and motivation for sustained activity.

Future Directions

Where does research on emotions and creativity go from here? As Sternberg (1999) outlined in the propulsion model of creative contributions, multiple avenues for research are possible, from replications and incremental changes, to integrative models that can be tested empirically (Figure 11.1), to those that attempt to replace current paradigms. All these contributions are necessary. A special section of *Psychology of Aesthetics, Creativity and the Arts* spoke to the importance of replication in the study of creativity (e.g., Makel & Plucker 2014). The systematic investigation of the conditions under which different emotion states affect creative idea generation is a wonderful example of forward incremental contributions (e.g., Van Kleef et al. 2010). Similarly, future research should address questions of how different facets of the major personality trait dimensions facilitate or inhibit creativity; while openness to experience is the only Big Five dimension consistently related to creativity,

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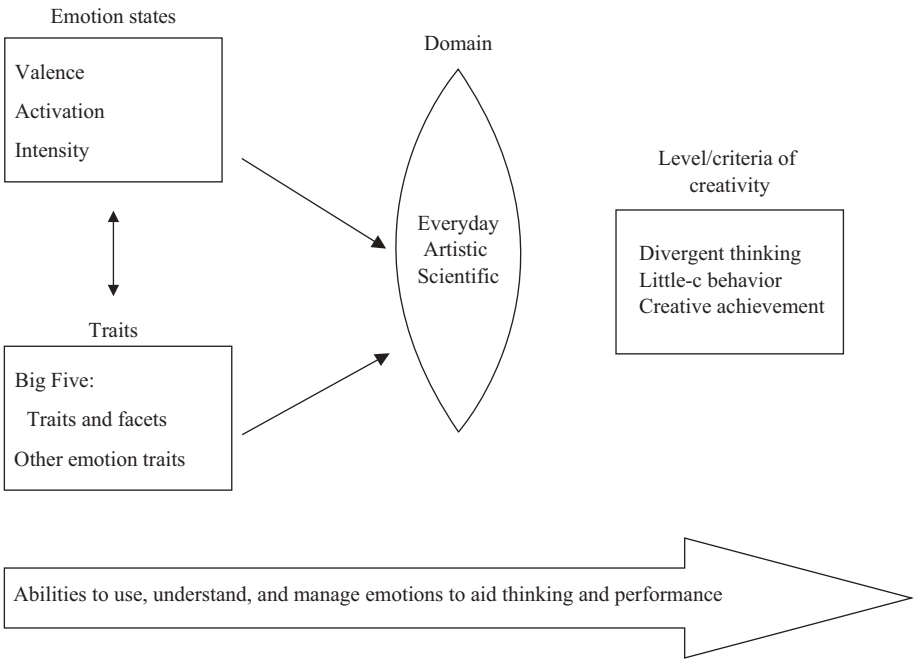

Figure 11.1 *The relationship between emotions and creativity: From emotion states to emotion traits and emotion abilities.*

it appears that some aspects of other dimensions also can be related to creativity in different domains. Without such research, we will fail to understand the creative person(ality).

It is much more difficult to predict potential paradigm-changing types of contributions. We prognosticate (and call for action on) two possible such avenues for creativity research, one focused on emerging technologies and one focused on the construct of emotion abilities and their interaction with emotion states and traits. The study of emotions in the creative process has relied on either correlational methods or experiments that induce a particular emotion state and then ask people to work on various creativity -related tasks. This method allows a measure of control over the input mood, but it does not enable us to assess what happens during the creative process. Can we open the black box of emotion during the creative process? Reliance on self-reports of mood prevents assessment of one's state while working on a task, but the emerging (and ever-improving) technologies should enable us to start answering such questions. For instance, wristband sensors can provide continuous assessment of electrodermal activity, a measure of physiological arousal (Poh, Swenson, & Picard 2009). These wristbands have been used successfully to study physiological activation in various situations, such as occupational therapy for children with disabilities (Hedman et al. 2012) and learning a new game (Hedman 2011). This technology can be easily applied to study creativity in the laboratory, as well as in more naturalistic settings for creative work.

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Another way to peek into the black box of emotion during the creative process might involve analysis of facial expressions of emotions while working on a creative task. This can be done by coding facial muscle movements of videotaped individuals engaged in a creative process (using Ekman and Friesen's [1978] facial action coding system). There are also several software packages available for this purpose (e.g., FaceReader from Noldus Information Technology) that make the research process more economical. Such software uses a camera to capture the person's face while he or she works on a task and analyzes facial expressions characteristic of a set of specific emotions, as well as the neutral expression. This technology has been used to understand performance-related emotions such as those students experience during computer-based assessments (Terzis, Moridis, & Economides 2013) and when different achievement goals are induced (Sideridis et al. 2014).

Another area of future research should include examination of emotion abilities, such as those pertaining to using emotions to aid thinking and problem solving, understanding, and managing emotions. This research area involves a redirection in the field; instead of asking what emotions affect creativity (as summarized in the meta-analyses by Baas and colleagues [2008]), this research asks what people do with their emotions and focuses on individual differences in people's ability to capitalize on and influence different emotion states. This approach builds into the research questions the assumption of individual agency in relation to emotions – people are able to influence the course of their emotions and mobilize their emotions to reach a goal. In this process, emotions can serve as inspiration (e.g., frustration when reading a research study inspires a new set of questions) and guides in the work process (e.g., times of low arousal and slightly negative mood can be used to review and revise one's work). Similarly, managing mood swings from frustration in front of obstacles or creative blocks to the elation of inspiration is crucial to maintain interest and persist on a project. As noted by Kinney and Richards (2014) in discussing the link between psychopathology and creativity, complex emotions and unusual ideas can be used as inspiration or serve as triggers for greater introspection. However, unusual emotions will lead to creative achievement only when paired with the ability to manage them.

Conclusion

In several decades of research on creativity and emotions, much has been learned. We know that emotion states affect creative idea generation (Baas et al. 2008), that the personality dimension of openness to experience reliably predicts creative thinking and achievement (e.g., Feist 1998; McCrae 1987; Nusbaum & Silvia 2011), and that a number of other emotion-related traits are linked to creativity, such as intrinsic motivation and passion (Amabile 1996; Vallerand et al. 2007). At present (and in the immediate future), research is focused on understanding more complex relationships of emotion states and

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traits in predicting creativity, such as when finding that for individuals high on neuroticism, feeling worry (rather than happiness) leads to better performance on creativity tasks (Leung et al. 2013). As outlined under "Future Directions," we have several hopes for the study of emotion and creativity, including the use of emerging technologies to measure different aspects of emotion during the creative process and the study of how emotion abilities affect creativity.

To summarize our review, Figure 11.1 illustrates the roles of emotion states, emotion traits, and emotion abilities in creativity.[3] Both emotion states and traits shape the creative process independently, as well as through their interactions. Caution is needed when making conclusions about creativity in general because different criteria are likely to have (somewhat) different predictors. Are we studying creative thinking or creative behavior and achievement? If we are studying creative thinking, are the tasks capturing only idea generation or also evaluation of ideas? Finally, outcomes have to be examined through the lens of different domains to be better able to understand both domain-specific and general aspects of creativity. Throughout the creative process, people vary in their ability to use emotions to help thinking and problem solving and to understand and manage emotions for greater success in their creative work. Empirical research that addresses interactions among various emotion states, traits, and abilities not only will further our knowledge of creativity but also will start enabling us to formulate practically useful suggestions and advice.

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Notes

1 In this chapter we focus on individual creativity and take the psychological perspective on emotion and creativity. By making this choice, we decided not to review research on group or team creativity or neuroscience research. Both these areas of work are increasingly popular and enrich our understanding of creativity. However, the space available to this chapter would not allow us to do justice in reviewing such a broad array of topics.

2 For the purposes of this chapter, hypomania is examined as a personality characteristic and is thus distinguished from the more severe hypomanic and manic episodes occurring in those diagnosed with the bipolar disorder. Richards (1990) suggests that milder elevated mood states, such as those experienced by people with cyclothymia or

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who are relatives of people with affective disorders, may carry the greatest creative advantages. See Feist (2013) for further discussion of affective traits occurring in mental illness and their relation to creative thought.

3 This figure is an elaboration of a model developed in collaboration between the Yale Center for Emotional Intelligence and the Botin Foundation that focuses on the role of emotion abilities in creativity (Ivcevic et al. 2014).

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12 Innovation Motivation

A Social Learning Model of Originality

Stephen P. Joy

Once upon a time, my young daughter stood on a tall hill and studied the surrounding landscape with a brass telescope. At first she fiddled around with the focus and magnification; one view yielded rich details about tiny spaces; another, a fuzzy image of the vast horizon. But soon she had found the proper range. Let us likewise begin in too-narrow compass (a personal anecdote) and then open out to a too-broad (almost impressionistic) perspective en route to a proper survey of the subject at hand.

For about a quarter century, the clinical psychology and personality programs at the University of Connecticut were dominated by the towering figure of Julian B. Rotter, whose synthesis of behavioral and gestalt/cognitive approaches formed the basis of social learning theory (Rotter 1982). Professor Rotter was also renowned as a personality test developer, having (most notably) introduced the Rotter Incomplete Sentences Blank (Rotter, Lah, & Rafferty 1992) and the "Locus of Control" scale (Rotter 1966). His required course on constructing and validating personality measures was a rite of passage for graduate students; the final paper was never completed by term's end and often haunted students for years in part because Professor Rotter was not satisfied with half-baked ideas. A remark he offered on an early iteration of my paper illustrates the point. I had been thinking chiefly in terms of a desire to be unique or unusual. "You're just looking for people like yourself," he quipped. This forced me to contemplate how the ideas I wanted to explore went beyond minor social eccentricity and led to an analysis of some basic parameters of thought and action – a protracted exercise. However, many of these "Rotter papers" became the basis for theses and dissertations: some of them, the foundation for decades-long research programs. I had entered the graduate program shortly after Professor Rotter assumed emeritus status, no longer directing dissertations. But the project I undertook for his class did lead to many years of thinking and research. This may be the last occasion on which that occurred, though I'm not sure. In any event, this chapter summarizes some of the ideas and many of the findings in that research program to date.

Now, the broad view:

For more than half a century, theorizing about personality has proceeded from four principal perspectives: the psychodynamic (Arlow & Brenner 1964; Greenberg & Mitchell 1983), the narrative or personological (McAdams 1988), the social cognitive (Rotter 1982), and the trait or factor analytic (Cattell &

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Cattell 1995; Eysenck & Eysenck 1985). To these may be added the atheoretical approach (sometimes termed *dust bowl empiricism*) that concerns itself solely with questions of diagnosis and prediction (Meehl 1956). I list these roughly in order from the most purely theoretical to the most thoroughly empirical. Clinical psychoanalysts generally have little inclination toward or expertise in research (but see Fisher & Greenberg [1976] and Westen [1991] for important exceptions). Trait psychologists, of course, tend to theorize only after collecting and analyzing data. The narrative and social cognitive approaches are perhaps more balanced in this regard.

When we zero in on the literature on *creative* personalities and rather oversimplify the situation, we find a fairly steady rivulet of psychodynamic ideas (as usual, seldom accompanied by hard data), a vast and increasing flood of purely empirical and trait-based research (the latter only occasionally accompanied by post hoc theorizing [cf. Eysenck 1993]) – and very little in between. For example, we know that empirically keyed scales (Gough 1979) can predict creative behavior (no great surprise, since such scales are derived by contrasting highly creative individuals with other groups). Similarly, we know that certain higher-order traits identified through factor analysis, such as openness to experience (McCrae 1987) and psychoticism (Eysenck 1993), correlate with some aspects of creativity (Feist 1998, 2010), or at least originality, as do weighted combinations of first-order traits (Drevdahl & Cattell 1958). We can leverage these findings into expanded knowledge of the correlates of creativity, but should not delude ourselves into believing that we have thereby decoded the creative mind itself.

What is needed, then, is a rationally derived theoretical model of creativity that also leads to a program of empirical research. This is most likely to emerge from either the social learning or the narrative tradition. This chapter presents a social learning theory of originality.

Begin with perhaps the most basic fact known to psychological science: *reinforcement guides future behavior*. To paraphrase Thorndike, actions that lead to satisfying outcomes tend to be repeated. It is seldom appreciated just how great a challenge this poses to the very existence of creativity. Were reinforcement the sole guiding principle, then competent organisms, having met with success, would tend to repeat themselves ad nauseam; only those with defective learning systems would continue to innovate. This goes beyond the oft-quoted dictum, "No great genius without a touch of madness"; it posits that creativity is nothing more than an accidental by-product of deteriorated cognition. Given that creative individuals tend to be of at least high-average intelligence, this is manifestly false. At least one more principle must be operative, something that tends to counter the impact of reinforcement. There are several ways to manage this, of which I will discuss two.

The first possibility is that there is a second motivational force impelling us to engage in behavioral variation. This would work in direct opposition to the tendency to repeat actions. Thorndike suggested as much with his *law of multiple responses*.

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The second relies on another fundamental psychological fact: *contrast enhances awareness*. Derived from the study of sense-perception, this principle also applies to learning. Conditioning occurs only to the extent that the results of our actions fail to conform to our initial expectations (Rescorla 1968; Rotter 1982), and when the same event occurs repeatedly, we habituate to it. That is to say, it ceases to have the power to command our attention – or, therefore, to motivate us. This underlies such phenomena as satiation and reactive inhibition. It may be able to account for our persisting tendency to engage in novel behaviors despite the success of our current adaptive efforts.

Whichever possibility proves to be closer to truth, the end result will be something like an opponent-process system, working to maintain balance in response to environmental challenges. And presumably the relative strength of the tendency to repeat reinforced behaviors and the disposition toward originality vary across individuals. Those in whom the craving for contrast is strong relative to the power of reinforcement to form habits will engage in more original thoughts and deeds. Some of these novel acts will succeed in solving important problems and so be deemed creative.

Starting with this analysis, we can construct a theory of originality based on an expanded version of Rotter's (1982) social learning theory. That theory maintains that *expectancy* and *reinforcement value* are the two factors inducing us to act as we do. *Expectancy* refers to the strength of our belief that we can attain a given outcome if we act in certain ways. *Reinforcement value* refers to the strength of our liking (or dislike) for said outcome. Years of experience in more or less related situations lead to generalization. These *generalized expectancies* and *need values* assume a traitlike stability: still subject to change, but only if we encounter a great many disconfirming experiences. The most interesting generalized expectancies are those deriving from abstracted problem-solving skills, such as the degree to which we trust others or believe we can control our lives by our own actions. Rotter (1982) discusses need values solely in terms of the nature of the reinforcements sought (such as approval from others). Drawing on the *Premack principle* (Premack 1959), I have argued that we also develop needs for whole classes of behavior. That is, the opportunity to engage in certain activities becomes a potent reinforcer in and of itself.

Innovation motivation theory posits that two socially learned personality variables should account for a substantial portion of the variance in behavioral variation. One of these is termed the *need to be different*. The *need to be different* is defined as the extent to which a person finds the opportunity to engage in behavioral variation intrinsically reinforcing. Such variation may include both varying one's own behavior (i.e., trying out new approaches even when the old one worked pretty well) and behaving differently than other people (perhaps ignoring or flouting social conventions). The other key variable is the generalized expectancy that behavioral variation will lead to reinforcing outcomes: in short, *innovation expectancy*.

The need to be different and innovation expectancy will often work in tandem, perhaps even interactively, to increase (or decrease) the likelihood of

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original behavior. However, they are likely to be activated under somewhat different circumstances and to have somewhat distinct, though overlapping behavioral results. For example, the need to be different involves the pursuit of novelty *for its own sake*. If a person high in this need sees an opportunity to earn extrinsic reinforcement through originality, s/he will happily do so (and be deemed creative). But if s/he does not see a way through to extrinsic reinforcement, s/he will be original nonetheless (and perhaps be deemed eccentric). Thus, the need to be different can explain the oft-noted correlation between creativity and eccentricity without rendering it as pathological. Innovation expectancy, however, is a problem-solving style that will be activated mainly when we are pursuing some kind of extrinsic reinforcement. It should be less strongly related to "art for art's sake" or personal eccentricity than the corresponding need value.

As with other cognitive theories, Rotter's (1982) tended to focus solely on conscious or explicit beliefs and values. This is partly because cognitive theorists, especially in the early years of the cognitive revolution, were concerned not to be grouped with the psychoanalysts, and partly because explicit thinking is easier to study. Of course, motivation researchers have long known that unconscious or implicit *needs* are as important as explicit *values* (McClelland 1985). We measure values using self-report inventories; we measure needs by other means, such as thematic coding of fantasy. It is safe to assert that the same is true of expectancies. We act based on both explicit and implicit beliefs and desires. In this sense, certain core psychodynamic hypotheses have been vindicated, albeit using a different vocabulary and improved research methods. Innovation motivation theory accepts the likelihood that innovation expectancy and the need to be different have both explicit and implicit aspects, which are likely to correlate only moderately with each other. However, to date, only self-report measures have been developed. That measuring the value set on the opportunity to engage in self-differentiating activities is termed the v*Differ scale* (Joy 2004); that measuring the generalized expectancy that innovation will lead to desirable results, the ge*Innova scale* (Joy 1998).

Properties of the Scales

The *v*Differ scale (see Joy 2004) is a forced-choice adjective checklist; the form used in most studies has 18 scored items and 14 "filler" items. Test takers are instructed to choose the one characteristic in each pair that they would rather exemplify. For example, would you rather be *individualistic* or *respectable*? *Imaginative* or *realistic*?

The *v*Differ scale has been administered to over a dozen samples totaling more than 800 participants. Averaging across samples, the mean score has been 9.33, and the standard deviation has averaged 4.08. Results have been rather consistent; whether in samples of students or those drawn from the wider community, the mean has been above 9 but less than 10. Thus far the scale has not been administered to specific groups expected to be more or less creative

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than the norm. Internal consistency has ranged from $\alpha = 0.65$ to $\alpha = 0.83$, with most results in the middle-to-upper seventies.

The *ge*Innova scale (Joy 1998) also uses a forced-choice format but consists of pairs of statements. Thirty of these are scored; six are used as "filler." In each case, test takers are instructed to select the statement they believe to be more accurate: a better depiction of how the world works. For example, would you say that *original ideas* or *skilled execution* is more likely to lead to success for an artist? Are you more likely to be hired for a job if you have *taken on diverse challenges* or *worked steadily in the field*?

The *ge*Innova scale has been administered to about eight samples totaling over 600 participants. The mean score across samples has been 16.72; the standard deviation has averaged 4.73. Mean scores have varied no more than 2 points from sample to sample. Again, the scale has not been administered to samples of people known to be highly innovative (or averse to innovation). Internal consistency has ranged from $\alpha = 0.70$ to $\alpha = 0.79$, with most results in the middle seventies.

Relationship between the Need to Be Different and Innovation Expectancy

The value set on a behavior that may lead to a reinforcer and the strength of the expectancy that the reinforcer will be forthcoming are logically distinct. However, in practice, the two variables are likely to correlate positively to some degree. People who are confident in their ability to obtain reinforcement through certain activities will tend to value those activities, and people who intrinsically enjoy certain activities will tend to remember the occasions on which they were reinforced for engaging in them. The relationship should be moderate in strength because other factors are in play as well. One therefore anticipates a moderately positive correlation between measures of expectancies and values relating to the same sorts of activity. Were the relationship too strong, it would suggest that the tests were merely alternative measures of the same underlying construct.

Five studies have reported correlations between the *v*Differ and *ge*Innova scales (Joy 2005, 2008, 2012; Joy & Breed 2012; Joy & Gauthier 2012). The mean result is $r = 0.40$, with values ranging from 0.30 to 0.50. Other unpublished data have yielded similar results. It seems safe to assert that the value set on the opportunity to engage in behavioral variation is moderately correlated with the strength of the belief that such activities will lead to reinforcing outcomes. This is consistent with the theoretical model.

Relationship with Intellectual Ability

Cognitive and affective variables being different in kind, they ought not to correlate very strongly. However, some personality characteristics (e.g., openness to experience) do manifest significant correlations with cognitive ability.

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Innovation motivation impels a person to explore novel approaches. Finding new ways of doing things requires cognitive activity, so being more clever would help one to do so. Furthermore, engaging in a wider range of activities and experiences should have some positive impact on the intellect. Therefore, one expects a modest positive correlation between innovation motivation and intellectual ability.

Five studies using the *v*Differ scale have included measures of cognitive ability: a multiple-choice version of the Wechsler Adult Intelligence Scale – Revised (WAIS-R) Information subtest (Joy 2005), scale B of the Sixteen Personality Factor Questionnaire (16PF [Joy 2012; Joy & Hicks 2004]), or the abstract reasoning subtest of the Differential Aptitude Test (DAT [Joy et al. 2011, 2013]). The mean correlation between the need to be different and intelligence was $r = 0.26$.

Three studies using the *ge*Innova scale have included measures of cognitive ability: Information Multiple Choice (Joy 2005), factor B of the 16PF (Joy 2012), or the DAT abstract reasoning subtest (Joy et al. 2011). The mean correlation between innovation expectancy and intelligence was $r = 0.28$.

Taken together, these findings suggest that there is, as expected, a modest correlation between innovation motivation and general cognitive ability.

Relationship with Personality Traits

Enduring motives ought to correlate with personality traits. Traits are partly genetic and predispose us to act in certain ways; actions taken early in life (and their consequences) help to form our motives. But in order for a motive (or motive pattern) to be useful as a predictor of behavior, it ought not to correspond to a single trait in a 1:1 fashion. The need to be different most obviously resembles factor V (*openness to experience*) – but is it simply another name for the same variable? Or does it correlate with a pattern of findings across several traits?

Seven studies have correlated the *v*Differ scale with measures of high-level personality traits: the Revised NEO Personality Inventory (NEO-PI-R) (Joy 2004), the 16PF (Joy 2012; Joy & Hicks 2004), the Eysenck Personality Questionnaire Revised (EPQ-R [Joy 2008; Joy & Gauthier 2012]), or selected brief scales (Joy et al. 2011, 2013). Table 12.1 shows the correlations obtained in these studies. Despite variability across samples, the overall pattern of results is clear. There is little or no relationship with extraversion or neuroticism. However, the need to be different correlates strongly with openness to experience and moderately to strongly with psychoticism. A moderate to strong negative correlation obtains with conscientiousness, and a moderate negative correlation is seen with agreeableness. Those high in the need to be different, then, tend to be eager to explore new activities and ideas, reluctant to be bound by conventional rules, and less concerned with how others perceive them.

The relationship between innovation expectancy and personality traits has been less extensively researched but enough to draw some generalizations, also

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Table 12.1 *Correlations between Innovation Motivation Variables and Personality Traits*

	Extra[a]	Agree[b]	Consc[c]	Neuro[d]	Open[e]	Psych[f]
*v*Differ scale[g]						
Joy (2004, sample 3)	.12	–.06	–.23*	.09	.67**	n/a
Joy & Hicks (2004)	.15	–.26*	–.74**	.00	.58**	n/a
Joy (2008)	–.04	n/a	n/a	–.13	n/a	.50**
Joy (2012)	.28^{+}	–.52**	–.39**	.03	.70**	n/a
Joy & Gauthier (2012)	.05	n/a	n/a	.00	n/a	.18
Joy et al. (2011)[h]	n/a	n/a	n/a	n/a	.53**	.55**
Joy et al. (2013)[h]	n/a	n/a	n/a	n/a	.53**	.26*
Mean	.11	–.28	–.45	–.02	.60	.37
*ge*Innova scale[i]						
Joy (1998)[j]	.32**	.10	.04	–.07	.53**	n/a
Joy (2008)	.01	n/a	n/a	–.09	n/a	.33*
Joy (2012)	.38**	–.27^{+}	–.47**	–.26^{+}	.44**	n/a
Joy & Gauthier (2012)	.21*	n/a	n/a	–.29*	n/a	.15
Joy et al. (2011)	n/a	n/a	n/a	n/a	.71**	.33*
Mean	.31	–.13	–.21	–.19	.56	.27

$^{+}$ $p < 0.10$;
* $p < 0.05$;
** $p < 0.01$
[a] Extraversion (NEO-PI-R, 16PF, or EPQ-R).
[b] Agreeableness (NEO-PI-R) or reversed independence (16PF).
[c] Conscientiousness (NEO-PI-R) or rule consciousness (16PF).
[d] Neuroticism (NEO-PI-R or EPQ-R) or anxiety (16PF).
[e] Openness to experience (NEO-PI-R) or reversed tough mindedness (16PF) unless otherwise noted.
[f] Psychoticism (EPQ-R) unless otherwise noted.
[g] Measure of the need to be different.
[h] In these studies, openness was measured using items from the International Personality Item Pool, and psychoticism was measured using an expanded version of the EPQ-R Short Form.
[i] Measure of innovation expectancy.
[j] This was the same sample as in Joy (2004).

shown in Table 12.1. As with the need to be different, we see a strongly positive correlation with openness, though it may be a bit weaker. The relationships with psychoticism and conscientiousness also seem weaker, and there is little or none with agreeableness. Also dissimilar to the *v*Differ findings are a moderately positive correlation with extraversion and a weakly negative one with neuroticism. A likely interpretation is that the expectancy of success in one's innovative striving is enhanced by the self-confidence typical of highly extraverted people – and there is less of a desire to be odd or unique for its own sake.

It seems clear that although innovation motivation is most strongly linked with openness to experience, it is not simply an alternative way of measuring this well-known trait. Rather, the motive is associated with a complex pattern of traits. This is even more evident on the primary factors of the 16PF (Joy 2012; Joy & Hicks 2004). The need to be different, for example, shows positive correlations with factors Q1 (openness to change or radicalism),

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M (abstractedness), I (sensitivity), and possibly F (liveliness): negative correlations with factors Q3 (perfectionism or compulsivity), G (rule consciousness), and probably N (privateness).

Relationship with Personal Adjustment

The need to be different displays a modest but consistent correlation with symptomatic distress as measured by the Symptom Checklist-90 Revised (SCL-90-R) (Derogatis 1994), with a mean result of $r = 0.23$ (Joy 2004, samples 1 and 2; Joy 2008). Similar results obtain with the Rotter Incomplete Sentences Blank (RISB) (Rotter, Lah, & Rafferty 1992), a reliable projective measure of adjustment (mean $r = 0.20$ – note that higher RISB scores indicate poorer adjustment) (Joy 2005, 2008). Given that there appears to be no relationship between the need to be different and neuroticism (the major personal factor underlying anxious depression), this finding demands some explanation. One possibility is that it is due to the overlap with psychoticism. The SCL-90-R does contain a psychoticism scale (though it does not really resemble Eysenck's scale), and RISB scores may correlate with psychoticism, albeit less strongly than with neuroticism (Joy 2003). Another possibility is that the enhanced maladjustment and distress suffered by people high in the need to be different result from social rejection and subsequent alienation caused by their unusual behaviors.

Less work has been done on innovation expectancy and adjustment, but the available data suggest that the expectancy is *not* associated with maladjustment. The mean correlation with symptomatic distress measured by the SCL-90-R is $r = -0.04$; that with the RISB Adjustment score was $r = 0.18$ in the only sample examined to date.

Validity Studies: Does Innovation Motivation Really Correlate with Creativity? And How Do We Measure Creativity, Anyway?

Strictly speaking, innovation motivation ought to predict originality of every description. When novelty leads to something useful or socially valued, we call it creative. But only a subset of our original deeds and ideas meets this standard. Other factors (such as intelligence, special talents, sustained effort, social opportunities, good timing, and sheer good luck) are every bit as important as innovation motivation. In cases where the individual sees little hope of achieving innovative success or wishes to be more unusual than his or her society will readily tolerate, s/he is likely to fall back on "bohemian" attitudes – to be original in the French sense: eccentric. It is likely that those with a strong need to be different but a low expectancy of innovative success will be the ones reporting high levels of maladjustment; the world they inhabit is not the world they wish it to be. For the present, however, we are concerned with creativity.

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Several research strategies can be employed to assess the validity of a theorized predictor of creativity. One is the divergent thinking approach, popularized by Guilford (1957). This capitalizes on the fact that to be creative, an idea must be novel or original. The basic hypothesis is that people who are able to generate more, and more unusual, ideas will tend to be more creative. A classic example is asking someone to think of new ways of using a common object (such as a spoon); another is to try to think of the possible consequences of a single major change (such as replacing universities with an apprenticeship system). Although much criticized in recent years (partly because the ideas in question need not be "good" ones), this approach dominated creativity research for many years and continues to be used. At a minimum, it seems fair to assert that divergent thinking is a necessary precondition for creativity.

An alternative approach is to have people actually create something (such as a picture or a story) and then have judges rate the products for their creative qualities. Popularized by Amabile (1982) as the *consensual assessment technique*, this has the advantage of allowing judges to incorporate both originality and quality into their ratings. Preferably, the judges have expertise in the domain in question. Inter-rater reliability needs to be evaluated, but tends to be reasonably strong (and if it is weak, adding more judges will remedy the situation).

As variants on the consensual assessment approach grow more popular, a question arises: to what extent may findings from the divergent thinking literature be generalized to this newer approach? I have examined this by devising originality scoring systems for creative products and then correlating them with the pooled ratings of my judges (Joy 2005, 2008, 2012). For example, a drawing of a house will usually include such features as a door, a chimney, and perhaps some shrubbery, but only rarely will an artist include a tricycle or a widow's walk – or portray a grass hut. In short, features can be scored based on their frequency of occurrence within a sample. These originality scores generally correlate quite well with judged creativity. Other researchers have found that responses on divergent thinking tasks can be judged for creativity; the resulting ratings not only correlate well with traditional scoring methods, but also show good evidence of validity (Batey & Furnham 2009; Silvia et al. 2008).

A third approach is to use actual creative output (e.g., number of patents filed or poems published) as the criterion. Such achievements have, of course, the advantage of *being* the criterion in which creativity researchers are interested. Several research designs can be employed. Perhaps the best is to administer one's predictive measures to a youthful sample and then wait a few decades before assessing creative output (Runco et al. 2010). More commonly, investigators conduct cross-sectional studies of groups whose members are known to differ in their creative output, but are similar in other ways (e.g., more versus less inventive engineers). Historiometric methods (Simonton 1999) also are useful in this regard.

Alternatively, one may employ self-report measures of creative works, such as the Creative Achievements Questionnaire (CAQ [Carlson, Peterson, &

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Higgins 2005]). This has the disadvantage of assuming that all participants set the same threshold for reporting an achievement. For example, if asked whether you had won an award for your scientific research, would you count that honorable mention in the eighth grade science fair? Does your CV count the column you wrote for the alumni newsletter as a publication? But it has the advantage of being an easy way to collect data.

Also widely used is the Remote Associates Test, pioneered by Mednick (1968). Like the divergent thinking approach, this presumes that highly creative people are able to access less common associations to stimulus ideas. Unlike divergent thinking measures, however, Remote Associates Tests are basically exercises in convergent problem solving. The challenge is to identify the single word that is associated with each of the three stimulus words presented.

All three of the major methods (divergent thinking, consensual assessment, and creative achievement) have been used in the innovation motivation research program, though the third is underresearched. A version of the Remote Associates Test (Bowden & Jung-Beeman 2003) has also been tried. Table 12.2 shows the zero-order correlations between innovation motivation and various criterion measures obtained in nine separate samples totaling about 650 participants. The following section discusses these findings according to the type of creativity measure used.

Divergent Thinking

Innovation motivation research has used two distinct approaches to measuring originality or divergent thinking. Two studies of the need to be different used traditional divergent thinking measures: the Torrance Tests of Creative Thinking – Verbal (TTCT) (Joy & Breed 2012) and a custom-designed set of tasks including a word association test as well as category exemplars, new uses, and social consequences (Joy 2001, 2004, sample 5). Three other studies applied an originality scoring approach to six different creative products: sets of drawings (Joy 2005, 2008), poems (Joy 2008, 2012), comics (Joy 2012), and Thematic Apperception Test (TAT) stories (Joy & Breed 2012). Seven of these correlations were statistically significant; the mean result was $r = .42$.

The relationship between innovation expectancy and original or divergent thinking also has been studied using the TTCT (Joy & Breed 2012), drawings (Joy 2005, 2008), poems (Joy 2008, 2012), comics (Joy 2012), and TAT stories (Joy & Breed 2012). Five of these seven analyses yielded significant or near-significant results, with mean $r = 0.29$.

Consensual Validation

Seven studies of the need to be different have used teams of judges to rate 11 different creative products for creativity or value. These have included drawings rendered using a No. 2 pencil, colored pencils, and crayons (Joy 2005, 2008; Joy & Hicks 2004; Joy et al. 2011, 2013), poems (Joy 2008, 2012;

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Table 12.2 *Correlations of Innovation Motivation, Personality Traits, and Ability with Creativity Measures*

	Innovation motivation		Personality traits		
Creativity measure[a]	*v*Differ[b]	*ge*Innova[c]	Openness[d]	Psychot[e]	Cognitive ability
Joy (2001, 2004[f])					
Word association	.30**	—	—	—	0.21^{+}
Category exemplars	.31**	—	—	—	.25*
Original uses	.31*	—	—	—	.14
Social consequences	.36**	—	—	—	.32*
Composite	.48**	—	—	—	.31*
Joy & Hicks (2004); Hicks (2002)					
H-T-P proficiency	.37**	—	.33*	—	.41**
H-T-P creativity	.30*	—	—	—	—
Joy (2005)					
Artifact originality	.47**	.51**	—	—	.21
Life-form originality	.30*	.34*	—	—	.37*
Person originality	.45**	.26^{+}	—	—	–.23
Composite	.57**	.51**	—	—	.18
Judged proficiency	.32*	.26^{+}	—	—	.20
Judged creativity	.40**	.34*	—	—	.38**
Joy (2008)					
Poem originality	.47**	.27*	—	.40*	—
Judged poetic value	.36**	.14	—	.10	—
H-T-P originality	.57**	.21	—	.31*	—
H-T-P judged proficiency	.47**	.06	—	.18	—
H-T-P judged creativity	.36**	.02	—	.12	—
Joy (2012)					
Poem originality	.31*	.29*	.26^{+}	—	.10
Judged poetic value	.34*	.20	.22	—	.26^{+}
DAS originality	.43**	.25^{+}	.20	—	.24^{+}
Judged DAS originality	.48**	.25^{+}	.33*	—	.50**
Joy & Breed (2012)					
TTCT verbal total	.37**	.29*	—	—	.34*
TAT "unusualness"	.13	.24	—	—	–.34*
Judged TAT creativity	.33*	.18	—	—	.33*
Joy & Gauthier (2012)					
CAQ self-estimate	.22*	.09	—	.27*	—
CAQ achievements	.32**	.34**	—	.00	—
Joy et al. (2011)					
Word associations	.39*	.50**	.30^{+}	.28^{+}	.17
Remote associates	.30^{+}	.17	.15	.13	.24
CAQ achievements	.43**	.33^{+}	.27^{+}	.32^{+}	.36*
Judged poetic originality	.29^{+}	.30^{+}	.30^{+}	.22	.29^{+}

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Table 12.2 (*cont.*)

	Innovation motivation		Personality traits		
Creativity measure[a]	*v*Differ[b]	*ge*Innova[c]	Openness[d]	Psychot[e]	Cognitive ability
Judged drawing originality	.28^{+}	.18	.20	.19	.19
Joy et al. (2013)					
Word associations	–.09	—	.13	.23*	.32*
Remote associates	.23*	—	–.01	–.19^{+}	.09
CAQ self-estimate	.24*	—	.16	.23*	.30**
CAQ achievements	.37**	—	.49**	.14	.31**
Judged poetic originality	.12	—	.22*	–.11	.42**
Judged drawing originality	.25*	—	.26*	.10	.42**

$^{+}$ $p < 0.10$;
* $p < 0.05$;
** $p < 0.01$.
[a] Organized by study.
[b] Measure of the need to be different.
[c] Measure of innovation expectancy.
[d] Openness to experience scale.
[e] Psychoticism scale.
[f] Sample 5 in Joy (2004) was a subset of the sample used in Joy (2001).

Joy et al. 2011, 2013), comics (Joy 2012), and TAT stories (Joy & Breed 2012). Drawing prompts have included the classic House-Tree-Person (H-T-P) procedure, a similar but more flexible Artifact–Life Form–Person set, and single drawings of a house or a "great day." Poetry prompts included associative exercises and haiku-like works. Comics were constructed using the Draw-A-Story procedure (Silver 2002). Judges have included graduate students in art therapy, professors of art and literature, secondary school teachers, and upper-level undergraduates. The mean correlation between the need to be different and the judged creative quality of these products was $r = 0.32$; 10 of 11 correlations were statistically significant or trended toward significance.

Five studies of innovation expectancy had teams of judges rate eight different creative products for creativity or value: drawings (Joy 2005, 2008; Joy et al. 2011), poems (Joy 2008, 2012; Joy et al. 2011), comics (Joy 2012), and TAT stories (Joy & Breed 2012). Only three of these correlations were statistically significant, but the mean was $r = 0.20$.

Figure 12.1 shows a drawing of a house rendered by a person low in innovation motivation. Some of these less creatively minded people rush through artistic tasks, apparently finding them unpleasant. Others, such as this individual, produce works that show evidence of invested effort and incorporate many details – but they tend to be the same details: flowers and shrubs in the garden and so on. Figure 12.2 shows a drawing of a house rendered by a person high in innovation motivation. Here we see a more unusual array of features, including a mailbox, a broken-down pickup truck, and a garbage can. Figure 12.3 shows

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Figure 12.1 *House drawing produced by a (male) participant low in innovation motivation.*

another such drawing. In this case, it is not rare details that mark the work (and artist) as original but the type of house portrayed – an igloo.

Remote Associates

The need to be different correlated with performance on a Remote Associates Test at an average $r = 0.26$ in two community samples; the correlation with *ge*Innova was $r = 0.17$.

Creative Achievements

To date, the innovation motivation research program has not included either long-term follow-up studies or samples of more versus less inventive/creative professionals; only self-reported past achievements have been assessed.

Three studies included both the Creative Achievements Questionnaire (CAQ) and the *v*Differ scale (Joy et al. 2011, 2013; Joy & Gauthier 2012). The mean correlation between the need to be different and self-reported achievements was $r = 0.37$. Two of these studies (Joy et al. 2011; Joy & Gauthier 2012) also included the *ge*Innova scale; the mean correlation between innovation expectancy and creative achievements was $r = 0.34$. To the extent that we can trust retrospective self-assessments, innovation motivation appears to be linked with actual creative achievement.

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Figure 12.2 *House drawing by a (male) participant high in innovation motivation.*

Figure 12.3 *House drawing produced by a (female) participant high in innovation motivation.*

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The association of innovation motivation with more unusual (and perhaps more creative) life courses also enjoys some anecdotal support. Unfortunately, most participants in our studies have been anonymous unless they requested individualized feedback on their performance at the time of participating. (In general, only people high in the need to be different exercise this option.) But among the earliest validity studies of the *v*Differ scale were three peer nomination studies in which participants not only completed the scale but also named classmates whom they believed most closely resembled descriptions of prototypal "high" and "low" need to be different. These students agreed to allow their names to remain with their test protocols. Two of those in this very early study stand out in my memory: Beryl and Lily (not their real names – and their stories are lightly disguised). They were two of the brightest psychology students in their year. They also happened to be the same height and have similar physiques. They were friends, but very unalike. Beryl had one of the highest scores on the *v*Differ scale in the sample, Lily, one of the lowest; they were separated by over two standard deviations. Today they are both master's-level mental health professionals, married, and mothers. But consider their histories since graduation. Lily entered a nearby graduate program in school psychology that fall. Within a few years, she was certified, living in the small semirural town where she grew up, married to a man of her own cultural background, and working as the high school's psychologist – a post she still holds, along with part-time coaching duties. Beryl tended bar for a year or so and then pursued graduate studies and certification as an English teacher. She married a college boyfriend but soon separated from him, moving to the Bronx to teach English in a middle school. She loved this job but eventually tired of it and moved to Seattle, where she earned a master's degree in gestalt therapy. Along the way, she remarried, had children, and came out as bisexual. In addition to her clinical work, she blogs regularly for a well-known feminist website.

Which young woman has lived a better life? I suspect that your answer to this question (and your confidence in that answer) could serve as a projective measure of your own need to be different. Lily's life has been one of contented stability, successfully pursuing the same goals for many years. Beryl's has been a life with many peaks and valleys, adventures and mishaps, not to mention sharp changes of course. Objectively, they are both fine human beings who have done well in life and served their communities – but how different their ways of getting there!

Comparison with Other Predictors: Major Personality Traits and Cognitive Ability

Most innovation motivation validity studies have included at least one other plausible predictor of original or creative thinking. Intellectual ability is one obvious candidate. Averaging across the various measures used, intelligence seems to correlate with divergent thinking at about $r = 0.12$ ($r = 0.23$ without the wildly discrepant finding for original elements in TAT stories). This is on the modest side. However, across the nine analyses in which intelligence was correlated with the judged creative quality of participants' art and writing, the

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mean result was $r = 0.36$: much stronger. (Some theorists like to argue that intelligence is unrelated to creativity, but the only evidence in support of this contention comes from samples comprised solely of very intelligent people. The restricted range of intelligence among, say, architects or students at elite universities, statistically attenuates its correlation with other variables. Our samples have been drawn from a regional college and the community in which it is embedded and so vary more widely in terms of intellectual endowment.)

Three studies (Joy 2004, sample 5; Joy 2005; Joy & Hicks 2004) examined whether the need to be different and intelligence make separate contributions to creativity. In general, the need to be different continued to correlate significantly with creativity after partialing out the influence of intelligence. Combining the need to be different with intelligence in a multiple regression model improved the predictive power slightly in Joy (2004) and considerably in Joy (2005). The combination explains about 25 percent of the variance in the judged creativity of participant art.

Openness to experience (factor V) is the single higher-order trait most frequently linked with creativity. As shown in Table 12.2, our studies replicate this, with a mean correlation of $r = 0.24$ between openness and divergent thinking measures and a mean $r = 0.27$ with judged creativity. The mean correlation with self-reported creative achievements was an impressive $r = 0.38$.

Psychoticism is the other higher-order trait often linked with creativity. It is a somewhat controversial construct. Advocates of the five-factor model argue that it represents an amalgam of two distinct traits: agreeableness and conscientiousness (with each of which it correlates *negatively*), and point to the relatively low internal consistency of psychoticism scales. Defenders of Eysenck's model respond by pointing out that agreeableness and conscientiousness correlate too strongly with each other for two supposedly orthogonal traits. Without trying to resolve this debate, one may recognize that Eysenck (1993) did at least develop a coherent theoretical rationale for why psychoticism ought to produce enhanced creativity. In our samples, psychoticism correlated with divergent thinking at an average $r = 0.30$ and with the judged creativity of art and writing at $r = 0.10$. As for self-reported creativity, psychoticism correlated fairly well with self-reported talents (mean $r = 0.25$) but weakly with actual accomplishments (mean $r = 0.15$). All this suggests that although psychoticism does lead to the production of unusual ideas, these ideas tend not to be of very high quality.

Summary of Validity Studies

The need to be different consistently predicts divergent thinking, the creative quality of "made to order" works of art and literature, and self-reported lifetime creative achievement. Results for innovation expectancy are similar, though weaker, with respect to divergent thinking and the quality of works produced in the research setting: comparable to those for the need to be different when it comes to self-reported accomplishments.

It will be noted that the results for divergent thinking tend to be stronger than those for judged creative quality. This makes theoretical sense. Innovation

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motivation is not precisely a model for creativity. Rather, it aims to predict original, unusual, or idiosyncratic behaviors – only some of which will prove to be valuable. The opposite pattern seems to hold for intelligence. This suggests that intelligence, as such, has only a weak impact on the generation of unusual ideas, but a much stronger one on the selection of "good" ideas and their subsequent elaboration.

It also is clear that the results are stronger for the need to be different than for innovation expectancy. Several competing explanations suggest themselves, and the evidence to date does not permit us to choose among them. It is, of course, possible that innovation expectancy just is not as strong a predictor (or cause) of creativity – though the results for actual achievements are solid. It is also possible that the *ge*Innova scale is to blame rather than the theory. Some of the items may, for example, be written at too high a level for some participants to understand them, thereby adding to the random error present in all measures. The third possibility is perhaps the most likely. One should remember that while the need to be different involves a desire to try original approaches for their own sake, innovation expectancy involves the belief that original approaches are likely to "work" – to lead to valued outcomes. Merely asking someone to draw a picture or free-associate to a set of words may not adequately activate the expectancy in the absence of incentives for superior performance. This would explain why results for lifetime creative achievements suggest equal contributions for expectancy and need. "Real life" offers rewards contingent on our labors, and the belief that innovation is (or is not) likely to earn those rewards is an important determinant of the strategy we adopt in their pursuit.

The correlation between the need to be different and various forms of creativity holds up after controlling for the impact of intellectual ability on performance. Combining the need to be different with ability measures produces even stronger correlations.

In general, the need to be different correlates more strongly with divergent thinking and judged creativity than either openness to experience or psychoticism, though openness is equally good at predicting self-reported achievements. Innovation expectancy appears to be about equal to these personality traits in the strength of its relationship with creativity.

Current Status of Innovation Motivation Theory, Challenges, and Future Directions

The evidentiary basis for innovation motivation theory is strong. Both the need to be different and innovation expectancy correlate predictably with other individual differences variables. Each (especially the need to be different) correlates well with a variety of creativity-related measures: divergent thinking, unusual word associations, remote associates, creative achievement, and the judged originality and quality of art and writing. As predicted by the theory, correlations with originality measures tend to be stronger than those with

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quality measures: innovation is a necessary but not sufficient precondition for creative accomplishment. In some cases, innovation motivation combined with intelligence predicts more of the variance in creative success. The individual samples are small, but the cumulative case is convincing.

There remain problems with the theoretical model and with the scales used to measure its components. Unfortunately, it is sometimes difficult to determine whether the theory or the scale is at fault when results do not come out as expected. This is a widespread problem in personality research, but frustrating nonetheless. We wish to study abstract, high-level constructs that often lack precise boundaries (sometimes termed *ballung* concepts [Cartwright et al. 1996]). We need to understand how the concept of interest may be represented (including the choice of scaling systems and measurement methods). And we need to develop procedures by which this may be accomplished (i.e., measurement instruments). When results fail to conform to theory, the error may be on any one of these three levels. The theoretical construct may be flawed (or just plain wrong – if it does not exist, you cannot measure it!). Alternatively, the measurement technology may be shoddy – or, trickiest of all, there may be a "disconnect" between theory and measure. Thus, even when we set out to test a hypothesis, we retain several "lines of retreat" and often fail to subject our ideas to a serious risk of refutation (Meehl 1978). In the innovation motivation research program, for example, is it enough to show that in most studies we obtain statistically significant correlations with most criterion variables?

For instance, one informal observation casts some doubt on the model as originally promulgated. The need to be different was posited as a continuous variable, likely to be normally distributed in the population. Yet this may not be the case. Very few people obtain scores on the *v*Differ scale more than one standard deviation below the mean. However, more people than expected seem to obtain scores two standard deviations above the mean. At the low end, this makes a certain amount of sense. What does it mean to be abnormally mainstream? But the little "bulge" at the upper end of the distribution suggests that we may be looking at a qualitatively distinct *type* of person here. Perhaps, for a subset of the population, the need to be different achieves a kind of metaphorical critical mass and becomes what Allport (1961) would have called a central or even the cardinal disposition – and perhaps it is chiefly in those cases that the motive really makes a difference. This riddle can be answered, but it will take much larger samples than have hitherto been available.

Future research will extend the range of divergent thinking tasks and creative products employed. It ought also to move in several new directions. Some of these are straightforward in design. Populations expected to be high or low in innovation motivation (e.g., architecture students versus accounting students) might be compared. The correlation between innovation motivation and creative achievement within occupational groups should be explored. The correlations between innovation motivation and other measures of "creative" personalities also need to be established. Following up on college students after 5 to 10 years to see whether those high in innovation motivation followed

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distinctive life trajectories would be valuable. In addition to enriching the nomological network in which innovation motivation theory is embedded, some of these stratagems also may help to disentangle the relative contributions made by the need to be different and innovation expectancy. These studies also might either support or challenge the hypothesis that generalized expectancies and need values interactively enhance originality.

Other avenues of investigation will be more challenging conceptually. Most notably, work needs to be done toward developing reliable methods of assessing implicit innovation motivation. A thematic coding system similar to those used for the power or intimacy motives would be the most obvious path to follow. Alternatively, a reaction-time task similar to the Implicit Association Test might be devised. Such measures might correlate only modestly with the self-report inventories yet predict unique variance in original behavior (McClelland 1985).

Finally, beyond the nuts-and-bolts instrumentation issues or even the status of innovation motivation theory, one crucial question remains to be answered: how and when does the desire for novelty translate into long-term success? There is a paradox here: one that is discussed all too seldom. We know that originality or innovation is necessary for valuable discoveries to be made or products created. But we also know that to produce masterly works in any field, a considerable investment of time and effort is required (Ericsson & Charness 1994). The very qualities that promote originality must militate against sustaining focus on the same set of knowledge and skills year in and year out. How is it that some people express both qualities? Is there an optimal balancing point? Must there be an all-consuming interest in one activity, one goal, so great that it overrides the tendency toward boredom and yearning for change? Or is there some as-yet-nondescript third force that interacts with our desires for reliable reinforcement, on the one hand, and stimulating contrast, on the other?

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13 Creative Genius and Psychopathology

Creativity as Positive and Negative Personality

Dean Keith Simonton

Among the oldest debates concerning the creativity–personality relation is the "mad genius" controversy (Becker 1978). This controversy deals largely with whether those individuals who display the most exceptional creativity tend to exhibit personality traits often associated with psychopathology, such as tendencies toward extreme depression. This question dates as far back as the ancient Greeks and Romans. For example, Seneca, the Roman dramatist and philosopher, quoted Plato as saying that "the sane mind knocks in vain at the door of poetry" and Aristotle as claiming that "no great genius has ever existed without some touch of madness" (Seneca 63/1932, p. 285). As with many debates in psychology – such as the nature–nurture issue – researchers will often advocate polarized positions (Simonton 2000).

On the one side are those who believe that any positive connection between creativity and psychopathology is a pure myth perpetrated without any grain of empirical evidence (e.g., Dietrich 2014; Schlesinger 2009). In fact, many argue that if any correlation exists, the relation will be negative, a position adopted by both humanistic and positive psychologists (e.g., May 1975; Seligman & Peterson 2004). Creativity must be a sure sign of mental health. For example, the historical figures who Maslow (1970) identified as healthy self-actualizers were most frequently highly creative people, such as Benjamin Franklin, Albert Einstein, Baruch Spinoza, Johann Wolfgang von Goethe, Pierre Renoir, and Franz Joseph Haydn.

On the other side are those who maintain that a positive relation does indeed exist but that the relation is complex (e.g., Carson 2014). Moreover, although some early proponents of the mad genius claimed that exceptional creators were outright insane – most notoriously Lombroso (1891) – few, if any, would advocate such an extreme stance today (cf. Hershman & Lieb 1988; Jamison 1993). It is only a matter that the creative genius may share certain traits with the mentally ill that are not found in the general population (Eysenck 1995). These shared characteristics may be subclinical yet still abnormal. Furthermore, there can be no doubt that some very notable creators attained clinical levels of psychopathology, including Robert Schumann, Emily Dickenson, Vincent van Gogh, Ernest Hemingway, and Sylvia Plath.

Unfortunately, again as in the nature–nurture debate, the arguments both pro and con with respect to the mad genius controversy have become somewhat repetitive. The opponents are talking past each other. Accordingly, in recent

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years I have attempted to take a fresh look at the subject by introducing more advanced empirical methods and theoretical analyses (Damian & Simonton 2014b; Simonton 2014c, 2014d). I believe that these advancements must elevate the discussion to a more sophisticated level than has hitherto been the norm. Any future researchers who persist in simplistic, one-sided treatments of the problem that ignore the actual complexities will then do so at their reputation's peril.

I begin with the empirical aspect of the mad genius issue and then turn to its theoretical features.

Empirical Research

The past research literature on the creativity–psychopathology issue has adopted a diversity of methodological approaches, including experimental, psychometric, psychiatric, psychobiographical, and historiometric (for reviews, see Silvia & J.C. Kaufman 2010; Simonton 2010). Each method has its own distinctive advantages and disadvantages. However, if the goal is to make empirical headway regarding the mad genius debate, historiometric techniques are by far the most useful (Simonton 2014a). After all, historiometry was specifically invented more than a century ago to facilitate the scientific study of historical geniuses (Woods 1911). That is, the approach applies quantitative measurement to historical data to test nomothetic hypotheses about those persons who manage to "make history" (Simonton 1990). Included in the historiometrician's toolbox are even methods for the at-a-distance assessment of personality traits (Song & Simonton 2007), including those attributes indicative of psychopathology (e.g., Ko & Kim 2008; Ludwig 1992a; Martindale 1972; Post 1994; Simonton & Song 2009).

Although the relevant historiometric research has undergone extensive review in a recent chapter (Simonton 2014b) that appeared in a volume entirely devoted to the creativity–psychopathology relationship (J.C. Kaufman 2014), that chapter is already woefully out of date! The realities of publishing edited volumes mean that it could not include two historiometric studies published in the same year: Damian and Simonton (2014a) and Simonton (2014d). It is to these two investigation to which I now turn, starting with the latter.

Linear and Nonlinear Functions: Simonton (2014d)

Although the first historiometric studies of the mad genius question date back to the beginning of the twentieth century (Ellis 1904), these investigations invariably suffered from one or more methodological deficiencies. First, dichotomous measurement was often implemented when the underlying constructs were clearly quantitative in nature. The latter fact is most obvious in the case of psychopathology, which can vary from none at all (*normality*) through various degrees of subclinical symptoms until those symptoms start interfering with the

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creator's life and work (*abnormality*) and perhaps even end it (as in suicide or substance abuse). Yet creative genius must also be viewed as a quantitative variable. Whether such genius is assessed by eminence or creative productivity, it is clear that these assessments must vary greatly even for those whose achievements secured them a place in the history books. Who has not heard of the "divine" Michelangelo? Yet how many with even an active interest in Italian Renaissance art has equal familiarity with his younger contemporary and would-be imitator Bartolommeo Bandinelli?

Second, the two measures of creativity and psychopathology were not independently quantified. Although this might seem an obvious methodological requirement for any at-a-distance assessment, it is seldom implemented in practice. Instead, the same researcher will often either assess both variables or else assess one already knowing how the creators scored on the other (e.g., Ludwig 1995; for rare exceptions, see Karlsson 1970; Ko & Kim 2008; Simonton & Song 2009). Needless to say, if the two measures are not fully independent, any correlation between the two may merely reflect the researcher's subjective bias.

Third, the researcher will just look for a simple positive or negative relation without realizing that not only may the association be curvilinear rather than linear but also that the exact function will depend on the domain of creative achievement. For example, Ludwig (1995) simply tested for a positive connection "psychological 'unease'" (depression and anxiety) and scores on the Creative Achievement Scale (Ludwig 1992b) without looking to see whether the function might be nonmonotonic and vary across domains of achievement.

Simonton (2014d) therefore conducted the very first historiometric study that avoided all three methodological problems. The sample was defined by 204 distinguished scientists, thinkers, writers, artists, and composers who had been previously assessed on eminence by Murray (2003) and on their degree of psychopathology by Post (1994). The former measure could range from 1 to 100, the latter from 0 to 3, where 0 = no symptoms and 3 = severe symptoms (but obviously not so debilitating that the genius would have been entirely absent from the sample). Linear and quadratic functions were then estimated for each of the five creative domains (including statistical tests for whether the domains exhibited the same or different functions). The results are depicted in Figure 13.1.

The findings could not be more strikingly different across creative domains. For the artists and writers in the sample, eminence was a positive monotonic function of the severity of psychopathology. For all practical purposes, the functions can be said to be linear. For the scientists, composers, and thinkers, in contrast, curvilinear single-peaked functions obtained, with the maximum points in very different places on the psychopathology scale. At one extreme, the thinkers attained a peak in the most severe range, so much so that the function was almost positive monotonic. At the other extreme, the scientists showed a peak in the more mild range, with a sudden drop thereafter, so that scientists in the severe range were less eminent than those who exhibited no

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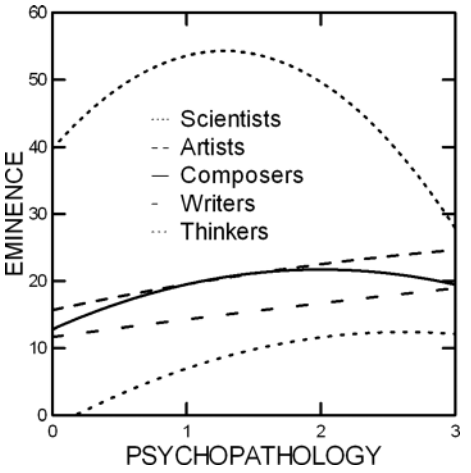

Figure 13.1 *The eminence–psychopathology functions are graphed for 42 scientists, 40 artists, 50 composers, 49 writers, and 23 thinkers (top to bottom, respectively). Eminence is assessed on a 1 to 100 scale (Murray 2003), whereas psychopathology is measured on a 0 to 3 scale (none to severe) (Post 1994). (Figure taken from Simonton 2014d.)*

psychopathology at all (cf. Abraham [2014], who proposed a very similar curve). Finally, the peak for the composers came somewhere between these two extremes, even if the overall linear component was positive.

Significantly, although this sample included first-rate geniuses – such as Charles Darwin, Jean-Paul Sartre, Leo Tolstoy, Pablo Picasso, and Frédéric Chopin – it obtained results that were not out of line with findings using less historic samples (Simonton 2010). Most notably, artistic creativity appears most strongly associated with psychopathology. Although this study cannot be considered the last word on the subject, it does make it more difficult to discount the mad genius hypothesis as pure myth. For example, the complexity of the functions in Figure 13.1 means that the results cannot be explained away by a tendency for more psychopathology to be falsely attributed to more famous creators. Such an artifact would yield uniformly positive monotonic functions for all five domains. Why would the scientists with the most psychopathology be precisely those who attain the lowest eminence? Why the downturns for the composers and thinkers?

Moderated Associations: Damian and Simonton (2014b)

One common objection to the mad genius hypothesis is that many eminent creators seem devoid of any psychopathology (Dietrich 2014). That absence holds for all five domains in the preceding study (Simonton 2014d). Among the composers, for example, Béla Bartók, Johannes Brahms, Ferruccio Busoni, Emmanuel Chabrier, Paul Hindemith, Leoš Janáček, Jacques Offenbach,

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Dmitri Shostakovich, and Bedřich Smetana, all received scores of zero, an indication of mental health. If creativity and psychopathology are positively related, how can this be?

There are actually several possibilities. For example, Ludwig (1998, p. 93) hypothesized that "persons in professions that require more logical, objective, and formal forms of expression tend be more emotionally stable than those in professions that require more intuitive, subjective, and emotive forms." This contrast can hold not only between domains but also within domains. Thus Ko and Kim (2008) found that while psychopathology was positively correlated with the eminence of revolutionary scientists, the eminence–psychopathology relation became negative for scientists who became eminent as preservers of the received paradigm, a far more constrained form of creativity (Simonton 2004). In other words, in domains of creativity that operate under more stringent constraints, any inclinations toward psychopathology may very well be a liability rather than an asset.

Yet Damian and Simonton (2014a) have put forward another possibility: perhaps the most critical factor in the development of creative potential is not psychopathology per se but rather what they term "diversifying experiences." These "diversifying experiences are 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, italics removed). Subclinical psychopathology provides just one type of diversifying experience, but other types can prove no less effective. Of special importance are various forms of developmental adversity, such as "trials and tribulations" in childhood and adolescence (Damian & Simonton 2014a). A dramatic example would be the loss of one or both parents. To be sure, just as psychopathology can be so extreme as to terminate creativity altogether, so can developmental adversity overwhelm the creative individual. The implication is that a tradeoff might exist between the two in order to find the optimum most conducive to creative development – the "sweet spot" in the personal growth of creative potential. Accordingly, those individuals who have already experienced unusual amounts of developmental adversity would more likely display lower rates and intensities of psychopathology.

This tradeoff hypothesis was specifically tested on a highly distinctive sample: 291 eminent African Americans (Damian & Simonton 2014b). Given that all members of the sample grew up in the United States prior to the civil rights era, they were conjectured to have experienced higher levels of developmental adversity than found in the majority-culture eminent, including poverty and discrimination. As a result, we would not expect the individuals to exhibit the same rates and intensities of psychopathology as found in the majority culture. At the same time, the distribution of psychopathology across various creative domains should not differ. Artistic creators would still be anticipated to display more psychopathology than nonartistic creators. Both of these predictions were confirmed. Remarkably, even though literary creativity is strongly associated with suicide, not one of the African American writers was a suicide, even among

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the African-American poets (cf. J.C. Kaufman & Baer 2002). The illustrious poets in the sample included Maya Angelou, Imamu Baraka, Arna Bontemps, Gwendolyn Brooks, Countee Cullen, Paul Lawrence Dunbar, Nikki Giovanni, Robert E. Hayden, Langston Hughes, Claude McKay, and Phyllis Wheatley – not a single one dying by their own hand!

I just described the results of Study 1 in Damian and Simonton (2014b). Study 2 used the same sample but went a step further by quantifying the eminence of these African Americans, where eminence was defined using both minority and majority culture sources (Simonton 1998a). It was then shown that psychopathology only predicted higher eminence for the artistic creators. Moreover, this effect diminished when developmental adversity was introduced as a control variable, a factor that also predicted eminence. In line with the overall hypothesis, the creativity–psychopathology "link probably represents just one of several routes by which diversifying experiences can influence eminence" for the "same developmental ends can be attained by different means" (Damian & Simonton 2014b, p. 623). The article closed with a specific case to illustrate this point: Maya Angelo, an incredibly creative artist who endured extreme developmental adversity without any sign of adulthood psychopathology.

Admittedly, this tradeoff hypothesis must be tested on other samples of highly eminent individuals. Even so, if the conjecture receives additional confirmation, it should help us to understand why psychopathology is not the sine qua non of creative genius even when it plays such an important role. It may be just one or several diversifying experiences that contribute to creative development.[1]

Theoretical Analysis: Simonton (2014c)

In Section I presented the chief conclusions from two recent empirical studies (Damian & Simonton 2014b; Simonton 2014d). Taken together, the results imply that the creativity–psychopathology connection is far more complicated than first meets the eye. First, Simonton (2014d) showed that the functional relation between eminence and psychopathology may be positive monotonic or single-peaked nonmonotonic with the high point at different levels of psychopathology – all depending on the domain to which the creative geniuses directed their efforts. Second, Damian and Simonton (2014b) presented evidence that psychopathology might just be one of several diversifying experiences that enhance creative potential, psychopathology even becoming partly interchangeable with developmental adversity. At this juncture, though, I want to switch from fact to logic, or data to theory. Too often psychologists talk past each other in various polarized debates because they never stopped to think about what each side is explicitly claiming. It could very well be that the disagreement is more apparent than real. This possibility was scrutinized in an article on the *mad genius paradox* (Simonton 2014c). To appreciate the nature

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of this paradox, let us first start with a general analysis before turning to a mathematical illustration.

Analysis

Let us begin with the following straightforward assertion:

> Proposition 1: Among all creative people, highly creative persons have higher rates of psychopathology than do less creative persons. In particular, the probability that an individual displays one or more psychopathological symptoms is a positive linear function of that person's lifetime creative productivity within a given domain. (Simonton 2014c, p. 471)

This proposition appears to support the concept of the mad genius. If genius is defined in terms of creative productivity (Albert 1975), and if the risk for psychopathology is a positive linear function of that lifetime output, then the creative geniuses will be at more at risk than their less prolific colleagues. Now consider the next affirmation:

> Proposition 2: Among all people, creative persons have lower rates of psychopathology than do noncreative persons. A creative individual is here defined as one who creates at least one product that satisfies the requirements for creativity in a given domain as determined by expert appraisals. (Simonton 2014c, p. 471)

On first glance, this statement seems to contract the first. How can creative people exhibit more mental health than noncreative people if the most creative people display more mental illness than the less creative people?

Nonetheless, closer analysis reveals that the two propositions constitute orthogonal statements in the sense that the truth or falsity of one is independent of the truth or falsity of the other (Simonton 2014c). They can both be true, both false, or one true and the other false in either order. When both propositions are valid, then the mad genius paradox results. How can this possibly happen?

To obtain an answer, we must contemplate two hidden features of these propositions. First, in Proposition 1, creators with higher creative productivity are having their risk compared with the risk of creators with lower creative productivity. But all of them are creative individuals who made at least one contribution to their chosen domain. By comparison, in Proposition 2, all creators regardless of lifetime output are being compared to all those individuals who never made a contribution to any creative domain.

Second, the compatibility or incompatibility of the forgoing two comparisons depends on the cross-sectional distribution of creative productivity. On the one hand, it can be shown that if creative productivity is normally distributed – the most typical distribution assumed by most researchers – then it would be very difficult, if not impossible, for both propositions to be valid (Simonton 2014c). The paradox then vanishes. On the other hand, if the lifetime creative

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productivity distribution is best described by a highly skewed distribution, with the modal output placed at a single creative product, then the mad genius paradox can easily emerge! Psychopathology can indeed be positively correlated with creativity even while creative people show less psychopathology than noncreative people! At this point, an illustration will help.

Illustration

To simplify the analysis, assume that we are dealing with a domain in which no creator can ever expect to generate more than 10 creative products in an entire lifetime. This specification would fit domains where true masterpieces tend to be few and far between, such as great operas or novels. If the number of creative products is specified by n, then we are assuming that $1 \leq n \leq 10$. The next step is to specify Proposition 1. For this purpose, we can posit a positive linear regression line defined as $R(n) = -0.1 + 0.1 \times n$, where $R(n)$ gives the psychopathology rate for a creator producing n masterworks in an entire career. This regression equation merely specifies that $R(1) = 0$, but $R(10) = 0.9$. The slope of the regression line was deliberately made very steep to make Proposition 2 look even more implausible. How can creative people show less inclination toward psychopathology with such a strong positive relation between psychopathology and creative productivity?

To answer the last question, the cross-sectional distribution must be specified, too. Here we must acknowledge that the normal distribution does *not* apply (O'Boyle & Aguinas 2012; Walberg et al. 1984). Instead, the distribution is best described by an inverse power function known as *Lotka's law* (Egghe 2005; Lotka 1926; Price 1986). In the present illustration, this law can be specified as follows: $f(n) = c/n^2$, where $c = 100$. According to this specification, 100 creators would have produced only one product each, whereas only one creator will have created as many as 10, the upper limit by assumption. Obviously, Lotka's law does not tell us the number of individuals who made no creative contribution, or $f(0)$. The law is strictly germane to the creative persons in Proposition 1. Although Lotka's law yields a frequency distribution, the frequencies can be converted into proportions by dividing each frequency by the cumulative number of creators from $n = 1$ to $n = 10$.

Figure 13.2 depicts two histograms side by side. On the one hand, the dark bars show the proportions of creators with a given level of productivity, as indicated by n. Here the highly skewed nature of the productivity distribution becomes most apparent. About two-thirds of the creators would be "one-hit wonders" (cf. Kozbelt 2008), and less than a fifth would be credited with two creative contributions in a lifetime. Thereafter, a long tail emerges, a tail much longer than that seen in the normal distribution. Just a single creator, representing less than 1 percent of all creators, will produce the maximum of 10 products. The second histogram, shown by the gray bars, indicates the linear increase in risk rate as a function of total creative output. The first bar for the $n = 1$ creators is zero and hence absent, while the remaining bars increase until

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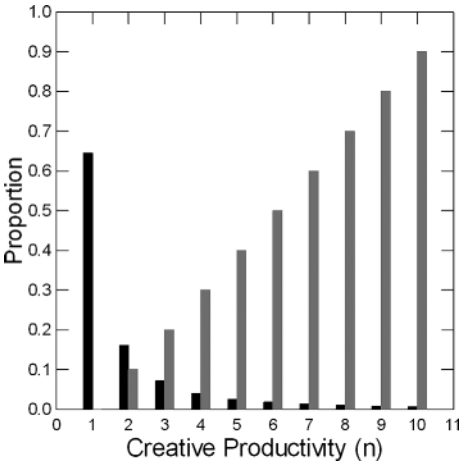

Figure 13.2 *Hypothetical relation between creative productivity and psychopathology that yields the mad genius paradox. Black bars show the proportion of people at each level of creative productivity (*n*): many creative people create only one product; fewer people create many products. Gray bars show the proportion of people at risk of psychopathology at each level of productivity: people who create one product have no risk, but the risk increases linearly as productivity increases.*
(Figure taken from Simonton 2014c.)

the proportion reaches the maximum at $n = 10$, or $R(10) = 0.9$. The positive relation between creativity and psychopathology affirmed in Proposition 1 could not be more conspicuous.

The question now becomes: what is the overall psychopathology rate for all creators? The surprising answer is 0.09, or about *one-tenth* the rate seen in the most prolific creator (Simonton 2014c). How can that be? After all, one might think that the average might be closer to 0.45, the midpoint between the risk for $n = 1$ and that for $n = 10$. But that figure would ignore the fact that each risk rate is represented by radically contrasting proportions of creators. About two-thirds are at zero risk, whereas much less than 1 percent are at the highest risk. Hence the overall risk must be computed with the 10 risk rates *weighted* by the proportion of creators who exhibit a given risk rate. Notice the impact of Lotka's law here: if creative productivity were normally distributed, with two tails, one ending at $n = 1$ and the other at $n = 10$, then the overall risk rate would be about *five* times higher (Simonton 2014c). The skewed distribution is really critical to the mad genius paradox.

We can now address Proposition 2. How would the overall rate of 0.09 compare with the general population of noncreative persons? Using a nationally representative sample, Kessler and colleagues (2005) estimated the lifetime prevalence of any disorder to be 46.4 percent, which suggests $R(0) \approx 0.46$ (coincidentally close to what would obtain if creative productivity were normally distributed). This figure is several times larger than the 0.09 just

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calculated under the assumption that Proposition 1 holds. Consequently, both Propositions 1 and 2 are true, validating the mad genius paradox. Creative people as a group can enjoy more mental health than noncreative people, yet the most highly creative people may suffer more mental illness than less creative people.

Discussion

In the original article demonstrating the mad genius paradox, I fleshed out the argument by discussing three larger issues (see Simonton [2014c] for details). In particular, I discussed alternative specifications, substantive explanations, and investigative implications. It is not necessary to repeat all that discussion here. May it suffice here to make the following three points:

First, the mad genius paradox is fairly robust under alternative specifications of Proposition 1. For example, a positive monotonic relationship between creativity and psychopathology will work just as well. Indeed, even a nonmonotonic relation will work, provided that the overall trend is largely positive. Hence, of the five disciplines graphed in Figure 13.1, only the scientists would probably not exhibit the paradox. The artists and writers definitely could, and composers and thinkers likely could. Of course, these conclusions assume a high correlation between eminence and creative productivity, an assumption that is empirically justified (Simonton 1997).

Second, although the main emphasis was on showing that Propositions 1 and 2 represent orthogonal claims, the mad genius paradox might have a substantive explanation – and even more than one. On the one hand, the *antecedents* of creativity might be linked with one or more psychopathological symptoms or traits. A prime example is the decisive role that cognitive disinhibition plays in creativity, a role that introduces a vulnerability to mental illness if not sufficiently moderated by general intelligence (Carson 2014). On the other hand, the *consequences* of creativity may also increase the susceptibility to subclinical levels of psychopathology. It may be no accident that approximately positive linear functions have been identified for artists, writers, thinkers, and revolutionary scientists (Ko & Kim 2008; Simonton 2014d); these creators are active in low-consensus domains where creative products may elicit rejection, criticism, or (if lucky) outright neglect (Simonton 2009). The higher the creative productivity, the greater is the adverse reaction.

Third and last, the mad genius paradox has noteworthy investigative implications. In the first place, the potential phenomenon suggests that the relation between creativity and psychopathology may be contingent on the method adopted. Methods that focus on genius-level creativity, such as the norm in historiometric research, will find more mental illness than those methods that concentrate on the lower end of the distribution, such as holds for psychometric studies. Hence discrepancies may just reflect which part of the elephant the researcher is investigating. A second implication concerns Proposition 2, which requires the introduction of $R(0)$ to provide the baseline for comparison. It is

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not obvious what should be considered the best control group for testing this hypothesis. A nationally representative sample, like that which gave us $R(0) \approx 0.46$ (Kessler et al. 2005), may not be the best option.[2] This difficulty helps us to appreciate why many researchers studying the creativity–psychopathology relation in creative geniuses often introduce control groups consisting of high achievers in supposedly noncreative domains, such as political and military leaders (e.g., Ludwig 1992a; Post 1994; Simonton & Song 2009). It makes more sense to compare Beethoven to Napoleon than to compare either one to a representative sample of twenty-first-century US survey respondents.

Conclusion

I was initially inspired to return to the mad genius controversy by an invitation to revise an out-of-date entry for a new edition of the *Encyclopedia of Mental Health* (Simonton 1998b; see Simonton 2016). When reviewing all the relevant publications that had appeared in the intervening period, I became concerned about the direction the research was taking. Despite some excellent literature reviews (Silvia & J.C. Kaufman 2010) and even meta-analyses (Acar & Runco 2012; Acar & Sen 2013), original empirical and theoretical studies directly relevant to the debate were becoming few and far between (Simonton 2014b). The most promising work in the area appeared to concern cognitive disinhibition and especially reduced latent inhibition (Carson 2014). Yet, with a few exceptions (e.g., J.C. Kaufman 2000–1, 2001, 2005), historiometric inquiries specifically devoted to the mad genius seem to have entered a lull (cf. Ludwig 2002).

In addition, with the advent of the positive psychology movement, the hypothesized positive connection began to undergo increased criticism as a mere myth (Sawyer 2012). These criticisms were not accompanied by new data but by the second-guessing of old data. These criticisms sometimes went over the top from a scientific perspective: it is one thing to criticize distinguished researchers – including a recipient of the National Medal of Science (the highest scientific honor in the United States) – for conducting less than perfect investigations and quite another to accuse such opponents of perpetrating a "hoax" with the necessary implication of fraud (Schlesinger 2012). But apart from these extreme accusations, I was especially struck by the often-repeated refrain that creative geniuses cannot be more vulnerable to mental illness because creativity is positively correlated with mental health. This statement seemed at once contaminated with an unavoidable non sequitur: the phrase before the *because* simply has no bearing on the phrase appearing after that conjunction. Creative geniuses, when all is said and done, represent such a minuscule proportion of creators in a given domain that they have no impact whatsoever on what a "typical" contributor to that domain may be like. The logical independence must reign supreme on a priori grounds unless scientific data indicate otherwise. Those data were not forthcoming – just glib nitpicking of past data.

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Hence arose my three most recent contributions to the mad genius controversy – two empirical studies and one theoretical analysis. Any skeptic regarding the creativity–psychopathology relation cannot ignore these three publications and still proclaim that he or she has a scientific disinterest in the debate.

First, Simonton (2014d) showed that the magnitude of subclinical psychopathology was at least approximately associated with the eminence in four domains out of five, only scientific genius showing some preference toward lower symptom levels, and even the most eminent among these scientists fell in the "mild" range. Moreover, the complex pattern of relationships, especially the curvilinear functions, could not be explained away by some simple bias. The latter should produce positive monotonic curves uniformly throughout, not curvilinear functions in the majority with the peaks at rather contrasting levels of psychopathology.

Second, Damian and Simonton (2014b) provided evidence that propensities toward psychopathology may be part of a more general impact of diversifying experiences on creativity, and thus these propensities might be offset by alternative diversifying factors, especially developmental adversity. This tradeoff then explains why even in the arts, creative geniuses need not inevitably betray any signs of mental illness whatsoever. Having a horrid family life will provide a nice replacement!

Third, and in an utterly distinct manner, a formal mathematical analysis of the association between creative productivity and psychopathology reveals that both positive and negative relations can hold simultaneously. It all depends on what is being compared to what. Given this analysis, creative geniuses of the highest order can be more at risk even though creators as a whole are less at risk than the average person on the street. Therefore, none of the five curves shown in Figure 13.1 can be taken to contradict Proposition 2.

If our collective goal is to contribute to the accumulation of scientific knowledge, then the results of these three contributions must be incorporated rather than dismissed simply because they are inconsistent with a position already advocated.[3] The nature–nurture issue has proven to be an extremely complex controversy, and the mad genius debate will no doubt prove comparably complex. Those who want simple answers should switch to questions that have really simple answers.

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Notes

1 Ritter and colleagues (2012) conducted two experimental simulations of diversifying experiences in which their positive impact on creativity was demonstrated. In the first study, the participants were put in a virtual reality situation where they would experience a world not unlike that often endured by a schizophrenic. In the second study, participants were exposed to a violation of convention that would be similar to exposure to mild developmental adversity. For compatible experimental evidence, see Rothenberg (1986), Sobel and Rothenberg (1980), and Vohs, Redden, and Rahinel (2013).

2 This issue may be applicable to many other correlations between creativity and personality, not just psychopathology. For example, Feist (1998) found that the traits that distinguish highly creative scientists from their less creative colleagues are not necessarily the same as the traits that distinguish scientists (presumably creative) from nonscientists.

3 In e-mail exchanges with one staunch opponent of the mad genius hypothesis, I provided a reprint of a behavior genetic study indicating a shared biological basis for creativity and psychopathology (*viz.* Kéri 2009). The recipient told me that there was no need to read it because the decision had already been made about what was true and false. The mad genius was a hoax. The study was therefore irrelevant because it contradicted the person's preformed (rather than informed) opinion. This is not the way science should operate.

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14 Personality Traits, Personality Disorders, and Creativity

Adrian Furnham

Introduction

This chapter is concerned with the "bright side" (normal personality traits, usually conceived with the five-factor model) and the "dark side" (personality disorders, usually conceived within the *DSM-5* model) of personality correlates of creativity. There has been a great deal of research over the years on normal personality trait correlates of creativity (Hennessey & Amabile 2010; J.C. Kaufman & Sternberg 2006; J.C. Kaufman, Plucker, & Baer 2008). There has been an equally rich literature on the relationship between various mental illnesses and creativity (Simonton 2014a, 2014b, 2014c, 2014d). Both of these literatures will be briefly reviewed. However, the main focus of this chapter is the scattered work on the relationship between the personality disorders and creativity.

Feist (1998) suggested that personality research with regard to creativity has taken two forms. The first is the *between-groups* comparison (e.g., artists compared with scientists). The second has sought to analyze *within-group* differences. In these cases, highly creative individuals from a domain (fine art, music, science) are compared with their less creative peers. Both methods have shown interesting differences that have not always been replicated

The early studies of creativity and personality were characterized by the diversity and dubiousness of the personality measures used. Similar to the study of creativity and intelligence, researchers have employed different definitions of personality and have sought to assess the construct using different measures. This makes interpretation of the results particularly difficult. The adoption of the five-factor model (FFM) of personality along with the use of well-validated questionnaires and measures of creativity has helped the field move forward.

Creativity in the Arts and Science

There has long been an interest in the different thinking styles of those in arts from those in science. This debate was structured by C. P. Snow in his 1959 lecture entitled, "The Two Cultures." He stressed the differences and poor communication between those in the sciences and those in the humanities. This debate has continued for 50 years (Williamson 2011).

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It was the work of Hudson (1966) that arguably stimulated psychological research in this art-versus-science area. Hudson (1966) was inspired by the book *Creativity and Intelligence* (Getzels & Jackson 1962). He suggested that those with a bias toward convergent thinking moved toward the physical sciences, while those with a divergent thinking bias moved toward the humanities. The book became a citation classic, receiving 225 citations up to 1980 and many hundreds more since then.

The Hudson book and its conclusion attracted criticism (Kinsbourne 1968) but also replication and extensions (Hocevar 1980). Hartley and Greggs (1997) gave four groups of students – pure arts, arts and social science, social science and science, and pure science – some divergent thinking tests. The hypothesis that divergent thinking would decline along the arts–science continuum found support in that arts students as a whole scored significantly higher than science students on four tests of divergent thinking.

Researchers have tested the idea that personality and thinking style differences between arts and science students account for the differences in creativity (Haller & Courvoisier 2010). However, one study of 116 British undergraduates found that there were small differences in learning style and no problem-solving differences in arts and science students, leading the author to conclude that modern students have a more balanced educational profile than their more specialized predecessors (Williamson 2011).

Furnham and Crump (2013) compared students of arts and science on Jackson's 16 Personality Factor Questionnaire (16PF) and found that half the scales yielded significant differences. The biggest differences were on sensitivity and abstractness, where arts students scored higher than science students. There have been various, more recent studies that have looked at individual difference predictors of creativity in the arts and sciences (Furnham et al. 2011). There also have been studies that looked at creativity and vocational preference. J.C. Kaufman, Pumaccahua, and Holt (2013) found that artistic and investigative student majors, as predicted, scored higher on self-assessed creativity. Although the studies differ on many dimensions, it is possible to summarize the findings of many studies in this area as follows: artists score significantly higher on neuroticism and openness but lower on extraversion, agreeableness, and conscientiousness than nonartists. Artists score significantly higher on psychoticism than nonartists. However, scientists score significantly higher on intelligence and conscientiousness than nonscientists. Everyday creatives score significantly higher on extraversion than artists or scientists. Everyday creatives score significantly higher on agreeableness than artists or scientists.

What is important, however, is to recognize that there are different types of creativity (Beghetto & J.C. Kaufman 2015). The creative writer and the creative chemist may be very different in their aptitudes and personality. Thus, when considering creativity, it is important to consider the sphere in which the creativity happens.

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Eysenck's Psychoticism

Before the advent of the Big Five, Eysenck's *Gigantic Three* tests were often used to measure personality and its relationship to creativity. Early work using the Eysenckian three-factor model identified psychoticism (P) as the major personality determinant of creativity (Eysenck & Eysenck 1976; Kline & Cooper 1986; Woody & Claridge 1977). Eysenck (1994, 1995) produced a model to explain how P and creativity were related. He suggested that there were three major variables that interactively relate to creativity as an achievement. These are *cognitive variables* (e.g., intelligence, knowledge, technical skills, and special talents), *environmental factors*, and *personality variables* (e.g., internal motivation, confidence, nonconformity, and trait creativity).

Eysenck suggested that it is the process of overinclusive or allusive thinking that characterizes both psychotic and creative thinking:

> Creativity is indexed by certain cognitive styles (overinclusiveness, allusive thinking, looseness or "slippage" of ideation), which increase fluency and originality. This type of cognitive style is closely related to psychoticism, and accounts for the many links between psychosis and creativity. Psychosis as such is, of course, likely to *prevent* creative achievement, in spite of being related to the trait of creativity; it constitutes a negative factor in the multiplicative relationship between the factors making for creative achievement. Psychoticism is linked directly with both trait creativity and achievement creativity, the link being overinclusiveness. (Eysenck 1994, p. 232)

Theories developed to explain the cognitive deficits in psychotics and those relating to the cognitive aspects of creativity (Lubow & Weiner 2010; Martindale 1999) show many similarities.

Provided that there is a link between psychosis and creativity *and* psychoticism taps a unitary dimension underlying susceptibility to psychotic illness, then it is postulated that the important personality factor that acts synergistically with trait creativity (DT) and that may, under favorable environmental conditions, lead to real-life creative achievement is psychoticism. Many studies have found a correlation between psychoticism and trait creativity (Acar & Sen 2013; Aguilar-Alonso 1996; Carson 2014; Keri 2009) and also between psychoticism and achievement creativity (Gotz & Gotz 1979a, 1979b; Rushton 1990). However, studies have also failed to find significant relationships between creativity and P (Martindale & Dailey 1996).

A recent meta-analytic review examined the relationship between psychoticism and creativity in 32 previous studies involving 6,771 people (Acar & Runco 2012). The authors confirmed that the association they showed was moderated by a number of variables including gender, age, the type of sample, the particular measure of creativity, the content of the particular creativity test, the index of creativity, the particular measure of psychoticism, and the domain of creativity.

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The Big Five's Openness

Various studies before the millennium suggested numerous Big Five trait correlates of different measures of creativity. As ever, the findings have been similar but not always consistent. However, most studies have found that *open to experience* is the highest and most consistent correlate of various measures of creativity in different cultures (Silvia et al. 2009; Sung & Choi 2009).

In an early study, McCrae (1987), for instance, found that *divergent thinking* (DT) was consistently associated with self-reports and peer ratings of openness to experience but not with extraversion, neuroticism, agreeableness, or conscientiousness. In a rather different study, Gelade (1997) found that compared with "noncreatives," "commercial creatives" were more neurotic (particularly in terms of anger, hostility, depression, self-consciousness, impulsivity, and vulnerability), more extraverted (especially in terms of gregariousness and excitement seeking), more open to experiences (particularly fantasy, aesthetics, and feelings), and less conscientious (particularly in terms of overall competence, order, self-discipline, and deliberation).

Feist (1998), in a meta-analysis, investigated the creative personality in the arts and science. The results indicated that O, E, and C differentiated scientists from nonscientists. The confidence-dominance subcomponent was found to be more important than the sociability subcomponent. Relative to nonscientists, scientists are about half a standard deviation higher on conscientiousness and controlling of impulses. Similar to the results from the comparison of scientists versus nonscientists, in artists (compared with nonartists), the confidence-dominant subcomponent of extraversion contributed to the effect size, with no effect derived from the sociability subcomponent. The moderate effect size of agreeableness was noted for the direct expression of needs and the psychopathic deviance subcomponents of conscientiousness.

Batey and Furnham (2006) argued that when the criterion of creativity employed is a divergent thinking (DT) test, the results tend to suggest that *extraversion* is predictive (Aguilar-Alonso 1996; King et al. 1996; Wuthrich & Bates 2001). This finding holds true whether the instrument is from the Gigantic Three or the Big Five (Martindale & Dailey 1996) but different from that of McCrae (1987), who found that extraversion did not reach significance. It may be that DT tests are often administered in group settings, which is a more conducive setting for an extravert than for an introvert. Also, extraverts may perform better at DT tests because they seek stimulation (Eysenck & Eysenck 1975), and the DT test environment provides the perfect opportunity to do just that. McCrae (1987) suggested that extraverts may be happier to exhibit their work. Some investigators have demonstrated relationships between DT and the P scale of the Eysenck Personality Questionnaire (EPQ) (Aguilar-Alonso 1996; Merten & Fischer, 1999; Woody & Claridge 1977), but others have failed to note such a correlation (Kline & Cooper 1986; Martindale & Dailey 1996; Rawlings 1985).

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Researchers who have examined DT and the Big Five have always found evidence for the role of openness to experience (King et al. 1996; McCrae 1987; Wuthrich & Bates 2001). There is a potential explanation of why openness may be implicated in rated products but not DT tests. The products of DT tests are rarely judged qualitatively. It is most common to take measures of fluency (number of responses) or originality (statistical infrequency). Because there is no judgment of quality in these measures, an individual high in openness to new experiences will not be discernible from an individual who is not; rather, the test will select an individual with high ideational fluency. When the quality or ingenuity of a product is rated, qualitative judgments are performed regarding the novelty or utility of the product. In this scenario, a preference for new and surprising behaviors (as measured by O) will be rated (Batey & Furnham 2006).

It seems, therefore, that there is no doubt that *certain* personality traits are important for explaining and predicting *certain* types of creativity. This may account for as much as one-quarter to one-third of the variance in explaining the causes of creative work and tests. However, most personality studies have assumed that underlying personality traits are domain general (i.e., arts, science, or business creativity). This approach has resulted in mixed evidence concerning which personality traits are important in what circumstances. As suggested earlier, possessing certain traits, such as openness or tough mindedness (psychoticism), is probably necessary but not sufficient for creativity as achievement. To ensure that a person fulfills his or her potential, other requisite cognitive and situational variables will need to be present. That is, a person's setting needs to foster and encourage creativity and, where appropriate, reward it. More recent attempts have been to review the biological foundations of the creative personality and investigate physiological processes that may explain it (Chavez-Eakle, Eakle, & Cruz-Fuentes 2012). However, these neuroscience attempts to understand creative processes are still in their infancy.

Mental Illness and Creativity

Since ancient times, people have held the belief that creativity and madness are intrinsically linked. In the last two decades there have been numerous studies into the alleged relationship between creativity and mental illness. Many have argued that the "mad genius" idea is a myth (Schlesinger 2009, 2012). However, due to the debilitating state that occurs during mental illness, patients are difficult to study, and if they do participate in a study, it is unclear whether what is being studied is due to medication, poor motivation, or the effects of the illness itself (Bentall 2004).

Studies using various methodologies have examined the relationship between creativity and psychopathology (Carson, Peterson, & Higgins 2003; Fink et al. 2012; Jamison 1989, 1993; MacKinnon 1965; Peterson, Smith, & Carson 2002; Sass 2001). Reviews have tended to show that when studies are chosen by strict criteria, there remains clear evidence of the relationship between creativity and

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mental disorders of many sorts (Lauronen et al. 2004). One study of over 300,000 people showed that bipolar and schizophrenic people were overrepresented in creative professions (Kyaga et al. 2013). Although a number of mental illnesses have been implicated, such as mania and attention deficit hyperactivity disorder (ADHD), the two illnesses that are nearly always associated with creativity are schizophrenia and bipolar disorder.

Schizophrenia

Batey and Furnham (2006) suggest that most of the theories relating to the cognitive deficit in schizophrenia seem to propose that there is a deficit in selective attention mechanisms, which results in schizophrenics being unable to inhibit irrelevant information from entering consciousness (Hemsley 1991). This is also called the *cognitive disinhibition thesis*, and it has been reviewed recently by Carson (2014). Consequently, many unrelated ideas become interconnected, resulting in a "widening of the associative horizons" (Eysenck 1993) of schizophrenics. Evidence that schizophrenics, as well as normal individuals who obtain high scores on psychoticism scales, are characterized by "wide associative horizons" (i.e., they produce more unusual associations between words and ideas compared to normal individuals and low-psychoticism scorers) comes from a number of studies (Merten & Fischer 1999; Miller & Chapman 1983; Upmanyu et al. 1996). However, the research interest is now with *schizotypy* – a related disorder to schizophrenia – rather than schizophrenia per se (see next section).

Bipolar Disorder

There is an equally rich and diverse literature on the creativity of many people with bipolar disorder. It has been shown that there is a strong relationship between the two (Simeonova et al. 2005). Jamison (1993) inspected autobiographical, biographical, and, where available, medical records of 36 major British poets born between 1705 and 1805. They were 30 times more likely to have suffered from bipolar disorder, 10 to 20 times more likely to be cyclothymic, more than 20 times as likely to have been admitted to a mental asylum, and at least 5 times as likely to have committed suicide compared with the general population (Jamison 1993). The author interpreted this as persuasive evidence for a relationship between mood disorders and artistic creativity. There have been critiques of this work, and a recent review has suggested that while there is evidence of a link, the understanding of the processes and mechanisms remains weak (Johnson et al. 2012).

Nonetheless, an essential fact seems to have been completely ignored in this research: the poets flourished in a period that overlaps the heyday of the Romantic era, 1780–1830 (Sass 2000–1). Artistic creativity was admired for the intense emotion it evoked and its vital and spontaneous qualities, which differed from both the more rational didactic notion in the previous period and

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the increasingly detached conception that arose with twentieth-century modernism. Indeed, the romantic's view can be summarized in a quote from Wordsworth: "the spontaneous overflow of powerful feelings" (Sass 2001, p. 57). Jamison's cultural bias is also shown in *Touched with Fire*, where she uses a sample of 13 writers, composers, and artists born between 1709 (Samuel Johnson) and 1899 (Ernest Hemingway) to draw attention to figures in whom bipolar disorder and creativity are seen and to illustrate the illness's propensity to run in families (Jamison 1993). At least half of these creatives lived in the Romantic period.

Arguably, Jamison is the most renowned figure in the field of bipolar disorder and creativity. What is of concern is that having herself suffered from bipolar disorder; having written a best-selling biography, *An Unquiet Mind*; and having co-written a standard textbook on bipolar disorder that sold over 300,000 copies of the high profile *Touched with Fire*, Jamison's word often appears to be taken as definitive without objective criticism. When I typed "manic depression and creativity" into an Internet search engine during work on this chapter, 80 percent of the principal matches featured Jamison and her research. It is plausible that, as a sufferer, she has an intrinsic motivation to find a positive association between bipolar disorder and creativity, and given her eminent profile, her findings filter into general society and deepen the already ingrained notion of the relationship between manic depression and creativity.

Indeed, there are now a number of scholars, such as Schlesinger (2009, 2012), who are deeply skeptical about the whole mad genius hypothesis. Many argue that mental illness would act as a major handicap in ensuring that a person is able to realize his or her creativity activity.

Personality Traits and Personality Disorders

There is now growing interest in the relationship between the personality disorders, particularly schizotypy and, to a lesser extent, narcissism and histrionic personality disorder, and creativity. Psychiatrists and psychologists share some simple assumptions with respect to personality. Both argue for the *stability* of personality. The *Diagnostic and Statistical Manual* (*DSM*) criteria for personality disorders talk of "enduring pattern," "inflexible and pervasive," and "stable and of long duration." In addition, the pattern of behavior cannot be a function of drug usage or some other medical condition or a manifestation or consequence of another mental disorder. Both psychiatrists and psychologists argue that the personality disorders consist of factors related to *cognitive*, *affective*, *and social aspects of functioning.* In other words, the disorder or traits affect how people think, feel, and act. It is where a person's behavior "deviates, markedly" from the expectations of an individual's culture that the disorder is manifest. The psychiatric manual is very clear that "odd behaviour" is not simply an expression of habits, customs, religious or political values professed or shown by a people of particular cultural origin.

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The *DSM-5* notes that personality orders all have a long history and have an onset no later than early adulthood. Moreover, there are some gender differences: thus antisocial disorder is more likely to be diagnosed in men, while borderline, histrionic, and dependent personality disorders are more likely to be diagnosed in women.

The *DSM-5* goes to great length to point out that some of the personality disorders look like other disorders – anxiety, mood, psychotic, substance-related, and so on – but have unique features. The essence of the argument is that "Personality Disorders must be distinguished from personality traits that do not reach the threshold for a Personality Disorder. Personality traits are diagnosed as a Personality Disorder only when they are inflexible, maladaptive, and persisting and cause significant functional impairment or subjective distress" (APA 2013, p. 633).

One of the most important ways to differentiate personal style from personality disorder is flexibility. There are lots of difficult people at work but relatively few whose rigid, maladaptive behaviors mean that they continually have disruptive, troubled lives. It is their *inflexible, repetitive, poor stress-coping responses* that are marks of disorder.

Personality disorders influence the *sense of self* – the way people think and feel about themselves and how other people see them. The disorders often powerfully influence *interpersonal relations at work.* They reveal themselves in how people "complete tasks, take and/or give orders, make decisions, plan, handle external and internal demands, take or give criticism, obey rules, take and delegate responsibility, and co-operate with people" (Oldham & Morris 1991, p. 24). The antisocial, obsessive, compulsive, passive-aggressive, and dependent types are particularly problematic in the workplace. People with personality disorders have difficulty expressing and understanding emotions. It is the intensity with which they express them and their variability that make them odd. More important, they often have serious problems with self-control.

There have been numerous attempts to relate the two worlds of traits and disorders. Perhaps the most comprehensive attempt has been by Widiger and colleagues (1999), who believed that having extreme (high or low) scores on personality traits renders individuals *at risk* for certain disorders. Their analysis is set out in Table 14.1 but will be described more simply thereafter.

1. **Paranoid.** Paranoid individuals score low on agreeableness (particularly low trust) and straightforwardness. They also score high on facets of neuroticism, particularly angry hostility. They also are cold and antisocial (introverts) and closed rather than being open to experience.
2. **Schizoid.** Schizoid individuals are strongly introverted: loners, isolated, withdrawn with little interest in or ability to initiate and maintain social relationships.
3. **Schizotypal.** Schizotypal individuals are introverted but can manifest fairly strong neuroticism traits. However, they tend to score high on

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Table 14.1 *Different Labels for Traits Associated with Similar Disorders*

DSM-IV personality disorder		Hogan & Hogan (1997) HDS themes		Correlations with artistic creativity	Correlations with scientific creativity
Borderline	Inappropriate anger; unstable and intense relationships alternating between idealization and devaluation	Excitable	Moody and hard to please; intense but short-lived enthusiasm for people, projects, or things.	+++	–
Paranoid	Distrustful and suspicious of others; motives are interpreted as malevolent	Skeptical	Cynical, distrustful, and doubting others' true intentions.	–	–
Avoidant	Social inhibition; feelings of inadequacy and hypersensitivity to criticism or rejection	Cautious	Reluctant to take risks for fear of being rejected or negatively evaluated	–	–
Schizoid	Emotional coldness and detachment from social relationships; indifferent to praise and criticism	Reserved	Aloof, detached and uncommunicative, lacking interest in or awareness of the feelings of others	–	++
Passive-aggressive	Passive resistance to adequate social and occupational performance; irritated when asked to do something he or she does not want to do	Leisurely	Independent; ignoring people's requests and becoming irritated or argumentative if they persist	–	–
Narcissistic	Arrogant and haughty behaviors or attitudes, grandiose sense of self-importance and entitlement	Bold	Unusually self-confident; feelings of grandiosity and entitlement; overvaluation of one's capabilities	++	+
Antisocial	Disregard for the truth; impulsivity and failure to plan ahead; failure to conform	Mischievous	Enjoying risk taking and testing the limits; needing excitement; manipulative, deceitful, cunning, and exploitative.	+	+

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Table 14.1 (*cont.*)

DSM-IV personality disorder		Hogan & Hogan (1997) HDS themes		Correlations with artistic creativity	Correlations with scientific creativity
Histrionic	Excessive emotionality and attention seeking; self-dramatizing, theatrical, and exaggerated emotional expression	Colorful	Expressive, animated, and dramatic; wanting to be noticed and needing to be the center of attention	++	+
Schizotypal	Odd beliefs or magical thinking; behavior or speech that is odd, eccentric, or peculiar	Imaginative	Acting and thinking in creative and sometimes odd or unusual ways	++++	+++
Obsessive-compulsive	Preoccupations with orderliness; rules, perfectionism, and control; overly conscientious and inflexible	Diligent	Meticulous, precise, and perfectionistic; inflexible about rules and procedures; critical of others.	–	+
Dependent	Difficulty making everyday decisions without excessive advice and reassurance; difficulty expressing disagreement out of fear of loss of support or approval	Dutiful	Eager to please and reliant on others for support and guidance; reluctant to take independent action or to go against popular opinion	–	–

openness, which reflects their association with creativity. This condition is particularly associated with self-consciousness, vulnerability, and a rich fantasy life.

4. **Antisocial.** Antisocial individuals are low on agreeableness and conscientiousness, being exploitative, vengeful, and antagonistic. They have a mixed profile on neuroticism, being high on hostility but low on self-consciousness.
5. **Borderline.** Borderline individuals are essentially unstable, having high scores in most neuroticism facets, particularly hostility, impulsivity, vulnerability, depression, and anxiety. They are hot-tempered, often apprehensive, and easily rattled. They are characterized by vulnerability to stress, impulsivity, poor control, and negative emotionality.
6. **Histrionic.** Histrionic individuals are extreme extraverts: convivial, assertive, energetic, flashy, and high spirited. They express emotions with inappropriate exaggeration and display inappropriate affection, intimacy, and seductiveness. They also may be low in self-discipline.
7. **Narcissistic.** Narcissistic individuals tend to score low on agreeableness and low on neuroticism. They are suspicious and manipulative, however, despite low self-consciousness, hostility, and depression. Their consciousness scores can be very low.
8. **Avoidant.** Avoidant individuals are clearly introverted neurotics. They are anxious, timid, and insecure; easily rattled and panicked; apprehensive; and prone to feelings of embarrassment and inferiority. They probably also have low openness scores.
9. **Dependent.** Dependent individuals tend to score high on both agreeableness and neuroticism. Their pathological agreeableness makes them self-effacing, docile, submissive, and sacrificial. They may describe themselves as being low in competence and dutifulness, which makes them look low in consciousness.
10. **Obsessive-Compulsive.** Obsessive-compulsive individuals are perfectionistic, overly conscientious people who tend to be preoccupied with details and order and often excessively devoted to productive work. But they can be very fearful of making mistakes. They can also be rather antagonistic: low on compliance and altruism, insisting that others follow orders, and stubborn. They are thus high on conscientiousness and neuroticism but low on agreeableness.
11. **Passive-Aggressive/Negativistic.** Passive-aggressive/negativistic individuals tend to be low on both agreeableness and conscientiousness. They can be said to be sullen, complaining, stubborn, irritable, and disgruntled. They also may be high on certain features of neuroticism such as hostility.
12. **Self-Defeating/Depressive.** Self-defeating/depressive individuals are neurotics with low conscientiousness scores. They feel inadequate, pessimistic, and worthless and are, as a result, self-blaming, self-critical, and brooding. They fail to finish tasks and choose situations that may lead to failure. They also may have low agreeableness.

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13. **Sadistic.** Sadistic individuals score very low on agreeableness but also high on extraversion and often low on conscientiousness. They are characterized by their tendency to harm, humiliate, intimidate, and act aggressively toward others. They are ruthless, domineering, and brutal, with few signs of the warm, gregariousness of positive emotions.

What all this suggests is that there is considerable logical overlap between the psychologists' categorization scheme for "normal" personality traits and the psychiatric criteria for *personality disorders*. It is therefore possible to speculate about the relationship between creativity and the personality traits based on the work on the Big Five noting that creative people tend to be high on openness and low on agreeableness and conscientiousness. These hypotheses are set out in Table 14.1.

The signs indicate the possible strength of the relationship. Each plus or minus sign stands for the magnitude of effect size (.1, .2, .3, etc.), or gives us the categorical interpretations, that is, one plus or minus sign is small effect, two is a medium effect, and three is a large effect. It should be pointed out that Table 14.1 is strictly speculative. It is derived from data on the relationship between the personality disorders and personality traits (Gotzsche-Astrup & Furnham 2016). These are hypotheses that merit testing.

Creativity has also been linked to the personality disorders now often called the *dark-side traits*, a term used to describe the personality disorders as measured by the Hogan Development Survey (Hogan & Hogan 2009). Schizotypy has been most consistently related to creativity (Batey & Furnham 2008; O'Reilly, Dunbar, & Bentall 2001). Others have suggested that both histrionic and narcissistic personality disorder (Kehagia 2009) and aggressive personality disorder are implicated in the process of creativity (Pool & Odell-Miller 2011). Furnham and colleagues (2009) showed narcissism positively and obsessive-compulsiveness negatively related to creativity. More recent studies have documented the dark side of creativity. Similarly, Gino and Ariely (2012) provided empirical evidence for an association between dishonesty and creativity. Indeed, there are now a number of papers on what have been called *creative liars* (Beaussart, Andrews, & J.C. Kaufman 2013) and well as the *evil genius* (Gino & Wiltermouth 2014). The basic idea is that rule breaking is common to both.

There have been a few studies on the relationship between creativity and all the personality disorders (Furnham et al. 2009; Furnham & Crump 2014). Using a measure of divergent thinking as the dependent variable and a large sample, Furnham and Crump (2014) found that the personality disorder variables accounted for around 4 to 9 percent of the variance. Imaginative/schizotypal and colorful/histrionic were the best positive predictors, and diligent (OCD), dutiful (dependent), and skeptical/paranoid were the most negative predictors. In another study using self-rated creativity, Furnham, Hughes, and Marshall (2013) looked at the relationship between OCD, narcissism, and creativity. They argued that OCD is characterized by

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intrusive, anxiety-causing thoughts (obsessions) that the individual attempts to relieve through repetitive or ritualistic actions (compulsions), which can be either observable behaviors or mental processes (Stein 2002). Obsessive-compulsive individuals tend to exhibit a preoccupation with orderliness and perfectionism at the expense of efficiency, openness, and flexibility. Narcissism is characterized by grandiosity, a sense of entitlement, and a belief by the individual that he or she is special and unique, and it is often accompanied by arrogant behavior and a lack of empathy. The authors suggested that if high levels of creativity are linked to the idea of the very flexible, overly inclusive thinking found at high levels of psychoticism, it would follow that those with particularly rigid thinking styles, such as those arguably seen in individuals with obsessive-compulsive traits, would exhibit lower levels of creativity. Research indeed suggests that a lower level of creativity is displayed in individuals with OCD (Moritz et al. 2002). Similarly, research into personality disorders and the Big Five suggests that there is a negative correlation between OCD and the factors of openness to experience and extraversion (the factors most commonly associated with creative individuals), as well as a positive correlation with neuroticism (Saulsman & Page 2004).

In the case of individuals displaying narcissistic traits, one would expect high levels of creativity to be seen when using self-report methods of creativity because narcissistic individuals are likely to consider themselves highly creative, but not necessarily when using more objective methods (Goncalo, Flynn, & Kim 2010). However, research into narcissism and the Big Five does show a slightly positive relationship with openness, as well as a positive correlation with extraversion and a negative correlation with agreeableness (Saulsman & Page 2004), which has been suggested as the mixture of Big Five factors most likely to correlate with creativity, indicating that those displaying narcissistic traits may actually exhibit higher levels of creativity as well as just reporting them. This idea is supported by research indicating a link between narcissism and creative achievement (Feldmann 1989), as well as self-reported creativity. The authors found, as predicted, that narcissism was strongly correlated with self-rated creativity, while OCD was unrelated to self-related creativity but was related to a biographical inventory of creative behaviors.

Schizotypal Personality Disorder

It seems obvious that the personality disorder most likely to be associated with creativity is *schizotypal personality disorder*. This disorder, more common in males than in females, has been estimated to affect about 3 percent of the population. In a sense, such subjects are "mild, or subclinical schizophrenics," but they do not show the gross disorganization in thinking and feeling or severe symptoms of the latter. However, they all appear to be pretty idiosyncratic and often creatively talented and curious. They often hold very strange beliefs involving the occult. They have odd habits, eccentric lifestyles, and a rich inner life. Schizotypal patients have a rich inner life and often seek emotional

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experience. Hence they are drawn to religion and pharmacological techniques that promise "testing the limits." They seek rapture and nirvana. They show many eccentricities of behavior. They may look odd and have a reputation for being "peculiar."

The *DSM-5* criteria note a pervasive pattern of deficits in interpersonal relatedness and peculiarities of ideation, appearance, and behavior beginning by early adulthood and present in a variety of contexts. Hogan and Hogan (2001) call these types *imaginative* and describe them thus: they think about the world in unusual and often quite interesting ways. They may enjoy entertaining others with their unusual perceptions and insights and applause, which explains the lengths that they are willing to go to attract it. They are constantly alert to new ways of seeing, thinking, and expressing themselves, unusual forms of self-expression. They often seem bright, colorful, insightful, imaginative, very playful, and innovative, but also eccentric, odd, and flighty.

Oldham and Morris (1991), who call these types *idiosyncratic*, note:

> The following six traits and behaviours are clues to the presence of the Idiosyncratic style. A person who reveals a strong Idiosyncratic tendency will demonstrate more of these behaviours more intensely than someone with less of this style in his or her personality profile.
>
> 1. *Inner life.* Idiosyncratic individuals are tuned in to, and sustained by, their own feelings and belief systems, whether or not others accept or understand their particular worldview or approach to life.
> 2. *Own world.* They are self-directed and independent, requiring few close relationships.
> 3. *Own thing.* Oblivious to convention, Idiosyncratic individuals create interesting, unusual, often eccentric lifestyles.
> 4. *Expanded reality.* Open to anything, they are interested in the occult, the extrasensory, and the supernatural.
> 5. *Metaphysics.* They are drawn to abstract and speculative thinking.
> 6. *Outward view.* Though they are inner-directed and follow their own hearts and minds, Idiosyncratic men and women are keen observers of others, particularly sensitive to how other people react to them.
>
> (Oldham and Morris 1991, pp. 242–3)

In a meta-analysis of the relationship between creativity and schizotypy, Acar and Sen (2013) found a mean effect size of .07 based on 45 studies that included 268 effect sizes. They looked at five possible moderators and found only the *type of schizotypy* significant. There was no effect for the different measures of schizotypy, but none chose to use the measure employed in this study. The results from the meta-analysis suggested that positive, impulsive schizotypy related to extraversion and not negative, disorganized schizotypy related to introversion was most closely related to creativity. However, there have been few studies that relate "normal," "bright-side" traits to measures of schizotypy, which is the focus of this chapter.

Eysenck (1993) suggested that it was schizotypy (he referred to it as *psychoticism*) that underlies creative achievement. The schizotypy measure most

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commonly used ranged from stable cognition and affect to florid schizophrenia and psychosis (Bentall 2004). Schizophrenics and, to a lesser extent, those with schizotypy tend to be overly inclusive in the amount of information they encode. They see relationships between things that are in fact completely independent, making causal assumptions where none are appropriate. This type of lateral thinking and originality are what the DT tests attempt to measure, and it is this reduced cognitive inhibition and disorganization that are suggested may aid creative thinking by providing the individual with a larger sample of ideas (Eysenck 1993).

The theory behind looking at psychotic-like features in the general population and then placing them on a continuum is now a multidimensional approach, with factor-analytic studies revealing three or four factors underlying the construct of schizotypy (Bentall, Claridge, & Slade 1989). The Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE) (Mason, Claridge, & Jackson 1995) is a popular measure of schizotypy that assesses four aspects: a positive symptom dimension ("unusual experiences"), a negative symptom dimension ("introvertive anhedonia"), and a disorganized symptom dimension ("cognitive disorganization"), as well as a fourth dimension based largely on Eysenck's psychoticism scale (Eysenck & Eysenck 1975), measuring impulsive, aggressive, and asocial aspects of psychosis ("impulsivity/nonconformity"). This scale has construct and predictive validity because many studies have shown that high schizotypy scorers on this scale do in fact show similar neurocognitive deficits to schizophrenic patients (Goodarzi, Wykes, & Hemsley 2000; Rawlings & Goldberg 2001; Tsakanikos & Reed 2003).

Recently, Furnham and Crump (2014) looked at the "bright-side" personality traits and schizotypal as measured by the Imaginative Scale of the Hogan Development Survey (Hogan & Hogan 2001). Results at the domain superfactor level showed that the imaginative types were open, disagreeable extraverts. Facet analysis showed which of the six subscale scores from each superfactor best predicted schizotypal personality disorder. The facets of openness were most highly and consistently correlated with the imaginative scale. Previous studies suggested that schizotypal types were neurotic introverts, while the Furnham and Crump (2014) study showed mixed results for neuroticism at the facet level but that subjects were clearly extraverted.

One possible explanation for these different findings lies in the idea of differentiating positive and negative schizotypy (Kwapil et al. 2012). *Positive schizotypy* is associated with increased negative affect, thought impairment, suspiciousness, negative beliefs about current activities, and feelings of rejection, but not social disinterest or decreased positive affect. *Negative schizotypy* was associated with decreased positive affect and pleasure in daily life, increased negative affect, and decreased social contact and interest. It is possible that the different measures of schizotypal personality disorder tap into different aspects of the disorder and that the measure used in this study may have had more positive than negative items.

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Conclusion

Nearly all psychometric researchers lament the paucity of established and validated measures of creativity that they can link to variables such as personality and intelligence. This has meant that compared with personality and intelligence, creativity has been something of a backwater for differential psychologists. Equally, problems with definitions and measurements of the personality disorders have also "put off" many differential psychologists from examining the disorders. There is, however, a growing literature in both fields and the relationship between these two areas, namely, creativity and the personality disorders.

It has long been acknowledged that the correlates and predictors of creativity in some worlds/sectors are different from others. One well explored is the difference between creativity in the arts and sciences. This explains in part why it appears as if the literature is inconsistent, whereas overall it appears that many findings have been replicated. Two personality traits have been consistently shown to relate to many measures of creativity. They are highly correlated. The first is psychoticism, as defined as part of the Gigantic 3 from the Eysenkian theoretical background. The second is openness to experience, as defined as one of the Big Five model traits. Apart from considerably evidence to link these traits to creativity, there are theoretical explanations for how the mechanism or process works.

There has long been a literature on mental illness and creativity and many popular books and academic papers. It is an area of considerable controversy. This chapter focused on the small but growing literature on personality disorder correlates of creativity. Recent rapprochement between psychologists and psychiatrists has meant that the overlap between the traits and disorders has been well researched. However, the literature on the relationship between the personality disorders and creativity is far less explored. While there is an extant literature on the relationship between schizotypy and creativity, there is very little other systematic research on the other disorders. This chapter offers some suggestions and hypotheses as to which and why it may be reasonable to expect a relationship between a particular disorder and various types of creativity. It was argued that some disorders, if not too severe, may help a person with creative ability and talent realize his or her potential. Thus the boldness and self-confidence of a narcissist may indeed help his or her efforts to complete and get recognition for his or her creative efforts. Equally, the emotionality of a person with hystrionic personality disorder may be very helpful in certain social creative situations. Similarly, it may be that OCD, again at not too high a level, may be to some extent helpful in creativity in science but not in art.

These speculations remain to be tested. However, with clear developments in the measurement of the personality disorders at both the domain and facet levels, it is hoped that this opens a new pathway in the area of mental health and creativity (Furnham 2015).

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PART III

Creativity and Personality

Measurement and Social Influences

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15 Creativity and the Big Five Personality Traits

Is the Relationship Dependent on the Creativity Measure?

Jason Hornberg and Roni Reiter-Palmon

Creativity can be described as the generation of a product, work, or solution that is considered both novel and useful (Amabile 1996; Runco 2004; Sternberg & Lubart 1999). While agreement about the definition of creativity has emerged in recent years, measurement of creativity has been quite varied. Measures of creativity include divergent thinking tests; creative achievement; creative behaviors, and creative task performance; self-ratings associated with perceived creativity or creative abilities; and ratings of creativity by other individuals. However, research on the relationship between personality, especially the Big Five measures, and creativity has differentiated these relationships based on how creativity is measured.

Research indicates that some individual difference variables correlate relatively consistently with creativity regardless of how it is measured (Batey 2007). In particular, the Big Five personality trait of *openness to experience* has been positively correlated with a variety of measures of creativity (Carson, Peterson, & Higgins 2005; DeYoung 2015; Feist 1998, S. B. Kaufman et al. 2016; McCrae 1987; Silvia et al. 2008, 2009). However, research examining the relationships between the other four Big Five personality traits and creativity has found inconsistent relationships.

Because the research examining the Big Five personality traits and specific measures of creativity is relatively fragmented, the intent of this chapter is to summarize the current state of research and examine differences in the relationships that have been reported between the Big Five personality traits and various measures of creativity. We are also following the recommendation of Batey and Furnham (2006: 403) that "to fully account for personality variables in creativity, we suggest that future researchers consider not only the domain of work but also the criterion of creativity used." Therefore, the goal of this chapter is to more fully account for the relationships between personality variables and measures of creativity while also considering the measure of creativity used. Ultimately, we believe that differences in the relationships between creativity and the Big Five personality traits indicate that the measure of creativity used in a study matters.

Divergent Thinking

Divergent thinking is considered to be the production of a diverse answers, responses, solutions, or questions in response to an open-ended verbal

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or figural prompt or problem (Baer 2011; Kim 2006; Runco 2007). Guilford (1950, 1956, 1967) considered an individual's ability to develop multiple solutions to open-ended problems to be one of the core skills associated with creativity. Despite Guilford's notion that divergent thinking was a set of subskills, divergent thinking tasks have frequently been used as domain-general measures of creative potential or even more generally as a substitute measure of creativity. Divergent thinking tasks continue to be used frequently as measures of creative potential or as a proxy measure of creativity in research. However, past research has not always found a relationship between divergent thinking and other measures of creativity (Batey, Furnham, & Safiullina 2010; Pretz & McCollum 2014). Despite concerns about what divergent thinking tasks measure, the continued use of these tests is largely due to the notion that they are still the best measure available for examining the foundation of creative ability (Plucker & Renzulli 1999; Runco 2007; Silvia et al. 2008).

Divergent thinking tasks can be scored in a variety of ways, including for fluency, flexibility, elaboration, and originality. *Fluency* is scored by counting the number of ideas a participant produced in a given period of time that were relevant to the situation. Similarly, *flexibility* is scored by counting the number of ideational categories or themes that were generated during a divergent thinking task by a participant. Alternately, *elaboration* is scored by rating the details associated with an idea generated by a participant during a divergent thinking task. Finally, *originality* is scored by rating the novelty of an idea generated by a participant during a divergent thinking task. Of the previously discussed scoring methods, divergent thinking tasks are most frequently scored for fluency and originality. In addition, some researchers form a composite score based on two or more of these scoring methods to create one score reflecting creativity.

Divergent Thinking and the Big Five Personality Traits

The most commonly reported relationship has been between divergent thinking and openness to experience. The first study to report this relationship was conducted by McCrae (1987), who found that four divergent thinking tasks scored for fluency, one of two divergent thinking tasks scored for originally, and a composite divergent thinking score that summated the fluency and originality scores had significant medium positive correlations with several different openness to experience measures. King, Walker, and Broyles (1996) also found a medium positive correlation between a standardized and summed composite divergent thinking score that included six different divergent thinking tasks that were scored for both fluency and originality and openness to experience.

Subsequently, a number of studies have reported significant positive relationships between a variety of divergent thinking tasks and openness to experience (Chamorro-Premuzic 2006; Chamorro-Premuzic & Reichenbacher 2008; Furnham & Bachtiar 2008; Furnham et al. 2008, 2009; Jauk

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et al. 2013; S. B. Kaufman et al. 2016; Sánchez-Ruiz et al. 2011; Silvia et al. 2008, 2009; von Strumm, Chung, & Furnham 2011; Walker & Jackson 2014). The divergent thinking measures used in these studies were predominantly alternate- or unusual-use tasks but also included consequence and figural tasks. These tasks were scored using a variety of methods, including for fluency, originality, or as a combined score that summated two or more methods of scoring the divergent thinking tasks. Overall these studies reported a range of small to large positive correlations between the divergent thinking task and openness to experience regardless of how the divergent thinking task was scored.

Divergent thinking and extraversion have also been reported as correlated in a number of studies. McCrae (1987) was the first to find that routine-consequence and remote-consequence tasks as well as a composite measure of divergent thinking, which was formed by summating the fluency and originality scores, had a small positive correlation with extraversion. Subsequent studies have reported small to medium positive correlations between divergent thinking and extraversion (Batey, Chamorro-Premuzic, & Furnham 2009; Chamorro-Premuzic 2006; Chamorro-Premuzic & Reichenbacher 2008; Furnham et al. 2008, 2009; Jauk et al. 2013; King et al. 1996; Martindale & Dailey 1996). Additionally, Furnham and Bachtiar (2008) reported a very large positive correlation (r = 0.69) between divergent thinking and extraversion. Many of the participants in this study were involved in art lessons, and this may have contributed to the larger correlation found.

Of the previously discussed studies, most reported using alternate- or unusual-use tasks or consequence tasks, and Batey and colleagues (2009) also used a word fluency task, which asked participants to generate as many words as possible beginning with a specified letter. Most of the divergent thinking tasks related to extraversion were scored using fluency. Several more of the studies reported that divergent thinking tasks were scored using originality, and Chamorro-Premuzic (2006) used elaboration, flexibility, and appropriateness scores. When multiple divergent thinking tasks were collected, composite scores were created using summation in the majority of the studies. Additionally, Chamorro-Premuzic (2006) used regression to create an overall creativity score from the fluency, originality, elaboration, flexibility, and appropriateness scores obtained within the study.

Differences in the relationship between divergent thinking tasks and extraversion may be associated with the method of scoring used or type of divergent thinking measure. Batey and Furnham (2006) proposed that extraversion was related to only the quantity of ideas, but not the quality of ideas produced. While studies that reported nonsignificant relationships also used fluency scores (e.g., Batey et al. 2010; S. B. Kaufman et al. 2016; Lee & Dow 2011; Martindale & Dailey 1996; Pretz & McCollum 2014; Sánchez-Ruiz et al. 2011; Silvia et al. 2009; von Strumm et al. 2011; Wuthrich & Bates 2001), several of these studies also only reported composite scores that included fluency and originality.

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The type of divergent thinking task might influence whether or not a relationship is found with extraversion. Of the studies that we reviewed, those that used divergent thinking tasks that required the production of drawings or figures did not report significant relationships with extraversion. However, when the divergent thinking task used was a consequences, alternate- or unusual-use, or verbal fluency task, significant relationships were frequently reported with extraversion (Batey et al. 2009; Chamorro-Premuzic & Reichenbacher 2008; Furnham et al. 2009; McCrae 1987). Overall, it is important to note that there were only a handful of studies that reported using figural production or consequences tasks, and these tasks were frequently only one of several divergent thinking tasks used to create a composite divergent thinking score. Yet, these results suggest that when figural divergent thinking tasks are used, there may not be a relationship with extraversion. Thus we suggest that the type of divergent thinking task and scoring might affect the relationship with extraversion, but more research is needed.

Divergent thinking and conscientiousness have been related inconsistently. Lee and Dow (2011) and Jauk and colleagues (2013) reported small to medium negative correlations between several alternate- or unusual-use divergent thinking tasks and conscientiousness. Of these tasks, Lee and Dow (2011) scored the divergent thinking tasks they used for fluency but also instructed their participants to be malevolent, and Jauk and colleagues (2013) scored their divergent thinking tasks for fluency and originality while instructing their participants to generate as many novel and uncommon uses as possible. Alternately, Wuthrich and Bates (2001) and Sánchez-Ruiz and colleagues (2011) reported small positive correlations between divergent thinking tasks that required figural production, when these tasks were scored using fluency and flexibility.

While the vast majority of the studies that we reviewed reported a nonsignificant relationship between divergent thinking and conscientiousness (e.g., Batey et al. 2009, 2010; Chamorro-Premuzic 2006; Chamorro-Premuzic & Reichenbacher 2008; Furnham & Bachtiar 2008; Furnham et al. 2008, 2009; S.B. Kaufman et al. 2015; King et al. 1996; Martindale & Dailey 1996; McCrae 1987; Pretz & McCollum 2014; Silvia et al. 2009; von Strumm et al. 2011; Walker & Jackson 2014), the studies that reported significant results are interesting. First, there is the possibility the instructions given to participants as part of the divergent thinking task might affect the relationship with conscientiousness. As such, more conscientious participants might respond to instructions directing the types of responses required to the divergent thinking task. Second, the relationship between divergent thinking and conscientiousness may differ based on the task such that figural tasks show positive relationships.

Divergent thinking and the Big Five personality trait of neuroticism also have been correlated inconsistently. Similar to conscientiousness, the majority of the studies that we reviewed reported a nonsignificant relationship between divergent thinking and neuroticism (e.g., Batey et al. 2009, 2010; Chamorro-Premuzic 2006; Furnham et al. 2008; Jauk et al. 2013; S.B. Kaufman et al. 2016; King et al. 1996; Lee & Dow 2011; McCrae 1987; Pretz & McCollum 2014;

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Silvia et al. 2009; von Strumm et al. 2011; Walker & Jackson 2014). However, the studies that reported significant relationships included both positive and negative relationships between divergent thinking and neuroticism (Chamorro-Premuzic & Reichenbacher 2008; Furnham et al. 2009; Furnham & Bachtiar 2008; Martindale & Dailey 1996; Sánchez-Ruiz et al. 2011; Wuthrich & Bates 2001). The inconsistent relationship between divergent thinking and neuroticism may be the result of two different influences on the relationship.

First, only two of the studies we examined used figural measures of divergent thinking, and both of these studies reported significant positive correlations with neuroticism (Sánchez-Ruiz et al. 2011; Wuthrich & Bates 2001). These relationships may indicate that figural divergent thinking tasks measure different cognitive abilities than verbal divergent thinking tasks, which has been suggested previously by Crammond and colleagues (2005). Therefore, we suggest that future research examine the relationships between the Big Five personality traits and measures of figural and verbal divergent thinking, and the unique relationships should be reported between these variables.

Second, there is an indication in the research we examined that gender differences may influence the relationship between divergent thinking tasks and neuroticism. Several, but not all, of the studies that reported negative relationships used samples that were entirely or largely male. Conversely, the studies that reported positive relationships and nonsignificant relationships between divergent thinking tasks and neuroticism used more balanced samples and did not appear to share a common type of divergent thinking task or a common scoring method. Because the number of studies reporting relationships between divergent thinking tasks and neuroticism was relatively small, we cautiously suggest that the relationship between divergent thinking tasks and neuroticism might be influenced by gender, but more research is needed.

Finally, while the majority of the studies reviewed reported a nonsignificant relationship between divergent thinking and agreeableness (e.g., Batey et al. 2009, 2010; Chamorro-Premuzic & Reichenbacher 2008; Furnham et al. 2008, 2009; S. B. Kaufman et al. 2016; King et al. 1996; Lee & Dow 2011; Martindale & Dailey 1996; McCrae 1987; Sanchez-Ruiz et al. 2011; Silvia et al. 2009; von Strumm et al. 2011; Walker & Jackson 2014; Wuthrich & Bates 2001), a few studies have reported significant relationships that differed in direction. Specifically, Chamorro-Premuzic (2006) and Furnham and Bachtiar (2008) reported positive correlations between measures of divergent thinking and agreeableness, while Jauk and colleagues (2013) and Pretz and McCollum (2014) reported negative correlations. Our examination of these studies failed to identify an apparent reason to explain the differences in the relationships between divergent thinking and agreeableness reported in these studies.

Divergent Thinking Conclusions

The literature reviewed in this section suggests that divergent thinking tasks are most consistently related to openness to experience and extraversion and less

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consistently with the traits of conscientiousness, neuroticism, and agreeableness. Depending on how divergent thinking tasks are scored, the relationship with the Big Five personality traits may change. An important finding from this literature review is that scoring can vary widely between studies, possibly masking the nature of the relationship between specific Big Five traits and creativity. As such, we recommend that studies include and report multiple scoring methods, and if composite scores are used, information regarding the components should be included in the paper.

Future research also needs to continue to examine the effect that instructions can have on the relationship between the divergent thinking task and the Big Five personality traits. Specifically, asking participants to be fluent or creative seems to influence the relationships between the various Big Five traits and divergent thinking (Nusbaum, Silvia, & Beaty 2014). More specifically, these authors suggest that when participants receive differing instructions, different variables are measured, a finding that has also been supported in some of the studies looking at divergent thinking and conscientiousness. While research has looked at some of the differences in the relationships given different instructions, most of the research focused mainly on the direct effect of instructions on performance on divergent thinking. Additional research evaluating the interaction with personality is needed.

Finally, future research should also examine the effect that the type of divergent thinking task has on the relationship with the Big Five personality traits. Specifically, limited research indicates that the type of divergent thinking task, such as verbal versus figural, may influence the relationships observed with the Big Five traits. It is important to determine whether different types of divergent thinking tasks have different relationships with some of the Big Five personality traits because these differences would indicate that the type of divergent thinking task used matters.

Creative Achievements

Research examining personality characteristics and creativity has attempted to identify activities and behaviors that might predict creativity. King and colleagues (1996) examined the five-factor model (FFM) of personality, creative accomplishments, and creativity. They found a large positive correlation between the Big Five personality trait of openness to experience and participant-generated lists of creative accomplishments and a medium negative correlation between the Big Five personality trait of agreeableness and creative achievements. Furthermore, these authors also found that higher levels of verbal creativity, which were measured using several different divergent thinking tasks from the Torrance Test of Creativity Thinking, and openness to experience interacted and resulted in more creative accomplishments. Alternately, greater verbal creativity and lower levels of conscientiousness interacted and resulted in more creative accomplishments (King et al. 1996).

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Feist (1998) also examined the relationships between creative achievement and the Big Five personality traits. He found that aspects of openness to experience were related to creative accomplishment for creative scientists and artists. When aspects of conscientiousness were examined, both scientists and artists were found to be significantly different from noncreative individuals; however, the direction of the differences differed for scientists and artists. Specifically, scientists scored higher on positive aspects of conscientiousness and lower on negative aspects compared with nonscientists. Artists, however, showed a reverse pattern such that they scored higher on the negative aspects and lower on the positive aspects of conscientiousness compared with nonartists.

Feist (1998) also identified a small difference between artists and nonartists regarding the negative aspects of neuroticism, such that artists scored lower on these. Scientists, however, showed more positive attributes associated with extraversion, notably the confidence aspect, compared with both nonscientists and less creative scientists. Further, artists were found to be less agreeable than nonartists. Overall, this analysis indicates that more creative accomplishments are associated with the traits of open to experience and conscientiousness. However, the direction of these relationships may be influenced by the types of creative individuals being examined (i.e., scientists versus artists).

Creative accomplishments have also been examined using the Creative Achievement Questionnaire (CAQ), an instrument that is commonly used to measure creative achievement across a number of domains. The CAQ assesses creative accomplishment in 10 domains and also can yield a total score, an artistic score, and a scientific score. The CAQ measures eminent creativity, as opposed to everyday creativity (Carson et al. 2005; Silvia et al. 2012). When CAQ total scores are correlated with the Big Five personality traits, a medium to large positive relationship between openness to experience and the CAQ total score has consistently been found (Beaty, Nusbaum, & Silvia 2014; S. B. Kaufman et al. 2016; Pretz & McCollum 2014; Silvia et al. 2009). Similarly, a small to medium positive relationship has been found less consistently between extraversion and the CAQ total score. Finally, Beaty and colleagues (2014) identified a small negative relationship between agreeableness and the CAQ total score in one of their studies. As such, none of the studies that we reviewed reported relationships between the CAQ and the personality traits of conscientiousness or neuroticism.

When the subscale scores of CAQ are used, the relationships between the domain scores and the Big Five personality traits can change depending on the domain being examined. S.B. Kaufman and colleagues (2015) reported a medium positive correlation between the CAQ summative art domain and openness to experience. However, when the individual artistic domains are examined, medium to small positive relationships exist between the visual arts, music, creative J and theater/film domains and openness to experience, but significant relationships were not found with the dance or humor domains. S.B. Kaufman and colleagues (2015) also reported a medium positive correlation between extraversion and the summative art factor from the CAQ. But when

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the relationship between extraversion and the individual artistic domains measured by the CAQ are examined, a positive relationship was only reported for the humor, theater/film, and culinary arts domains, while the relationship is not significant for the visual arts, music, dance, or creative writing domains. Finally, S. B. Kaufman and colleagues (2016) reported a small positive correlation between openness to experience and the summative sciences factor as well as the invention and scientific discovery domains within the CAQ.

Creative Achievements Conclusions

When creative achievements are examined without regard to domain, relatively consistent relationships emerge between the traits of openness to experience and extraversion. However, the limited research in this area suggests that when more refined relationships are considered, such as domains of creativity or facets of personality, the relationships between measures of creative achievement and personality become less consistent. The research so far indicates that extraversion seems to be correlated more strongly with creative activities that involve performance to a group or crowd, whereas those activities that show lower and nonsignificant relationships tend to be more solitary in nature. In addition, the research by Feist (1998) identified some interesting differences between artists and scientists, again indicating that the domain in which creative accomplishments are measured is important. Additional research is needed to determine the relationship between creative accomplishments using the CAQ or other approaches and the Big Five traits in order to verify these differences and potentially uncover a more nuanced understanding of the relationship between creativity and personality.

Creative Behaviors

Creative behaviors are a common metric used to assess creativity. Creative behavioral measures include questionnaires that focus specifically on participation in activities that are considered creative across multiple domains. One such measure is the Creative Behavior Inventory (CBI) developed by Hocevar (1979), which has several short forms and a long form. When a short form is used, a single measure of everyday creativity is obtained, but when the long form is used, everyday creativity and eminent creativity are assessed, and domain-specific scores can be obtained (Dollinger 2007; Silvia et al. 2012). Openness to experiences frequently is found to have a large to medium correlation or a unique relationship with overall creativity, as measured by the CBI (Dollinger 2007, 2011; Dollinger, Urban, & James 2004; Lee & Kemple 2014; Silvia et al. 2009). Additionally, Dollinger (2011) and Dollinger and colleagues (2004) have reported a small to medium correlation between extraversion and overall creativity, as measured by the CBI. No significant relationships have been reported between the agreeableness, conscientiousness, or neuroticism traits and creative behaviors measured by CBI.

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As previously mentioned, the CBI has also been used to examine domains of artistic and scientific creativity. Dollinger et al. (2004) reported a moderate positive correlations between openness to experience and the CBI creativity total score as well as the creativity domains associated with the visual arts, literary accomplishment, crafts, performance, and math and science. However, no significant relationship was reported for the music domain and the openness to experience trait. Dollinger and colleagues also reported moderate positive correlation between extraversion and the CBI total creativity score and the creativity measures associated with literary accomplishments and performances, but not with the measures associated with visual arts, crafts, or music. Finally, no significant relationships were reported between any of the CBI scores and the traits of agreeableness, conscientiousness, or neuroticism.

Another commonly used measure of creative behavior is the Biographical Inventory of Creative Behavior (BICB), which is a self-report measure of everyday creativity that is focused on problem solving and creative behaviors across a variety of domains (Batey 2007; Silvia et al. 2012). Studies that report correlations between the Big Five personality traits and creativity have most frequently reported a medium relationship between openness to experience and the BICB (Batey et al. 2010, 2014; Furnham et al. 2008; Furnham, Hughes, & Marshall 2013; Silvia et al. 2014). Several studies have also reported a medium positive correlation between extraversion and the BICB (Furnham & Bachtiar 2008; Furnham et al. 2008; Furnham et al. 2013). Additionally, two studies have reported the neuroticism and the BICB were correlated. However, Beaty and colleagues (2014) reported a small negative relationship between neuroticism and the BICB, while Furnham and colleagues (2013) reported a medium positive correlation. No significant relationships have been reported between the traits of agreeableness or conscientiousness and creative behaviors.

Finally, creative behavior can be examined using the Creative Activities and Interests Checklist or one of its variants. The Creative Activities and Interests Checklist assesses creative behaviors in a variety of domains depending on which variant is used. However, the studies that have used the Creative Activities and Interests Checklist and also reported correlations with the Big Five personality traits frequently use a composite score rather than reported relationships between the domains of creativity. One of the studies that used the Creative Activities and Interests Checklist to examine relationships with the Big Five personality traits was conducted by Beaussart, S.B. Kaufman, and J.C. Kaufman (2012).

Within the study by Beaussart and colleagues (2012), the relationships between a composite score for creative engagement as measured by the Creative Activities and Interests Checklist and the Big Five personality traits were reported. These authors also reported the relationships between these measures for males ($n = 105$) and females ($n = 603$) because the overall sample population was predominantly female. They found small positive correlations between the Creative Activities and Interests Checklist composite score and the traits of openness to experience and extraversion for the total sample and for females.

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They also found a small negative relationship between the checklist composite score and conscientiousness for the total sample and for females. However, the relationships between the composite score for the checklist and the traits of openness to experience, extraversion, and conscientiousness were all nonsignificant in the male sample. When the relationship between creativity and neuroticism was examined, a nonsignificant relationship was found in the total sample. But a small negative relationship was found in the female sample, and a moderate positive relationship was found in the male sample. Finally, no significant relationships were reported between the creative behavior measure and agreeableness.

Another study that used a variant of the Creative Activities and Interests Checklist was conducted by Reiter-Palmon, Illies, and Kobe-Cross (2009), in which the authors examined the relationships between facets of conscientiousness and creative behavior. The authors found small positive correlations between two facets of conscientiousness, achievement and competence and a total score for creativity as measured by the Creative Activities Checklist. Furthermore, this relationship remained when divergent thinking tasks that were indexed for originality and quality were used as covariates. However, the relationship became nonsignificant when the divergent thinking task used as a covariate was indexed for fluency. According to the authors, the inconsistent relationship between creativity as measured by the Creative Activities and Interests Checklist and the full measure of conscientiousness might be due to suppression.

Creative Behaviors Conclusions

When measures of creative behavior are related to the Big Five personality traits, relatively consistent moderate positive relationships seem to exist between measures of creative behavior and the traits of openness to experience and extraversion. However, research in this area indicates that different relationships might exist when subdimensions of creative behaviors or personality facets are considered. As such, we suggest that future research needs to report scores associated with creative domains, genders, and facets of personality, along with total or composite scores. By refining the way that we examine the relationships between the Big Five personality traits and measures of creative behavior, and perhaps creativity as a whole, we might identify instances where meaningful differences were suppressed by the use of total, composite, and summary scores.

Self-Ratings of Creativity

Self-rated creativity can be thought of as an assessment of potential and creative abilities by an individual (Furnham et al. 2008; Hughes, Furnham, & Batey 2013). One way that self-ratings of creativity have been obtained is by

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asking participants how creative they are in comparison with other people. Studies conducted by Batey and colleagues (2010), Furnham and Bachtiar (2008), Furnham and colleagues (2008), and Hughes, Furnham, & Batey (2013) have used this approach to obtain overall or domain-specific self-ratings of creativity. Self-ratings of creativity were also obtained from an individual measure or as part of a composite measure of self-perceived creativity as part of these studies. Participants' level of self-rated creativity was then correlated with the Big Five personality traits. Of the Big Five personality traits, openness to experience had medium to large positive correlations with self-ratings of creativity within several studies (Batey et al. 2010; Furnham et al. 2008; Hughes et al. 2013). The Big Five personality trait of extraversion was also moderately and positively correlated with overall self-ratings of creativity in several studies (Furnham & Bachtiar 2008; Furnham et al. 2008; Hughes et al. 2013). Finally, Batey and colleagues (2010) reported that neuroticism had a small negative relationship with self-reported creativity.

Self-ratings of creativity have also been obtained by asking participants to rate how creative they are within a creative domain. Several studies have examined performance-specific self-ratings of creativity that are associated with a specific activity or task. Pretz and McCollum (2014) and Sung and Choi (2009) examined the relationship between the Big Five personality traits and task-specific self-rated performance. These studies found that the Big Five personality trait of openness to experience was moderately and positively correlated with participants' self-rated creativity on a caption task, on an essay task, and within a college course. The Big Five personality trait of extraversion was moderately and positively related to self-rated creativity on a caption task, on a divergent thinking task, and within a college course. Pretz and McCollum (2014) also found that neuroticism had a small positive relationship with self-reported creativity on an essay task, while conscientiousness was moderately and negatively related to self-reported creativity on a divergent thinking task.

Self-ratings of creativity also were measured using psychometric scales such as the Creativity Scale for Different Domains (CSDD), the Revised Creativity Domain Questionnaire (CDQ-R), and the Kaufman Domains of Creativity Scale (K-DOCS). These instruments yield scores that are related to an individual's self-perceived levels of creativity in areas and domains that are associated with creativity (Silvia et al. 2012). However, only a few studies have used these instruments and also reported relationships with the Big Five personality traits.

One of these studies used the CDSS to examine self-perceived general creativity and the domains of hands-on creativity, empathic-interpersonal creativity, and math–science creativity, along with the relationships between these measures of creativity and the Big Five personality traits (Silvia et al. 2009). These authors found that openness to experience had a medium positive relationship with self-perceived general creativity, hands-on creativity, and empathic-interpersonal creativity but a nonsignificant relationship with math-science creativity. The authors also found that empathic-interpersonal creativity and math–science creativity had a small negative relationship with neuroticism,

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while general creativity and hands-on creativity did not have a significant relationship with neuroticism. Additionally, empathic-interpersonal creativity was the only domain of creativity that was found to have a small positive relationship with conscientiousness. Finally, extraversion and agreeableness were not found to have a relationship with general creativity or the three domains of creativity in this study (Silvia et al. 2009).

J. C. Kaufman and colleagues (2009) conducted a study that used the short form of the CDQ-R to examine relationships between self-rated creativity and the Big Five personality traits. The short form of the CDQ-R provides self-ratings of general creativity and self-ratings associated with four domains: math/science, drama, interaction, and the arts. J. C. Kaufman and colleagues (2009) found medium to large positive relationships between general creativity and the four domains of creativity and openness to experience. Similarly, general creativity and the domains of drama, interaction, and the arts were found to have medium to strong relationships with extraversion, but a nonsignificant relationship was found with math/science. J.C. Kaufman and colleagues (2009) also found significant positive relationships between self-rated general creativity and the domains of math/science and interaction and emotional stability, while nonsignificant relationships were found with the domains of drama and the arts. Additionally, small positive relationships were found between the general creativity domain and the domains of drama, interaction, and the arts and the trait of agreeableness, but not between the math/science domain and agreeableness. Finally, no significant relationships were reported between the general creativity as measured by the CDQ-R or any of the domains of creativity and the trait of conscientiousness (J. C. Kaufman et al. 2009)

S. B. Kaufman (2012) also conducted a study examining the relationships between domains of self-rated creativity and the Big Five personality traits. However, in this study, the author used the newly created K-DOCS, which measures self-rated creativity across five creative domains: self/everyday, scholarly, performance, mechanical/science, and artistic. S. B. Kaufman (2012) found that the domains of self/everyday, scholarly, performance, and artistic creativity were positively correlated with openness to experience. But the strength of these relationships differed, with a strong relationship being observed with scholarly creativity, a medium relationship being found with performance creativity, and medium to small relationships being found with self/everyday and artistic creativity. The author also found that the self/everyday, scholarly, and performance domains all had medium to small positive correlations with extraversion but that the domains of mechanical/science and artistic creativity were not correlated with extraversion. Furthermore, the scholarly, performance, and mechanical/science domains were found to be correlated with agreeableness, but the domains of self/everyday and artistic creativity were not. Interestingly, the strength and direction of these correlations differed such that the performance domain was found to have a medium to strong positive relationship with agreeableness, while the scholarship domain had a small positive correlation and the mechanical/science domain had a small negative correlation. S. B. Kaufman (2012) also

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reported that the scholarly and performance domains had small positive relationships with conscientiousness, while the self/everyday domain had a small negative relationship and nonsignificant relationships were reported for the mechanical/science and artistic domains. Finally, S. B. Kaufman (2012) reported that the performance and mechanical/science domains had small positive relationships with emotional stability, while the self/everyday, scholarly, and artistic domains did not have a significant relationship.

Self-Ratings of Creativity Conclusions

Research examining the relationships between personality traits and measures of self-rated creativity has indicated that there are relatively consistent positive relationships between openness to experience and a variety of measures of self-rated creativity, specifically within artistic and scholarly domains. However, this relationship does not appear to exist as consistently when mathematical/scientific domains are examined. That said, the research on domains is fairly new and therefore limited. Future research needs to examine this difference to further refine our understanding of the relationship between the mathematical/scientific domain and openness to experience.

Ratings of Creative Products

Creativity has also been measured using creative products and expert or quasi-expert ratings of these products. The most common approach to providing these ratings was developed by Amabile (1982). The Consensual Assessment Technique (CAT) is a systematic method of obtaining subjective judgments of creativity for a product or response. Thus, the CAT provides a framework in which subjective judgments of creative products can be quantified.

Studies that have examined the relationships between the Big Five personality traits and ratings of creative products have typically used one or more written products to assess creativity. Martindale and Dailey (1996) and Pretz and McCollum (2014) had their participants create a written product that was subsequently rated for creativity. Specifically, Martindale and Dailey (1996) instructed participants to be as imaginative as possible as they wrote a fantasy story, while Pretz and McCollum (2014) instructed their participants to write an essay that described a dream project associated with their major or primary field of study. Interestingly, both studies did not find any significant relationships between any of the Big Five personality factors and ratings of creativity for their creative story-writing task. However, other studies have reported relationships between factors associated with the Big Five personality traits and creativity rated using the CAT.

Several studies have assessed creativity by asking participants to write a story about one or more pictures. Specifically, Wolfradt and Pretz (2001) instructed

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their participants to be imaginative as they wrote a story about a picture. Similarly, Dollinger and colleagues (2004) instructed participants to write a story about a picture from the Urban and Jellen Test of Creative Thinking – Drawing Production (TCT-DP). Pretz and McCollum (2014) asked participants to write a caption for an ambiguous photograph. Finally, Dollinger (2007, 2011), Dollinger and Clancy (1993), and Dollinger and colleagues (2004) used a task that required participants to select 20 photographs, to write a description of each photograph, and then to write an essay about the collection of photographs. Participants' written products were then rated for creativity using a five-point Likert-type scale by a panel of judges using the CAT.

All of the studies found a medium to small positive relationship between openness to experience and ratings of creativity associated with participants' photographic essays. Furthermore, Dollinger (2011) and Wolfradt and Pretz (2001) also found a small to medium negative relationship between conscientiousness and ratings of creativity for the essay associated with the photograph(s) the participants were presented. Dollinger and Clancy (1993) found that extraversion had a small negative correlation with photograph essays rated for creativity, but only when examining data associated with the females in their study. The authors also found that neuroticism had a small relationship with the creativity of the photograph essays, and again, this relationship was only found when examining data associated with females in the study.

In addition to ratings of creativity associated with writing products such as stories and essays, several studies have examined the relationship between the Big Five personality traits and drawings associated with Urban and Jellen's TCT-DP. The TCT-DP task used by Dollinger (2007, 2011) and Dollinger and colleagues (2004) asked participants to complete an incomplete drawing, which was then scored using the CAT. These authors consistently report a medium to small positive relationship between openness to experience and ratings of creativity associated with participants' drawings. Additionally, Dollinger (2011) also found a small negative relationship between conscientiousness and ratings of creativity associated with the TCT-DP.

Ratings of Creative Products Conclusions

Of the Big Five factors, openness to experience was most consistently found to have a significant positive relationship with ratings of creativity for written and figural products. However, there are a limited number of published studies using creative production and the Big Five personality measure. Additional research is necessary before we can reach any solid conclusions regarding the other Big Five constructs (outside of openness). More research is also needed to explore the relationships between the Big Five personality traits and additional creative production tasks in different domains and using different tasks. For example, future research might examine the relationships between the Big Five personality traits and ratings of creativity associated with architectural products, the writing of poetry, or solutions to everyday problems.

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Overall Conclusions

Overall, this summary suggests that the type of creativity measure used can influence the observed relationships with the Big Five personality traits. While openness to experience was found to have a significant relationship with creativity in most studies, regardless of the measure used, this was not the case for the relationships between the other four traits and the various measures of creativity reviewed in this chapter. Specifically, it seems that the domain and type of measure used have an effect on the relationship. For example, extraversion seems to be related to creativity for divergent thinking measures that are verbal and for measures focusing on domains that require social interactions such as drama. Conscientiousness seems to be related to creativity depending on the instructions given for divergent thinking or creative production tasks as well as with achievements, behaviors, and self-ratings associated with science. The relationship with neuroticism seems to show a small relationship when present, typically negative, and also shows some gender differences. Finally, agreeableness tends to also show inconsistent and small relationships but typically for behaviors and self-ratings of more social and interactional aspects of creativity.

Given these results, researchers need to properly consider the influence that a measure of creativity may have on the observed relationships with the Big Five personality traits. Further, since most of the work on creativity and personality has used divergent thinking measures, and usually verbal divergent thinking scored for fluency, future research should evaluate additional measures of creativity. In fact, it would be beneficial to have multiple measures of creativity and multiple domains in the same study.

Some of the studies reviewed also provide intriguing insights into potential moderators of the relationship between personality and creativity in addition to measures and domains. Specifically, a number of studies have examined the effects of prompts and instructions on performance associated with divergent thinking and, to a lesser extent, creative product-generation tasks (Chen et al. 2002, 2005; Niu & Liu 2009; Nusbaum et al. 2014; Runco, Illies, & Reiter-Palmon 2005; Runco & Okuda 1991). Research examining prompts and instructions tends to support the notion that the type and specificity of the instructions provided to participants can influence subsequent task performance when a complementary scoring index is used. However, only a few of the studies that examined the effect of instructions on subsequent creative performance reported the correlations between the measure of creativity and the Big Five personality traits. Future research should examine the strength and pattern of relationships between measures of creativity discussed in this chapter and the Big Five personality traits when differing instructions are used. Other studies have found that gender may be a moderator of these relationships (Beaussart et al. 2012; Dollinger & Clancy 1993; Furnham et al. 2009; Martindale & Dailey 1996). Therefore, future research should purposefully evaluate whether the relationships between the Big Five personality measures and creativity vary by gender.

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16 What Are Funny People Like?

Exploring the Crossroads of Humor Ability and Openness to Experience

Emily C. Nusbaum and Paul J. Silvia

Personality is central to creativity: certain kinds of personality traits, alone or in combination, are important to the many meanings of creativity (Feist 2010; Fürst, Ghisletta, & Lubart 2016). The role of personality in creativity has been studied extensively in the most popular sides of creativity research. Divergent thinking, for example, has been connected to just about any personality trait that an individual-differences researcher would care to study. The role of personality in lifespan creativity has attracted significant attention in Big-C creative achievements as well (e.g., Feist 1998; Feist & Barron 2003; Helson, Roberts, & Agronick 1995).

In this chapter we explore humor, a quirky and understudied side of creativity research. Humor research has a long history in psychology, but to date it has attracted relatively little attention from researchers interested in personality or creativity. We focus on individual differences in the ability to be funny, which clearly varies. Some people are very funny, others are very unfunny – often painfully so – and most are somewhere in the middle. Our question, then, is, what are funny people like, and what can models of personality tell us about the ability to be funny?

We start by describing and defining humor, locating it within the broader world of creativity research, and reviewing how it is assessed. Our review takes a comparative approach: we describe both creativity assessment and humor assessment because researchers interested in measuring humor could learn some lessons from the successes and travails of creativity researchers. We then turn to personality and humor. Using the five-factor model's personality traits as a framework, we review the small literature on personality and the ability to be funny. Our review emphasizes openness to experience, a trait that looms large in creativity research and appears to be at least as important to humor. We review what is known about creativity and openness to experience and then consider whether openness similarly influences humor ability. The chapter concludes with some suggestions for future research in this developing field.

What Is Humor Production?

Like *creativity*, the word *humor* has many meanings in individual-differences research. One branch of research uses it to refer to a *sense of*

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humor – a description of the individual differences in people's sense of the boundary between what's funny and what's distasteful, inappropriate, or nonsensical (Martin 2003; Martin & Sullivan 2013). Another branch of research uses *humor* to refer to the *use of humor* – how people employ humor in their everyday lives, whether it's for coping, ostracizing, managing stress, starting relationships, or other reasons (Abel 2002; Caird & Martin 2014). Some research uses *humor* to refer to people's *perception of humor* – people's responsiveness or sensitivity to noticing humor in the environment (Papousek et al. 2014; Veatch 1998).

And finally, researchers use the term *humor* to describe *humor production* – how well people can produce something funny on the spot. Also called *humor ability*, humor production is the most analogous to research on individual differences in divergent thinking and creative thought. It is typically assessed in the laboratory using performance tasks that give people some kind of prompt and then ask them to generate something funny. The responses are then scored by a number of independent raters. The resulting scores are used to estimate some underlying general ability, be it the ability to generate interesting ideas or to generate off-the-cuff witticisms.

Together these four aspects of humor (sense of, uses of, perception of, and production of) are important for understanding the global psychology of humor – which, for something so salient in everyday life, deserves more attention than research has given it in the past. But one aspect in particular, humor production, has been especially understudied and so is the focus of this chapter.

We see humor production as an instance of the more general category of creative thought. Tasks used to assess creative cognition are typically production tasks: the participants are asked to generate ideas, such as unusual uses for objects (Silvia et al. 2008), metaphors (Primi 2014; Silvia & Beaty 2012), titles for short stories (Christensen, Guilford, & Wilson 1957), brief poems (Baer 1996), ways that different concepts are alike (Wallach & Kogan 1965), or drawings and collages (Amabile 1982; Kim 2006). What these tasks share are the two major aspects of creativity: *novelty* and *aptness*.

Humor clearly reflects both novelty and usefulness. To be funny, something must be unexpected in a broad sense: funny ideas conflict with existing knowledge, create uncertainty, and employ surprise and contradiction (Berlyne 1960). And to be funny, an idea has to work: it needs to make people laugh. Verbal humor, like metaphor, must be apt: it has to be comprehensible and resolved or, in the case of bizarre or nonsensical humor, to evoke and maintain uncertainty (Earleywine 2010).

Like other forms of verbal creativity, humor is abstract and conceptual. Generating jokes involves reconfiguring knowledge and concepts, such as finding unexpected similarities between seemingly different things, finding surprising differences between seemingly similar things, tinkering with different senses of words and concepts, or exaggerating or minimizing a concept's features. Like other forms of creative cognition, humor is thus highly abstract and executive, in that it involves selectively retrieving and manipulating knowledge, usually in

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the face of interference from highly accessible, salient, and overlearned associations (Silvia 2015).

And like creativity, humor is essentially unconventional. The central animating idea behind creative thought is "it could be different." Being creative necessarily involves breaking away from how things are and wondering how they might be. Similarly, humor theorists note that humor is essentially subversive because it works by getting an audience to see new meanings of familiar concepts and to entertain an alternative understanding of what the world is like and how it works (Dagnes 2012; Earleywine 2010).

Creativity Assessment and Humor Assessment

How do people measure humor production? Appreciating humor assessment involves stepping back and looking at creativity assessment, which provides most of the backdrop for humor research. Humor assessment also could learn some lessons from creativity assessment, which has struggled with and solved some problems that humor research will face as it develops.

Measuring Creativity

Over the considerable number of years since Binet and Henri first developed open-ended problems designed to examine imagination in 1896, creativity researchers have tinkered with tools for measuring creativity. The modern era of creativity assessment starts with Guilford's landmark line of research in the 1950s. The divergent thinking tasks developed by Guilford and his group are still used extensively by contemporary creativity researchers (Christensen et al. 1957; Getzels & Jackson 1962; Wallach & Kogan 1965; Wilson et al. 1953). At their core, verbal divergent thinking tasks are like verbal fluency tasks with additional constraints (Silvia, Beaty, & Nusbaum 2013). People are asked to come up with as many ideas as they can in response to open-ended scenarios or for everyday objects. For example, common divergent thinking tasks such as the "Consequences" Test ask people to list what might happen or what it might be like if people shrank to 12 inches tall, if people no longer needed to sleep, or if people could turn invisible at will. Instances tasks similarly ask people to think of many different examples of things that fit some given category (i.e., things that are round). The most common type of divergent thinking task – the Alternative Uses Test – asks people to come up with atypical uses for everyday objects such as a brick, a rope, or a cardboard box. The *creativity constraint* is subtle but critical. By asking people to use their imaginations and to come up with offbeat and interesting ideas, these tasks go beyond simple verbal fluency tasks (e.g., list things that start with the letter *F*) and allow researchers to observe the mechanics of creative thought (Nusbaum, Silvia, & Beaty 2014; Silvia et al.2013).

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Guilford and colleagues developed 24 different types of divergent thinking task – one for each component of intellect. The assessments asked people to complete a variety of tasks, including manipulating physical and mental objects, drawing many variations of a picture, thinking of consequences, listing unusual uses for common objects, and coming up with a third word to link two given words. The most commonly used of Guilford's tasks include the Alternative Uses Test, the Consequences Test, and the Plot Titles Test, in which participants come up with a creative title for a short story. From these many tasks, Guilford and colleagues (Wilson, Guilford, & Christensen 1953) distilled the task responses into a workable definition of a creative idea. According to this seminal research, a creative idea has three characteristics: it is uncommon, it is remote or unconventional, and it is clever. Indeed, many researchers still rely on this definition of creativity in their studies today (Silvia et al. 2008).

The Torrance Tests of Creative Thinking (TTCT) drew inspiration from Guilford's Structure of Intellect (SOI) battery of divergent thinking tasks (Torrance 1974, 2008; Torrance & Haensly 2003). Torrance's tasks, however, are significantly more simplified – they are designed to be an assessment for all ages, and they include instructions for administration, scoring, and score reporting, which has made them popular in education research. In all, participants taking the TTCT complete up to 10 divergent thinking tasks – seven verbal tasks (e.g., ideas to improve a product, unusual-uses tasks, listing questions about a product) and three figural tasks that involve either adding to an incomplete drawing or constructing a new drawing. Researchers using the TTCT score the tasks along dimensions of fluency, originality, and flexibility.

Scouring the creativity literature would reveal a great amalgam of different divergent thinking tasks that have been created over the years. But most divergent thinking tasks are variations on the tasks developed by Guilford and Torrance (see J.C. Kaufman, Plucker, & Baer [2008] for a review), such as the verbal and visual divergent thinking tasks used by Wallach and Kogan (1965). Other research diverges from the typical creativity tasks discussed earlier in an attempt to avoid the possible confounding influence of verbal ability in creativity assessment. These studies usually involve some sort of creative performance, such as creating photograph essays (Dollinger & Clancy 1993; Ziller 1990), drawing a picture that incorporates specified abstract lines and shapes (Dollinger 2011; Urban 1991), or assembling a collage (Akinola & Mendes 2008; Amabile 1982). But studies generally find weak or nonsignificant correlations between divergent thinking tasks and these measures of creative performance (Baer 1991; Han 2003; Runco 1986).

Distilling the responses to open-ended creativity tasks into tidy numerical scores is probably the most vexing aspect of creativity assessment. Scoring systems have diverged in recent years into two camps. The more traditional of the two scoring methods involves objective metrics such as *fluency* (number of ideas), *originality* (statistical infrequency of ideas), and *flexibility* (number of different categories of ideas). These methods – popularized by the TTCT and by Wallach and Kogan (1965) – have been widely used for decades despite decades

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of criticism (Clark & Mirels 1970; Hocevar 1979; Plucker, Qian, & Wang 2011). The second scoring method involves subjective scores for creativity given by independent raters on a spectrum of creativeness (e.g., *not at all creative* to *very creative*). Although used by Guilford in the 1950s, subjective scoring gained traction with Amabile's (1982, 1996) Consensual Assessment Technique and has recently become popular in certain circles (Benedek et al. 2013; Silvia et al. 2008).

In an examination of the reliability and validity of different methods for scoring divergent thinking tests, Plucker and colleagues (2011) explored whether traditional scoring methods are more informative than other methods of scoring. The authors pointed out that although many methods of scoring divergent thinking tasks have been devised, many run into the common issue of conflating fluency scores with originality scores or flexibility scores, and most provide evidence for only discriminant validity at the expense of convergent validity (or vice versa). Because fluency is strongly correlated with statistical infrequency (r = 0.88; Torrance, 2008; cf. Silvia et al. 2008), the more responses a person gives, the more likely at least one of those responses will be statistically unique. And uniqueness as a proxy for creativity is problematic in and of itself. As Silvia et al. (2008) point out, responses that are statistically infrequent are often either inappropriate or random; therefore, responses that are nonsensical or irrelevant solutions for the divergent thinking task are deemed creative because they are encountered only once in the response pool. Paradoxically, the problem of misidentifying responses as creative is heavily dependent on the *size* of the response pool. In a small sample, responses that aren't particularly creative (i.e., build a brick fireplace) may be given by only one person, which results in that uncreative response getting a creative score. In large samples, the likelihood of any response occurring more than once is increased due to the law of large numbers – extreme responses in a small data set become less extreme as the size of the data set increases – and creative responses are no exception. Thus Plucker and colleagues (2011) designed a study in which several different methods of scoring divergent thinking tasks could be compared in terms of the measure's validity and reliability.

A sample of adolescent students in grades 8 to 10 completed two classic divergent thinking tasks designed by Wallach and Kogan (1965) – name things that have wheels and name things that make noise – and their responses were scored in several ways. Participants were given five minutes to complete each divergent thinking task, and their responses were scored in the following ways: (1) traditional fluency scoring, (2) traditional originality scoring (here a point is awarded to any response that is given by less than 20 percent of the sample), (3) a percentage formula obtained by dividing a person's originality score by the fluency score, (4) scoring originality of a person's first 10 ideas, (5) scoring originality of a person's last 10 ideas, (6) raters' scores of response originality given for the entire data set, (7) raters' scores of response originality given for each participant's first 10 ideas, and (8) raters' scores of response originality

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given for each participant's last 10 ideas. To evaluate the validity of the different scoring methods, participants also completed the Creative Personality Scale (Gough 1979) and Hocevar's (1981) Creative Behavior Inventory and, finally, wrote a short creative story about what it would be like to live on the moon. Plucker and colleagues (2011) then computed a series of intraclass correlations to assess the reliability of the scoring methods and a series of bivariate correlations to assess the validity of the eight different scoring methods.

Overall, Plucker and colleagues (2011) concluded that when independent raters scored the entire data set for originality using subjective scoring methods, divergent thinking tasks were more reliable than objective scoring methods such as statistical originality or simple fluency. However, the authors only partially replicated earlier work by Silvia and colleagues (2008) in which subjective scoring appeared to be a significantly better measure of creativity in terms of concurrent validity with other measures of creativity. Although Plucker and colleagues (2011) also found that the three subjective scoring methods were more concurrently valid measures of creativity, they were only slightly better than the more traditional objective measures of originality and fluency. The authors speculated that subjectively scoring divergent thinking tasks may only appear more valid when compared with certain criteria. Personality, for example – which has been used by other researchers to assess convergent validity of divergent thinking scores (see Silvia et al. 2008; Nusbaum et al. 2014) – strongly correlates with creativity when divergent thinking tasks are scored subjectively by independent raters. Most notably, Plucker and colleagues (2011) pointed out that when using rank-order correlations, the same participant fell in different places among the sample in terms of creativity depending on what type of method was used to score the divergent thinking responses and suggested that creativity researchers ought to make an effort to standardize how we measure creativity.

Benedek and colleagues (2013) recently suggested a fertile method in an extension of the idea of top-two scoring. Because originality scores are confounded with fluency scores, these authors explored whether an optimal combination of task time and top responses to score might exist. Participants in this study completed six five-minute divergent thinking tasks and ranked their responses for each task in order of creativity (most creative to least creative). The responses were automatically time stamped when participants first started typing. Four independent raters then rated each response, and different combinations of raters' scores were correlated with task fluency. In this study, the less raters' scores correlated with fluency, the better because this eliminates the confounding influence of fluency. Benedek and colleagues (2013) found that two to three minutes per divergent thinking task and scores for the top three ideas yielded near-zero correlations with fluency. Thus the researchers suggested that divergent thinking tasks last three minutes and that raters' scores for the top three ideas (indicated by participants) provide the most accurate estimate of people's best creative ideas.

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Measuring Humor

Compared to creativity tests, tests of humor production have a shorter history. Fundamentally, humor production tasks resemble divergent thinking tasks: people are given some sort of prompt and are asked to generate one or more responses to it. The key constraint, of course, is humor: people are told to generate responses that are funny. The variability surrounding humor assessment involves aspects of what sort of task participants do (i.e., cartoon caption, joke completion, or funny definitions, to name a few) and how those task responses are distilled into quantitative scores.

Researchers have, in the past, used humor production tasks that ask people to come up with something funny on the spot by writing a cartoon caption, drawing a funny picture, writing a funny résumé, finishing an incomplete joke, or coming up with a funny definition. In the earliest work, Smith and Goodchilds (1963) evaluated the function of "deliberate wits" in group problem-solving activities and recorded instances of joking among group members. Koppel and Sechrest (1970) appear to have originated the most popular of humor assessment tasks, in which participants are shown a captionless cartoon and instructed to write a funny caption for the cartoon. Because this is a landmark study in the assessment of humor production ability, we should examine it in some detail.

In this experiment, 62 men from fraternities at metropolitan universities were shown a series of 10 cartoons and given one to two minutes to write down the funniest caption they could think of for each one. The cartoons used in this experiment were single-panel cartoons that came from *The New Yorker* and *Medical Economics* magazines. The selected cartoons were strategically chosen because they depicted a structured scene – that is, they displayed "a relatively complex and suggestive content, such as two people clinging to a plank after a shipwreck rather than two people sitting in chairs" (Koppel & Sechrest 1970, p. 80). The authors reasoned that these more structured cartoons would make the task a bit less abstract, provide the participants with a bit of direction, and ultimately make it easier for participants to complete the task. Twenty psychology graduate students then rated the captions generated by participants on a 1 to 5 scale of funniness, and the mean of those ratings was the level of each participant's funniness. The task seemed to work well – correlations among self- and peer-rated humor production and self- and graduate student–rated humor production were sizable (r = 0.62 and 0.43, respectively).

Curiously, a second study published around the same time as Koppel and Sechrest (1970) also employed a cartoon captioning task (Treadwell 1970). In this study, participants were instructed to write a "humorous and appropriate" caption for each of 11 cartoons that had been drawn specifically for the experiment by a graphic designer colleague of the author. The captions were then rated on a 1 to 5 funniness scale by two raters. The ratings were then standardized and summed for a final humor score for each participant. In this experiment, humor scores were positively correlated with the ability to solve remote

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association puzzles (an indicator of creativity) (Mednick 1968) (r = 0.24) and with the ability to reorganize or redefine concepts (r = 0.28). The cartoon caption task has endured through 45 years of humor research, with only small changes in cartoon stimuli, number of cartoon captions requested for each cartoon, number of cartoon captioning tasks, time allowed on task, and the scoring procedure for the task.

A few years after these studies, for example, Babad (1974) gave participants 15 minutes to write one funny caption for 15 different captionless cartoons. The cartoon tasks were initially scored three ways: the number of captions people came up with, the number of those captions that were retrieved from memory, and the number of those captions that were original productions (i.e., created during the task). In a second round of scoring, 13 psychology graduate students categorized each caption as either funny or unfunny; if a caption was designated as funny by at least 7 of the 13 judges, it counted toward 3 new scores: the total number of funny captions, the number of funny captions retrieved from memory, and the number of original funny captions. Although Babad (1974) did not report where the cartoons came from and used a measure of fluency for the humor scores, this study closely resembled the gist of the earlier two studies (Koppel & Sechrest 1970; Treadwell 1970). A second study around this same time likewise closely resembled these earlier studies: Brodzinsky and Rubien (1976) had students write funny captions for six different single-panel cartoons. Five judges rated the captions on a 1 to 5 funniness scale, and the ratings were averaged across caption tasks and raters to create a mean humor score. In the decade following these studies, the small world of humor researchers continued to rely on these caption tasks to assess humor ability, with varying numbers of tasks, sources of cartoons, and number of raters using a typical 1 to 5 funniness scale (Masten 1986; Turner 1980).

After a period of silence in the humor production literature, Feingold and Mazella (1993) returned to the cartoon captions task while developing a multidimensional model of wittiness. In one sample, the researchers pulled 8 cartoons from *The New Yorker* magazine, removed the captions, and gave participants unlimited time to write a funny caption for each cartoon. The humor score in this study was computed from two judges' ratings: every caption was scored on a 1 to 5 funniness scale, the scores for each participant's 8 captions were summed, and finally the sums calculated by the 2 raters were averaged for an overall humor production score.

Köhler and Ruch (1993, 1996) used a similar task in their research on humor production. Participants were given 15 captionless cartoons and were asked to write a funny caption for each – however, participants had unlimited time for this task and weren't restricted to writing one caption for each cartoon. Twelve raters used a 9-point scale to rate the wittiness and originality of each caption, and the overall humor score was a mean of the ratings across the task for the 12 raters.

In more recent work, Kozbelt and Nishioka (2010) slightly altered the cartoon caption task. Instead of writing captions for a cartoon, participants were asked to write a funny caption for each of 20 different publicly accessible photographs

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and had about one minute to write a caption for each photograph. Twelve raters rated the captions on a 1 to 8 scale for funniness, and the scores were collapsed across tasks and raters to compute a total humor score for each participant.

The cartoon captioning task has clearly experienced a long tenure as the go-to humor production assessment, but in recent years, a few different tasks have emerged. One of those tasks involves writing a funny résumé for a pictured subject – essentially, a longer and more in-depth version of writing a cartoon caption – where participants describe the hobbies, interests, occupations, life philosophies, and typical days of each target, with the ultimate goal of coming up with something humorous. This résumé task has been used in a couple of different studies in recent years. Howrigan and MacDonald (2008) explored the utility of the task in a sample of 185 undergraduates. Participants were asked to complete six of these résumés, which were scored on a 1 to 7 humor scale by 28 undergraduate raters. The total humor score was collapsed across ratings and tasks for each participant.

A second task assessing humor production that has recently emerged in the field is a joke completion task. Nusbaum, Silvia, and Beaty (in press) adapted this task from earlier work in which creativity was assessed with metaphor production (Beaty & Silvia 2013). In this task, participants are given a scenario and the beginning of a joke and are asked to complete the joke in a humorous way. Here's an example of what this task looks like:

> Imagine that your friend invites you over and cooks dinner – and the food is totally horrible and disgusting. Later, when describing it to someone else, you say, "Wow, that food was so bad . . ."
>
> Please complete the phrase "Wow, that food was so bad . . ." with something funny.

The responses are then rated on a 5-point funniness scale by two to four independent raters. Funny responses that participants have given to this task include such things as "Wow, that food was so bad that it should have an evil henchman" or "Wow, that food was so bad that my taste buds fell out of my mouth and started whimpering." However, responses that are consistently rated as not funny include such things as "Wow, that food was so bad that the dog wouldn't eat it" or "Wow, that food was so bad that I threw up." Other joke stems that we have used in this work follow the same format but ask people to describe the most boring class they've ever taken or an honest opinion on friend's terrible singing.

A third novel task that we developed to assess humor production ability is a funny definitions task (Nusbaum et al. in press). In this task, participants are shown a nonsense noun–noun combination (Wisniewski 1997) and must come up with a funny definition for that novel compound word:

> A classic form of humor is coming up with funny definitions for things. So, for this next task, you will be given an unusual noun and asked to come up with a funny definition for it, something that most people would find funny or silly. It's fine to be weird, silly, dirty, ironic, bizarre, or whatever, so long as it's funny. For example, you might define "professor" as "someone who talks in someone else's sleep."

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Researchers could conceivably choose any nonsense noun–noun combination, but we have found success in our work with *cereal bus*, *snuggle war*, *yoga bank*, and *fruit jar*. A *cereal bus*, for example, was defined by one participant as "a bus made of cereal," while another participant defined it as "the ghetto version of an ice-cream truck." Participants are given unlimited time to come up with one humorous definition for each compound word. The responses are then rated on a 5-point funniness scale by two to four independent raters.

We have found that these humor tasks all correlate well with each other (Nusbaum et al. in press), but they do have their idiosyncrasies. For example, consider the cartoon caption task. Although many studies assessing humor production use classic cartoon captions tasks with the same gist of assessment (in which participants must write a funny caption for a captionless single-panel cartoon), there is little standardization across researchers or studies with this task. Some studies ask participants to write multiple captions for one cartoon, while others limit participants to writing one caption for each of many cartoons. Some procedures limit the amount of time participants can work on coming up with a caption, while others allow participants as much time as they want to produce a caption. Some caption tasks ask participants to come up with their own funny caption, while others force participants to complete fill-in-the-blank partially composed captions. Finally, researchers draw cartoons for their caption tasks from many different (and not always named) sources and presumably cover many different cartoon styles and topics.

But besides the type of task used to generate funny responses, there are also inconsistencies in the scoring of these humor production tasks – the number of raters scoring participants' responses and how those responses are scored vary from study to study. Researchers don't have an empirically informed consensus of how many raters are enough for good interrater reliability and how many are too few. A wide range of raters has been employed in studies – from just 2 raters in Feingold and Mazzella (1991, 1993) and Masten (1986) to 6 raters in Greengross and Miller (2011) to 12 raters in Köhler and Ruch (1996) and Kozbelt and Nishioka (2010). In addition, it is unclear whether researchers should gender balance the raters to avoid gender biases in the ratings because, as Martin and colleagues (2003) point out, there appear to be gender differences in sense of humor. This latter issue is likely of greater importance to researchers because Silvia and colleagues (2008) have already made the general point that increasing the number of raters for divergent thinking tasks yields diminishing returns beyond about three or four raters.

Humor research would also benefit from having a common rating system. Although some studies rate humor responses on some sort of Likert scale assessing funniness (e.g., 1 [*not at all funny*] to 7 [*very funny*]), few studies have described the guidelines that raters may have used to rate the humor responses. Other studies assess humor with fluency, which is simply how many responses people generate. And perhaps as a result, reliability in these tasks has been limited. A typical Cronbach's alpha for a cartoon captions task, for example, is around .60 to .75 (Feingold & Mazzella 1991, 1993; Greengross et al. 2012; Kozbelt & Nishioka 2010).

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What's Next for Humor Assessment?

By reviewing both creativity assessment and humor assessment, we hoped to highlight some key issues that humor assessment faces and some key lessons it might learn from its older sibling. First, it is obvious that humor assessment is not nearly as developed as creativity assessment is. Tasks for measuring humor production have not received the same level of psychometric scrutiny, such as comparisons of different tasks, scoring methods, rating systems, and so on. Psychometric research is usually more rancorous than glamorous, but it is pivotal for moving a field forward by improving the quality of its tools.

A few psychometric issues are worth examining. For one, little is known about efficient combinations of tasks and raters, such as the point at which adding tasks and raters leads to diminishing returns in reliability. Such designs can be estimated using generalizability theory (Cardinet, Johnson, & Pini 2010) and Rasch and item response theory models. In addition, research has not generally tried to account for variance due to raters, which could be done using structural equation modeling or with many-facet Rasch models (Primi 2014). Variance due to raters is probably higher for humor tasks than for divergent thinking, so separating rater-specific variance from true trait variance would improve the quality of the assessment method (Kozbelt & Nishioka 2010).

Second, like creativity research, humor research has probably funneled in on an overly narrow set of tasks. Most studies that measure creative cognition use divergent thinking tasks. These tasks are useful, but recent work has sought to diversify into other task types, such as asking people to generate creative metaphors (e.g., Beaty & Silvia 2013; Primi 2014; Silvia & Beaty 2012). Likewise, cartoon caption tasks dominate humor research: the large majority of studies use caption tasks, which create the risk that task-specific features could bias or conceal interesting findings. Caption tasks, for example, are both visual and verbal and – in our informal experience – strike participants as challenging.

Third, humor research, out of necessity, has embraced subjective scoring methods more readily than creativity research has. The ostensibly objective methods popularized by Wallach and Kogan (1965) and Torrance (2008) remain popular despite serious criticism (e.g., Silvia et al. 2008). For humor tasks, the essentially subjective nature of funniness has resulted in an emphasis on using subjective ratings instead of seemingly objective methods. At the same time, a few humor studies have dipped their toes into the dark waters of fluency scoring, such as merely counting how many captions someone generates. Fluency is an interesting outcome, but mere quantity is a poor measure of quality (Nusbaum et al. 2014).

Personality and Creativity: The Big O

What are creative people like? Many times, when you ask people to describe a creative person, they use adjectives such as *quirky*, *imaginative*, and

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off-beat. Just as there are many ways we think of and define creativity, there are many ways in which researchers conceptualize and define personality traits. Although most of the models of personality echo each other in terms of basic traits and characteristics, researchers have developed a handful of models that differ in terms of how the traits relate to one another and what observable behaviors define the traits. The differences are often nuanced but nonetheless account for important distinctions.

In this section we'll review how four different models of openness define what it means to be open and how that concept of *openness to experience* relates to creativity. We focus on openness to experience because of its deep significance to creativity and – based on a handful of studies – to humor as well.

Five-Factor Model

The classic five-factor model (FFM) of personality traits (McCrae & Costa 2008) had an early start in the empirical study of personality. Researchers approached the issue of outlining a common set of traits with lexical analysis of trait-descriptive adjectives – all nearly 18,000 of them (Allport & Odbert 1936). Over the years, several attempts were made to identify a common core of personality traits; the resulting models ranged in size from just two factors (Eysenck 1947) all the way to 16 factors (Cattell 1948).

As researchers began to reexamine the taxonomy of traits, many of their pursuits lead to a model that included five trait dimensions of personality (Digman 1990; Fiske 1949; Goldberg 1981). During the 1970s and 1980s, researchers began to reach a consensus that personality was likely best described along the five dimensions. Four of those dimensions were relatively stable and agreed on – neuroticism, extraversion, agreeableness, and conscientiousness – but the fifth factor was more controversial. It has at times been labeled *culture*, *intelligence*, and *creativity* (Digman 1990), and it describes someone who is intellectual yet dreamy and imaginative – two seemingly disparate traits. As a result, different personality assessments sometimes assign different labels to this trait.

The NEO Personality Inventory (NEO-PI) (Costa & McCrae 1985), probably the most widely used measure of personality, calls the fifth factor *openness to experience* and defines it via six facets:

- *Fantasy* – engages in fantasy and daydreams, imaginative;
- *Aesthetics* – engages with aesthetics, sensitive to subtle details;
- *Feelings* – emotive, identifies emotions well, perceptive of interpersonal cues;
- *Actions* – impulsive, engages in varied activities and experiences;
- *Ideas* – intellectual, curious, diverse interests; and
- *Values* – open to evaluating and adjusting personal values, scrutinizes authority.

The introduction of Costa and McCrae's (1985) NEO-PI ignited a major movement in the field of personality research and, in particular, in the study

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of factor structure. The current version – the NEO-PI 3 (McCrae, Costa, & Martin 2005) – looks fairly similar to the original scale, but other widely used versions evaluate openness only at the domain level (NEO-FFI 3) (McCrae & Costa 2007).

The NEO model and its scales are probably the most prominent perspective in research on personality and creativity. Naturally, creativity researchers are most interested in the openness domain, and most of this research finds that openness is strongly associated with creativity (Puryear, Kettler, & Rinn, in press). A meta-analysis of personality and creativity found consistently large effects of openness when comparing personalities of scientists and artists (Feist 1998). Other research has found effects of openness on divergent thinking in the .40 to .60 range (King, Walker, & Broyles 1996; Pretz & McCollum 2014; Silvia 2008; Silvia et al. 2008, 2009). The few studies that show smaller effects of openness or show other personality domains overshadowing the effect of openness (e.g., Furnham & Bachtiar 2008; Furnham et al. 2009; Walker & Jackson 2014) are often measuring creativity with metrics such as fluency of ideas or originality of ideas, which are poor assessments of creative thinking (Silvia et al. 2008). Measures of openness to experience also predict people's ability to discern whether they themselves are creative (Pretz & McCollum 2014) and whether an idea is creative (Silvia 2008).

In a study examining the relationship between personality and chosen college major, Silvia and Nusbaum (2012) found that being high in openness singularly and overwhelmingly predicted whether people chose a creative major such as fine arts, music, or dance. When majors were classified as Holland (1997) RIASEC (realistic, investigative, artistic, social, enterprising, and conventional) types, openness to experience was associated with investigative and artistic majors (J.C. Kaufman, Pumaccahua, & Holt 2013). In another study, Silvia (2007) found that openness was by far the strongest predictor of knowledge about the arts. Evidently, people high in openness are drawn to college majors that encourage autonomy and imagination while solving complex, open-ended quandaries. Wolfradt and Pretz (2001) found that, in fact, openness was the only significant personality domain that predicted engaging in creative hobbies; the higher the openness score, the more creative the hobbies were. Ecological momentary assessment research shows that openness to experience strongly predicts how much time people spend on creative hobbies in a typical day or week (Conner, DeYoung, & Silvia, in press; Conner & Silvia 2015; Silvia et al. 2014). Likewise, Hughes, Furnham, and Batey (2013) found that openness was the strongest predictor of self-rated creativity. Thus it's not surprising that studies have also identified openness as the strongest predictor of having creative achievements (King et al. 1996; Pretz & McCollum 2014) and of viewing oneself as a creative person (Karwowski & Lebuda 2016).

In addition to creative ideation and everyday creative behaviors, openness also predicts creative achievements. In a meta-analysis of personality and creativity in scientific and artistic domains, Feist (1998) found medium to large differences in openness when comparing scientists with nonscientists, creative

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scientists with noncreative scientists, and artists with nonartists. Scientists were less open than nonscientists ($d = 0.30$), noncreative scientists were less open than creative scientists ($d = 0.40$), and nonartists were less open than artists ($d = 0.44$). And although openness per se wasn't measured (the NEO inventory did not exist yet when this longitudinal study began in 1950), Feist and Barron (2003) found that personality characteristics reminiscent of openness (e.g., tolerance and intellect) measured at age 27 predicted lifetime creative achievement (publications, awards, citations) measured at age 72.

HEXACO Model

Like the NEO model, the HEXACO model began life as a lexical taxonomy of personality adjectives. Noting several occurrences of a sixth factor emerging in French (Boies et al. 2001), German (Angleitner & Ostendorf 1989), Korean (Hahn, Lee, & Ashton 1999), and Dutch (De Raad 1992) studies, Ashton and colleagues (2004a) acquired several other data sets of personality adjectives to explore and compare the factor structures within each. They obtained eight different data sets representing seven different languages and explored the factor structure of each data set using principal-components analyses. The smallest data set appeared in the Roman sample (285 adjectives) and the largest appeared in the Dutch sample (551 adjectives).

In all eight data sets, analyses suggested that six principal components existed. Although the serial order in which the factors emerged varied, similar components were identified in each analysis. The first common component was characterized in the various languages by such words as *exuberant*, *social*, and *talkative*; Ashton and colleagues (2004a) labeled this component *extraversion* due to its noted similarity with the FFM's extraversion. The second common component was characterized by such words as *good-natured*, *gentle*, and *calm* and was cautiously labeled *agreeableness*; most adjectives in this factor represented the literal definition of agreeable (i.e., *pleasant*, *cheerful*, and *tolerant*), but some adjectives loading here described characteristics that conventional FFMs would call *neuroticism* (i.e., *irritability* and *emotionality*). The third common component included typical descriptions of FFM conscientiousness (i.e., *careful*, *orderly*, *diligent*, and *precise*), so the authors also labeled it *conscientiousness*. The fourth component was comprised of words that are typical of emotional instability/neuroticism (i.e., *oversensitive*, *anxious*, *emotional*, and *insecure*) but are atypically contrasted with words describing fearlessness (i.e., *courageous*, *tough*, and *self-assured*); thus this component was cautiously labeled *emotionality*. Words such as *sincere*, *genuine*, *honest*, *arrogant* (low), *greedy* (low), and *cunning* (low) described component five; due to its blended nature, it was labeled *honesty–humility*. The final common factor that emerged in all the data sets included such words as *intelligent*, *artistic*, *bright*, *creative*, *progressive*, and *cultured* and was labeled *intellect/imagination*.

The authors then developed a personality inventory from the existing International Personality Item Pool (IPIP) items to measure the new six-factor

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model, which they called the *HEXACO model*. What resulted was the HEXACO Personality Inventory (HEXACO-PI) (Lee & Ashton 2004), which, along with its related metrics – a revised scale (HEXACO-PI-R) (Ashton & Lee 2008), a 60-item HEXACO-60 (Ashton & Lee 2009), and a 24-item Brief HEXACO Inventory (BHI) (de Vries 2013) – has repeatedly demonstrated convergent validity with other personality metrics (Aghababaei 2012; Ashton & Lee 2009; Dunlop et al. 2012; Gaughan, Miller, & Lynam 2012; Lee & Ashton 2013, 2014; Thalmayer, Saucier, & Eigenhuis 2011; Wasti et al. 2008).

The HEXACO model adapts a two-level taxonomy of traits that measures 24 facets across six higher-order domains. The *openness to experience* domain defines openness via four facets: *aesthetic appreciation* (being interested in and valuing the arts), *inquisitiveness* (being curious and having broad interests), *creativity* (seeing oneself as a creative person and enjoying opportunities to be creative), and *unconventionality* (being quirky, offbeat, and eccentric). The main difference between five- and six-factor openness lies in the emotional and political facets in the NEO: the emphasis on sensitivity to feelings and liberal political values are omitted from the HEXACO. Moreover, creativity appears much more explicitly in the HEXACO: it is assumed to be central to openness to experience.

The HEXACO model is gaining popularity among creativity researchers. Although the six-factor model has yet to be used in studies of creative eminence, researchers have found that HEXACO openness has the largest effects on creativity measured by divergent thinking using the Torrance Tests, as well as subjectively scored alternative-uses tasks. Lin and colleagues (2011) asked people to complete three divergent thinking tasks (list as many questions as possible and two figural completion tasks) and scored them in the TTCT tradition of fluency, flexibility, originality, and elaboration. Although the correlations between the four divergent thinking scores were all significant, in the expected direction, similar to past results, and strongest for openness, they were smaller ($.19 < r < .24$) than would be expected with subjective scoring. In our research on divergent thinking and metaphor production, openness to experience consistently has the largest effect of the Big Five factors, and the effect is at least medium in size and usually large (e.g., Silvia & Beaty 2012; Silvia et al. 2008, 2009). Studies also find that openness is the strongest predictor of people's creative achievements on the Creative Achievement Questionnaire (CAQ) (J.C. Kaufman et al. 2009), number of different creative activities done in the past year (BICB), having creative hobbies (Creative Behavior Inventory [CBI]), and having self-concepts in diverse domains of creativity, measured by the Revised Creativity Domain Questionnaire (CDQ-R) (J.C. Kaufman et al. 2009).

Openness/Intellect Model

Of all the models of personality, the FFM – and its Revised NEO Personality Inventory (NEO-PI-R) assessment (Costa & McCrae 1992) – is probably the most widely recognized personality model in circulation today. One particularly

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interesting evaluation of the NEO-PI-R factors analyzed the influence of genetics along the dimensions of the NEO factors in a twin study (Jang et al. 2002). The researchers found that for each of the five domains, the six facets belonging to that domain loaded onto two genetic factors. In the openness domain, the *fantasy*, *aesthetics*, and *feelings* facets loaded primarily on one genetic factor, while the *ideas*, *values*, and *actions* facets loaded primarily on a different genetic factor. This finding seemed to indicate that another level of factor hierarchy could exist between the domains and their facets.

DeYoung, Quilty, and Peterson (2007) sought to expand this work by examining whether a second two-factor level could be modeled using the NEO-PI-R as well as Goldberg's (1999) Abridged Big Five Circumplex scales from the IPIP (AB5C-IPIP) assessment. A factor analysis of the facet scales of these tests identified two separate yet correlated factors encompassing the facet subscale of each domain. With further testing, DeYoung and colleagues (2007) were able to develop an assessment of personality from the pool of existing IPIP items known as the *Big Five Aspect Scales* (BFAS).

Of particular interest to creativity researchers are the openness and intellect subfactors of the global openness-to-experience domain. The BFAS includes 10 items for each of the separate subscales – thus the global openness domain contains 20 items: 10 for the openness subfactor and 10 for the intellect subfactor. The intellect scale includes items such as "think quickly," "can handle a lot of information," "have a rich vocabulary," and "like to solve complex problems"; it evaluates intellectual aspects of personality such as learning things quickly, expressing ideas clearly, and possessing an affinity for the abstract. The openness scale contains items such as "get deeply immersed in music," "enjoy the beauty of nature," and "need a creative outlet"; it evaluates the artsy, eccentric aspects of personality such as frequently getting lost in thought, daydreaming, placing high value on the arts, and appreciating the beauty in things that other people might not notice.

Because the two aspects are moderately positively correlated, someone who is high in one aspect is likely to also be high in the other aspect, making it difficult to isolate which aspect is driving the person's creativity. But early evidence suggests that DeYoung's openness/intellect model would easily predict performance on different types of creativity measures. In a test of the openness/intellect model of global openness, Nusbaum and Silvia (2011) found that openness significantly predicted latent creativity assessed with self-report measures of typically little-c creativity – namely, CAQ, the BICB (Batey 2007), and the CBI (Dollinger 2007) – but that intellect did not. Conversely, they found that intellect significantly predicted latent fluid intelligence but that openness did not. Recently, S.B. Kaufman and colleagues (2016) found that openness predicted creative achievements in the arts, whereas intellect predicted creative achievements in the sciences. Silvia and Nusbaum (2012) found that the BFAS openness scale was the strongest predictor of having a creative college major (for every one unit increase in openness, the odds of having a creative college major were 13.66 times higher). In contrast, for every one-unit increase in intellect, the

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odds of having a conventional college major were 1.82 times higher than the odds of having a *creative* major. The openness/intellect model may be new, but given the findings reviewed earlier, openness should be a better predictor of creative self-concept and everyday creative behaviors than intellect.

Four O-Factors Model

Recent work exploring cognitive bases of DeYoung's openness and intellect constructs has found evidence suggesting that although openness and intellect are strongly correlated, they differ in relation to creativity in a few intriguing ways. A new addition to the openness-to-experience literature seeks to account for this divergence. Given recent findings that establish that some aspects of creativity (i.e., intelligence and working memory) are associated with only intellect and that other aspects of creativity (i.e., latent inhibition and implicit learning) are associated with only openness, S.B. Kaufman (2013) speculated that DeYoung, Peterson, and Higgins's (2005) openness/intellect model could be expanded into a dual-process framework (DeYoung 2011; S.B. Kaufman 2009; S.B. Kaufman et al. 2010). Within this framework, S.B. Kaufman surmised that openness would be more closely associated with type 1 (automatic) cognitive processes, while intellect would be more closely associated with type 2 (directed) cognitive processes.

Factor analyses revealed a four-factor structure existing within a battery of 10 tasks assessing cognitive ability, personality, and creative achievement. The four factors were labeled "affective engagement," "aesthetic engagement," "intellectual engagement," and "explicit cognitive ability." All four factors correlated significantly with NEO openness (openness/intellect in DeYoung 2005). Of the four scales of impulsivity, lack of premeditation, urgency, and sensation seeking were significantly correlated with both affective and aesthetic engagement, while lack of perseverance correlated positively with aesthetic engagement and negatively with intellectual engagement.

Although the model is young, studies assessing the relationships among the four factors and creative achievement look promising for other metrics of creativity (i.e., divergent thinking, everyday creative behaviors, and creative self-concepts). In S.B. Kaufman's (2013) research, the four factors were associated with different domains of creative achievement. Intellectual engagement correlated with achievements in inventions and scientific discovery; explicit cognitive ability was positively associated with scientific discovery and culinary arts; affective engagement was positively associated with achievements in music, dance, humor, and theater and negatively related to scientific achievements; and aesthetic engagement was positively associated with achievements in the arts, music, dance, and theater. In a regression model, with the four factors predicting creative achievement in the arts and sciences, intellectual engagement and explicit cognitive ability significantly predicted science achievements (but not the arts), while aesthetic engagement significantly predicted arts achievements (but not science), and affective engagement significantly predicted arts achievements (positive) *and* science achievements (negative).

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Summary

Openness to experience is a quirky trait: it has probably attracted more models than the other major traits, including a couple not reviewed here (e.g., Connelly et al. 2014; Woo et al. 2014). Nevertheless, the role of openness to experience in creativity is clear. Regardless of how its structure is conceived, openness to experience is the *creativity trait*. The other major traits are important to creativity, to be sure, but openness to experience appears to be the only one that is important in a domain-general and task-general way – if an outcome reflects creativity, openness to experience will predict it.

What about Personality and Humor?

Personality traits – most notably openness to experience – have been shown to be important to creativity, but what about humor? The literature on humor production – the ability to produce something that other people find funny – is decidedly smaller. Studies examining humor production have explored its basic relationships with such things as gender (Greengross, Martin, & Miller 2012; Mickes et al. 2012; Robinson & Smith-Lovin 2001), intelligence (Greengross & Miller 2011; Howrigan & MacDonald 2008; Weisfield et al. 2011), other cognitive abilities (Kozbelt & Nishioka 2010), and even terror management (Long & Greenwood 2013) and pain tolerance (Zweyer, Velker, & Ruch 2004). But this literature has not examined personality as much as one would expect.

Five-factor (or six-factor, for the HEXACOians) models of personality are a natural place to start exploring differences between funny and less-funny people. Although what we know about differences in humor production is sparse, there are some natural predictions we might make about who – in terms of personality – is funny. In particular, people high in openness would be expected to be funnier, given that high openness is associated with greater crystallized intelligence, vocabulary size, and verbal fluency (e.g., Ashton et al. 2000). Indeed, Sneed, McCrae, and Funder (1998) found that people perceive others as higher in openness to experience when the observed people were more humorous.

It's notable that none of the widely used measures of openness to experience mentions humor at all (e.g., NEO-PI-R, NEO-FFI-3, Big Five Inventory, or HEXACO-100). Scales typically assess people's engagement in and appreciation of the arts and aesthetics, curiosity, and unconventionality. Although humor seems like it might fit in with these items, no assessment actually includes it. Thus, while we might naturally expect funny people to be more open, the lack of humor-related items in openness scales indicates that humor and openness are not merely two sides of the same coin.

Nonetheless, studies that do examine humor production and personality often find significant positive correlations between humor production and openness to experience. Greengross and colleagues (2012), for example, had 400 college students complete the 60-item NEO-FFI-R (Costa &

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McCrae 1992) and a version of the cartoon caption task in which people were given three captionless cartoons and told to come up with as many captions as they could within 10 minutes. Six judges rated the captions on a 1 to 7 funniness scale. The three cartoons were reasonably reliable (αs = 0.69 to 0.78) and were similar to other researchers' findings. People's funniness score was computed as the average of each judge's score for the highest-rated caption. Overall, the authors found that the only Big Five trait significantly correlated with humor production was openness to experience (r = 0.26). As an interesting aside, the authors included an assessment of verbal intelligence (a vocabulary test) and found that humor production correlated significantly with verbal ability (r = 0.39).

Howrigan and MacDonald (2008) likewise found small but positive correlations between personality and humor production. In this study, 185 college students completed measures of personality (50-item IPIP), intelligence (Raven's Advanced Progressive Matrices), and humor production. To measure humor in this study, the authors asked participants to complete six résumé tasks and two other novel types of humor production tasks. In one of those tasks, people were told

> For this task, I want you to imagine that you've just received an e-mail by a fellow student asking if you could write some responses to the questions posed below. Your fellow student mentions that this is for a school project on the diversity of humorous responses, and asks that you try to write something funny for each question.
>
> Question 1: "If you could experience what it's like to be a different kind of animal for a day, what kind would of animal would you not want to be, and why?"
> Question 2: "How would you make a marriage exciting after the first couple of years?"
> Question 3: "What do you think the world will be like in a hundred years?"

The second novel task was specifically aimed at assessing nonverbal humor production and asked participants to draw "the funniest, most amusing depiction" of four different animals (e.g., monkey, penguin, octopus, and giraffe) and four different occupations (e.g., politician, professor, bodybuilder, and artist).

Twenty-eight undergraduates rated the humor tasks for funniness on a 1 to 7 scale. Raters were randomly assigned to blocks of participants so that four different judges rated each participant's tasks. The three different tasks were reasonably reliable (αs = 0.63 to 0.72) and again reflected the reliabilities reported in earlier humor production research. Judges' scores were standardized and averaged to produce an overall humor score for each participant. Humor production scores correlated significantly, positively, and equally with openness to experience and extraversion (r = 0.17). Notably, the authors found that humor production also significantly and positively correlated with performance on the intelligence task (r = 0.29).

In our recent studies, openness to experience strongly predicted humor (Nusbaum et al. in press). In these three studies, humor was measured with different combinations of cartoon captions, joke stems, definitions, and résumé

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tasks. Humor scores were estimated using many-facet Rasch models, which adjust for the difficulty of an item and the severity of a rater (Primi 2014). Using the task scores as indicators, a latent humor variable was then formed. When measured with the NEO, openness to experience had large effects on humor ability ($\beta = 0.48$ and $\beta = 0.54$). When measured with the HEXACO, the effect was somewhat smaller but nevertheless notable ($\beta = 0.36$).

Taken together, this small literature seems to indicate that the relationship between humor production and personality closely imitates the relationship between openness to experience and creativity, suggesting that the two skills – humor production and creative ideation – may be more closely related than current theories have considered. The effects of other personality domains on humor production, however, are much less clear. Studies often fail to identify significant effects for agreeableness, neuroticism, and conscientiousness and only sporadically identify significant effects for extraversion in either direction (Babad 1974; Greengross et al. 2011; Köhler & Ruch 1996; Koppel & Sechrest 1970; Moran et al. 2014; Nusbaum et al. in press).

One of the earlier studies on humor production and personality found a significant correlation between one aspect of extraversion (i.e., sociability) and humor production (Babad 1974) and inspired much of the theory relating extraversion to humor production ability. Intuitively, the relationship makes sense: extraverted people are affable, energetic, garrulous, and thrive in the spotlight, and these qualities exemplify the stereotypically funny person. Later research provided mixed evidence. Howrigan and Macdonald (2008) and Köhler and Ruch (1996) found significant correlations between extraversion and humor production ($r = 0.17$ to 0.19). Other studies found only marginally significant correlations and in the opposing direction (e.g., Moran et al. 2014). Still other studies, such as ours, find no effects of extraversion on humor ability. Clearly, the role of extraversion is murky.

Directions for Future Research

This chapter has explored the intersection of personality, creativity, and humor. We see humor production as an instance of creative cognition: it seems to share some essential things with more common measures of creative thought. As a result, one would expect personality to have similar influences on humor production and creative thought. Based on the small literature on humor to date, there are some strong parallels between humor and creativity. Most notably, openness to experience appears to be important to humor, just as it is to creative cognition. One clear message from this chapter is that the small field of humor studies is dwarfed by creativity, its larger sibling. But humor research appears to be catching up, given the appearance of much new work on humor in recent years, so here are some worthy directions for future research.

One serious priority for humor research is to push humor assessment forward, both in quantity and in quality. For quantity, the field is endangered by

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relying almost exclusively on cartoon caption tasks. These tasks appear to work well, but humor researchers should diversify their methods. Creativity research has not been helped by its overreliance on alternate-uses tasks, and humor research can prevent a similar narrowing by developing a wide range of tasks. For quality, humor research needs more psychometric research that evaluates the strengths or weaknesses of humor tasks and develops empirically informed guidance for researchers. Issues related to reliability – such as good guidelines for the number of items, raters, and task types needed for dependable scores – need to be sorted out. The nature of the raters seems particularly important to address, given individual differences in people's sense of humor. Methods for estimating the contributions of raters to scores – such as generalizability theory or many-facet Rasch models (Primi 2014) – would be valuable.

Second, research on humor production has generally been small in scale, with a fairly small number of participants completing a single type of humor task. There are notable exceptions, of course, but one does not see the large-sample multivariate latent-variable studies that are much more common in creativity research. Collecting larger samples and assessing a wider range of tasks will yield more precise estimates of the true effect size. One advantage comes from mere sample size, for substantial samples are needed to get estimates of effect sizes that are likely to replicate (Schönbrodt & Perugini 2013). Another advantage comes from statistically extricating true score variance from error variance via latent-variable models (Skrondahl & Rabe-Hesketh 2004). This increases the reliability of the constructs and thus usually reveals larger effect sizes than analyses based on observed scores.

Finally, the problem of how personality traits predict humor production lends itself well to meta-analysis, and one should be undertaken. Researchers often think of meta-analysis as a literature's terminus, the last thing one does after a huge amount of research has accumulated. Methodologists interested in research synthesis, however, point out that meta-analysis is an excellent formative tool for small, emerging literatures (e.g., Cooper 2009). By synthesizing a youthful literature, salient findings can be established (i.e., hypotheses that don't need to be tested yet again), points of uncertainty can be identified, and promising moderators can be explored. A meta-analysis of personality and humor production could clarify some sticky points, such as the inconsistent effects of extraversion on humor, and illuminate any methodological factors – from type of humor task to number of raters – that influence effect sizes.

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17 Much More than Selfies

Autophotography, Individuality, and Creativity

Stephen J. Dollinger

Developments in digital photography and the technologies of social networking offer fertile research opportunities (and new publication outlets) for personality, social, and developmental psychologists. Society now has the term *selfie* – the 2013 word of the year – to denote photographs taken in the moment by people who depict themselves along with close others or celebrities. As a social phenomenon, the selfie is receiving considerable attention and, in the view of some, too much attention (Brumfield 2013; Dvorak 2013; Steadman 2014; Wortham 2013). Long before the cell phone camera and the selfie, however, a number of social scientists used self-selected photographs to understand people's identities, environments, and social norms. The purpose of this chapter is to consider how autophotography expands our understanding of the creative, individualistic person – and his or her values and life paths.

One of the first to direct psychologists' attention to photography was Stanley Milgram (1977), who offered a number of observations about the social psychology of camera usage. He regarded the camera as an *imagine-freezing machine*, allowing anyone "to freeze a moment of visual experience" to be shared with others or to augment memory (p. 339). Milgram proposed a number of hypotheses and speculations about the potential of photography for social psychology. So too, Beloff (1988) offered intrapsychic understandings of eminent photographers' self-portraits. However, the empirical work of social psychologist Robert Ziller and colleagues (Ziller 1990/2000; Ziller & Lewis 1981; Ziller & Rorer 1985) really showed the heuristic possibilities for self-directed photography. His method of autophotography addressed such issues as shyness, delinquency, poverty in different cultures, aging, life events and values in different countries, the experience of divorce/social disconnection, and life in a wheelchair. The basic instruction – to take a set of photos to answer the question, "Who are you as you see yourself?" – portrays people's orientations with "a rich revealingness" (Ziller 1990/2000, p. 11). Subsequent studies showed the relevance of autophotography to explicating gender and the socially connected self (Clancy & Dollinger 1993; Lippa 1997), personality (Henry & Solano 1983), alcohol use (Casey & Dollinger 2007), inner-city life and homelessness (Aitken & Wingate 1993; Johnsen, May, & Cloke 2008; Jones 2004; Monteiro & Dollinger 1998), bereavement (Yang 2012), educational environments (DeMarie 2010), race differences (Damico 1985), and settlements in Mexico (Lombard 2013). Thus Ziller's influence has extended

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far beyond psychology to education, sociology, speech communication, and geography. The particular focus of my own research program, however, has been the rich individualistic quality of some college students' autophotographic essays and what the most creative photo essays can tell us about those incipient creative personalities.

Autophotography and Individuality

Individuality is rarely the focus of study. Various writers have equated the term broadly with personality or individual differences (e.g., Brody & Ehrlichman 1998; Ghiselli 1960; Tyler 1978) or with aspects of life story or life history data (McAdams 1996; Mumford, Stokes, & Owens 1990). Authors generally use the term with an implicit reference to the classic truism – that each person is to some degree like all others, like some others, and *like no other person* (Kluckhohn & Murray 1953). That is, to be individualistic is to be unique and irreproducible. Although everyone is supposed to possess individuality, calling someone *individualistic* implies uniqueness, nonconformity, or oddness (e.g., Suran 1978). Individuality is also conceptualized as involved in if not central to creativity (Barron1997; Helson & Roberts 1992; Martindale 1993). Being individualistic implies a greater focus on thoughtful, creative interests than in people (Storr 1988). Individuality thus conveys qualities of creativity and imagination, as well as unconventionality or nonconformity (e.g., Helson & Roberts 1992). As such, it fits within the five-factor concept of openness to experience (McCrae 1993–4; McCrae & Costa 1997). In short, individualistic persons are seen as having a richer inner life as compared with more conventional peers. This can be illustrated by excerpts from a photo essay by a young woman named Samantha who received the highest rating from all judges in my laboratory in spring 2000:

> *(Starting with photo of sunset)* A sunset holds many qualities I aspire to possess: beauty, peaceful, romantic, full of color and always changing. I definitely have the always changing part down and the full of color part as well . . . I like to do things other people wouldn't think of. I didn't care about the way I dressed or what people thought of me. I didn't try to impress anyone. *(Several photos show her many different hair colors and dressed in suit with bra for a top.)* This is an outfit I would wear out or to school. I like to press what people consider the proper ways to dress. I change my style from day to day. I like to keep people on their toes. You don't know what to expect when I walk out of my room. *(Photo showing self seated on motorcycle)* I like to do things "girls" aren't supposed to do. My sense of adventure intimidates people sometimes but that is who I am. I won't change for anyone . . . This is a picture of my poems and my fortunes from Chinese restaurants. I don't put a lot of faith in them but they make me feel good to read them. My poems are a huge part of me. I love to write and read poems. I express all of my emotions in my poems . . . I love to draw [and] I am very interested in the mature naked human body. *(Photo of tattoo on her shoulder reads "Everything was for you.")* That is the name of my book of poems. It is not for anyone in particular. I haven't met

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> anyone that special yet. The broken spiral signifies most of my relationships . . . I don't have too many meaningful or long lasting relationships. *(A final photo shows the tattoo on her back with the word* Desire*)* One of my favorite words. I don't want to be with anyone who doesn't have desire, desire in anything they do.

Across a series of studies, my collaborators and I have argued that the method of autophotography is a useful way to identify variations in individuality such as that exhibited by Samantha. Even with college student participants, our use of the method has shown a range of what Ziller called "rich revealingness." For example, some college students portray themselves in one-dimensional ways, such as the "self-as-partier" stereotype; other participants portray themselves in more differentiated ways, showing themselves to fill a variety of life roles, most of which still conform to college student prototypes (e.g., student, girlfriend, athlete, and student-worker). An intriguing minority portrays themselves in ways that are highly individualistic – multifaceted and distinctive, but also integrative and noninterchangeable (Dollinger & Clancy 1993; Dollinger & Clancy Dollinger, 1997; Dollinger et al. 1996). Based on those early studies, we described the most individualistic photo essays as multifaceted, aesthetically sensitive, and rich in depth of self-understanding (see Table 17.1). Moreover, the most individualistic photo essayists sometimes use metaphors or poetry to signify aspects of their inner selves. Thus, from photo essays we see that the individualistic person appears to be creative and thoughtful and to have an active "life of the mind." Individualists are more self-aware, occasionally self-critical, and more concerned with inner realities than outer perceptions. Such participants also seem less concerned with whether they fit into society. Not surprisingly, individualistic photo essays are considerably more interesting to view than are the stereotypical conventional ones. Following Ziller's description, we originally referred to the dimension as "richness" but have subsequently viewed it as a dimension of *individuality*. This chapter reviews the empirical evidence for the personality profile of individualistic autophotographers.

Autophotographic Method in the Present Series of Studies

Ziller's studies involved volunteers of various backgrounds and ages, usually given a disposable camera and invited to take 10 new photographs and then to describe their photographic products orally. However, for the present studies, all participants were college students who completed photo essays (usually with 20 photographs) and questionnaires for course credit in a midlevel personality psychology course. Students could earn about 15 percent of the total course points by completing optional projects, two of which were the photo essay and questionnaire. At the start of each semester, a course packet described these options and gave specific guidelines for the photo essays with the instructions modified slightly from Ziller:

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Table 17.1 *Verbal Description of Autophotographic Individuality-Richness Ratings*

Level 1: *Concrete, unimaginative, or dull style; commonplace and prosaic photographs; repetitive content*: Participants include many photographs of people, especially themselves and others smiling; overall presentation seems similar to most people's family albums. At this level, they tend to focus on single themes such as self-as-partier or repetitive presentations such as self in different rooms of apartment. Many include sophomoric humor (tongues exposed to show "wild and crazy" attitude), have an emphasis on possessions (e.g., cars) or body (self sleeping) without self-exploration of the meanings behind such photographs. Sometimes at this level there is the unarticulated theme: "I am my pleasures."

Level 2: *Typical or normative (statistically, this is the most common rating)*: At this level, participants show themselves in a greater variety of life roles (e.g., student, employee, daughter, boyfriend) and as having likes and dislikes. Athletic and pet photographs are common at (but not definitive of) this level. Participants commonly seem self-satisfied (e.g., showing pride at graduation); self-criticism and dissatisfaction are rare at this level. Possessions are accompanied by a little more self-realization ("I can be materialistic"). Conventional religious feelings are depicted (e.g., church membership but without much elaboration).

Level 3: *(none)*: Level 3 is similar to level 2, but here participants more often portray the self as possessing at least some inner traits. Level 3 shows the first signs of creativity but in sex-role stereotypic ways (cake decorating, hair) and in just a few photographs. At this level we see a few signs of representational or metaphoric photographs, conveying traits or personal qualities. Levels 3–5 show greater artistic engagements such as drama and painting and interest in science (e.g., Einstein as hero, thoughts on the value of the Internet) and generally greater curiosity about ideas.

Level 4: *(none)*: Representational photographs are common. Examples include stuffed bear prompts childhood memories; comments about relationships or need for security; basketball hoop signifies reaching for high goals in life; blank photograph signifies "being in the dark too often in my life"; bottle of Prozac shows "my struggle with depression." Photo essays show greater integration, such as using multiple photographs linked by theme or story ("my characteristic duality – sometimes messy [shown on left], other times orderly [on right] – I'm very unpredictable.") In such a manner, the self is differentiated into two aspects which are then integrated as the broader concept "unpredictability." Another example is a photograph of an ex-boyfriend currently in prison positioned next to a photograph of the current roommate's newborn in hospital; together these depict "my tendency to pick men who are bad for me; this is as close as I'll get to having a child" (implying that I'll never have my own child with such bad choices). At level 4, there are more themes of self-discovery, more complexity in exploration of feelings rather than simply listing likes/dislikes. There may be a focus on life as a story or experience to understand and appreciate: "Life carries on – I see it as a path and one that I usually walk alone"; "Who knows what the future will hold, but I am eager to find out." There will often be a valuing of nature, the outdoors, and quietness.

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Table 17.1 (*cont.*)

(Note, however, that nature photographs (e.g., sunsets) can be shown at lower levels usually with few words or appreciation other than "I like to watch the ocean"). At this level, one sees greater valuing of creativity but less than at level 5, and individualistic religious views are more common for levels 4 and 5 (e.g., seeing God in nature).

Level 5: *Abstract, metaphoric with many photographs having deeper meanings; imaginative; creative interpretation of the photo essay task; aesthetic or artistic sensibility shown; self-expressive; self-reflective; interesting variety of themes and photographs*. At this level, poetry is fairly common, and participants show self-insight in a variety of ways. One woman depicted issues of sexual identity after unsuccessful marriages and portrayed self behind a fishbowl to show the feelings of growing up in a small town. In two photographs she juxtaposed images of herself pulling a rope in opposite directions, thus conveying her inner conflict as she begins each new adventure in living. One young man portrayed himself sitting next to campus fountain, noting, "A lot of the time I feel like I am sitting still while the world is 'passing me by' – I'm pretty slow paced in my relationships, and most people aren't used to that it seems." Along with a photograph of himself looking out a window, he wrote, "I have often found myself dreaming about what could have been or what could be." In another, he superimposed a ghostlike shot of a woman in the background and commented, "I feel like there is a barrier that is preventing me from a real relationship." These illustrate the quality rather than quantity of level 5 photographs; the quality is pervasive (more than just in say two photos). Finally, the photo essay itself is a creative and valued product implying considerable investment of self.

Note: The original description of levels is presented in italics. The additional descriptions come from later work.

> We would like you to take (or have someone else take) 20 photographs that tell who you are. These photographs can be of anything just as long as they tell something about who you are. If you wish, you may use some photos taken previously; but at least half of the photos should be new ones taken for this assignment. You need not be concerned about your skill as a photographer. Rather, we would like you to keep in mind that the photographs should *describe who you are as you see yourself*.

Instructions gave additional examples, and participants were promised that photo essays would be viewed by the instructor and teaching assistants, used for research purposes, and be returned with feedback at the end of the semester. The autophotographic method was later discussed during a lecture on self psychology. In the 1990s, all products were presented as some kind of photographic album. Starting in 2007, PowerPoint presentations and other electronic formats became popular and, by 2010, normative. In addition to the photo essay, predictor variables were obtained in a research questionnaire given about two weeks into the semester (including demographics, personality measures, and advanced organizers to course topics).

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Scaling Individuality: Content and Process

The majority of Robert Ziller's research focused on content analyses designed to identify participants' orientations, thereby reflecting self-identity. Our method of scaling individuality was akin to what he called a *process* rather than *content* approach (Amerikaner, Schauble, & Ziller 1980) and was influenced by Amabile's (1982, 1996) work on creativity and the Consensual Assessment Technique. Specifically, to measure individuality/richness, we obtained subjective ratings of the overall photo essay by several raters (Dollinger & Clancy 1993; Dollinger & Clancy Dollinger 1997; Dollinger et al. 1996). These raters independently viewed all photo essays in different orders of presentation using a common rating scale with the high and low points anchored in descriptions (1 = concrete, unimaginative, or dull style, commonplace and prosaic photographs, repetitive content; 5 = abstract, metaphoric, with many photographs having deeper meanings; imaginative; creative interpretation of the photo essay task; aesthetic or artistic sensibility shown; self-expressive; self-reflective; interesting variety of themes and photos). Four raters – three graduate students and the author – achieved Pearson intercorrelations ranging from .52 to .71 with a Spearman Brown reliability of .89 for individuality/richness. Subsequent studies achieved comparable values with three to five raters.

Two slight modifications were made in the scale. Based on the data in that first study, level 2 was labeled a *typical* rating. Additionally, two sets of photo essays were duplicated for training future raters. One set of 25 high-consensus photo essays helped new raters appreciate the five levels. A second set of 14 with somewhat less consensus was used for a pretest of rater reliability before judging a new sample. Because most studies used new judges, this helped judges to feel more confident in rating photo essays without changing the rating method.

Photographic essay content codes were too narrow and too infrequent to capture "richness," but several routinely correlated negatively with the rating, notably interpersonal codes such as number of photographs of self-with-others, related interpersonal codes such as people touching or groups of four or more in foreground, and number of photographs with alcohol present. Thus the content codes tended to show what *low-individualistic* photo essays included. One study showed that the individuality/richness rating was unrelated to a physical attractiveness rating also derived from the photo essay, whereas most of the interpersonal content codes were positively correlated with this attractiveness rating. Thus individuality seemed unbiased by the halo of attractiveness (Dollinger 2002). Like Ziller (1990/2000), we used content codes in a number of studies, particularly on the themes of alcohol and religiosity, suggesting that with photo essays, "what you see is what you get" but also that photo essays reveal "more than meets the eye" (Casey & Dollinger 2007; Dollinger 1996, 2001). Alcohol photographs were linearly and positively related to frequent and problematic drinking and to such less obvious correlates as grade point average (GPA), high school class rank, philosophy of college attendance, and endorsement of a hedonistic value system.

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Big Five Correlates of Individuality

Given the conceptual descriptions of creativity and individuality (e.g., Barron 1997; Barron & Harrington 1981; Helson & Roberts 1992; MacKinnon 1962; Storr 1988), our expectation in initial work was that *openness to experience* should stand out as the largest Big Five correlate of individuality/richness. For example, MacKinnon (1962, p. 488) concluded that creative persons present a picture of "complexity and richness of personality. . . openness to experience, and especially openness to experience of one's inner life." *Openness to experience* can be defined as the extent to which people think in broad and deep ways – as opposed to narrow or shallow thought – and the permeability of boundaries in their consciousness and experience (McCrae 1993–4; McCrae and Costa 1997); the artist and poet can be taken as prototypes of the open person (McCrae & Costa 1997). Being open, then, reflects a richness of inner life experience, broad interests, and receptivity to new ideas. Being closed may reflect a narrow rigidity, conformity to what is conventional, and a preference for down-to-earth or "tried-and-true" ways of experiencing the world. Openness to experience is the personality factor most reliably correlated with artistic and scientific creativity (Feist 1998; Silvia et al. 2009). Costa and McCrae (1985, 1992) operationalized the openness factor of personality with six facet scales: fantasy, aesthetics, feelings, actions, ideas, and values. Thus open persons are oriented toward art and beauty and the world of imagination; they are affectively attuned, prefer variety in their lives, are intellectually curious, and hold to liberal rather than conservative values.

This expectation of an individuality–openness connection was affirmed in a study with 201 college students who took the NEO Personality Inventory (NEO-PI) (Dollinger & Clancy 1993), showing in particular that the aesthetics facet of openness was the most consistent correlate of richer photo essays. (Correlations and regression β values for openness generally ranged from .3 to .45; most other richness correlates fell in the .10 to .30 range. Only previously unpublished inferential statistics will be presented here.) Richer photo essays were also devised by women who scored higher on the neuroticism factor (especially anxiety, depression, and self-consciousness) and lower on extraversion (especially gregariousness). In contrast, interpersonal codes (e.g., people touching) correlated meaningfully with extraversion and agreeableness.

Later studies replicated the key finding of an individuality–openness connection (Dollinger & Clancy Dollinger 1997; Dollinger et al. 1996) using the brief NEO-Five Factor Inventory (NEO-FFI) (Costa & McCrae 1992). Both studies showed small effects for introversion and agreeableness; neuroticism made a contribution to individuality in one study. Richness and openness also correlated using Saucier's (1994) lexical scale (Mealer 1997).

Finally, in all the samples since 2000, I included Oliver John's Big Five Inventory (BFI) (Benet-Martínez & John 1998), and these samples were pooled for a further analysis in this chapter. Using the 1,352 cases with BFI and photo

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Table 17.2 *Predicting Individuality/Richness from the Big Five Inventory Partitioned by Age and Gender*

	Men		Women	
	Age $\leq$ 24	Age $>$ 24	Age $\leq$ 24	Age $>$ 24
Neuroticism	–0.06	–0.04	–0.01	0.16
Extraversion	–0.20**	–0.20	–0.08*	0.16
Openness	0.22**	0.55**	0.24**	0.36**
Agreeableness	0.08	0.07	0.04	–0.21
Conscientiousness	0.03	0.07	–0.06	–0.16

Note: Entries are standardized beta weights from simultaneous multiple regressions predicting individuality/richness from the five BFI scores. N = 379 and 54 for younger and older male students, respectively; N = 795 and 82 for younger and older female students, respectively.
*$p < 0.05$;
**$p \leq 0.001$.

essay data, I regressed the five factors on individuality richness scores, yielding a significant model [$F(5, 1{,}346) = 21.3$, $p < 0.001$, $R^2 = 0.07$]. Two significant effects in this model included openness and low extraversion (respective $\beta = 0.26$ and –0.11, both $p < 0.001$). To test the generality of these predictors, I partitioned the sample into traditional-aged male and female students (age $\leq$ 24 years) and nontraditional aged male and female students. Table 17.2 shows that the individuality–openness association held true for all four groups.

In sum, the consistent picture is that individualistic photo essays are always associated with openness to experience regardless of gender, age group, or Big Five measure used. Across samples and measures, individuality/richness ratings usually reflect low introversion and sometimes high neuroticism and high agreeableness. Conscientiousness appears to be irrelevant to individuality/richness. In the remainder of this chapter I consider other predictors of such photo essays and then discuss a conceptualization based on clusters of these correlates.

Openness-Related Concepts

A number of other concepts are conceptually similar to openness to experience, and these too characterize individualistic photoessayists. Later consideration is given to cognitive/intellectual aspects of personality and values/conservatism. Here we consider the concepts of boundary permeability, need for uniqueness, universal orientation, identity, and imagined future experiences.

Permeable Boundaries

Psychoanalytically oriented dream researcher Ernest Hartmann (1991) offered the concept of *boundaries*, specifically the thinness/thickness of perceptual

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styles, affective life, states of consciousness, dreams, personal space, and relationships. High scorers on Hartmann's measure possess a flexible, fluid style of consciousness, a concept very close to openness to experience. Sample items include "I have often had the experience of different senses coming together – for example, I have felt that I could smell a color, or see a sound, or hear an odor" and "All men have something feminine in them and all women something masculine." Of particular relevance, Hartmann reported that artistic groups scored much higher than other occupational groups. As predicted, in two samples we found positive correlations of individuality/richness and thin boundaries (Dollinger, Robinson, & Ross 1999b).

Need for Uniqueness

Snyder and Fromkin (1977, 1980) started with the assumption that people have different optimal levels of distinctiveness from others. The notion evolved from a state to a trait concept measured with the Need for Uniqueness scale, comprised of three factors – lack of concern for others' reactions to one's own different ideas, desire to not always follow rules, and willingness to defend one's beliefs publically. A sample item reads, "It bothers me if people think I am being too unconventional." Uniqueness motivation has been found to be useful in studies on consumer and marketing psychology. Of relevance to creativity, one of the validation studies showed that low-need/uniqueness individuals gave fewer conventional or popular responses in a word association task (Snyder & Fromkin 1980). Dollinger (2003) found a positive correlation between need for uniqueness and individuality/richness ratings.

Universal Orientation

Robert Ziller's contribution to peace psychology was the concept of *universal orientation*, defined as an individual difference in acknowledging commonalities with others, accepting others who are different, and avoidance of viewing others in categories (Phillips & Ziller 1997). One illustrative item is "I can understand almost anyone because I'm a little like everyone." The scale was validated with measures of empathy, humanitarianism, perspective taking, and (inversely) dogmatism and modern racism. Universal orientation also predicted individuality/richness ratings (Dollinger et al. 1999b).

Identity Concepts

Two identity traditions have been examined. Reviewed in detail elsewhere (Dollinger & Clancy Dollinger in press), this discussion will be brief. In his *aspects of identity* conception, Jonathan Cheek and colleagues (Cheek 1989; Cheek et al. 1994) noted that some people regard the inner world of personal identity (e.g., dreams, imagination) as most self-defining. For others, impressions created on others and reputation – social identity – are most defining.

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Similarly, some people focus on their collective identity or group memberships. Dollinger and colleagues (1996) found that personal identity was a positive predictor of individuality/richness, whereas social and collective identities were negatively related to individuality/richness. Supplementary results showed that self-definitions in observable superficial terms (e.g., my age, possessions) correlated inversely with individuality/richness.

Based on Erik Erikson's theory, an extensive literature exists on the concepts of *identity statuses* and *identity styles* (starting, respectively, with Marcia [1966] and Berzonsky [1989]). Dollinger and Clancy Dollinger (1997) showed that college students scoring as foreclosed and diffuse in identity produced lower-richness photo essays than did students scoring in the achieved and moratorium statuses – in other words, individuality/richness seemed to reflect the experience of identity exploration. A second study conceptually replicated this finding, showing that the information-seeking identity style predicted the highest individuality/richness, whereas the normative style predicted the lowest. Across different identity conceptions, individualistic persons focus on inner rather than superficial aspects of self, whereas their more conventional peers construe their identities in terms of the social/collective/normative aspects of self.

Imagined Futures

Inspired by the concept of the possible self (Markus & Nurius 1986), my Imagined Futures scale reflected young adults' expectations for a range of future life experiences, significant events, and the "stuff of life narratives." Generating ideas from news events, conversations with former students and clients, and the personality literature, I included items about points of life change ("fall in love"), lifestyle choices with consequences ("have sex with a person you hardly know"), and dramatic or mundane acts that were self-sacrificing or self-serving. Participants rated the imagined likelihood of events happening in the next five years on a scale from 1 (impossible) to 5 (50-50 odds or better). Five scales emerged from factor analyses of several samples; the most relevant here was labeled "Culturally Diverse Futures." It included such items as "spend a year just traveling and seeing new places"; "eat in at least one Ethiopian, Thai, Greek, and Indian restaurant"; "attend a jazz concert"; and "act in a dramatic production." Other scales were "Emotionally Distressed Futures" (e.g., "have a nervous breakdown"), "Agentic Futures" (e.g., "invest in the stock market"), "Rule Violations" (e.g., "cheat on your taxes"), and "Physically Threatening Futures" (e.g., "contract AIDS"). The scales had meaningful personality correlates and, like the possible self, were temporally susceptible to news events. Individualistic photo essayists did indeed imagine more culturally diverse futures than did their peers (Dollinger et al. 1999b) but also more expected emotional distress and more physical threat (to be considered later in this chapter). Individuality/richness correlated with several items that were not in a composite scale, and these also show the boundary-crossing quality of individualists: "date someone of a different race" and "participate in

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a protest march." Thus individuality/richness correlated with a variety of openness-related constructs, indicating that individualistic persons anticipate future experiences that embrace culture and diversity, and they tend to have permeable boundaries, take a more universal approach toward humanity, strive for uniqueness, and are more identity exploring.

Individuality and Creativity

Given that individuality was conceptualized and measured in a manner similar to creativity, a logical step was to assess the extent to which individualistic persons are more creative than their conventional peers. This question was examined using divergent thinking tasks, judge-rated creative products, and self-reported accomplishments.

Divergent Thought

Starting with Guilford's work (e.g., Wilson, Guilford, & Chistensen 1953), divergent thinking is frequently taken as an indicator of potential creativity (Baer 1993; Runco & Acar 2012). Tasks such as unusual uses or word associations can be scored for infrequent or unique responses, as well as the converse, common or popular responses (Eysenck 1994; Merten 1995). For example, with a word-association task, the response *grass* is fairly popular to the stimulus *green*, given by over 20 percent of respondents in most samples. Such a response would count in the total number of common answers. In contrast, a response such as *ocean*, given by just one participant, would count as unique. *Fluency*, or the total number of responses given, is also a potentially useful measure when unlimited numbers of responses can be given, such as in the pattern meanings and line meanings divergent thinking tasks (Wallach & Kogan 1965; Wallach & Wing 1969). Mixed support has been found for divergent thinking and individuality/richness. Dollinger and colleagues (1999b) found that such ratings correlated positively with unique word-association responses, marginally related to fluency scores, but was unrelated to unique responses on pattern and line meanings. Subsequently, Dollinger (2003) found word associations unrelated to individuality/richness. This weak support is surprising because taking photographs of people is the normative use of the camera (Milgram 1977), whereas the depiction of meaningful or storied possessions or objects to serve as metaphors for trait or abstract values clearly involves divergent thought. However, compared to products, divergent thinking tasks usually require less investment from participants.

Creative Products

We have examined a variety of creative product correlates of individuality/richness and in each case used the Consensual Assessment Technique (CAT) (Amabile

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1982, 1996) for judging creativity. Three studies included a story-making task using pictures from the classic Thematic Apperception Test (Murray 1943). Stories were judged by a creative writing instructor and several research assistants. Three samples showed weak correspondence between photo essays and creative story telling. On the assumption that creative individuals experience and recall their dreams more vividly (cf. Domino 1976), one study used a dream-vividness task (Dollinger 2003). Participants were invited to write about a recent dream in as much detail as they could recall. A composite score of rated vividness, dreamlikeness, and bizarreness was positively related to individuality/richness. In another unpublished sample, participants were invited to devise seven captions or titles for photographs from books of professional photography (four photographs featured famous Americans, whereas three featured dogs). Titles were typed and independently judged by three judges. Creative photograph titles were related to individuality ($r = 0.23$, $p = 0.02$, $N = 96$).

Turning to visually creative products, in five samples we invited drawing completions to an ambiguous stimulus using the Urban and Jellen (1991) Test of Creative Thinking Drawing Production (Dollinger 2003, 2007, 2011; Dollinger, Burke, & Gump 2007). This stimulus consists of five fragments of figures within a large square frame – a semicircle, a point, a large right angle, a curved line, and a dashed line; in addition, a small square, open on one side, is located outside the large frame. Instructions tell participants that an artist was interrupted when making the artwork, and "you are asked to continue with this incomplete drawing – you are allowed to draw whatever you wish." In the first of these studies, we used the formal coding system devised by Urban and Jellen (1991) and found that it was highly correlated with the CAT approach (Dollinger et al. 2004). In later studies, drawings were rated by MFA art students using the CAT. Sample high- and low-creative drawings can be found in Dollinger (2011). Correlations between individuality/richness and creativity of drawings were consistently positive and significant (with a median correlation of .25).

The Inside-Me Drawing Product

One final product deserves special mention because visual and verbal components were used, and it was explicitly focused on the self. I present it in greater detail because it included results not previously published. A creative in-class activity called "Inside Me/Outside Me" was devised by an art educator based on her work with abused women. This workshop product is noteworthy because it not only correlated with photographic individuality but also revealed connections to negative life events. The workshop began with an introduction on types of drawing strokes and orientations, plus hand/foot symbolism, followed by 50 minutes of art making and then a brief evaluation of the activity and a negative life events form. Participants traced either their hand or foot to represent the boundary between the inner self and the outer world and then elaborated their work according to their own images and words while reflecting

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on the inner and outer self (for results and sample products, see Dollinger, Kazmierczak, & Storkerson [2011]). Products were later rated by judges with art or psychology backgrounds for overall effort ("sheer amount of pencil lead on the paper"), creativity, and self-reflection or psychological relevance.

The focus of this study was predictors of workshop evaluations and creativity and self-reflection ratings. Notably, women who had experienced negative events (and particularly physical, emotional, or sexual abuse) rated the workshop most favorably and devised more *psychologically reflective* products. In contrast, openness and past visual art experience predicted *creativity* of the products. Individuality/richness of photo essays was significantly correlated with both the creativity rating ($r = 0.24$, $p < 0.001$, $N = 187$) and the self-reflection/psychological relevance rating ($r = 0.19$, $p = 0.02$, $N = 187$). It was unrelated to rated effort ($r = 0.07$). The magnitudes of these relations were not reduced when openness and verbal ability were included in a regression model. Unexpectedly, photographic individuality/richness also correlated with the experience of interpersonal abuse. Also not previously reported, this relationship emerged in the two samples comprising this published study ($r = 0.24$, $p < 0.05$, $N = 96$, $r = 0.34$, $p < 0.01$, $N = 94$ pooled) and in four subsequent samples pooled ($r = 0.15$, $p < 0.001$, $N = 544$). Thus those who had experienced some kind of abuse also devised richer photo essays. Together the findings on the workshop product and the photo essay suggest that these creative activities can be used as part of the meaning-making process for dealing with abuse.

Creative Accomplishments

Self-reported checklists of accomplishments are an accepted approach for studying creativity in general populations (Hocevar 1981; Plucker 1999; Silvia et al. 2012). As this research moved toward creativity, I examined the Creative Behavior Inventory (CBI) (Hocevar 1979) as a potential correlate. This 90-item inventory, initially based on college students' open-ended descriptions of their accomplishments, includes a total score and six subscales – visual arts, literary accomplishments, crafts, music, performance, and math/science. Dollinger and colleagues (2004) found a moderate correlation of individuality/richness with the CBI total score as well as small correlations with the visual, literary, crafts, and music subscales. That initial study was also the basis for analyses leading to a 28-item short-form CBI. Although the short form correlated with personality measures, it was less predictive of individuality/richness (Dollinger 2003, 2007, 2011).

The open-ended description of creative accomplishments has the advantage of including accomplishments that, with newer technologies, were not included when the CBI was designed. In one unpublished study, we asked students to report their accomplishments on a form titled "Creativity Dossier," with the task of imagining that they had been nominated for an undergraduate award. They were to list up to five creative accomplishments or activities, including things done outside college coursework. Low-rated activities were generally socially useful but noncreative activities (e.g., "spent summer as a life guard"

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and "ran an antidrug retreat"), whereas high-rated activities were quite creative (e.g., "designed web pages for a local band"). Dossier ratings correlated well with individuality/richness in one unpublished sample ($r = 0.34$, $p = 0.001$, $N = 86$) but somewhat less successfully in another ($r = 0.15$, $p = 0.14$, $N = 97$).

Finally, a similar method was used as part of a follow-up study of students who completed photo essays approximately seven years earlier (or, on average, five years after earning their BA degrees) (Dollinger 2006). Given the lag time, marital name changes, and limitations of which students actually provided contact information to the alumni association, the response rate was low ($N = 44$, 10 percent response rate). However, respondents and nonrespondents were comparable in gender, GPA, personality scores on the NEO-PI, and photo essays. Respondents were slightly older than nonrespondents. Among other questions, the follow-up survey asked about creative activities and accomplishments as well as awards and honors received. Five judges with varying creative backgrounds rated the typed responses. As an example, one low-rated response stated: "I have not had enough free time to pursue creative endeavors. My life since 1995 has been spent in pursuit of degrees, jobs, and licensure as a Clinical Professional Counselor." One high-rated response was "I have taken oil painting classes and hand coloring black and white photos. I start an acrylic painting class this week." Because openness is consistently the best personality predictor of creativity (Feist 1998), a regression model predicted postcollege creativity from individuality/richness ratings and NEO-PI openness *both measured seven years earlier*. The significant model showed that just individuality/richness made a contribution. Thus individuality predicted later creativity even when openness was controlled. In sum, although results are not always consistent, compared with their conventional peers, individualistic persons generally were more creative at the time of devising the photo essay, and they had more creative accomplishments seven years later.

Individuality and Intellect

As noted earlier, openness to experience is defined not only by an aesthetic orientation but also by intellectual curiosity and cognitive complexity. One kind of complexity is seen in Loevinger's ego-development concept (Loevinger 1976; Loevinger & Blasi, 1991). Here the moderately low conformist stage represents, in part, an overconcern with the group and with one's social self within the group. Two of the highest levels of mature ego development are denoted as *individualistic* and *autonomous*, reflecting more complexity. Ego development is measured from responses to the Washington University Sentence Completion Test (WUSCT) into stages or levels of maturity. College samples often result in few individuals scoring at the lowest and highest levels, and participants are thus grouped into categories such as pre-self-aware (conformist and lower) or conscientious and above. In one of our first photo essay studies, we found that pre-self-aware individuals scored lower on photographic

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individuality/richness than did participants higher in ego development (Dollinger et al. 1996). Because the WUSCT measure very much depends on verbal ability, we also included a vocabulary measure as a proxy for this construct. This scale, from the Short Form Test of Mental Maturity (Sullivan, Clark, & Tiegs 1970), correlated quite well with individuality/richness ratings. Differences among ego levels were not reduced when verbal ability was controlled.

Building on those findings, further studies examined a variety of cognitive-intellective constructs related to Fiske's (1949) *inquiring intellect* concept (Dollinger et al. 1999b, 2002). Using the Jackson Personality Inventory (JPI) (Jackson 1994), we found that those devising more individualistic photo essays also were likely to score high on the JPI analytic factor, particularly the *breadth of interests* and *complexity* scales. Later, Dollinger et al. (2002) showed that individuality/richness was predicted by a range of inquiring intellect measures including the NEO-PI ideas facet (Costa & McCrae 1992), trait curiosity (Spielberger 1979), investigative interests in the Vocational Preference Inventory (VPI) (Holland 1985), and need for cognition (Cacioppo, Petty, & Kao 1984). Based on a composite of all measures, we selected high- and low-intellect participants for qualitative analyses of the photographs. Themes in the photo essays of high-intellect participants included their love of learning, enjoyment of books, admiration for scientific heroes, and appreciation for the intelligence of particular friends (cf. McCrae 1996). Some commented on their creativity, environmental concerns, nonconformity, and quest-oriented nontraditional religiosity. In contrast, low-intellect participants focused on the happiness of their social lives and, among women, their love of children.

Across several published and unpublished studies, we found evidence that individuality/richness related to being a dedicated and competent student. Students who endorsed a more intellectual philosophy of college – valuing learning for its own sake – scored higher on individuality/richness than those with social or vocational orientations to college (Dollinger, Ross, & Preston 2002). In a later unpublished study, a measure of student anti-intellectualism (Eigenberger & Sealander 2001) also proved to be a negative correlate of individuality/richness ($r = –0.24$, $p = 0.009$, $N = 115$). Individualists also scored higher on the ACT college admissions test, suggesting that "standardized tests do not equate to standardized minds" (Dollinger 2011). In 6 of 10 samples, we found that they devote more of their time to study ($r = –0.04$ to 0.32, median $r = 0.22$); time spent socializing or in part-time jobs was almost always unrelated to individuality/richness. Pooled across 13 samples, individuality/richness was also predicted by the Short Form Vocabulary score ($\beta = 0.20$, $p < 0.001$, $N = 1{,}036$) and GPA ($\beta = 0.11$, $p < 0.001$). Thus individualists seem to be serious students. It is worth noting, too, that creativity measures have predictive validity for academic achievement. For example, course grades were significantly predicted by individuality/richness ratings and creative drawings, accounting for variance over and above that explained by the ACT and GPA measures (Dollinger 2011). In an unpublished replication pooling across nine later semesters of data, individuality accounted for an additional 1.6 percent of

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the variance ($p < 0.001$) over and above the 38 percent accounted for by GPA and the vocabulary pretest. Although these were small magnitudes, it is remarkable that the photo essay accounted for *any* variance in academic performance after past performance and an intellectual measure were included and that the findings were replicated.

Individualistic students' cognitive focus is evident in two other ways – how they write about their photographs (Burke & Dollinger 2005) and their reading (Dollinger 2016). The words in photo essays were subjected to a linguistic analysis using Pennebaker's Linguistic Inquiry and Word Count Program (Pennebaker, Francis, & Booth 2001). In accord with expectations, analyses showed a number of correlates of individuality/richness ratings: overall word count, particularly *cognitive* word use, plus the relative absence of social process word use. High-individuality photo essays were best characterized by subsidiary categories of insight, tentativeness, and self-discrepancy words but not by references to friends or family (negative correlates). In terms of personal concerns, individuality correlated with more metaphysical issues and fewer leisure themes. In short, individualists presented as unique and complex people, oriented toward self-exploration and existential concerns. Their use of tentative and insight-oriented words suggested that they are more thoughtful and introspective, consistent with other findings reviewed here (e.g., identity crises, psychotherapy experience). In contrast, their conventional peers oriented toward friends and leisure activities.

Finally, recalling individualists' love of books, a pair of recent studies provided evidence that individuality/richness indeed correlates with the enjoyment of reading and with particular reading interests (Dollinger 2016). With a sample of 381 students pooled over consecutive years, an enjoyment of reading measure predicted individuality/richness even when demographic and personality factors were controlled, with the best predictors being openness to experience, hours of study per week, enjoyment of reading, and introversion. Using a reading-preferences survey (Schutte & Malouff 2004), a second study addressed whether individuality/richness reflected particular kinds of fiction and nonfiction reading. Individualistic students' reading-preference factors focused on the more academically oriented reading of (a) humanities and social sciences, and (b) fiction. More conventional (or low-individuality/richness) students' interests ran toward news/sports and romance/sexuality. The strongest positive individual-item correlates of individuality/richness included classics/literature, psychology/social science, human interest reports, and humanities; the strongest negative correlate was sports coverage. Although correlational in nature, the results at least raise the question of whether reading choices contribute to the development of individuality among young adults. Taken together, these studies clearly show that individuality/richness reflects an inquiring intellect and active pursuit of the "inner life" of the mind rather than that of the outer social world. Individualistic photo essays not only correlated with measures of intellectual complexity and curiosity but also qualitatively and quantitatively reflected more complexity.

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Individuality and Values

The orientations presented in photo essays not only convey aspects of personality and lifestyle but also give hints to people's values regarding work, leisure, religiosity, alcohol use, aesthetics – and the truism that people sometimes hold particular photographs to have great personal significance (Dollinger & Clancy 1993). In our earliest research, the religion photograph code was associated with lower (i.e., conservative) scores on the NEO-PI openness-to-values scale (Dollinger & Clancy 1993). Several studies explicitly focused on values following in the research tradition of Rokeach (1973) and Schwartz (1992). As noted by these authors, values are desirable trans-situational goals that serve as guiding life principles and comprise a key part of people's conscious world views. Unlike traits, values serve to justify a person's actions.

Three studies gave special attention to social and political values (Dollinger 2007; Dollinger et al. 1996, 2007). In the 1996 publication, we included the Schwartz and Bilsky (1990) version of Rokeach's values survey. Rather than ranking values, this version used ratings and combined items into values clusters: enjoyment, maturity, pro-social, security, achievement, restrictive conformity, and self-direction. Individuality/richness ratings were in fact correlated with four of these clusters. Partialing the average rating for all values, individuality/richness correlated positively with maturity and self-direction and negatively with restrictive conformity and security. Considering specific items, those who devised individualistic photo essays most valued wisdom and being imaginative but devalued being self-controlled and polite. These correlates seem to fit well with the picture that individualists are less concerned about conforming to social boundaries.

Schwartz's developing theoretical model postulated a near-circumplex structure such that values on opposite sides of the circle should correlate in reverse directions with outcome measures (e.g., religiosity, vocational choices, and outgroup contact) (Schwartz 1992, Schwartz & Bardi 2001). For example, if a criterion measure (say, creativity) correlates positively with universalism, a negative correlation should obtain with power, falling at the opposite side of the circumplex. Schwartz's revised measure included 56 values that – based on replication across 60+ cultures – usually reveal the same structure of 10 composite-value clusters. These include power, achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity, and security. The 10 clusters also form higher-order dimensions, that is, openness to change versus conservatism and self-transcendence versus self-enhancement. Dollinger and colleagues (2007) combined ratings of photo essays and drawing and story-writing products to give a composite measure of creativity. Creative products were predicted by the openness-to-change and self-transcendence dimensions (as were creative accomplishments on the short CBI). Moreover, both accomplishments and products related positively with self-direction, universalism, and stimulation values but negatively with power, security, conformity, and tradition values (see Figure 17.1). Although not using photo essays, nearly identical results were found in a study by Kasof and colleagues (2007).

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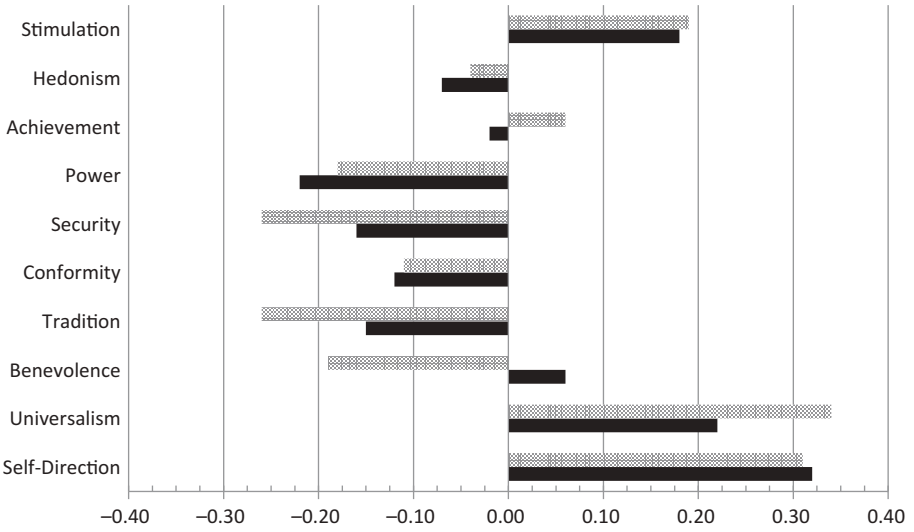

Figure 17.1 *Partial correlations (removing average-value rating) of Schwartz values clusters with creative accomplishments (shaded bars) and creative products (dark bars). Products are the average of standardized photo essays, drawings, and creative stories. For products and accomplishments, correlations exceeding ±.3 are significant at* $p < 0.001$. *For accomplishments, correlations of ±.12 are significant at* $p < 0.05$ *(*$N = 278$*). For products, correlations of ±.17 are significant at* $p < 0.05$ *(*$N = 134$*).*

Considering items not included in a composite, we found that both creativity measures correlated negatively with *social recognition* and *healthy*. Creative products also correlated with *inner harmony*. Finally, the single-value item *creativity* was a significant predictor of both creative accomplishments and products, suggesting that one of the first components of the creative personality is simply the desire to create (cf. Barron 1997; Helson 1996).

Although the Schwartz model applies to a range of abstract values, political values represent a topic of particular interest. Dollinger (2007) noted that a negative relationship is assumed between creativity and political conservatism across a range of academic disciplines (e.g., clothing design, crime and corrections, elementary education, data analysis, information technology, and management). Little evidence has documented this association. However, an early study showed that more conservative people disliked complex artforms, preferring simple representational art (Wilson, Ausman, & Mathews 1973; see also Feist & Brady 2004). Dollinger (2007) used a short conservatism scale (Henningham 1996) in which participants made judgments on 12 hot-button issues (e.g., "favor, oppose, no opinion" on gay rights or legalized abortion). Correlational and regression analyses showed that conservatives were indeed less creative on the CBI and drawing products. However, the significant negative correlation with individuality/richness became nonsignificant when openness and vocabulary were included in the regression analysis. Qualitatively, the photo essays of conservatives conveyed a wholesome family-oriented quality

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along with expressions of religiosity, pride in past military service, and satisfaction with life. More liberal students depicted their love of art, music, and writing as well as boundary-crossing activities (e.g., substance use and parking "over the lines" to display a disdain for rules).

The findings of Dollinger (2007) were replicated in an impressive macro-level study by McCann (2011) using state-level patents granted and political poll results. He found that more patents were granted in states where the population scored as less conservative. Several factors may contribute to the conservatism–creativity association. Those who are threatened by uncertainty may focus on lower-order needs such as security. Second, conservatives value conformity and tradition, which would tend to be incompatible with the (by definition) focus on what is novel. Third, the authoritarian elements of the construct might lead conservatives to devalue imagination. All these possibilities deserve further investigation.

Values were also considered in the seven-year follow-up study (Dollinger 2006). Along with open-ended questions about creative accomplishments, participants rated 15 work values that they might desire or value in their jobs. Individuality/richness predicted four work values measured years later, one of which was positive and predicted: *creativity* (*being able to design new products, develop new ideas,* or *invent new things*). Individuality/richness also correlated negatively with *supervisory relations* (*working under* or *getting along with a fair supervisor*), *surroundings* (*pleasant work environment*), and *economic returns* (*salary*). However, the value *aesthetics (doing work that contributes to the beauty of the world*) had a nonsignificant correlation.

In sum, it seems clear that individualistic persons hold to values that promote their creativity and imagination, and they oppose values that constrain that freedom or demand conformity to the normative. Moreover, they seem less concerned with economic reward and security but are focused on "internal" values such as inner harmony and wisdom.

Additional Findings Characterizing Individuality

Age Differences

Autophotographic individuality can be seen not only as related to creativity but also as a kind of self-representation that varies across the lifespan (Labouvie-Vief et al. 1995). Using writing samples, Labouvie-Vief and colleagues have shown that the self becomes more unique, individualistic, and complex with age. Such complexity is evident in roles, traits, interpersonal relations, activities, interests, and physical descriptions. Based on this conceptualization, we studied age trends in individuality/richness, pooling data across six samples (Dollinger & Clancy Dollinger 2003). Older participants represented themselves in more individualistic ways in the photo essay (see Figure 17.2). Orthogonal contrasts comparing each age group to all older groups showed that the

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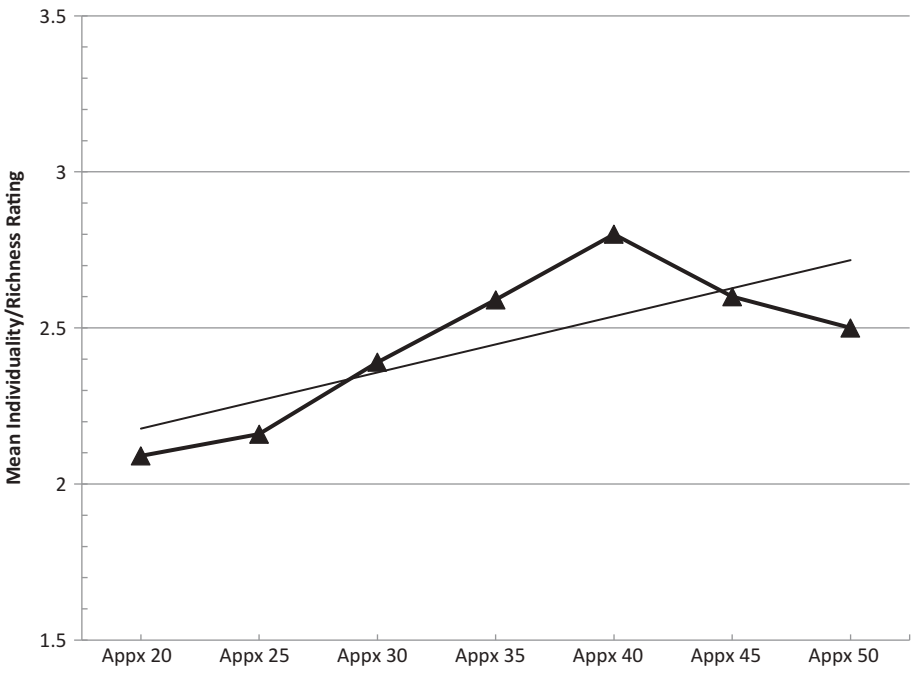

Figure 17.2 *Mean individuality/richness as a function of age. Appx 20 = 18–22 years (*N *= 603). Appx 25 = 23–27 (*N *= 146). Appx 30 = 28–32 (*N *= 35). Appx 35 = 33–37 (*N *= 19). Appx 40 = 38–42 (*N *= 22). Appx 45 = 43–47 (*N *= 11). Appx 50 = 48–54 (*N *= 7). The individuality/richness rating could range from 1 to 5, with 2 labeled as "typical."*

first two were significant, indicating the greatest change in individuality after the twenties. (The slight drop from the forties to fifties was not significant.) Five content codes also increased with age: work, achievement, creative activity, religion, and use of black-and-white photographs; two codes decreased: self-smiling and alcohol. Pooling across 13 samples of data collected after that publication, the age trend was replicated, albeit smaller in magnitude ($r = 0.09$, $p < 0.001$, $N = 1{,}310$). In short, it does appear that cohorts become more individualistic with age.

Self-Esteem, Therapy, and Relationships

As noted earlier, past history of abusive treatment and neuroticism have been correlates of individuality/richness. Similarly, individualistic students appear to have lower self-esteem than their more conventional peers (Dollinger et al. 1996). Based on these findings and work comparing counseling center clientele with control students (Combs & Ziller 1977), we examined individuality/richness in relation to loneliness or to having experienced therapy (Dollinger, Cook, & Robinson 1999a). Two samples showed that the greater the individuality/richness, the more likely students were to have sought personal therapy.

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Additionally, in separate samples, individuality correlated with loneliness and with feelings of alienation. However, individualistic students were not particularly shy or anxious. Thus some individualistic students may be disconnected from others. However, they appear to have a readiness to engage in the self-exploration entailed in counseling.

Cook (1996) further explored the relationships of individualistic and conventional college students using the Inclusion of Other in Self scale (IOS) (Aron, Aron, & Smollan 1992). Cook predicted a negative association between individuality/richness ratings and being in a romantic relationship; in fact, she found a nonsignificant one ($r = –0.06$). However, using Aron's Circles of Closeness measure, she found that – for those in a romantic relationship – greater individuality was associated with less overlap between self and other ($r = –0.43$, $p < 0.001$, $N = 67$). Thus individualists viewed greater individuation within their romantic relationships, but they were no less likely to have formed romantic attachments.

Psychological-Mindedness

One other set of unpublished findings suggests that individualists are more psychologically minded. Participants with photo essays also completed a set of 15 self-ratings, notably the critical item *psychological-mindedness*. Participants also took the Word Association Implications Test, a task measuring "reading between the lines" of word associations, and they read descriptions of 10 psychological experiments, rating their willingness to volunteer for each (the score was the average of all 10, with Cronbach $\alpha = 0.76$). All three of these measures correlated with individuality/richness (respectively, $r = 0.31$, $p = 0.01$; $r = 0.21$, $p = 0.07$; and $r = 0.23$, $p = 0.05$, $N = 76$).

Narcissism

One critique of the individuality concept might be that it promotes self-absorption. To test this, in one sample I included an abbreviated narcissism scale (Ames, Rose, & Anderson 2006) among the questionnaire predictors. Not only was narcissism not a positive correlate of individuality, in fact it was marginally negatively related ($r = –0.20$, $p = 0.08$, $N = 76$).

Conclusions

As noted at the start of this chapter, the concept of individuality was initially recognized as characterizing unusually rich college student photo essays but was then grounded in a set of related personality conceptualizations focused on people who are eccentrics, oddballs, or just highly open to experience. This review shows that openness to experience has been a consistent and usually the largest correlate of individuality/richness. Openness is not the only Big Five

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correlate; depending on the study, neuroticism, agreeableness, and low extraversion also play a part. Furthermore, different aspects of openness characterize the individualist. I suggest four themes that run across the many correlates: (1) an inquiring intellect, (2) the valuing of creativity and desire to be creative, (3) social alienation or disconnection, and (4) maturity and interiority.

First, a consistent correlate of individuality/richness is verbal ability, originally a secondary focus in this line of research. Inquiring intellect has shown up in correlates such as trait curiosity, need for cognition, investigative vocational interests, breadth of cognitive interests, reading interests, and college admission test scores, as well as in measures directly based on the photo essays, such as *cognitive* word use. In some ways, it appears that individuality is better expressed in what participants write about their photographs than the photographs themselves. These correlates fit with and expand the meaning of the intellectual aspect of openness.

Also reflecting openness, a second theme is the desire to be unique, self-directed, and creative and simultaneously to disdain conformity to norms. Those who devise individualistic photo essays produce more creative drawings and other products and report more creative accomplishments – both while in college and seven years later. Individualists also imagine their futures as including culturally diverse experiences that may promote their own creativity and help them to appreciate that of others. The findings for creative products were not as consistent as for intellectual and values correlates. Perhaps the cross-domain consistency of creativity derives in part from the common association of various creative products with openness.

A third theme is that of negative emotion and relationships. Individualists report lower self-esteem and greater loneliness and alienation than more conventional peers. Although they seem as likely as peers to be in romantic relationships, individualists define their relationships less in terms of fusion or overlap with the partner and more as separate equals. In thinking of identity development, individualists tend not to follow the guidance of family or peers, nor do they focus on social or collective identity. Within their photo essays, individualists make fewer references to friends and have fewer photographs showing social connection (e.g., people touching). Individuality/richness has also correlated in several studies with negative life experiences, particularly of an abusive nature, and greater expectations of emotionally distressing or physically threatening events in their imagined futures. Devaluing *recognition*, individualists are not particularly self-promoting and years later tend to devalue the importance of relationships with work supervisors. Together these correlates seem to fit with the early studies connecting individuality with introversion and show individualists striving to find their own life paths, consistent with the meaning of the concept *individuality*.

Fourth, as suggested by the conceptualizations of Loevinger and Labouvie-Vief, maturity and interiority seem to be involved in individuality. Across different studies, individuality/richness ratings correlated with ego development, with age, with vivid recall of dreams, and with mature values (in an

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earlier version of Schwartz's model). In terms of individual values, individuality correlated with a contemporaneous valuing of *wisdom* and the tendency not to value extrinsic rewards at work seven years after doing the photo essay. Moreover, a strong element of interiority is suggested. Within their photo essays, individualists' word use reflects insight and tentativeness plus metaphysical themes such as death and dying rather than leisure interests. Those who devise rich photo essays reject superficial identity concepts as self-defining and focus on inner aspects. They present more vivid dreams, seem to be more psychologically minded, and are more likely to have experienced therapy. Their reading interests are more intellectual as opposed to focusing on sports or romance and sexuality. In general, individualistic young adults have a more serious approach to their current lifestyle, reflected in their greater investment of time in study and their lower likelihood of depicting alcohol within photo essays. Taken together, this set of correlates suggests considerable maturity and inner direction to those who devise richer photo essays.

Methodological Factors in Autophotography Research

Like any research tool, the autophotographic method has weaknesses, including at least five things. A first issue is that of volunteer bias. Whereas Ziller gave disposable cameras to volunteers, my program has depended on college students, and typically about half are willing to participate. Probably they are more conscientious than the typical nonvolunteer because those who do any kind of extra credit score higher on conscientiousness (Dollinger, Matyja, & Huber 2008). The sharing of photographs in this context is an unusual experience and may depend on trust between participant and psychologist. Unpublished data suggested, however, that very few students considered their photographs to be too personal to share; instead, they claimed to have run short on time for extra-credit activities. Another limitation draws from Milgram's initial speculations on the social psychology of camera use (Milgram 1977). For some participants, the photograph-taking process may involve feelings of embarrassment or not wanting to be intrusive in their photograph taking; of course, these may be less the case in the era of selfies. Photographic essays are potentially time-consuming to devise, and they cannot easily be repeated for short-term longitudinal study. Another weakness is the issue of cognitive limitations, for example, the student who "couldn't figure out how to show that I am religious" or making the claim "I didn't think to include my religion but had I thought about it, I would have included this." There are also issues of range restriction on content codes. Finally, like projective tests, this method does not yield the strong correlations that are sometimes found when questionnaires are correlated with other questionnaires. Perhaps magnitudes of effect could increase by using more photographs and raters.

Nevertheless, the autophotographic method has a number of strengths. First, this method conveys an inherent respect for each person's uniqueness; it can illustrate the sense of pride and ownership of the participant in what is shown

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(akin to a creative product) that is unlike any response on a Scantron form or keyboard click. Unlike questionnaire methods, photo essays can elicit enthusiasm in participants and, for some, insight or empowerment. Photographic essays include many kinds of richness – the power of visual images to elicit memories and self-reflections, potential for depicting metaphors and traits, the cross-cultural and across-age applicability, and the potential for focusing on quantitative or qualitative and verbal or nonverbal aspects of the product. Finally, the technique seems rich because of the wide variety of correlates that this review has summarized.

Future Directions

I suggest three directions for continued study within social, personality, and clinical psychology. First, the links between autophotographic individuality and self-presentation in social network and personal websites might be profitably explored. A number of person-perception studies suggest that traits (e.g., extraversion) can be accurately inferred from people's online self-depictions, which typically include photographs (Back et al. 2010; Marcus, Machilek, & Schütz 2006). Like photo essays, social network sites may include sexualized photographs or depictions of substance use – sometimes to a problematic degree (Karl, Peluchette, & Schlaegel 2010). All contain information about social lives, cultural preferences, likes and dislikes, and silly content (Ivcevic & Ambady 2013). Moreover, they share similar issues regarding privacy (Christofides, Muise, & Desmarais 2009). It would be particularly interesting to view the online identities of highly individualistic young adults; they will likely include images of their creativity and breadth of interests. In contrast, more conventional socially focused young adults are likely to present repetitive and formulaic content. The present findings also suggest that within social network sites, what people write about photographs may be more telling than the photographs themselves.

Longitudinal research should be directed toward understanding the development of family, peer, and romantic relationships of young adults who differ in individuality/richness. Based on this review, notable research questions include the following: Does individuality "grow" following relationship disruptions such as abusive experiences or childhood unhappiness? Are there normative and nonnormative life experiences that might promote individuality? What are the long-term life experiences of participants differing in individuality? Although difficult to do, obtaining multiple photo essays over time would afford cross-lagged panel analyses implicating the causal priority of the aesthetic, intellective, and social factors that link to individuality.

Cross-cultural studies of participants and raters might help to appraise whether the present findings are limited to students from Western and individualistic groups. Some recent findings suggest that individualism rather than collectivism contributes to creativity (Rinne, Steel, & Fairweather 2013; Yao et al. 2012). My own pilot efforts yielded nonsignificant results, but we noted

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that some aspects of individualism – illustrated by the item "winning is everything" – are incompatible with the individuality depicted in the highest-rated photo essays. Cross-cultural studies will be instructive but also challenging because the consensual assessment method was used in the initial operationalization of individuality.

Autophotography has a rich potential for qualitative and quantitative analysis that will contribute to its continued use as a tool in the study of creativity. It has already revealed a number of insights about individualistic people's intellective qualities, creativity and values, social alienation, and interiority. But is auto photography really much more than a set of selfies? Obviously, this rhetorical claim is based on my own biased perception of selfies and those of the writers who inform my view. If selfies are included in photo essays – selfies as they are usually portrayed in the media – they would likely result in a low score on individuality/richness. Of course, this could be reframed as an empirical question by asking participants to include one selfie in their photo essays and see what creative, nonconforming, or unique interpretations are generated by the individualists. Reflecting on the thousands of photo essays viewed over two decades, often with a feeling of privilege to peer deeply into the personalities of unique individuals, I have to again quote Robert Ziller (1990/2000, p. 147), who closed his seminal work with the observation, "This research has been exhilarating!"

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18 Can Teams Have a Creative Personality?

Robert C. Litchfield, Lucy L. Gilson, and Christina E. Shalley

Personality has long been recognized as influential for the creative performance of individuals' (Mumford & Gustafson 1988). As teams have become more recognized as central to creative work (Gilson et al. 2015), researchers have begun to theorize what personality at the team level can mean with regard to creativity (e.g., Baer et al. 2008; Robert & Cheung 2010). In particular, discussions have started to consider how the profile of personality traits within a team might affect both the creativity of individuals within the team and the team as a collective unit. However, to date, only a limited number of studies have considered the relationship between personality and team creativity (Reiter-Palmon, Wigert, & Vreede 2012), suggesting that the time is right for some elaboration of what we mean when we talk about *team personality* and *creativity*. In this chapter we start with a discussion of the concept of team personality and then consider how productive conceptualizations of team personality might vary depending on the degree to which the level of creativity studied is individual or collective. We use the commonly accepted definition of *creativity* from the organizational creativity literature (e.g., Amabile 1988; George 2007; Shalley 1991; Zhou and Shalley 2011), which states that creativity is the production of novel and appropriate ideas, processes, products, or solutions. Finally, we close with a discussion of future directions for incorporating team personality into the study of creativity.

Even taking creativity out of the equation, the concept of *team personality* introduces substantial complexity over and above that of individual personality. The debate over what is meant by a team personality construct is not new (for reviews, see Barry & Stewart 1997; Peeters et al. 2006). Complicating this landscape is the argument that for a single trait, the overall level of the trait within a team, its distribution across individuals, or both might differentially affect creativity and/or other team outcomes. Furthermore, the presence of multiple traits that might be contradictory when possessed by a single individual can, in a team, lead to interesting combinatorial between-person effects (e.g., the presence of creative and at the same time conformist tendencies) (Miron-Spektor, Erez, & Naveh 2011). Yet, just as the traits required for routine versus creative performance have been found to differ (cf. Barrick & Mount 1991; Shalley, Zhou, & Oldham 2004), team personality profiles for routine performance are not necessarily informative for creative performance.

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In this chapter we provide some initial observations about team personality and creativity that we hope will serve as a starting point to further this conversation. We start by discussing composition and compilation models of team personality and some extant empirical research focused on creativity. In particular, we focus on the well-accepted Big Five (Barrick & Mount 1991) personality framework because it represents a general trait approach that has received some attention in the creativity literature. We also briefly consider additional traits that have been examined in conjunction with creativity (i.e., creative personality and cognitive style). Our understanding of how the Big Five, along with creative personality and cognitive style, affect creativity at the team level should be of interest to researchers as they seek to develop a set of directions to guide future theoretical and empirical work in this domain. Ultimately, we suggest that team personality is a fertile area for future research with regard to both individual creativity within teams and team creativity as a collective phenomenon. We hope to inspire others to explore this exciting, albeit complex, frontier of creativity research.

What Is Team Personality?

Composition variables have a long history in team research (e.g., Hackman & Morris 1975) and have received some, although not much, consideration in team creativity research (for reviews, see Gilson et al. 2015; Reiter-Palmon et al. 2012). The term *team personality* refers to the level and/or distribution of individual personality traits among individual team members (e.g., Bell 2007; Bradley et al. 2012; for review and meta-analysis, see Peeters et al. 2006). Although there have been many debates about how to best represent individual personality, team personality is perhaps even more complicated because in addition to the variety of different personality traits, there are also a number of different aggregation mechanisms that can be used to examine how these traits are constructed at the team level. For example, consider a team-level aggregation of the trait *extraversion*. Extraversion captures individual inclinations toward being enthusiastic, assertive, energetic, and action oriented and has been associated with divergent thinking (McCrae 1987). At the individual level, there is support for a positive association between extraversion and creativity (e.g., Barron & Harrington 1981; Feist 1998; McCrae 1987). At the team level, a team's level of extraversion can be considered as an average of all the individual members' ratings of their individual levels of extraversion. However, team extraversion also might be the variance among team members on this trait. Alternatively, the level of extraversion possessed by the highest-scoring individual member also can be used as the team score if having at least one member who scores highly on this trait is enough for the team to act accordingly. Lastly, the level of extraversion of the lowest-scoring individual member could be used as the team score if it is important to not have any member that is very low on extraversion in order

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for the team to be creative. Clearly, each of these different team-level constructions of the trait may result in a different rating. Before moving to how to measure team personality, we first unpack reports of team-level Big Five traits in studies of creativity as a starting point for considering the complexity of team personality.

Team-Level Big Five Traits and Creativity

The so-called Big Five personality traits (i.e., extraversion, neuroticism, agreeableness, conscientiousness, and openness to experience) have been regarded for some time as an important organizing framework for describing individual personality at a broad level (Barrick & Mount 1991). While team-level personality research has often used the Big Five (e.g., Peeters et al. 2006), this research has tended not to consider creativity. Indeed, at the team level of analysis, we found only five prior studies examining Big Five traits and creativity-related outcomes. Hence, despite its popularity in general, the Big Five has received limited attention with regard to creativity at the team level. In what follows we detail the findings from each of these five studies.

First, a study by Bolin and Neuman (2006) examined the impact of all Big Five traits on performance in interactive brainstorming groups. In this work, creativity was ascertained using two classic idea-generation tasks. While the authors hoped to unpack the effect of personality on brainstorming performance through process mediators found in the brainstorming literature (i.e., social loafing, production blocking, and evaluation apprehension), they instead found almost no support for their hypotheses and observed only slight evidence that any of the Big Five traits were associated with overall brainstorming performance. Although the completeness of the group-level trait reporting is to be commended (i.e., the authors examined mean, variance, minimum, and maximum trait levels), this study's insights are perhaps limited by the research sample. Specifically, the study used one-off student groups in a laboratory context where the benefits of team-level personality probably did not have time to emerge (i.e., the total time for the two brainstorming tasks was only 20 minutes). In other words, the task was a "simple" brainstorming task with no end product beyond the sample of ideas generated. Furthermore, there was little need for participants to interact with each other to leverage any team-level personality trait, nor was there any incentive to do so. Finally, it should be noted that the researchers measured components of creativity (e.g., originality, feasibility, and effectiveness) and then averaged them to form ratings of "idea quality." Similar strategies often have been used in the brainstorming literature (for review, see Reinig, Briggs, & Nunamaker 2007); however, averaged idea-quality measures are far less common in the organizational creativity literature, where a more holistic measure of overall creativity is most often applied.

A second paper by Baer and colleagues (2008) also examined all the Big Five traits. In this study, 147 student teams completed personality inventories and then engaged in a total of eight different idea-generation tasks during two

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one-hour sessions covering human resource problems (session 1) and product-development problems (session 2). Similar to those of Bolin and Neuman (2006), the results here suggest no significant correlations between the Big Five traits and creativity during either session. However, Baer and colleagues also hypothesized that trait effects on the second set of tasks would depend on the level of creative confidence developed by the team, as assessed after completion of the first set of tasks, and it is here that they found several potentially interesting effects. Specifically, they found that when team creative confidence was high after completion of the first set of tasks, having more members high on extraversion resulted in higher levels of team creativity on the second-session tasks. In contrast, when team creative confidence was low after completion of the first set of tasks, having only one member high in extraversion was associated with higher team creativity, but having more members high on extraversion was associated with lower team creativity (i.e., a curvilinear relationship). Likewise, having more members high on openness to experience led quadratically to higher team creativity in the second session, but again only when team creative confidence was high after the first session. Finally, having more members low on conscientiousness led to higher creativity in the second session for teams with high, but not low, creative confidence after completion of the first session. No results were found for neuroticism or agreeableness. Taken together, these results suggest that team personality effects for creativity might be quite complex. Although the authors did not pursue this line of investigation, the study by Baer and colleagues (2008) opens the possibility of multiple simultaneous effects of team-level traits.

Moving to our third paper, we find the first examination of a single Big Five trait, *conscientiousness*. Here Robert and Cheung (2010) focused on team-level conscientiousness in two studies that engaged ad hoc student teams in a slightly more in-depth task requiring the development of rudimentary marketing plans for novel products. In the first study, team-level conscientiousness, operationalized as either the mean (i.e., composition) or minimum score within the group (i.e., compilation), negatively affected team creative performance. That is, similar to the results found by Baer and colleagues (2008), *lower* aggregate conscientiousness resulted in *higher* creativity. It should be noted that in this work, team-level means of extraversion and openness to experience were collected as control variables and were found to be unrelated to creative performance. Robert and Cheung (2010) also hypothesized a mechanism for the effects of team-level conscientiousness, suggesting that it would influence creativity by decreasing idea and information sharing, which they expected to positively relate to creative performance. Additionally, they suggested that team-level conscientiousness would affect creativity by increasing the use of systematic task processes, which they expected to negatively relate to creativity. However, they found no evidence that conscientiousness related to either mediator. Furthermore, both idea and information sharing and systematic task processes were positively associated with creative performance.

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In order to unravel the question of how team-level conscientiousness works in more detail, Robert and Cheung (2010) conducted a second study that drew on a trait activation theory perspective, suggesting that traits are most likely to be influential drivers of behavior in situations where they are cued without being either required or prohibited (Tett & Burnett 2003). In this study, the authors proposed that slanting the instructions to favor either a flexible or systematic approach might determine the direction of the effect of team-level conscientiousness on team creativity. Under flexible instructions, they proposed that low conscientiousness would lead to the highest team creativity, as they found in their first study. In contrast, they proposed that high conscientiousness would be more functional to creativity when participants were instructed to take a systematic approach. Therefore, in this work, the researchers manipulated conscientiousness through prescreening by selecting low- and high-conscientiousness participants and assigning them to teams that were uniformly either low or high on the trait. Using a variation on the same marketing-plan task from their first study, the authors found that low-conscientiousness teams performed better under flexible instructions, but there was no significant difference in instruction performance for high-conscientiousness teams. Overall, their two studies suggest that team conscientiousness might display complex relationships with team creativity.

In a fourth study on team-level creativity, Schilpzand, Herold, and Shalley (2011) examined openness to experience using 31 graduate student project teams engaged in a semester-long graded project. Although the number of teams studied is modest, an advantage of the design is that it allows substantial time for trait effects to emerge. Participants completed a measure of openness to experience at the beginning of the term and then participated in a project over the course of the semester to develop a creative product or service to meet a market problem or opportunity. Fellow students rated the creativity of team presentations about their developed creative products or services at the end of the course. Unpacking the potential ways in which team-level openness to experience might affect team creativity, the researchers tested both mean and variation effects. Similar to Bolin and Neuman (2006), Baer and colleagues (2008), and Robert and Cheung (2010), Schilpzand and colleagues (2011) found that the overall mean for team openness to experience was unrelated to team creativity. However, they found that variation in team-level openness to experience matters for creativity and that particular benefits were observed when teams possessed at least one member who was very low on openness to experience. This effect was unexpected, but the authors conjectured that teams need to have some members who are, at the very least, moderate on openness to experience in order to be able to generate a number of ideas but also have at least one member who is low on openness in order to help the team evaluate their ideas as to feasibility and reach convergence on the best idea to pursue. Furthermore, they suggested that if a member is too high on openness, this might lead the team to focus too much on divergent thinking, solely the novelty component of creativity, and thus fail to spend adequate time on critically evaluating the usefulness of the ideas generated.

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Finally, and most recently, Hunter and Cushenbery (2014) studied the relationship between team agreeableness and team creativity. Although much of their research was at the individual level of analysis, the authors found some evidence in a laboratory experiment with psychology subject pool students as participants that group agreeableness may be negatively associated with aspects of group creativity under certain conditions. Specifically, these researchers found that for teams low in mean agreeableness, disagreeable individuals' contributions were used more frequently.

Overall, it appears to us that reviewing this prior work reveals at least four key insights. First, team-level personality traits can have effects that are very different from what is expected based solely on prior research at the individual level. To take the most obvious example, at the individual level, there is a significant positive association between openness to experience and individual creativity. This relationship is both theoretically and empirically clear (e.g., Baer 2010; Barron & Harrington 1981; Feist 1998; McCrae 1987). However, at the team level, none of the extant studies reviewed earlier found such an unqualified relationship. Second, team personality effects on creativity do not necessarily parallel those observed for routine performance. For instance, low conscientiousness seems to have an association with team creativity (Baer et al. 2008; Robert & Cheung 2010), whereas high conscientiousness is associated with routine performance (Peeters et al. 2006). Third, results to date must be regarded as extremely tentative. For instance, the study by Schilpzand and colleagues (2011) offers a seemingly clean empirical finding, but we note that they sampled only 31 student teams. Furthermore, they found essentially that the presence of team members *low* in openness could be beneficial for team creativity. In contrast, Baer and colleagues (2008) found that low-openness members were associated with either no or negative effects on team creativity depending on creative confidence. Fourth, none of the existing studies was guided by "strong theory" because no such theory exists at present for how team-level personality should affect creativity. In order to aid future researchers in the absence of such strong theory, we turn now to factors that might guide the choice of analytic strategies for considering the relationship between team personality and creativity.

How Do We Ascertain Team Personality?

Personality is inherently an element of team composition in the sense that it involves the attributes of team members and their combination (Mathieu et al. 2014). Somewhat confusingly, however, there are two overarching methods for aggregating individual traits to the team level; these methods are known as *composition* and *compilation* (Kozlowski & Klein 2000; Mathieu et al. 2008). Composition models treat each member of the team as equal and therefore derive a team-level construct that is a result of either a mean or variance in a trait. In comparison, compilation models examine traits in terms of more complex configurations such that, for instance, a single individual with a high

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or low score on a trait might be seen as the defining factor for the team-level construct.

Composition approaches aggregate individual traits into a measure that is in some sense descriptive of the team as a whole. For instance, Somech and Drach-Zahavy (2013) found that healthcare teams with a higher average "creative personality" generated more creative outcomes (i.e., ideas). However, the aggregation need not involve a simple mean of a single trait. For instance, the Baer and colleagues (2008) study reviewed previously considered the impact of the personality mix (across people and traits) on team creativity. This study is interesting, in particular, because it highlights the potential for developing "profiles" of team personality traits that might contribute to creativity.

Compilation approaches differ from composition approaches by moving away from the assumption that all members equally affect the team's processes and performance. Instead, these approaches suggest that even having a single individual with an extreme trait score might exert a strong and disproportionate influence on the overall creativity of the team. In other words, the "relative contribution" of any one team member might make a difference (Mathieu et al. 2014). For example, although not a personality trait study, research on creativity in string quartets has found evidence of a disproportionate role for the second violinist (Murnighan & Conlon 1991). Specifically, the second violinists in successful groups were more accepting of their role than those in less successful quartets.

Underscoring the complexity of team personality, the study by Schilpzand and colleagues (2011) previously reviewed considers the effect of personality (i.e., openness to experience) on team creativity using both a composition (i.e., average and standard deviation) and a compilation approach (i.e., maximum and minimum score). From a composition perspective, these authors found that diversity (i.e., standard deviation) in openness to experience was significantly related to team creativity, yet the average measure (i.e., mean) of team members' openness to experience was not. Moving to a compilation view, Schilpzand and colleagues's (2011) results were counterintuitive in that teams where one or more members had a low openness score produced the most favorable outcomes for team creative idea generation. In their research, Robert and Cheung (2010) found higher average (i.e., composition) conscientiousness related to lower team creativity. However, the presence of as little as a single member (i.e., compilation) with very low conscientiousness improved creativity. The compilation results found by Schilpzand and colleagues (2011) as well as by Robert and Cheung (2010) highlight that having a team member who is low on certain personality factors can be more important for team creativity than having one that is relatively high on the personality characteristic. While this is a counterintuitive finding, it is interesting, particularly because there is some consistency in findings between the two studies. Taken together, such findings indicate that any simple articulation of what team personality "is," at least in the realm of creativity, will remain elusive in the near term.

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Toward a Metaframework for Team Personality and Creativity Research

One way to strengthen theory is to narrow the scope of theorizing (Weick 1989). Given that the Big Five represent a higher-order summary of personality, an analog for such meso-level theorizing in the present domain is to seek out more narrowly tailored traits. Within the broader creativity literature there have been several customized trait measures, such as creative personality and having a cognitive style conducive to creative thinking, that are often considered. Creative personality is typically measured using Gough's Creative Personality Scale (CPS) (Gough 1979), and cognitive style typically is measured using scales developed by either Jabri (1991) or Kirton (1976). In addition to creative personality and cognitive style, there is work that has examined other traits such as *goal orientations* (Dweck 1986) that are considered to be lower in a "trait hierarchy" relative to the Big Five (De Shon & Gillespie 2005). At the team level, researchers have found that the team-level mean of "creative personality" (Somech & Drach-Zahavy 2013) and the interaction of multiple means of "creative personality dimensions" (Mathisen, Martinsen, & Einarsen 2008), as well as learning and proving goal orientations (Gong et al. 2013) are each related to creativity. Hence a possible strategy for future research is to concentrate more effort on these focused traits. Indeed, we heartily recommend such a strategy where appropriate.

But *when* is it appropriate? Despite the logic of focusing on creativity-specific traits, the range of discrepant and surprising results among studies using the Big Five framework suggest that another productive avenue might be to consider more carefully the dependent variable itself (i.e., creativity). Even if creativity is considered as an outcome variable, as it most commonly is in organizational research (Gilson 2008; Mumford 2003; Shalley et al. 2004), there is still much variance to be parsed. For instance, researchers might ask if they are intending to investigate team personality effects on individual creativity or team creativity, and if it is the latter, what is the nature of the team creativity they are examining? A recent review of the team creativity literature reveals that the idea of a creative "outcome" is not necessarily the same thing as a creative "product" (Gilson et al. 2015). Specifically, Gilson and colleagues found that outcome measures of creativity in the organizational literature often confound aspects of persons or teams with those of processes or products (cf. Rhodes 1961). Even in the case of relatively pure measures of creative products, such as ratings of an idea, the degree to which the product is truly a collective one can vary substantially.

Within Table 18.1 we outline three different analytic approaches to team personality based on differing levels of the collectivity of creativity. Beginning with individual creativity, we suggest that team personality in this case forms a kind of climate within which individuals work. Climate research tends to measure climate according to the composition approach, using the mean of team members' views of climate (e.g., Gonzalez-Roma, Fortes-Ferreira, &

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Table 18.1 *High-Potential Approaches to Team Personality Research by the Degree to Which Creativity Is Collective*

Type of creativity/ approach to team personality	Individual creativity	Individual blessed by team (pooled interdependence)	Team creativity = modifications of individual ideas	Collective creativity
Mean trait (climate)	X	X		X
Variance trait		X	X	
Max/min compilation	X		X	X

Peiro 2009; Pirola-Merlo 2010). Accordingly, we propose that this approach might be productive for investigations that aim to explain how team personality leads to the development of a particular team climate that subsequently has an impact on an individual team member's creativity. Given the evidence that an individual's personality traits predict his or her creativity (Shalley et al. 2004), maximum/minimum levels of team-level traits also may be useful if the aim of a research question is to predict when some individual team members may exhibit creativity on the team. Notice, however, that this is more of an individual-level research question (i.e., an individual's traits predicting the same individual's creativity) framed within a team context as opposed to a true team-level personality question. Research shows that individuals' levels of extraversion, agreeableness, and conscientiousness can all positively relate to their expression of creativity-relevant behavior within work teams (Taggar 2002).

Moving to the team level in its most "minimal" form, it is possible to construe team creativity as a pooled phenomenon. That is, the creativity of individuals may in some circumstances *be* team creativity if the group simply takes the collection of individual ideas unaltered. Here again, the mean of a team's trait level might be an informative measure of climate. However, the maximum/minimum level of a trait in the team might be less informative about the creativity of ideas that advance to the team level in this type of team creativity (i.e., pooled interdependence). However, we do see a potential role for trait variance such that groups that contain more variance in creative traits might be hypothesized to be either more or less likely to ultimately be creative. For instance, in the Schilpzand and colleagues (2011) study, diversity in openness to experience was found to positively relate to team creativity. However, when unpacking this variance as a maximum/minimum, the authors found that openness had only a negative relationship with creativity, whereas Baer and colleagues (2008) found that it can have a positive relationship with creativity. Of note here, however, are the differences in the tasks used in these studies, which may help us to further glean some insight into the complexities of team personality and creativity. For example, Schilpzand and colleagues (2011) examined the creativity of a single team product in a semester-long project,

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whereas Baer and colleagues (2008) looked at the creativity of multiple ideas generated in shorter sessions and hence containing more potential for individual ideas to survive unmodified. Furthermore, since the project in the Schilpzand and colleagues (2011) study was graded and represented a significant portion of the teams' overall grade in the course, team members should have been motivated to critically evaluate the ideas generated and their resulting product. As such, we suggest that variance may be of interest when team creativity is a pooled measure.

Many instances of team creativity are probably of the type where a team modifies the ideas that were originally generated by one of its individual members. Indeed, most organizational creativity theory suggests this sort of upward aggregation (e.g., Amabile 1988; Ford & Sullivan 2004; Glynn 1996; Woodman, Sawyer, & Griffin 1993) occurs often. Essentially, individual ideas are pooled, and the team screens and selects some to continue developing and refining (Gilson et al. 2005). Given the paucity of results for group-level means of Big Five traits on team-level creativity, researchers will certainly want to investigate variance and compilation approaches for team creativity. One potentially interesting theoretical platform might be to examine the nature of the contextual triggers for creativity. For instance, Robert and Cheung's (2010) use of a trait activation theory lens suggests that team-level personality effects might be observed in contexts where trait expression is cued but neither demanded nor prohibited. Given the ambiguity inherent in many real-world team environments, where creativity is required by the job or demanded by the role or organization, variance in traits might be a good place to start looking for such effects because teams with greater trait variance might be more likely to contain a member whose creativity will be triggered by an ambiguous context.

Finally, the idea of a true *collective creativity*, where "the locus of creative problem solving shifts, at times, from the individual to the interactions of a collective" (Hargadon & Bechky, 2006, p. 484), has been a source of both interest and controversy in part because people feel more creative in a group and in part because prior research has found that this feeling is often misleading (Paulus et al. 1993). In addition, it is also difficult to empirically identify moments of true collective ideation (cf., Hargadon & Bechky 2006; Harvey 2014; Weick 1998; Zack 2000). Highly controlled research on brainstorming has established that individuals will sometimes combine ideas in more creative ways than groups (Kohn, Paulus, & Choi 2011), but the complexity, number of controls, and artificiality of the procedures used in this type of research cast doubt on the degree to which such practices are actually likely to be of value or applied in organizational contexts. A fundamental attraction of the concept of collective creativity is that it represents a seemingly clear example of the group's value as a whole exceeding the sum of its parts by achieving a shared understanding that melds multiple perspectives (Harvey 2014). Although this idea of variance presumes that at least some knowledge diversity would benefit collective creativity, an open question from the view of personality is whether shared understandings that facilitate collective creativity are more likely to involve similarities or differences in team personality.

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One reason to think that a mean-composition approach to team-level personality traits might explain collective creativity is that this form of creativity has been posited to require collective attention (Harvey 2014), and such focusing might benefit from people who are similarly oriented at each stage of the creative process. That is, when it is time to generate ideas, perhaps a team with a higher mean openness to experience will be more successful in divergent thinking. Extant team research offers some support for the view that when team environments are highly collaborative, higher mean levels of team personality traits are more positive for performance (Peeters et al. 2006). Currently, empirical research is needed to examine whether this is true for collective creativity.

Although mean approaches to understanding team personality's role in collective creativity may prove valuable, there are many reasons to doubt the assumption that team members' characteristics are of equal importance, especially given the temporal nature of team activity (Mathieu et al. 2014) and the unpacking of creativity (Gilson et al. 2014). Compilation approaches might be particularly useful to track profiles of traits that provide the best mix across different stages of the creative process. For instance, while higher mean openness to experience may be good for the divergence of the teams' ideas, in order to successfully complete this process, the team also must reach convergence in evaluating and selecting ideas for further development. It is not clear that having all members relatively high on openness to experience will facilitate the team's convergence of ideas, and it might be that like Schilpzand and colleagues' (2011) findings, having someone low on openness will in fact aid with closure. Relatedly, research has found that the presence of members low in conscientiousness can aid team creativity (Baer et al. 2008; Robert & Cheung 2010), but neither of these studies required participants to engage in selection processes to winnow down their ideas. Since creativity includes both idea generation and idea selection, with the selection of a final idea requiring some degree of evaluation of the ideas, potentially combining and recombining them (e.g., Amabile 1988), these studies do not tell us much about such activities. Therefore, future work is needed in this area. For now, given the important role of conscientiousness in work life (Barrick & Mount 1991), it seems premature to suggest that eliminating it from creative groups is a good idea!

Conclusion and Future Research Directions

Can teams have a creative personality? Our review suggests that this question may be more complex than it first appears. Given the small volume of existing research, it is far from clear how best to incorporate team personality into creativity research. We have suggested that a productive approach to developing insight into this area involves researchers considering the degree to which they are studying creativity as an individual versus a collective phenomenon. However, as we have alluded to already, future research also should consider the temporal nature of creativity. We do not pretend that this task

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will be straightforward, since there is ample evidence that team composition (Mathieu et al. 2014) and creativity (Gilson et al. 2014) each involves substantial temporal complexity. Hence any attempt to comprehensively cross-index the two is formidable and certainly beyond the scope of this chapter. Yet we hope that our framework will be of use to researchers precisely because of its relative simplicity as a starting point for considering what to do with regard to team personality and creativity. We believe that many researchers will recognize that the setting for a particular study favors one of the conceptualizations listed in Table 18.1 and thus limits the foci of their a priori theorizing. For instance, suppose that one is studying team creativity as the modification of individual ideas, and thus the variance or compilation approach may be indicated. Now, if the subject of the study is further delineated as focusing on the selection stage, wherein the team comes to closure on which ideas will be supported, our comments suggest that a compilation approach focusing on the presence of one or more conscientious members who can bring the process to completion by focusing the team on the goal may be of particular use. However, if idea selection requires consensus from all members of the team, using a composition approach may be best.

Another dimension of creativity that has received increasing attention is the degree to which it is characterized by high versus low novelty (i.e., radical versus incremental creativity) (Gilson & Madjar 2011; Litchfield 2008; Madjar, Greenberg, & Chen 2011). This may be important because both climate (Mainemelis 2010) and collectivity (Harvey 2014) have been explicitly related to the degree of novelty in prior theorizing. One speculation consistent with most views of novelty in general (e.g., Campbell 1960; Kuhn 1970; March 1976; Osborn 1957) is that variance-based approaches (including compilation) will be more predictive of creativity with higher novelty. Future research is needed to examine this in more detail, especially in light of recent suggestions that evolutionary processes might not best describe collective creativity (Harvey 2014).

Additionally, when discussing personality and team creativity, this opens up the possibility that there may be certain profiles or combinatorial effects of members' personality traits that would be more beneficial for creativity. For example, within one team you could have a range of levels of openness to experience. This can be beneficial for the different processes required for creativity to occur (i.e., divergent and convergent thinking) so that members moderate or high on openness may be more proactive in encouraging the team to come up with many new ideas, while those lower in openness may help to push the team to be more critical in evaluating the value of each idea generated and in selecting the best. Similarly, it may be helpful for some teams to have members who are low on conscientiousness because they may not be as focused on executing the task, potentially procrastinating as ideas incubate in their minds, which could facilitate flexibility and divergent thinking. At the same time, it could be helpful to have other team members who are higher on conscientiousness and help to move the team through the stages of the creative process in a timely manner. Here we are thinking about managing the inherent

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tensions that sometimes exist between opposing approaches that also can be beneficial for creativity and innovation (e.g., Gilson et al. 2005; Harrison & Rouse 2014; Ohly, Sonnentag, & Pluntke 2006; Robert & Cheung 2010). For example, earlier work by Gilson and colleagues (2005) found that following standardized procedures improved the impact of engaging in creative processes for customer satisfaction. Harrison and Rouse (2014) found that group interactions that were coordinated by cycling between giving members a lot of autonomy and constraining what they could do enabled the team to function well as a team and, at the same time, be creative in their work. If team members are high on different personality traits that dynamically complement each other, these could lead to a team that is more "ambidextrous" in its work. Note that the opposite also may be true if the traits do not complement one another. Work on exploration and exploitation (e.g., Gupta et al. 2006; He & Wong 2004) grapples with how to manage these two very different processes that can sometimes be complementary while at other times compete with one another.

With regard to explore and exploit, research finds that some organizations are viewed as being more "ambidextrous" in how they are structured and function (e.g., Benner & Tushman 2003), with different units handling one or the other, so that there is some orthogonality (see Gupta et al. [2006] for a discussion of this). We see this approach being used in the customer-service teams surveyed by Gilson and colleagues (2005), who worked to balance creative and standardized work processes. Alternatively, organizations may try to attain balance between the two opposing approaches by using a punctuated equilibrium approach (Burgelman 2002; Gupta et al. 2006). This approach can be illustrated in a team by examining what happened in the Harrison and Rouse (2014) study, where creative teams temporally cycled between two opposing approaches in order to achieve the balance needed to coordinate. Therefore, teams, like organizations, should strive for compositions that have a mix of personality traits that may help to facilitate the team's creativity.

A final promising area for future research is examining the simultaneous effects of multiple personality traits. Such interactive effects have been found, albeit in a single study with a modest sample size, using a creativity-specific trait measure (Mathisen et al. 2008), and the work by Baer and colleagues (2008) highlights the important combination of creative confidence and conscientiousness. It is possible that there are other interesting combinations of personality traits that could be examined. Furthermore, research by Perry-Smith and Shalley (2014) has indicated that at times team members can learn from each other and adopt new ways of thinking about issues from their potentially more creative counterparts. Therefore, also examining whether team members' different cognitive styles interact with their personality traits to affect creativity would be a promising avenue for future research.

In conclusion, this chapter has reviewed the fledgling work already conducted on team personality and creativity. We raised a number of issues for researchers to consider, particularly with regard to how creativity is defined, such as

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collective creativity versus pooling team members' ideas. We also raised some promising areas that are fertile for future research. It is our hope that this chapter will help to stimulate the field to further examine team personality and creativity and at some point potentially discover different profiles of personality traits that may be best for creativity.

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19 The Entrepreneurial Personality

Individual Differences and Social Capital in Work-Related Innovation

Reece Akhtar, Gorkan Ahmetoglu, and Tomas Chamorro-Premuzic

Introduction

In both academia and the popular media, entrepreneurship has received considerable interest of late, given its allure of autonomy, innovation, and ability to produce considerable amounts of wealth and value (Hisrich, Langan-Fox, & Grant 2007). In essence, the startup is the new garage rock band with its promises of fame and fortune. Yet this analogy is sobered by the fact that the majority of startups fail to grow and become sustainable businesses (Shane 2008). In light of this, the question of which entrepreneurial ventures do go on to achieve success and grow exponentially and in what contexts becomes of primary interest. Given that entrepreneurship is a key driver of economic, technological, and social progress, answering these questions has important practical and theoretical implications (Kuratko 2007).

Accordingly, this chapter sets forth the hypothesis that although an individual's *entrepreneurial potential* is critical for success, it can be developed by the moderating influence of social capital. In light of this, we suggest that individual-difference researchers adopt network theory as a viable methodology to both measure and understand how entrepreneurial potential is moderated by social capital and can be manifested at the group level. Specifically, we argue that through the use of social network analysis as a methodology to research entrepreneurial behavior, researchers are able to empirically model *intra-* and *interpersonal* dynamics, both within and between groups and organizations of all sizes (i.e., both startups and established firms).

If this hypothesis is to be discussed, it is important to first clarify what exactly entrepreneurship is and is not. *Entrepreneurship* is most commonly defined as the process of creating and owning a business (Shane 2008); however, this definition has been criticized for being overly narrow and decontextualizing (McKenzie, Ugbah, & Smothers 2007). Hence recent developments have seen broader definitions being attributed to the concept. In particular, entrepreneurship is more widely attributed to any opportunistic behavior (Shane & Venkataraman 2000) that contributes to organizational innovation and growth, and this can include *corporate entrepreneurship* (Kuratko 2007; Thornberry 2001), social welfare (described as *social entrepreneurship*) (Mair & Marti 2006), and technological progress (i.e., inventing and implementing new technologies) (Prodan 2007). More succinctly, *entrepreneurship* has been defined as the

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creation of value through visionary values and opportunistic and innovative behaviors (Hisrich, Peters, & Sheperd 2005).

In this sense, entrepreneurship is a strategic extension of creativity and innovation (Gündogdu 2012). *Creativity* generally can be defined as the creation of novel and useful ideas (e.g., ideas for minor improvements in work processes to major product developments) (Amabile 1996), whereas *innovation* concerns the implementation of such ideas (Mumford & Gustafon 1988). Entrepreneurial behaviors, however, go beyond creativity and innovation to include opportunistic and visionary behaviors. For example, for a social welfare organization to behave entrepreneurially, it could use new innovations, but it could also exploit new opportunities in order to effectively achieve its aim of delivering humanitarian value. Accordingly, entrepreneurial potential is more than just innovative and creative behavioral dispositions; instead, it requires the ability to think ahead, spot opportunities that are yet to be exploited by others, and connect various streams of information to identify hidden avenues that could lead to the creation of value (Ahmetoglu, Leutner, & Chamorro-Premuzic 2011).

Toward an Integration of Social Capital and the Entrepreneurial Individual

The interdisciplinary nature of entrepreneurship has resulted in the literature featuring an array of theoretical and research paradigms. In recent years, researchers have begun to move away from a situational perspective of entrepreneurial success to adopt trait theory (Rauch & Frese 2007). Here the primary focus is on the entrepreneur's skills, abilities, and personal characteristics that are theorized to increase one's ability to successfully engage in entrepreneurship. Yet many still maintain a situational philosophy, whereby the role of social capital is viewed to be the primary source of opportunity recognition and exploitation due to the fact that individuals occupy a specific location within a social network. This social network, in turn, increases the likelihood of entrepreneurial success because of increased social support and shared resources and information (De Carolis & Saparito 2006). Although the two approaches may appear contradictory, we argue that it is logical to view them as complementary, in that individual differences and social capital both influence entrepreneurial success.

An analogous example of this point can be taken from the creativity literature. For instance, J.C. Kaufman and Beghetto's four-C model (2009) distinguishes between everyday creativity (*little-c*) and eminent creativity (*Big-C*) but also describes the genesis of creative insight and interpretation (*mini-c*), alongside the application of creativity in a professional domain through expertise (*Pro-C*). The distinction between various types of creativity (at varying degrees of success and eminence) echoes the broad definition of entrepreneurship; that is, while the popular media portrays entrepreneurs as idols (analogously described as *Big-E*),

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many people have the ability to display entrepreneurial behaviors in many aspects of their lives (i.e., *little-e*). For example, individuals can create new ventures that although they are not truly innovative or original, they successfully exploit a valuable opportunity to serve a particular market. Furthermore, *mini-e* would describe the "latent" entrepreneur – an individual who may internally recognize an innovative and valuable opportunity due to an interaction between his or her dispositional aptitudes and surrounding environment (Plucker, Beghetto, & Dow 2004) yet may require more experience and learning before he or she actually exploits the opportunity. Lastly, *Pro-E* would describe individuals who have gained particular expertise and use it to develop new markets, products, and services while under the employment of another organization. Specifically, while they are able to identify and exploit innovative opportunities, thereby moving beyond little-e, they have not reached the eminence afforded by Big-E (e.g., Steve Jobs, Richard Branson, Jeff Bezos, etc.). A typical example of a Pro-E individual would be a senior product engineer who has played a critical role in developing innovative products and services but is yet to create his or her own disruptive venture. Using J.C. Kaufman and Beghetto's four-C model as a metaphor for entrepreneurship is useful not only because it allows for nuanced definitions, but it also appreciates the various interactions between the individual and the wider environment.

To best test the hypothesis that entrepreneurial success is the result of an interaction between individual differences and social capital, we argue that two popular research methodologies can be combined: *psychometrics* and *social network analysis*. Both techniques have been used extensively to understand entrepreneurial success (Rauch & Frese 2007; Ng & Rieple 2014), yet there are very few studies that demonstrate the moderating effect of social capital (as measured by social networks) on individual potential using real network data. Previous attempts to understand the phenomenon have typically used poorly operationalized variables and have failed to measure an individual's entrepreneurial potential (De Carolis, Litzky, & Eddleston 2009). More specifically, Ng and Rieple (2014) pointed out that although researchers have paid much attention to the outcomes of social networks, there is a paucity of knowledge about exactly *how* networks are leveraged. By combining social network analysis with psychometric data, researchers not only can investigate what role entrepreneurs play within their social network but also can explore how this transposes to performance in entrepreneurial teams and collectives (i.e., startup incubators). Two questions are of particular importance here; first, do successful entrepreneurs and teams have a specific combination of skills and abilities? And second, are there structural differences in their informal social landscape that further contribute to entrepreneurial success? To address these questions, the following sections of this chapter will review the literature on individual differences in entrepreneurial potential to identify the specific traits and abilities needed for entrepreneurial success and then review relevant prominent network theories. Finally, the two streams of research will be integrated into a revised social network theory of entrepreneurial potential.

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The Entrepreneurial Individual

Broad versus Narrow Personality Traits

When attempting to explore the relationship between personality and a given criterion (in this case entrepreneurship), the *five-factor model* (FFM) (Costa & McCrae 1985) is most commonly used. Yet this advantage of the FFM is also a limitation in that its five broad traits obscure the influence of more narrow personality traits (a problem commonly described as the *bandwidth-fidelity problem*) (Hogan & Roberts 1996). When trying to identify what behaviors are most strongly related to entrepreneurial success, the bandwidth-fidelity problem becomes an issue because null findings (and their subsequent impact on the future direction of the field) may be due to measurement issues.

A seminal meta-analysis by Zhao and Siebert (2006) demonstrated that when compared with managers, entrepreneurs displayed lower levels of agreeableness and neuroticism alongside elevated levels of openness and conscientiousness. These findings demonstrate a significant behavioral distinction in that entrepreneurs are more disagreeable and risk taking while being psychologically flexible and dependable. Although these findings demonstrate personality to be an influential construct in predicting entrepreneurial behavior, its moderate effect size (average $r = 0.37$) can be interpreted as an indicator of a lack of specificity in its measurement of personality. Following this, a second meta-analysis carried out by Rauch and Frese (2007) found narrow traits, such as *need for autonomy*, *need for self-achievement*, and *stress tolerance* to also predict entrepreneurial success, albeit with a smaller effect size (average $r = 0.25$). Despite including more specific predictors of the criterion the researchers were trying to predict, the varying effect sizes in both studies do not indicate what are the most predictive traits of entrepreneurial success and whether broad over narrow traits offer incremental validity.

Following these unanswered questions, Leutner and colleagues (2014) tested the incremental validity of broad over narrow traits in the prediction of a broad definition of entrepreneurial success (i.e., technological, corporate, and social entrepreneurship). Alongside a measure of the FFM, Leutner and colleagues used the *Measure of Entrepreneurial Tendencies and Abilities* (META) (Ahmetoglu et al. 2011) – a measure of entrepreneurial potential that operationalizes Hisrich colleagues' (2005) definition of entrepreneurial behavior into four narrow traits: *vision*, *creativity*, *opportunism*, and *proactivity.* Of the five factors, extraversion was found to predict overall entrepreneurial success ($\beta = 0.26$), although a latent entrepreneurial potential factor had an effect size of 0.62. This study clearly illustrates that narrow traits hold incremental validity in predicting entrepreneurial achievements and can be more strongly related to such achievements. Given that similar narrow traits have been found to be susceptible to training and development interventions (Tiernay & Farmer 2011), the

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theory that anybody can engage in, and develop, *everyday* entrepreneurial potential (i.e., the equivalent to little-c) is partially supported by this research.

The Dark and Light Sides of Entrepreneurial Potential

Given the social nature of entrepreneurship, entrepreneurs need to effectively use relationships with peers, customers, and competitors to gain resources, support, and ideas (Chrisman, Bauerschmidt, & Hofer 1998). In light of the fact that personality disorders (e.g., psychopathy and narcissism) have been found to be adaptive in the workplace due to their exploitive interpersonal characteristics (Moscoso & Salgado 2004), it can be asked whether entrepreneurs are also likely to display such "dark" behaviors. The relationship between entrepreneurial success and the display of subclinical psychopathy has long been hypothesized due to the trait's association with dominance, social influence, and political skill (Babiak & Hare 2006). Since the objective of most entrepreneurial ventures is to exploit valuable opportunities, callous and manipulative behaviors are likely to aid the acquisition of resources and ideas. One of the first researchers to explore this relationship was Kets de Vries (1985), who found resentment toward authority, self-centeredness, and exploitative tendencies to be common among entrepreneurs. More recently, Akhtar, Ahmetoglu, and Chamorro-Premuzic (2013) demonstrated that while psychopathy was moderately correlated with entrepreneurial potential (as assessed by META), it was not predictive of overall entrepreneurial success. This finding indicates that although psychopathy is associated with entrepreneurial tendencies, they are not required for entrepreneurial success. This finding is important given that there is a tendency for the media to portray highly successful entrepreneurs and visionaries as antisocial individuals.

The prevalence of antisocial and psychopathic tendencies in entrepreneurial individuals may not in fact represent a "dark side"; rather, it indicates an inhibition toward feelings of anxiety when taking risks, increased feelings of self-assuredness, and a willingness to nonconform to societal norms. This interpretation of the preceding research would suggest that entrepreneurs have higher levels of trait emotional intelligence (TEI) (Petrides & Furnham 2001) and core-self evaluation (CSE) (Judge & Bono 2001), thereby enabling better emotional regulation when under stress and in the face of uncertainty. It can be hypothesized that CSE promotes persistence in entrepreneurial individuals because the construct is related to feelings of self-esteem, locus of control, and self-efficacy (Judge & Bono 2001). Additionally, TEI (i.e., the ability to understand and manage others' and one's own emotions) (Petrides & Furnham 2001) can be expected to aid entrepreneurial success in a similar way that political skill is viewed to aid the acquisition of resources and deployment of social support (Chell & Baines 2000). Accordingly, Ahmetoglu and colleagues (2011) found similar findings as Akhtar and colleagues (2013) – both TEI and CSE were moderately correlated with META scores ($r > .50$). Accordingly, it can be said that although an individual's entrepreneurial potential is largely defined by his

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or her creative, opportunistic, and visionary behaviors and values, effective social strategies are likely to influence other factors that contribute to success. Therefore, individuals looking to become more entrepreneurial should develop their emotional and psychological well-being in order to persist in the face of adversity and seek to use their interpersonal relations as sources of support and creativity.

Cognitive Biases and Expertise

It is evident that narrow personality traits (i.e., opportunistic, innovative, proactive, and desire for change) are predictive of entrepreneurial success and complemented by a variety of sociocognitive traits. What role do cognitive factors play in the pursuit of entrepreneurial success? If entrepreneurial potential depends primarily on personality and personality is a function of one's cognition (Sun & Wilson 2014), the argument that entrepreneurial individuals process information differently can be made, given that a similar phenomenon is also found in creative individuals (Mumford et al. 2006).

Although the relationship between cognitive ability and entrepreneurial success has largely been ignored (despite there being a strong theoretical argument) (Shane & Venkataraman 2000), much effort has been expended in identifying and understanding how entrepreneurs use cognitive biases when making decisions. For example, Busenitz and Barney (1997) found that entrepreneurs were more likely to demonstrate overconfidence and representativeness biases compared to managers, while a meta-analysis by Stewart and Roth (2001) found entrepreneurs to have greater risk propensity when making decisions. These findings provide some evidence toward explaining how exactly entrepreneurs identify and exploit opportunities. In particular, these studies highlight the interactional nature of opportunism: the environment provides information that is subsequently recognized and processed as a function of the individual's cognition. Although the aforementioned research did not take into account personality factors, it is suggested that entrepreneurial success is a result of internal and external factors influencing each other rather than operating in a parallel or additive fashion.

Continuing the aforementioned reasoning of internal and external factors, Read and Sarasvathy (2005) suggest that an individual's knowledge and expertise develop an individual's entrepreneurial potential. This suggestion echoes the inclusive nature of entrepreneurship, as argued previously: entrepreneurs are made not born. It is argued that entrepreneurs are *made* through participating in deliberate practice to develop both their ability to be an effective entrepreneur and gain new knowledge in specialized topics that serve to identify new opportunities. Ericsson, Krampe, and Tesch-Römer (1993) state that deliberate practice is more than simply experiencing an activity a given amount of time; rather, the individual can achieve superior knowledge acquisition and expertise by being intrinsically motivated, dividing complex tasks into manageable objectives (enabling connections between information to be easily recognized),

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seeking specific and immediate feedback, and continually practicing the activity in order to build on existing knowledge and skills. It is therefore suggested that obtaining expertise modifies cognitive processes so that the individual is more able to draw intuitive connections between novel sources of information; this, in turn, enables the recognition of opportunities and the creation of new ideas (Bessant et al. 2012).

Restating the importance of internal and external factors, Shane (2000) suggests that the recognition of valuable opportunities is the result of an interaction between preexisting knowledge and environmental cues. As Shane explains, if all entrepreneurs possessed the same information at the same time, all ventures would be uniform. It is the variability in expertise that influences the entrepreneur's ability to recognize and willingness to pursue an opportunity. In sum, existing internal factors are stimulated and developed by the immediate environment, and it is variations in both internal and external factors that interact to produce originality and the identification of lucrative opportunities.

Social Capital and Network Theory

The dynamic nature of identifying and exploiting opportunities to create value is fundamental to what it means to behave as an entrepreneur (Schroeder, Buckman, & Cardozo 1996). More important, both the identification and the exploitation of such opportunities depend on social factors in that contextual variables determine whether the entrepreneur perceives the opportunity to be lucrative or not (Ardichvili et al. 2003). As Shane and Venkatarman (2000) describe it, entrepreneurship is at the nexus of the presence of valuable opportunities and the presence of enterprising individuals.

Social capital can be described as the reciprocity, trust, respect, friendship, and a willingness to cooperate shared between two or more individuals (Adler & Kwon 2002). It has been theorized that social capital can be further divided into either *bonding* (the influence and exploitation of the social capital within a group) or *bridging* (the influence and exploitation of the social capital held between two or more external parties). Whereas entrepreneurial potential is predominantly a function of personality and is highly predictive of one's likelihood to successfully engage in entrepreneurial activities (Leutner et al. 2014), it can be argued that social capital is an advantageous resource that enables new opportunities to be more readily identified and exploited for one party compared with another. This is due to an increased access to and combinations of unique knowledge and resources alongside acquiring the social influence and support needed to persuade and inspire others (Burt 1992).

Researchers and practitioners can measure the social capital of their staff at both the individual and group levels by using a sociometric technique called *social network analysis* – the quantitative measurement of a set of connected individuals that comes to represent how people are organized and work with each other (Borgatti & Halgin 2011; Wasserman & Faust 1994). Social network

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analysis is a technique that originated in sociology and is increasingly popular among computer and information scientists (Otte & Rousseau 2002). Unfortunately, psychologists, in particular, those who focus on the study of individual differences, have largely ignored the technique despite is ability to quantitatively model both individual and group behaviors. This is important given the method's ability to explore not only how stable psychological constructs are manifested in social interactions but also how they interact with another's personality. To put it plainly, the method allows the simultaneous measurement of *intra-* and *interpersonal* factors (Borgatti & Halgin 2011). Within the context of entrepreneurship, understanding how entrepreneurial potential is expressed and developed in social situations could have positive influences on how entrepreneurial organizations of all sizes and interests manage their staff and structure internal processes.

Within the field of network theory, there are two predominant schools of thought on social capital, both of which explain how ideas are shared between individuals and aid opportunism. Granovetter (1973) proposed a theory called *strength of weak ties* that states that the strength of the relationship between two individuals brings varying levels of information, trust, and reciprocity as a function of the emotion intensity and intimacy shared between individuals. Individuals who hold strong ties with each other are likely to have high levels of trust accompanied by an increased flow of information and resources. Conversely, weak ties are advantageous because they are sources of new information that is not widely circulated among the rest of the social network. Burt (1992, 2004) offers a different perspective with his *structural holes theory.* Burt's theory is not concerned with the strength of the ties between individuals; rather, it is the clusters of individuals that one surrounds themselves with that shapes the behavior and outcomes. According to Burt (2004), an individual who connects two groups of people can be described as filling a structural hole, and that individual subsequently acts as broker between the two groups. Burt states that brokers are well positioned to acquire new ideas because they are able to synthesize the information that is being circulated within the two social groups. Through the connection of different groups, new opportunities and creative ideas are discovered because the broker is able to gain additional resources and perspectives on a given problem. It must be stressed that the aforementioned theories should not be viewed as to be in competition with each other; rather, they are both complementary in understanding the influence of social capital on behavior.

A Revised Social Network Theory of Entrepreneurial Potential

It would be erroneous to claim that we are the first to apply social network analysis to the study of entrepreneurship or to hypothesize that entrepreneurial success and behavior are a result of the additive influences of individual differences and social capital. Although previous attempts have greatly

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contributed to the theoretical understanding of how social capital and individual differences contribute to entrepreneurial success, they are either conceptually flawed, no longer represent recent developments in the psychological literature, or fail to answer exactly how social networks are leveraged (Ng & Rieple 2014). In light of this and the practical need for having a better understanding of the manifestation of entrepreneurial behavior and success (Ng & Rieple 2014), this section will first review existing theories and then propose a revised social network theory of entrepreneurial potential.

One of the most prominent theories was proposed by Ardichvili and colleagues (2003), who argued that entrepreneurial opportunity identification and exploitation were the result of an *entrepreneurial alertness threshold* being exceeded as a product of an individual's social network, as shaped by personality traits and existing knowledge. Specifically, through high levels of creativity and optimism and a combination of specialized and industry knowledge, the individual is able to identify new and valuable opportunities via weak social ties that act as bridges to novel sources of information. Similarly, to exploit opportunities, Ardichvili and colleagues (2003) recommended entrepreneurs to seek out individuals with whom they share strong social ties (i.e., long-term acquaintances and venture partners) in order to secure vital skills, support, and resources. These authors' understanding of both individual differences and social capital as important and complementary factors is commendable, yet it undervalues the role of personality in the identification and exploitation of opportunities. They concluded that "the relationship between opportunity identification and personality traits other than creativity and optimism seems to be weak" (Ardichvili et al. 2003, p. 116), quoting Shaver and Scott (1991), who were unable to find a distinct differentiation in personality profiles when comparing managers and entrepreneurs. In light of the research discussed in Section "The Entrepreneurial Individual", this simply does not reflect current developments in the understanding of entrepreneurial potential as a function of personality (Chell 2008).

A second theoretical model comes from De Carolis and Saparito (2006), who adopted a situationist perspective, suggesting that social capital (as a function of structural holes, weak ties, and cultural values) promotes the use of cognitive biases that, in turn, positively or negatively influences the entrepreneur's risk perception and his or her ability to exploit entrepreneurial opportunities. This theory is valuable in that its hypotheses regarding the value of social capital in promoting entrepreneurial behavior are theoretically congruent with the Granovetter's (1973) and Burt's (2004) theories of social networks. Nonetheless, the psychological study of individual differences (including entrepreneurship) is largely dominated by the trait approach (i.e., stable and internal dispositions) (Sun & Wilson 2014); therefore, it is at odds with De Carolis and Sapartio's (2006) theory that social factors drive internal psychological processes.

When considering the aforementioned theories, it would be unwise to undervalue the contributions they both made, yet, in order to promote better theory and practice, a revised model is needed that takes into account recent developments in understanding the entrepreneurial individual. Accordingly, we adopt

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an interactionist perspective (Woodman, Sawyer, & Griffin 1993) in that we view the relationship between individual differences in entrepreneurial potential (as identified in Section "The Entrepreneurial Individual") and entrepreneurial success to be moderated by social capital. Here individuals who are creative, emotionally resilient, persuasive, visionary, proactive, and opportunistic by nature are more likely to identify and exploit new opportunities as a function of the amount and quality of their social capital. Furthermore, as a way of virtue, social capital positively reinforces and develops the aforementioned personality traits. This perspective suggests that within a given collective (i.e., a team, a startup incubator, an organizational department, etc.), there are naturally varying degrees of entrepreneurial potential among each of its members. As a result, this not only shapes the type and quality of the social interactions they have, both internally and externally (i.e., with other teams and organizations), but also develops entrepreneurial potential through the increase in novel information, resources, and social support that can be found in a given social network.

The proposed model places less emphasis on assuming the causal direction of internal or situational factors than on outcomes. Rather, it is more inclusive because it focuses on the development of entrepreneurial potential by appreciating the interconnectedness of internal and social factors that are integral to the practice of entrepreneurship. As Garavan and O'Cinneide (1994) argued, the psychological attributes needed for entrepreneurial success are stimulated by the nature of the task at hand. In response to Ng and Rieple's (2014) criticisms of the current state of the literature that fail to explain *how* social networks are leveraged in the pursuit of entrepreneurial success, the model has three central hypotheses that address the expression of entrepreneurial behavior at the individual and group levels:

1. The interaction between personality and cognitive ability with weak social ties increases creativity and opportunity identification (Zhou et al. 2009).
2. The interaction between proactivity, leadership qualities, and strong social ties aids the implementation and exploitation of opportunities by producing social cohesiveness, support, and efficacy among entrepreneurial collectives (Hmieleski & Ensley 2007; Hülsheger, Anderson, & Salgado 2009).
3. The political skill common in entrepreneurs drives the individual to seek out and occupy structural holes in order to garner political influence that aids in the acquisition of resources (Akhtar et al. 2013 Krackhardt 1990).

Although we cannot present data that empirically support this model, the following paragraphs further explain the three hypotheses in the context of existing empirical support.

Entrepreneurial Creativity and Opportunity Identification Are the Products of an Interaction between Individual Differences and Weak Social Ties

The importance of environmental factors in opportunity identification and exploitation is clear (for a review, see Ardichvili et al. 2003). Yet the

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heterogeneity in entrepreneurial potential and the types of entrepreneurial ventures pursued suggest that individual differences in the propensity to seek out new and creative opportunities play a crucial role in acquisition of the novel information held by loosely connected acquaintances. It can therefore be hypothesized that entrepreneurial success is an interaction between individual differences in creativity, curiosity, and opportunism and weak social ties (Granovetter 1973).

Social networks have long been used to explain creative and innovative outcomes. For example, a study by Kratzer, Leenders, and Van Engelen (2010) found that product-development teams who held more informational connections with other teams throughout the organization produced more innovative output. Yet few social network studies have included measures of individual differences, while those that do treat such factors as predictors of network positions (Klein et al. 2004). One such study, however, by Zhou and colleagues (2009), explored the interaction between personal values in nonconformity and weak ties in the prediction of creative achievement. Although that authors did not explicitly explore entrepreneurship, given that creativity shares a conceptual overlap with the entrepreneurship, it is useful to note that they found an interaction effect between weak ties and elevated personal values of nonconformity in the prediction of creative achievement. In particular, the relationship between the interaction term and creative outcomes was curvilinear: too many or too few weak ties coupled with a willingness to conform were negatively associated with creative outcomes. Replicating these findings, Baer (2010) found that an individual's creative achievement was positively predicted by a quadratic four-way interaction between an individual's level of openness to experience and his or her social network size, strength, and diversity ($r = 0.67$, $p < 0.01$). Specifically, Baer (2010) found the same curvilinear relationship as Zhou and colleagues (2009), which further supports the hypothesis that creative achievement is positively facilitated by an "optimal" social network and specific individual dispositions. These findings are poignant because they provide some support for the premise that individual differences interact with the constraints of a social network, thereby shaping an individual's social capital and his or her ability to maximize his or her entrepreneurial potential. If researchers were to replicate such studies within the context of corporate entrepreneurship, the practical implications would be of considerable importance when attempting to develop a workforce's or team's entrepreneurial potential.

The Performance of an Entrepreneurial Collective Is the Product of an Interaction between Leadership Styles, Proactivity, and Strong Social Ties

Given that entrepreneurship is a largely social activity that involves two or more individuals (Schumpeter 1934; Venkataraman 1997; Witt 2004), it is hypothesized that highly entrepreneurial individuals need to also play a leadership role in order to promote group motivation and cohesiveness – a statement given more weight in the context of corporate entrepreneurship (Gupta

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et al. 2004). We argue that this is primarily a function of the entrepreneur-as-leader's proactivity to get things done and a vision for change interacting with strong social ties held with key stakeholders and team members (De Carolis & Saparito 2006). It is hypothesized that this fosters trust among team members (Coleman 1988), alongside aiding a greater transfer of knowledge – a construct imperative in opportunity recognition given that the creation of value (i.e., new products, services, technology, etc.) is largely a highly iterative process (Ardichvili et al. 2003).

Although there is a lack of empirical evidence to fully support this, there is evidence to justify our reasoning. For example, a study by Hmieleski and Ensley (2007) found that the performance of new-venture teams was positively related to empowering leadership styles that encouraged informal leadership and autonomy among team members. Furthermore, previous research has found strong ties to be both high and related to performance in new-venture teams (Ruef, Aldrich, & Carter 2003). It can therefore be suggested that leaders who promote autonomy and empowerment among their team members are more likely to benefit from entrepreneurial behavior. This can be further explained as a result of strong social ties, proactivity and vision, building trust, and collective efficacy among team members – all of which are significantly and positively related to innovative output (Hülsheger et al. 2009). As a result, information is more readily shared, alongside the collective being more cohesive, easily managed, and innovative. Put more clearly, the entrepreneurial leader's desire for change and sense of urgency interact with his or her position at the center of the social network in such way that develops the entrepreneurial potential found in each team member. Such a hypothesis explains how entrepreneurs act as technological and social change agents.

The Political Maneuvering Needed to Acquire Resources and Social Influence Is the Product of an Interaction between Individual Differences and Occupying Structural Holes

As described in Section "The Dark and Light Sides of Entrepreneurial Potential", there is evidence to suggest that elevated levels of entrepreneurial potential are also associated with manipulative, exploitative, and superficial tendencies. Although these traits were not predictive of entrepreneurial success, it is hypothesized that they influence the types of social interactions that the entrepreneur holds as way of acquiring resources, ideas, and influence. As a result, such political skill is needed to ensure that entrepreneurs achieve and maintain a competitive advantage. As Burt (2004) describes, occupying structural holes enables the individual to synthesize ideas and resources circulating in both groups that he or she is bridging. Furthermore, in order to persuade others to provide information and resources or publicly endorse a given venture, entrepreneurs need a thorough understanding of who has influence in a given network. In the field of network theory, this is described as a *cognitive social structure* – the accuracy of one's perceptions of the relationships held between

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other individuals (i.e., the individual knows who regards whom as a trusted friend or colleague) (Brands 2013). When trying to access new resources, information, or clients, the ability to accurately understand who holds formal and informal influence with whom can determine the life or death of an entrepreneurial venture (Chrisman et al. 1998). Similarly, this mirrors the Machiavellian nature of some psychopathic traits associated with entrepreneurial potential (Akhtar et al. 2013; Paulhus & Williams 2002). Therefore, within the context of social network theory, it can be suggested that political skill (i.e., Machiavellianism) positively interacts with the likelihood of occupying structural holes alongside having an accurate cognitive representation of the social relationships held between other members of the network (i.e., Brands 2013; Burt, Kilduff, & Tasselli 2013). Together this aids the acquisition of the ideas, resources, and influence needed to implement and develop entrepreneurial ventures.

Although research has not explored the relationship between political maneuvering, entrepreneurship, and social networks, there is one seminal study that provides some support for the current hypothesis. A study by Krackhardt (1990) found that in an entrepreneurial venture, those who were more central to the social network, as well as possessing more accurate cognitive social structures, were rated as being more influential irrespective of their formal position. Although additional research is needed to further explain this relationship and how it adds to entrepreneurial success, not only does it have important implications for how ventures are incubated and funded, but it also points to possible concerns surrounding ethical practices (i.e., ownership of intellectual property) and the implementation of entrepreneurship in highly political organization environments (Vigoda-Gadot & Drory 2006).

Practical Implications and Future Directions

Of all the literature reviewed and hypotheses discussed, it is evident that although the psychological study of entrepreneurship has considerably grown in recent years, there is still much room for it to grow and develop. This chapter started by making an analogy between J.C. Kaufman and Beghetto's four-c model of creativity (2009) and recent conceptualizations of entrepreneurial potential. Specifically, entrepreneurial potential is a normally distributed construct that is largely a function of individual differences and can be expressed at everyday, professional, and eminent levels. When applying this into practice, it is reasonable to assume that entrepreneurial potential can be reliably identified and developed.

When attempting to identify entrepreneurial potential to drive innovation and growth within an organization, practitioners should adopt evidence-based selection practices. In particular, individuals should be screened for creative, opportunistic, visionary, and proactive personality traits and values while selecting out individuals who display an extremely high propensity for risk taking and overreliance on cognitive biases. Although the ability to take risks is inherent to entrepreneurship, as Murmann and Sardana (2013) state, a "risk tolerance" is

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more influential of entrepreneurial success than simply a "risk appetite." Similarly, when looking to develop an individual's entrepreneurial potential, practitioners should make attempts to build social connections between those who share weak ties (i.e., acquaintances, friends of friends, colleagues in other departments, etc.) in order to increase the discovery of new ideas and opportunities for value creation (Pentland 2014). Likewise, those who have already recognized their entrepreneurial opportunity and are now looking to exploit it via the recruitment of staff and acquisition resources should turn to the colleagues they trust the most and with whom they have an effective working relationship. These recommendations are somewhat limited, however, given that they are based on cross-sectional samples. Accordingly, we urge both practitioners and researchers to make greater efforts to collaborate so that not only the hypotheses this chapter has set forward can be tested but to also conduct longitudinal studies to better understand how entrepreneurial potential is related to success and how susceptible it is to development and training interventions.

At the beginning of this chapter it was stated that combining psychometrics and social network analysis brings great utility because it is possible to empirically model *intra-* and *interpersonal* interactions. Although it is straightforward for researchers to measure intrapersonal factors, given that it is the foundation of psychometric theory and practice (i.e., paper and pen questionnaires), there may be a slight learning curve for psychologists when attempting to measure interpersonal relationship via social networks. Although network data can also be collected via surveys, researchers must be aware that the social nature of network data violates the independence assumption of the general linear model; therefore, it is best practice to use alternative statistical methods that can accommodate for this (see Dekker, Krackhardt, & Snijders 2007). Similarly, psychologists may need to familiarize themselves with statistical software and techniques for analyzing network data (i.e., UCINET) (Borgatti, Everett, & Freeman 2002; see also Wasserman & Faust 1994). Methodological issues aside, the value of learning how to collect, analyze, and interpret social network data is highly rewarding. For example, statistically sound metrics can be produced for the frequency and types of relationships each individual holds with each other member of the network, alongside allowing for community detection (i.e., informal cliques and workgroups). When combined with psychometric data, it is possible to simultaneously test how entrepreneurial success is influenced by interactions between social structures and the composition of individual differences (i.e., personality traits, cognition, knowledge, etc.) among members across various hierarchical levels (i.e., workgroups, teams, departments, and organizations) (Wasserman & Faust 1994).

Conclusion

It is hoped that the research discussed in this chapter not only informs evidence-based practice but also serves as a useful resource for researchers looking

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to further develop the theoretical understanding surrounding the interaction between personal and social factors in entrepreneurship. We believe that this can be most effectively accomplished by combining psychometric methodologies and social network analysis – a sociological technique largely ignored by psychologists. We argue that psychologists are well positioned to have a rich and holistic understanding of behavior. Yet the reluctance to combine valuable methodologies that are common in other fields of research is inhibiting us from making both theoretical and applied advances. By explaining how these methodologies are complementary to psychometrics, we hope the value in doing is clear and that the psychological understanding of entrepreneurship continues to prosper.

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20 Effects of Creativity Training Programs on Individual Characteristics

Denise S. Fleith

Creativity has been described as a dynamic, evolving, systemic, and interrelated process that includes individual characteristics as well as social, cultural, and historical factors (Csikszentmihalyi 1999; Lubart 2007; Sawyer 2012; Simonton 1999). The importance of studying and nurturing creativity lies in societies' need to face their challenges and successfully solve their problems, as well as to achieving well-being and fulfilling lives. According to Csikszentmihalyi (1996, p. 2), the "reason creativity is so fascinating is that when we are involved in it, we feel that we are living more fully than during the rest of life." Likewise, Starko (1995, p. vii) states that creativity brings "joy and meaning to the human condition."

Since creativity has been considered to be a process that can be developed, in the past 40 years there has been a proliferation of programs, courses, and guidelines focusing on how to promote creativity (Alencar & Fleith 2009; Cropley 2005; Parnes 1970; Starko 1995; Wechsler & Souza, 2011). Their common premise is that practice, involvement, commitment, and a supportive and encouraging psychological climate can foster individuals' creativity. With regard to this, reviews of training programs have corroborated the idea that it is possible to teach people to think creatively (Ma 2006; Nakano 2011; Rose & Lin 1984; Scott, Leritz, & Mumford 2004a, 2004b; Torrance 1972). Although research findings have concluded that creativity can be improved with training, a "creativity training should not be viewed as simply a particular program or the result of applying a fixed set of techniques" (Scott et al. 2004a: 383). In order to conduct a successful creativity intervention, one must consider many factors, such as the participants' needs, interests, and individual characteristics; the resources available; the location; the psychological climate; and the support provided by the institution where the training program will take place.

This chapter focuses on the effects of creativity training programs on individual characteristics. It opens with a brief description of the results of review studies mentioned in the preceding paragraph. Next, the chapter gives an overview of the empirical findings of Brazilian investigations with respect to the effects of creativity training programs. In the Section "Effects of Creativity Training Programs on Individual Characteristics: Conclusions", comparisons and conclusions regarding the studies are presented, as well as a discussion of how individual characteristics would influence creativity training outcomes and how creativity interventions affect individual characteristics.

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Review Studies on the Effectiveness of Creativity Training Programs

In the 1970s, Torrance (1972) examined 142 empirical studies about teaching children to think creatively. The studies were classified into nine categories: (1) Osborn-Parnes Creative Problem Solving procedures; (2) other disciplined approaches (e.g., method of teaching reading involving creative dramatics, a program for training in creative research); (3) packages of materials, such as the Purdue Creativity Program, (4) creative arts (e.g., visual arts, creative writing, and movement); (5) media and reading programs (e.g., Junior Great Books Program, Imagi/Craft Program: multimedia sensory exercises); (6) curricular and administrative arrangements (e.g., independent study, summer enrichment program, cognitive-structured curriculum); (7) teacher–classroom variables, such as classroom climate; (8) motivation (e.g., evaluation, reward, competition); and (9) testing conditions, such as variation in time limits for response and warm-up exercises. In most of the studies (n = 103), performance on the Torrance Tests of Creative Thinking (TTCT) was used as the criterion to assess changes on the creativity level.

Results, based on an index of percentage success, indicated that the most successful interventions were those that employed the Osborn-Parnes Creative Problem Solving Program (91 percent), other disciplined approaches (92 percent), creative arts (81 percent), and media/reading programs (78 percent). Furthermore, the most effective approaches, according to Torrance (1972, pp. 132–3), "seem to be those that involve both cognitive and emotional functioning, provide adequate structure and motivation, and give opportunities for involvement, practice, and interaction with teachers and other children." He also highlighted that teaching a child how to think creatively, in a deliberate way, is another effective condition to foster creativity.

A decade later, Rose and Lin (1984) conducted a meta-analysis to examine the impact of long-term creativity training programs. Forty-six studies were selected according to the criteria established by the authors; that is, only investigations using the TTCT were included in the study. The programs were classified into six categories: (1) Osborn-Parnes Creative Problem Solving Program, (2) Covington's Productive Thinking Program, (3) Purdue Creative Thinking Program, (4) other creative training programs that combine several components of creativity, (5) regular classroom arrangements, and (6) programs that use special techniques, such as creative dramatics and kinesthetic experiences. The findings revealed that verbal creativity is more affected by programs than figural creativity. Similar to the results obtained by Torrance (1972), the authors found that the Osborn-Parnes Creative Problem Solving Program was the most successful program (d = 0.63). Also, creative training programs that combine several creativity components and special techniques "may offer more varied and flexible experiences than the packaged programs" (Rose & Lin 1984, p. 22).

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In the 2000s, some review studies aimed to answer the question: is creativity training effective? Scott and colleagues (2004a) conducted a meta-analytic review to examine potential influences on program success. Seventy studies were selected after the criteria application. The analysis pointed out that the largest effect size was obtained by studies that employed divergent thinking and problem-solving measures to assess changes. In contrast, investigations using performance (e.g., product development) or attitudes/behavioral criteria had smaller effect sizes. Moreover, by examining overall effects, the review indicated that nongifted and low-achieving students seemed to benefit more from creativity training programs, as well as males, than gifted or female students. Regarding the intervention content, successful trainings tended to be based on a cognitive approach in comparison with those based on a social, motivational, personality-wise, or confluence-like framework. Also, training programs that focused on processes, such as problem identification, idea generation, conceptual combination, and domain-based performance exercises, were the ones that worked better.

In another quantitative review, Scott and colleagues (2004b) examined the effectiveness of creativity training types. One hundred and six investigations were included in the research. The authors asked three trained judges to assess, on a 4-point scale, the extent to which each program mentioned in the studies contemplated cognitive process skills, training techniques, delivery media, and practice exercises. The programs were categorized into 11 clusters: (1) analogy, (2) open idea production, (3) interactive idea production, (4) creative process, (5) imagery, (6) computer-based production, (7) structured idea production, (8) analytical training, (9) critical/creative thinking, (10) situated idea production, and (11) conceptual combination. Although all 11 types seemed to have some value, idea production and cognitive training (e.g., creative process and conceptual combination) "proved particularly effective while some commonly applied training strategies, specifically imagery training, proved less effective" (Scott et al. 2004b: 149). The effect sizes obtained for idea-production training, creative process training, and conceptual combination training were .78, 1.10, and .88, respectively.

Using meta-analysis, Ma (2006) synthesized the effects of creativity training programs. The interventions were categorized as follows: simple ideation, brainstorming, incubation, forced relation, catalog, part improving, morphological synthesis, attitude training, synectics, idea checklist/SCAMPER, computer-aided creativity training program, Purdue Creative Thinking Program, New Directions in Creativity, Khatena's Training Method, and Osborn-Parnes Creative Problem Solving Program. The overall effect size was large, indicating that training does affect creativity. Findings also suggested that programs are most successful when implemented with older participants than younger ones. Type of instruments measuring creativity, experimental design, and duration of the program were found not to interfere with the effectiveness of the interventions.

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Nakano (2011) examined 30 studies, 16 published in Brazil and 14 elsewhere, regarding the effects of creativity training programs. The results pointed out an improvement in creative abilities, motivation to learn, and school performance in experimental groups compared with control groups. The majority of studies were conducted having elementary school students or teachers as participants. Many studies used performance on the TTCT as the criterion, especially the Brazilian ones.

The review studies mentioned previously provided evidence for the effectiveness of creative training programs. The most effective results were found when the training included a cognitive approach and varied and flexible activities (instead of a packaged program) and was administered to low-achieving and older participants. However, it is necessary to understand how creativity training works. Findings indicated that some intervention components, such as content, techniques, theoretical approaches, and participants' characteristics, may have an influence on the impact of the programs. This means that there is not a prescribed, generalized scheme that could foster creativity.

Most training programs reviewed are based on models of general creativity. Some researchers (Baer 2010; Feist 2004; J.C. Kaufman & Baer 2004), however, have argued that creativity is domain specific. In this regard, "if domain specificity plays a significant role in creativity, then it matters greatly for creativity training" (Baer & J.C. Kaufman 2005, p. 159). Moreover, the review studies analyzed effects of interventions mainly on creative abilities.

There has been a proliferation of investigations aiming at examining how creativity is (or is not) associated with other variables, such as intelligence (Gonçalves & Fleith 2011; Mendonça & Fleith 2005; Nakano 2012; Wechsler Nunes et al. 2010), self-concept (Al-Qaisy & Turki 2011; Fleith, Renzulli, & Westberg 2002; Garaigordobil 1999; Lau, Li, & Chu 2004), motivation (Amabile 1996; Hennessey 2010), school performance (Gras et al. 2010; Siqueira & Wechsler 2004), and personality traits (Feist 2010). In this regard, it has become imperative to understand to what extent creativity affects these individual characteristics and vice versa. With regard to this, there has been an effort among Brazilian researchers to implement studies that investigate effects of creativity training programs on individual characteristics.

Brazilian Studies

Creativity has been a topic of interest to Brazilian researchers for almost 40 years. One of the pioneering studies in the area was led by Alencar (1975) as a result of her doctorate in the United States. The influence of American creativity studies on Brazilian investigations, concerning theoretical approaches, research designs, and instruments, is unquestionable. Since the 1970s, many studies about the effects of creativity training programs on individual characteristics have been conducted, mainly in the educational environment.

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Studies Conducted in the 1970s

Alencar (1975) examined the effects of Purdue Creative Thinking Program on 791 fifth-andsixth-grade students. Sixteen teachers implemented the program in their classrooms once a week. Students of these teachers performed better on creative thinking abilities, as measured by the TTCT, compared with students from control groups. Treatment-group students were very enthusiastic and interested in the activities. Marin (1976) analyzed the effects of a creative artistic activities program on the figural creativity of 37 high school students. She found that students who participated in the program obtained higher scores on fluency, flexibility, and originality compared with students who were not trained.

Studies Conducted in the 1980s

The 1980s was a prolific decade for studies about the effects of creativity training in Brazil. The research carried out indicated that teachers benefit more from the trainings than students. Alencar (1986) examined the short- and medium-term effects of a creativity training program administered to teachers on teachers' and students' creative thinking abilities. The sample included 53 teachers and 265 third-and fourth-grade students. Twenty-six of the 53 teachers participated in 15 training sessions. The results showed that teachers who were trained obtained higher scores on figural fluency and flexibility and verbal originality than teachers from the control group. However, there were no significant differences between students whose teachers were trained and students whose teachers were not trained. Five months later, in a follow-up study, Alencar, Fleith, and Rodrigues (1987) examined the effects of the program on teachers' creative thinking abilities. The treatment group outperformed the control group on most of creativity measures, which suggests evidence of program effectiveness.

Alencar and colleagues (1987) conducted a study to investigate the effects of a creativity training program administered to teachers on their students' creative thinking abilities and characteristics associated with creativity. Forty-two teachers participated in the study: 23 were trained on techniques and activities, and 19 integrated the control group. The teacher training program included 10 sessions of two and a half hours involving theoretical aspects of creativity, such as myths, personality traits, and cognitive factors associated with creativity; barriers to creativity; family and school influence on creativity development; and practical activities illustrating divergent production strategies and creative problem-solving techniques. With respect to personality traits training, the teachers were asked to think of strategies to encourage students' curiosity, flexibility, independent thinking, and self-confidence, as well as to design projects to incorporate creativity in their classrooms. Results indicated no significant differences between students of trained teachers and students of nontrained teachers. Similarly, no differences were observed between students with respect

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to interests and characteristics related to creative behavior, such as imagination, curiosity, and persistence. In addition, Alencar and Fleith (1987) administered a questionnaire to the trained teachers to evaluate the creativity training program. Teachers reported that the training was an opportunity to have information about creativity misconceptions and to exchange ideas and share experiences with their colleagues about creativity. They also emphasized the short duration of the training period and the need to have more practical activities.

Guerreiro (1987) examined the influence of a school curriculum adaptation program involving creative techniques and cognitive styles on school achievement and creativity of elementary school underachievers. The program was implemented with public school teachers and students. Findings indicated that teachers who were trained outperformed control-group teachers in creativity measures. Similarly, students who participated in the program had better school performance and higher scores on creativity tests than the control-group students.

Wechsler (1987) examined the effects of a creativity training program on gifted and nongifted children's creative thinking abilities, motivation, and school achievement. The training was implemented in 23 sessions, including activities such as analogies' production, problem solving, and problem definition. The results indicated that gifted and nongifted children who were trained improved their creativity level and academic performance. However, nongifted children had much more gains in creativity and motivation than gifted students.

Alencar and colleagues (1988) evaluated the effects of a creativity training program on 41 elementary school teachers' performance in the classroom, as well as on their level of creativity. Seventeen of them attended a creativity training program, and the others made up the control group. Trained teachers had better scores on verbal creativity than the nontrained teachers. Four teachers from each group were observed in the classroom before and after the training. The treatment group also improved their ability to enhance students' participation, imagination, and curiosity.

Studies Conducted in the 1990s and 2000s

Whereas most studies conducted in the 1970s and 1980s focused on elementary school students or teachers, more diversity characterized the research participants in the following two decades (e.g., learning-disabled children, attention deficit hyperactivity disorder [ADHD] children, bilingual students, and secondary school and university students). Fleith (1990), for example, examined the effects of a creativity training program on future teachers' creativity by using the TTCT. Those who participated in the training obtained higher scores on creativity measures than trainees who did not participate in the program. In addition, the participants of the treatment group perceived themselves as more creative than the others and developed activities that enhanced students' creativity more often than trainees who did not participate in the training.

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Similarly, Alencar and Virgolim (1990) studied the influence of a creativity training program on creative thinking abilities of university students. Twelve students participated in 10 creativity training sessions that included techniques of creative problem solving, sensory images, and interpersonal activities. Test results indicated that students who were trained perceived themselves as more creative than those who were not trained. The authors evaluated the program positively and highlighted its importance for their personal and academic life.

In a study with secondary school students, Alencar (1992) investigated the impact of a creativity program on students' creative thinking abilities. Thirty-six students were trained over 14 weeks. Barriers to creativity were discussed, and creative problem-solving techniques were carried out in the program. The treatment-group students scored higher on creativity measures and perceived themselves as more creative than the control-group students. During a program for creative poetry writing, Bragotto (1994) examined whether secondary and elementary school students interest in the Portuguese language would be influenced by creativity. The treatment group consisted of 30 students, and the control group had 15. The program was implemented over 12 sessions. The treatment group performed higher on verbal creativity measures and poetry writing than the control group.

Neves-Pereira (1996) analyzed the effects of a creativity training program on the academic performance and creative thinking abilities of 29 learning-disabled children. The children were assisted by a psychoeducational service. Fifteen students participated in the training program and 14 in the control group. The treatment group presented a significantly higher school performance in the second academic semester than in the first semester. The treatment group also outperformed the control group with respect to creative thinking abilities. Results indicated that a creativity program may help learning-disabled children in their education process.

Fleith and colleagues (2002) investigated the effects a creativity training program called "New Directions on Creativity" had on the creative abilities and self-concept of students in elementary monolingual (American students) and bilingual (Brazilian immigrants students) classrooms. The program slightly improved the creative abilities of students in the treatment group. Results also indicated that the effect of the program on increasing self-concept was small, and control-group students experienced a decline in self-concept between pretest and posttest. Placement in monolingual or bilingual classrooms was not related to students' creative abilities and self-concept. Moreover, qualitative analysis suggested that a supportive and encouraging classroom climate in which the creativity training was implemented was an essential factor for success of the program. The creativity training program also had a positive impact on the self-concepts of less academically able students.

The purpose of the study designed by Fadel and Wechsler (2011) was to analyze the effects of a creativity development program for university professors on their students. The sample included 240 participants (30 professors and

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210 students) from a private university. The creativity program was implemented in 11 three-hour sessions and involved discussion of creativity stimulants and inhibiting factors, as well as the practice of techniques and exercises. The treatment group consisted of 15 teachers who participated in the program, whereas the control group consisted of 15 teachers who participated in a pedagogical program (e.g., educational assessment, special education, bullying, technology in the classroom). Results indicated that the creativity development program enhanced students' creative abilities and positively influenced professors and students on the perception of a creative environment.

In a study conducted with and without ADHD students, Mendonça (2012) verified the short- and medium-term effects of a creativity training program with fourth grade elementary school teachers on the creative abilities and academic performance of their students. The study had the participation of 235 students and 9 teachers from a private school. The treatment group consisted of four teachers who participated in nine training sessions of 1 hour and 40 minutes each, focusing on the development of creative potential in the school context and ADHD students' characteristics. The results revealed that the creativity training program slightly contributed to the increase in verbal creativity in the treatment-group students in the short term and moderately contributed to all creativity abilities in the medium term in comparison with the control group. Students without ADHD characteristics achieved higher performance than those with ADHD characteristics in relation to creative abilities and academic performance both before and after the intervention. In addition, the creativity program had no impact on the creative abilities and academic performance of students with ADHD characteristics.

In a recent study, Santos (2014) investigated the short- and medium-term effects of two creative programs, one for teachers and one for mothers, involving creative ability, self-concept, motivation to learn, school performance, and perception of the climate for creativity in third-grade students' classrooms. The participants were 128 children, 5 teachers and 9 mothers from a public school. The intervention with teachers consisted of a brief theoretical part that addressed aspects related to creativity, motivation, and self-concept and other parts of a more extensive practical nature that included weekly activities of self-assessment, discussions of such activities, researcher observations in the classroom with subsequent feedback, and creativity exercises in reference to the school curriculum. The training of the teachers occurred in 11 weekly meetings with an average duration of one and a half hours each. The program with mothers totaled four weekly meetings lasting two hours each, and the following topics were covered: promoting and inhibiting factors of creative ability, motivation, and self-concept. The results indicated that the intervention with teachers produced, in the short term, an increase in the student scores in three measures of creativity (verbal fluency, figural flexibility, and originality), intrinsic motivation, and positive perception of the classroom climate for creativity. In the medium term, four months after the end of training, the intervention had a positive impact on verbal fluency, verbal flexibility, intrinsic motivation, and

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perception of the climate for creativity in the classroom. No differences were noticed regarding self-concept. Findings related to the program with mothers showed positive effects on verbal originality in the short term and global self-concept in the medium term.

Brazilian research regarding the effects of creativity training programs on individual characteristics has been carried out for four decades. Most studies in the 1980s and 2000s focused on training teachers to foster creativity in elementary school classrooms. Conversely, the investigations carried out in the 1970s and 1990s centered on implementing creativity programs with students. Furthermore, the studies conducted in the past 20 years included not only children and regular students but also learning-disabled, ADHD, and bilingual children as well as secondary school and university students. The earlier investigations examined the effects of the programs mainly on creative thinking abilities, whereas the later investigations aimed at analyzing the impact of creativity training on other variables, such as school achievement, motivation, self-concept, and perception of the classroom climate for creativity. With respect to instruments, the most used was the TTCT, independent of the decade during which the research was conducted. A few studies adopted creativity packages designed in the United States. Most interventions were planned by Brazilian researchers and included discussion of theoretical aspects of creativity and practice of techniques and activities.

Effects of Creativity Training Programs on Individual Characteristics: Conclusions

Brazilian research has indicated that creativity programs may be effective concerning the development of creative abilities, whether the training was implemented with elementary, secondary school, or university students or teachers. These findings are similar to those obtained in the meta-analytic studies mentioned previously, including non-Brazilian studies. Also, the perception of Brazilian students and teachers with respect to the classroom climate for creativity improved after the training. Participants could recognize changes in teaching practices in favor of creativity and in the student–teacher relationship. However, results are far from clear considering the effects of the programs regarding other variables, such as self-concept, motivation to learn, and school performance.

Moreover, some characteristics of research participants, such as being monolingual or bilingual, for example, did not make a difference concerning the impact of creativity programs. However, Brazilian results did reveal that non-gifted students and students without learning disabilities or low school performance benefited academically (e.g., better grades) and emotionally (e.g., positive self-concept) as a result of creativity training. However, the findings also suggested that the positive impact of creativity trainings on students was more evident when the students were submitted to the intervention rather than when the teachers were trained.

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The Brazilian and non-Brazilian studies review presented in this chapter suggests a scarcity of investigations regarding the impact of creativity training programs on individual characteristics. Brazilian research has focused on the investigation of cognitive outcomes, such as divergent thinking abilities (fluency, flexibility, and originality) and school performance. The studies that analyzed the effects of interventions on self-concept found no significant changes after the training. However, motivation was slightly improved after training. May these results be due to the relative stability of individual or personality characteristics over the course of life? Was the short period of time of implementation of most interventions not enough to produce changes on individual characteristics? Most studies revisited in this chapter analyzed short-term effects of creativity training program on individual characteristics. Could a creativity training implemented regularly throughout the academic year, rather than in a short period of time, and incorporated into the regular curriculum be more efficient concerning changes on personality traits? Future studies should investigate the long-term effects of creativity interventions on both cognitive and socioemotional factors.

Also, according to Martindale (1989, p. 211), personality cannot be considered in isolation. In this regard, we should take into account other factors interacting with individual characteristics, such as culture, social environment, history, biological maturation, and so on. How do we tease apart the interaction between individuals' personality and the outcomes of the intervention? Furthermore, the sociocultural environment has a strong influence on creativity by supporting or inhibiting the development of personality traits associated with creativity. The Brazilian family, for example, can be described as supportive, protective, and responsible for the maintenance of relationship links. As a consequence, independence, willingness to take risks, and perseverance are not characteristics usually encouraged in children by the culture (Fleith 2011). In order to understand how creativity training programs influence personality traits, it is important to analyze the social and cultural backgrounds of the participants and take them into consideration when planning the intervention. Future studies on creative personality traits within and across cultures may help us to understand the impact of creativity training on individual characteristics.

Another question we should ask is how the participants' personality affects their performance on creativity training programs. Studer-Luethi and colleagues (2012) found that individual differences in personality traits, such as neuroticism and conscientiousness, as measured by the Mini-Marker Set (Saucier 1994), had an effect on cognitive (working memory) training outcomes. Based on their results, the authors recommended that individual differences in personality should be considered in cognitive interventions to reach optimal effectiveness. Could we take this precaution in the case of creativity training?

An understanding of the interrelationship between creativity and individual characteristics may help to plan and implement educational policies, as well as

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to guide teachers and parents to adopt practices that foster creativity, self-concept, and motivation to learn. However, studies suggest that enhancing creativity through training programs does not necessarily guarantee gains with respect to individual characteristics.

Future investigations need to be conducted to determine whether socioemotional programs, in combination with creativity training, have any influence on creative abilities, self-concept, and motivation. In addition, further research concerning the impact of creativity training programs on personality traits, temperament, level of stress, and mental health would contribute to a better understanding of the effectiveness of creativity interventions on individual characteristics. Cross-cultural studies involving the effects of creativity programs on values, beliefs, traditions, personality, and creativity across cultures might provide insight into whether and how culture channels creativity and personality traits.

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21 Creativity and Personality Research

Themes and Future Directions

Patricia O'Rourke, James C. Kaufman, Gregory J. Feist, and Roni Reiter-Palmon

As vast a topic as creativity can be, most approaches tend to revolve around the four P's proposed by Rhodes (1962) – person, process, product, and press. These correspond to the who, how, what, and where of creativity (respectively), and the *who* is a natural starting point. What kinds of people are more (or less) creative? The connection between creativity and personality has resulted in decades of intense study.

In this book we have gathered a group of current leading experts to share their research, theories, and ideas on this broad intersection. We hope that this book is not only a compendium of exciting work but also a source of new questions and future investigations. Although the chapters are diverse and represent many perspectives and approaches, several common themes emerge. Our goal in this final chapter is to provide a brief history of where the field has been, to synthesize some of the ideas presented throughout this book, and to offer suggestions for future directions.

A Brief History of Creativity and Personality Research

One missing element from this handbook – handbooks, by definition, tend to focus on the most current research and theory – is a historical perspective on the topic of creativity and personality. Now is not the place for an extensive historical recap, but a brief history would do well to put the current research into its historical context. In so doing, this brief history will provide a clearer view of where the field is heading – or should head – in the future, a topic we address at the end of this chapter. If the field is to progress, it must build on its past. It can only build on its past if it is aware of it.

Given their shared focus on the uniqueness of thought and behavior, personality and creativity make ideal partners. Beginning with classic personality theorists – Freud, Jung, Fromm, Maslow, Rogers, Skinner, and Eysenck – the nature of creativity and how it relates to personality have intrigued and puzzled. Freud (1908), of course, argued that creativity in general is sublimated (frustrated and unfulfilled) sexual energy and is fantasy expressed in a constructive manner for an audience. Jung (1923) believed that the artistic creative act stemmed from the collective unconscious and hence

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often made use of archetypal images that defy rational explanation. Fromm (1959) viewed creativity as the expression of the psychologically healthy person who possesses the following attitudes and traits: to be puzzled and surprised, to concentrate, to feel connection with others, to accept conflict and tension between ideas, and to be willing and able to "be born new every day." Maslow (1959) proposed that creativity in everyday life, not professional creativity, is one of the central traits of a self-actualizing person. Rogers (1959) put forth a theory that not only is there a strong social need for creativity but that it stems from a motivation for a person to become his or her potentialities, that is, to become fully himself or herself. The conditions of creativity include openness to experience, an internal locus of evaluation, and the ability to toy with ideas. Rogers was probably the first psychologist to see the connection between the openness to experience and creativity found throughout this book. Skinner (1972) argued that creativity is like any other behavior and results from operant contingencies and reinforcers of novel behavior. Finally, Eysenck (1995) situated creativity in the context of the psychoticism dimension of personality, with its traits of impulsivity and lack of latent inhibition.

Creativity and personality are not just theoretically connected but also empirically. Over the last 50 to 60 years, the nature of the creative personality has garnered serious empirical attention. This focus was best exemplified by the work conducted at the University of California, Berkeley's Institute of Personality Assessment and Research (IPAR) in the 1950s, 1960s, and 1970s. Founded in 1949 by Donald MacKinnon, IPAR became *the* center for research on personality and creativity. Under MacKinnon's guidance, IPAR pioneered the weekend assessment method, where creative people literally lived with an august psychological staff (including Erik Erikson) and were interviewed, tested, and observed in both formal and informal settings with an extensive battery of personality, behavioral, cognitive, and intellectual assessments. In addition to MacKinnon (1978), such scholars as Frank Barron (1955), Ravenna Helson (1971), and Harrison Gough (1976) conducted decades of groundbreaking research on creative architects, mathematicians, writers, and scientists.

Additional Factors Affecting Creativity and Personality

Motivation and Self-Beliefs

Joy (Chapter 12) proposes a social learning theory of innovation made up of two components: the *need to be different* and *innovation expectancy*, counterbalancing traits that influence creative achievement through a combination of risk-taking and follow-through behaviors. He has studied how these components are related to personality factors associated with creativity and has found promising results. He does note that the sample sizes involved were small and

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suggests additional research with larger samples. Further, studies that examine innovation motivation in specific occupations and over extended periods of time will illuminate its relationship to creative achievement. In addition, Ivcevic and Hoffman (Chapter 11) review research on the emotion-related trait of intrinsic motivation and creativity and report on its interaction with other domain-related personality traits in positively influencing persistence and creative achievement.

What we want to do is related to what we believe about ourselves and our abilities. Creative self-belief (CSB), like motivation, is a distinct concept from personality traits. As Karwowski and Lebuda (Chapter 6) discuss, two CSB variables include creative self-efficacy (CSE), or your belief that you are capable of creative behavior and achievement, and creative personal identity (CPI), which is the importance of creativity to your identity. They highlight questions of creative potential and how it can be converted into creative achievement, such as at Pro-C and Big-C levels (e.g., J.C Kaufman & Beghetto 2009).

Woo and colleagues (Chapter 4) also focus on what distinguishes creative behavior from higher-level creative achievement. They argue that while facets of openness are conducive to creative behavior, domain-specific interest is also necessary for creative outcomes at an advanced level, and interests and curiosity can interact in a number of different ways to influence choices at different stages of the creative process.

Emotion and Moods

If personality is consistent across a lifetime, emotions and moods can vary from moment to moment. Ivcevic and Hoffman (Chapter 11) investigate the complex relationship of emotions and moods with creativity. They report substantial evidence of positive emotions being connected with creativity, although these results vary depending on other factors (such as time on task). The relationship of neutral or negative moods with creativity is more complex, but they tend to be more highly associated when studies focus on later stages of the creative process and creative achievement. Therefore, both positive and negative moods influence creativity, and the nature of the relationship depends on many factors, including the domain being studied. In general, positive emotions are associated with a broadening of perspective, whereas negative emotions can contribute to persistence in following through on new ideas.

Taylor, McKay, and J.C. Kaufman (Chapter 10) also address the complexity of mood and creativity associations due to factors such as domain specificity and types of measurement in studies of intrapersonal effects. In addition, they discuss research on interpersonal effects based on the emotions as social information (EASI) model that could be useful in the workplace and field of education. Ivcevic and Hoffman (Chapter 11) also examine the abilities involved in using emotions to aid thinking and emotion regulation. They

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then describe the important role these abilities have on creative behavior, such as how individuals may choose activities that induce particular moods in order to facilitate their own creativity. Further, these abilities moderate the negative effects of outside influences on a person's emotions and creativity. They support additional research in this area of personal agency related to emotions and creativity. They also call for the consideration and use of developing technologies that allow for directly monitoring moods and emotions, providing information previously not available for observation, in studying links to creativity.

The Dark Side

A recurrent theme in creativity and personality research is an interest in the potential interplay of psychopathology and creative behavior and achievement. Both Furnham (Chapter 14) and Simonton (Chapter 13) place the beginning of this inquiry in ancient times and report that interest today is still strong. They describe what can appear as paradoxical relationships in which disorders experienced at a mild to moderate level can at times promote creativity and performance while proving to be an obstacle to creative achievement when present at a more severe level, and creators in different domains are affected by psychopathology at considerably different rates. Simonton (Chapter 13) further reports that the relationship of psychopathology and creativity varies depending on the level of creativity being examined, with high rates of psychopathology correlated with creative eminence and low rates with everyday creativity.

Damian (Chapter 7), like Simonton, also suggested that the search for answers in this area may be forwarded by considering psychopathology as one example of a broader category of experiences influencing creativity. This broader category of "diversifying experiences" refers to unusual, extreme, and sometimes traumatic life events. As she points out, considerable information has already been collected on the diversifying life experiences of historical creative geniuses. Although this could be taken to signal a strong relationship between diversifying experiences and creative accomplishment in general, Damian notes that the relationship is more complex; diversifying experiences can also impede creative achievement. The next questions to be answered are what factors are involved in the different effects.

Furnham (Chapter 14) focuses primarily on personality disorders and reports that the available literature on the correlation between personality traits and personality disorders has helped to form a basis for extending this research to creativity. He offers hypotheses for expected relationships between each personality disorder and artistic and scientific creativity; he then calls for continued investigation at the domain and facet levels. Oleynick and colleagues (Chapter 2) note that there are particular facets of the openness/intellect factor that relate to susceptibility to specific forms of mental illness and propose that pursuing these links could lead to a better understanding of the risk.

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Theories, Structure, and Measurement Issues

The Five-Factor Model and Beyond

The five-factor model (FFM) is by far the most commonly used framework for studying and reporting on the relationship between creativity and personality, and it is referenced throughout the chapters. Indeed, Furnham (Chapter 14) points to use of the FFM of personality (DeYoung 2015; Goldberg 1992; McCrae & Costa 1997) and well-validated measures of creativity as key steps in articulating the two constructs.

Oleynick and colleagues (Chapter 2) provide a detailed history of the derivation of the model and the primary factor associated with creativity, *openness/intellect* (a split of the broader factor of *openness to experience*). They discuss how this factor encompasses a broad range of facets all related to cognitive flexibility, with facets of openness more closely correlated with artistic creativity and facets of intellect more closely correlated with scientific creativity. Extraversion comes in a distant second in strength of positive relationship with creativity and also varies by domain of creative achievement. Extraversion is more highly correlated with performing arts, for example, than visual arts or the sciences. Although these findings have been widely reported, it is important to note that the strengths of the relationships vary depending on many other factors as well, including the level or aspect of creativity being measured. The remaining factors of neuroticism, agreeableness, and conscientiousness tend to be less consistently related to creativity, whether showing great variation by domain (conscientiousness) or weaker relationships (neuroticism and agreeableness).

Fürst and Lubart (Chapter 9) propose an integrative theory of creativity, order and chaos, to provide a framework for synthesizing the Big Five model and other models that focus on specific traits. In the model, divergent thinking is represented in the chaos dimension, convergent thinking in the order dimension, and creativity is viewed as the intersection of these two extremes.

Feist (Chapter 5) presents a model that begins with biological factors, brain structure, and function, which then influence personality traits. These traits then lower behavioral thresholds that make particular behaviors more or less likely; the behaviors of interest in this chapter are those related to scientific creativity. He also suggests that the model could be considered bidirectional, with the experiences caused by creative behavior, in turn, influencing personality traits over time. In seeking to identify which traits are associated with higher levels of creative behavior in science, and specifically physical sciences, Feist considers both normal traits, as represented by the FFM, and clinical traits, such as those associated with high-functioning autism and psychoticism.

The Brain

Jung and Meadows (Chapter 3) contribute a neuroscience perspective to the collection with their chapter on openness/intellect and brain networks.

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Several other chapters reference such connections as well (such as Oleynick and colleagues [Chapter 2] and Feist [Chapter 5]). Jung and Meadows focus on how the facets of openness/intellect can be mapped onto specific networks of the brain. They argue that with additional study, it will be confirmed that each facet will map onto separate networks. They also speculate that the brain functions related to imagination developed relatively recently in humans.

Definitions and Measures

Several authors in this book address the importance of recognizing that common definitions and theories and extensive measures and domains studied will influence both results and the degree of comparison that can happen across studies. Fürst and Lubart (Chapter 9) offer definitions of each of the individual constructs, as well as a definition of *creative personality*: "a complex array of traits – tendencies toward certain behavior, thoughts, and affect – that are characteristics of individuals who produce novel, appropriate work." According to Hornberg and Reiter-Palmon (Chapter 15), the field would also benefit from expanding the use of measures beyond divergent thinking scores, using multiple measures and domains in the same study, and including the analysis of the effect of instructions and prompts. They examine how accounting for variations in measures and domains can result in more meaningful interpretation of the relationships of factors of the FFM and creativity.

Ivcevic and Hoffman (Chapter 11) point out that definitions of creativity can be focused either on the products or processes of creativity. Recognizing that there is a difference between measuring divergent thinking and creative achievement, they reviewed research that encompassed both in their examination of the relationship of emotional states and traits with creativity. They point out that it is important to ask what aspect of creativity is being studied and recognizing that there will be differences in results by domain. Woo, Keith, Su, Saef, and Parrigon (Chapter 4) suggest that it is important to consider both domain-general and domain-specific factors when studying creativity and personality (also discussed in Taylor, McKay, and J.C. Kaufman [Chapter 10]), and Damian (Chapter 7) mentions that the research on diversifying experiences currently consists of studies focused on particular types of experiences and would benefit from a more general measure for the construct, thereby allowing for better interpretation and increased value to the field of creativity research.

Workplace and Everyday Applications

Workplace Applications

As mentioned earlier, Taylor and colleagues (Chapter 10) included interpersonal effects of personality and creativity, a topic of great relevance in the

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workplace – an area addressed in several chapters. Litchfield, Gilson, and Shalley (Chapter 18) considered personality and creativity at the team level, both cumulative and combinatorial. They found similarities of results – including complexities and paradoxical results – of looking at team creativity through the FFM as for individual creativity. They point out that there has been very little research in this area and that one of the most important questions to address in any study is how team creativity is being defined, collectively or individually. Akhtar, Ahmetoglu, and Chamorro-Premuzic (Chapter 19) looked at applying network theory along with psychometric methodologies to the question of how social capital affect entrepreneurial potential. Their focus on entrepreneurship goes beyond the meaning of opening and operating a business to encompass the traits and behaviors associated with innovation and value production in multiple settings. Creative behavior is a fundamental component of entrepreneurship, as are opportunistic and visionary behaviors. Akhtar and colleagues (Chapter 19) provide both a theoretical framework and practical recommendations for supporting entrepreneurship, and they assert that entrepreneurship can be developed.

Training and development are another important area of concern in the workplace that overlaps with creativity and personality, and this is also true in education. Fleith (Chapter 20) discusses the interplay of creativity training and individual characteristics, a bidirectional relationship. Her information is based on training programs in Brazil, and she notes the importance of considering the sociocultural environment in addition to other factors in interpreting results and making recommendations for future training programs.

Everyday Life

Other chapters emphasize the type of creativity found in everyday life, such as humor. According to Nusbaum and Silvia (Chapter 16), creativity research is more developed than humor research and can offer some useful lessons to those interested in better understanding the relationship between humor and personality, including dealing with issues of measurement and interpretation. It is interesting to note that humor appears to share a similar positive association as creativity with openness to experience. Of the four aspects of humor Nussbaum and Silvia name – *sense of, uses of*, *perception of*, and *production of* – they choose to focus on humor production due to it being understudied. They describe humor production as a form of creative thought that can be assessed using the two fundamental creativity assessment criteria: novelty and appropriateness to the situation.

Other chapters discuss different aspects of creativity that are related to everyday creativity. Dollinger (Chapter 17) uses the activity of autophotography to study the personality and creativity link in what he refers to as the "individualistic" person. Recognizing that the studies involved have weaknesses, as any study does, he believes that autophotography has great potential

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for qualitative and quantitative analysis. One of the areas for potential future extension of this area is in social media and online presence.

Chang, Su, and Chen (Chapter 8) explore nuances of the multicultural experience–creativity link by examining the role of individual disposition. Although there has been a general consensus that exposure to multicultural experiences leads to enhanced creativity, the authors posit that personality traits influence the effect. They suggest three facets of dispositional plasticity – openness to experience, racial essentialism, and multicultural identity integration – that moderate the relationship and propose further research in this area for both knowledge and application.

Future Directions

We hope that you agree with our overall conclusion that the field of personality and creativity is a vibrant and healthy one. As briefly touched on at the beginning of this chapter, the field of creativity and personality has a long and rich theoretical and empirical history. The work presented in this handbook is simply a continuation of this history.

Needless to say, none of us has the potential to predict the future. The best we can do is to speculate on what we think might be the future topics of the field and perhaps what we would like them to be. It probably is best to combine "might be" and "want." First, one of the safer speculations would be that the neuroscience and genetic/epigenetic studies of personality and creativity will continue to grow in number and scope. Given the ubiquity of the Big Five in the literature and the consensual finding of the importance of openness to experience in creative thought and behavior, a theoretical model will have to be developed to explain the mechanisms connecting these two relative constructs.

In addition, the age-old question of cause and effect needs to be addressed. Given the inherently nonexperimental nature of research in personality, the only methodology that can even approach an answer of cause or an effect between personality traits and creativity is longitudinal investigations. Similar to Terman's near lifelong studies of intelligence, future researchers need to start studying personality, creativity, and other psychological qualities in childhood and continue regular assessments every couple of years for decades. By doing so, we could see which traits arise first and how they covary (or not) over time. Structural and growth-modeling techniques could examine the structure and change over time of these relationships. Causation, however, requires not only covariation and temporal precedence but also ruling out third-variable (extraneous) variable explanations. For that, statistical techniques such as hierarchical multiple regression could be implemented to hold extraneous variables statistically constant by being entered in first steps in the regression. Longitudinal data are inherently difficult and costly to collect, so it will not be easy, but in the end, it has to be done if the question of causality between personality and creativity is going to be addressed.

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Finally, just as using longitudinal methodologies would facilitate our understanding of the relationship between personality and creativity, so too would greater attention to how creativity is operationalized. There are many ways in which creativity can be evaluated, and when discussing the relationship between creativity and personality, we need to be careful about what we mean when we say "creativity."

In the end, it is clear that creativity and personality – each with their focus on unique behavior – are perfect partners. If this handbook spurs on and stimulates further explorations in the investigation into how these two fascinating constructs interact, it will have done its job.

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