Lay Theories of Creativity

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Creativity is considered to be one of humanity's most complex and important behaviors, and its effects are widespread. Over time, creativity has allowed us to create art, develop computers, and cure illnesses. In addition to its importance in science and the arts (Feist & Gorman, 1998; Kaufman, 2002; Mackinnon, 1962), the significance of creativity has also been recognized in daily life problem-solving (Cropley, 1990) and in successful adaptation to change (Cropley, 1990; Reiter-Palmon, Mumford, & Threlfall, 1998). Moreover, creativity helps us to sustain and promote our well being (Hirt, Devers, & McCrea, 2008), it allows us to gain power (Sligte, De Dreu, & Nijstad, 2011), it makes us more attractive mating partners (Griskevicius, Cialdini, & Kenrick, 2006), and it is core to successful innovation (Amabile, 1996). Due to the crucial role of creativity in innovation, creativity has become a key concern for most organizations and businesses (Runco, 2004), and some scholars even refer to today's economy as a *creative economy* (Florida, 2002; Howkins, 2002).

Not only in our current society, but throughout the history of mankind, creativity has been of great appeal and importance to people (Mithen, 1998). Therefore, it is not surprising that people strive to understand creativity, and that they develop *lay theories* to do so. Lay theories are the informal theories and beliefs that lay people hold about a phenomenon and its causes or consequences (e.g., Furnham, 1988). Lay theories are usually not based on scientific research or a systematic analysis of the phenomenon in question (although some lay theories may be partly informed by such research), but rather take the shape of stereotypes and everyday beliefs

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('everybody knows that …'). Lay theories can be encountered in everyday conversations and popular publications (books, news articles, websites). However, they are not always formulated as an explicit theory, but sometimes take the form of unspoken assumptions, or implicit beliefs. As we will describe in this chapter, lay theories about creativity have been developed about personality traits and mental disorders that are associated with creativity, about what can be considered to be creative, and about the specific environments or techniques that support or kill creativity.

The lay theories and beliefs that people hold about creativity (i.e., everyday, informal, and often implicit beliefs about creativity, how it works, how it is best stimulated, or who has the highest creative potential) are not just important from a theoretical perspective, but may directly influence creativity itself (Runco, Johnson, & Baer, 1993). For example, beliefs about personality traits and characteristics associated with creativity influence whether people, ideas, and products are perceived and recognized as creative, and beliefs about the creative processes shape what parents, educators, and organizations do in order to facilitate creativity.

Research conducted by Baas, Koch, Nijstad, and De Dreu (2015) demonstrated that people have strong beliefs about creativity and, importantly, that these beliefs are often incomplete and not in line with the state-of the-art scientific evidence. This becomes problematic when such lay beliefs inform the choices that people make. Lay beliefs, for example, shape the circumstances people create in order to stimulate their and each other's creativity (Baas et al., 2015). They may, thus, lead stakeholders such as policy makers, supervisors, and instructors to develop or implement expensive but ineffective—and in the worst case even harmful—interventions. Therefore, a better understanding on which beliefs about creativity are supported by scientific evidence, and which can be considered misunderstandings, will help to foster creativity in the entire population. The aim of the current chapter is to test several lay theories about creativity against the available scientific evidence. We will describe these lay theories and beliefs, and then critically appraise them in light of what creativity research has shown.

Lay Theories of Creativity

Unfortunately, there is little systematic research on the content or the structure of the lay theories that people hold about creativity. However, there has been some research about specific beliefs and stereotypes that people hold, and we will discuss these in the current chapter—as we will see, creativity researchers have worked hard to dispel some of these beliefs and stereotypes. Moreover, we will address various lay theories and lay beliefs about creativity that are clearly present in the field, that is, among people who work on a professional or semi-professional basis in the field of creativity, or in creative professions. One can encounter these lay theories, for example, when reading blogs or books about creativity, when visiting websites of companies that offer creativity trainings, business seminars, or creativity

and innovation consultancy, or when browsing through creativity-relevant quotes by famous creative individuals. However, few of these can really be counted as 'theories,' in the sense that they are used systematically to explain or predict. Furnham (1988) describes several characteristics of lay theories as compared to scientific theories, such as their lack of explicitness (people may not always be able to clearly state their theories), lack of coherence and consistency (the theories may be fragmented and self-contradictory), the emphasis on verification rather than falsification (people are generally more interested in applying their lay theories than in testing them), and the focus on content rather than process (i.e., lay theories tend to describe types or categories, rather than describe underlying processes that may give rise to certain differences). It seems that this also holds for lay theories or lay beliefs regarding creativity. Generally speaking, then, we will use the term 'lay theories' rather loosely, as referring to all theories, beliefs, or stereotypes that lay people tend to hold regarding creativity.

One way of organizing these lay theories is by using the 'Four P' model of creativity, which distinguishes between the creative *Person, Process, Press* (*or Place*), and *Product* (Rhodes, 1961). This principle is commonly used to organize the research literature on creativity; we will use it to organize the different lay theories we discuss (and the support or lack thereof). Thus, lay theories concerning the following aspects of creativity will be addressed: what are individual characteristics of the creator (*Person*), which skills and processes are needed to achieve creativity (*Process*), which environment stimulates or hinders creativity (*Place*), and what is considered to be creative (*Product*).

Defining Creativity

Before we compare lay theories about creativity with scientific knowledge about the creative person, process, press, and product, we should provide a *definition of creativity*. Creativity can take many forms and can be found within a variety of contexts. What exactly is creativity? The word *creativity* has its roots in the Latin term *creō,* which means 'to create, to make.' In the current chapter, we use a definition of creativity that is commonly used in the research literature: creativity is the ability to generate ideas or problem solutions that are both *original* and *useful* (e.g., Amabile, 1983; Mumford, 2003; Sternberg & Lubart, 1999). If something is not novel, unusual, or unique, it is mundane, commonplace, or conventional—it is not original, and therefore not creative. Important to notice, an idea or product that is original can be unique or uncommon for a good reason: it might be useless. Ideas or responses that are highly unusual, but not appropriate to the task at hand, might be called eccentric, bizarre, or even pathological, but not creative. In other words, originality is vital (Barron, 1955; Stein, 1953), but must be balanced with 'usefulness,' that is, with fit and appropriateness (Runco, 1988).

Lay Theories About the Creative Person

Some of the best-known lay theories on creativity revolve around the creative person: who are those creative people, and what makes them so special? One global implicit theory underlying these questions is that there is not only a clear distinction between creative and less creative people (i.e., that the former have distinct abilities or traits that they do not share with the rest of us), but also that creative potential is something one either has or does not have, without much room for improvement. In this section, we will discuss three (interrelated) lay theories on creativity: the 'creative genius' belief, the 'mad genius' belief, and the belief that older people are less creative.

Creative Genius

The natural starting point for enquiries into creativity is to think about *examples* of creativity: when we think about creative performance, what comes to mind? Following this availability heuristic, the exemplars that often come to mind are well-known cases of extremely gifted creators, who have had a major and lasting impact on their field (and sometimes even outside of their field); names like Mozart, Da Vinci, or Einstein are among the ones people tend to mention. The association between the concept of 'creativity' and these eminent exemplars seems to be quite strong, and indeed, in the absence of modern research methods and detailed theories of the creative process, early creativity research focused on case studies of eminent creative individuals and their work (e.g., Ghiselin, 1952; Guilford, 1950; see Van Strien, 2015, for a recent overview and discussion). Although creativity research has since then expanded its focus considerably, research on eminent creative individuals is still important (e.g., Simonton, 2004).

The 'creative genius' theory comprises three different beliefs, which we will discuss in turn: first, the belief that *creativity is rare*; second, the belief that this kind of *creativity is fundamentally different* from everyday creativity; and third, an 'entity theory' regarding creative potential, stating that *creativity is unlearnable*.

Is Creativity Rare?

The first issue basically comes down to a point of semantics, and whether one wishes to limit the meaning of the term 'creativity' to exceptional cases. In fact, people often tend to adopt this narrow meaning, either implicitly or explicitly; in (informal) discussions of creativity, it usually does not take long before somebody brings up Einstein or Mozart (or perhaps a more contemporary example like Steve Jobs), and makes the argument that such exceptional cases reflect 'true' creativity. Indeed, in line with Furnham's (1988) discussion, lay theories of creativity often

seem to be strongly categorical, in that people tend to want to arrive at some criterion to decide whether somebody (or something, in case of a creative product) 'is creative or not.' In the creativity literature, in contrast, researchers generally distinguish between different *types* or *levels* of creativity. For example, a distinction is often made between so-called *Big-C* and *little-c* creativity (e.g., Csikszentmihalyi, 1997; Gardner, 1993). Big-C creativity refers to highly eminent creators who have had a lasting and transformative impact on their field; little-c creativity refers to the rest of us, people who may display creativity in their own way, but who will never reach the level of the truly great. Kaufman and Beghetto (2009) extend this distinction into a Four-C model, adding *mini-c* creativity (individual creative insights) and *pro-C* creativity (creative performance at a highly skilled, professional level that is nevertheless not revolutionary or transformative). Similarly, Boden (2004) distinguishes between *P-creativity* and *H-creativity*. P-creativity is *psychological* creativity, creative ideas or insights that are novel to the person who had the idea; H-creativity is *historical* creativity, referring to ideas that are novel for humanity or society in general. Thus, one of the main differences between lay and scientific theories of creativity is that the latter do not consider exceptional and lasting impact as a criterion to decide whether somebody is creative or not; instead, scientific creativity theories acknowledge that creativity can occur at different levels.

Are Creative People Fundamentally Different?

Whichever distinction one uses, the question remains whether there is anything *fundamentally* different between these levels of creative performance; i.e., whether what Big-C creators do, differs in a qualitative sense from what all others do, or whether the processes or abilities leading to H-creativity are fundamentally different from those leading to P-creativity. Again, this is a very popular notion. A Google search for 'highly creative people' yields many articles with titles such as "20 Things Only Highly Creative People Would Understand" (Kaiser, n.d.), "18 Things Highly Creative People Do Differently" (Gregoire, 2016), and "Creative People's Brains Really Do Work Differently" (Gregoire & Kaufman, 2016). What such articles have in common is that, even though many of them are grounded in actual research, they strongly emphasize the difference between highly creative people and the rest of humanity, suggesting that there really is some fundamental difference between 'the creative person' and ordinary people. Van Strien (2012) notes that this belief can be traced back to ancient Greece, with its conception of the artist as somebody who is susceptible to a form of divine inspiration not available to ordinary people, and further shows how the belief of the creative person as 'extraordinary' (in a literal sense) was further cultivated in the Romantic period. There seems to be a persistent belief that creative individuals possess a set of traits or abilities that somehow sets them apart from the rest of humanity. However, the consensus in the research field is that this is not the case, and that even creative performance at exceptional levels differs gradually, not fundamentally, from other

levels of creativity (the *continuity principle*; Guilford, 1950). Although Big-C creativity may require a unique *combination* of individual and contextual factors that only rarely co-occur at high levels (e.g., high abilities, strong internal motivation, relevant personality traits, opportunities for training, and interpersonal skills), none of these traits in themselves are fundamentally different from those of other people who perform at more ordinary levels. Thus, for example, in the next section (Creative Process), we will address the *creative cognition* approach, which explicitly takes the continuity principle as its starting point (e.g., Finke, Ward, & Smith, 1995; Nijstad & Stroebe, 2006; Ward, 1994).

Is Creativity Unlearnable?

A third aspect of the creative genius theory is that, since the difference between highly creative and less creative people is fundamental, creativity is not something we can learn; we either have it, or we do not. Although few if any informal sources espouse this belief (in fact, most intend to help people *overcome* this idea), it is a common remark in informal conversations about creativity: many people seem to believe that they "simply are not creative." These negative claims are then usually supported by 'evidence' such as a lack of artistic skills. This kind of thinking is what Dweck, Hong, and Chiu (1993) refer to as an *entity theory*: the belief that performance is a matter of stable, unchangeable traits. Entity theories are contrasted with *incremental theories*, according to which performance is something that can be enhanced through development of the underlying traits and abilities. Thus, if someone fails to perform creatively, an entity theorist might conclude that this person simply 'is not creative,' whereas an incrementalist might conclude that he or she needs to develop certain creativity-relevant skills (e.g., Amabile, 1996). As we will see later, the risk of entity theories is that they can become a self-fulfilling prophecy, because they tend to significantly inhibit motivation and learning performance as compared to incremental theories (Burnette, O'Boyle, VanEpps, Pollack, & Finkel, 2013).

    Of course, even if creativity is considered a stable trait, this does not mean that it is impossible or unnecessary to try to stimulate it. Even stable traits, such as personality dimensions, are associated with a broad range of intrapersonal variability (Fleeson, 2001): somebody who is highly extraverted, for example, may be led to behave in a more introverted manner in various situations. Thus, the question may not be whether creative potential is stable, and how high one's level of creative potential is, but rather how *broad* one's range of intra-individual variation is (Fleeson, 2001). The degree to which creative potential is expressed does, to a certain extent, depend on the situation—extensive research has shown that people can be induced to behave or perform more creatively by a variety of task manipulations and environmental factors. For example, people's creativity can be stimulated by traveling and other 'diversifying experiences' (e.g., Maddux & Galinsky, 2009; Ritter et al., 2012a), by situationally inducing a so-called *promotion focus* (a focus on attaining gains and realizing ambitions; Friedman & Förster, 2001;

Higgins, 1997), and by exposure to creative examples or models (Shalley & Perry-Smith, 2001). Thus, even if some people do have more creative potential than others, there is sufficient evidence for intra-individual variability, and the question can be raised whether it is possible to develop one's creative skills. In fact, researchers agree that creativity *is* something that can be developed, for example, through training (e.g., Ritter & Mostert, 2016; Scott, Leritz, & Mumford, 2004). Moreover, study of typical Big-C creators shows that these people actually spent enormous amounts of time and effort into developing their creative and domain-relevant skills (cf. Ghiselin, 1952), showing that the entity theory of creative ability does not even hold for those examples that are most often invoked in support of the creative genius myth.

Creativity and Psychopathology

Perhaps the most pervasive belief about the creative person, next to the 'creative genius' belief, is the idea that highly creative individuals tend to be unstable at best, and tend to have psychotic tendencies at worst (e.g., Baas, Nijstad, Boot, & De Dreu, 2016; Silvia & Kaufman, 2010; Simonton, 2014a, b; Van Strien, 2015). This belief, traced back as far as ancient Greece and Rome, partly rests on the creative genius belief, in that it seems to be largely based on the availability of highly salient examples of eminent yet unstable creators. Vincent Van Gogh probably is one of the best-known examples of the 'unstable artist,' and as remarked above, the availability of such examples has probably contributed greatly to the stereotype. It may also be partly due to the romantic notion of the artist as a highly sensitive individual, who is in touch with his or her inner life and emotional turmoil to a far greater degree than ordinary people (Van Strien, 2012). Yet another reason for this belief may be that creativity is strongly associated with spontaneity, impulsivity, and a rejection of social or group norms (e.g., Feist, 1998), all of which can, when present at extreme levels, be associated with psychopathology as well.

The belief that highly creative people are mentally unstable has been the subject of debate in the scientific literature; Simonton (2014a) called it the 'mad genius controversy,' with some researchers supporting this belief, and others strongly rejecting it (see Baas et al., 2016, for an overview). To the extent that research data support either the one or the other perspective, the lack of true experiments in this area makes the data difficult to interpret: the available data are typically correlational, precluding causal interpretations. As Furnham (1988) noted, lay theories tend to confuse correlation and causation, and the mad genius belief seems to be a good example of this tendency. Even if there is a correlation between psychopathology and creativity, this does not mean that people are more creative *because* of their psychopathology. First, the causal relation might run in the opposite direction—creativity might somehow contribute to psychopathology, for example, because people get used to taking highly uncommon perspectives and get estranged from 'typical' trains of thought. Second, the relation might be explained

by a third variable that predicts both creativity and a propensity toward psychopathology. Third, even if there is a causal path from psychopathology to creativity, this might exist for other reasons than commonly thought; for example, people might pursue creative endeavors as a coping strategy (e.g., Greene, 1980).

The Role of Approach and Avoidance

Baas et al. (2016) recently published a review and meta-analysis on the mad genius belief. Their paper is worth describing in some detail, as it is one of the few studies that systematically address a specific lay belief in the area of creativity. Baas et al. argue that the relation between creativity and psychopathology is best understood from the perspective of *approach* versus *avoidance motivation* (Carver, Sutton & Scheier, 2000), because—they argue—these reflect two fundamental motivational systems that have been linked to both creativity and various forms of psychopathology. The *approach system* is concerned with eager striving toward (approaching) positive, rewarding outcomes and situations, including novel stimuli and experiences. In contrast, the *avoidance system* is concerned with vigilance, fear, and withdrawal from aversive outcomes and risky situations. Approach motivation has been shown to be a positive predictor of cognitive flexibility and creativity; avoidance motivation, in contract, generally negatively predicts creativity (however, see Roskes, De Dreu, & Nijstad, 2012, for a possible exception). Baas and colleagues further state that several psychopathologies have strong roots in these approach and avoidance systems; for example, *depression* is linked to avoidance motivation and its correlates, whereas *bipolar disorder* (specifically, mania or hypomania, which are states of high cognitive activation and extremely elated mood states) tends to be associated more with the approach system. In their review and meta-analysis, Baas and colleagues indeed find that approach-related pathologies, such as mania and hypomania, positively relate to creativity, whereas avoidance-related pathologies, such as depression, negatively relate to creativity. However, they also find that the effect sizes for the latter (avoidance-related) relationships are quite small, bordering on the 'trivial.' Thus, the relationships are there, but explain only very little variance in creativity.

Creativity and Age

Another pervasive belief is that creativity mostly comes from younger people (Rietzschel, Zacher, & Stroebe, 2016). Actually, this lay belief comprises two different beliefs: first, the belief that children are more creative than adults (at least up to a certain age), and second the belief that adults become less creative in old age.

Children and Creativity

A popular lay belief holds that young children are much more creative than adults, and even than older children. Creativity is thought to decline when children are socialized into thinking along more conventional lines and to worry more about being evaluated positively by others. For example, the creativity website Creating Minds states that, "Our decline in creativity does not start when we are 40 or 50. It starts around about the age when we enter school" (Creating Minds, n.d.) and goes on to state that "At around about the age of five, we are using about 80% of our creative potential … by the age of twelve, our creative output has declined to about 2% of our potential, and it generally stays there for the rest of our lives." A related claim is made by the website stephenshapiro, which states that "98% of 5-year olds test as highly creative, yet only 2% of adults do." Other such claims are not difficult to find, as a Google search for 'children more creative than adults' will show. What is difficult, however, is to find scientific research actually supporting them. It is not always clear where the numbers come from, or even what they are supposed to mean, for example, if 98% of children "test as highly creative," this should raise some serious concerns regarding the norm scores used.

Regardless of such issues, however, the basis for the "children are more creative" belief seems to lie mostly in the notion that young children supposedly do not worry as much about giving the 'correct' response, and instead are more likely to do what they like or what occurs to them. As they get older, children learn that some behaviors are rewarded, for example, with praise or with high grades, and this—it is thought—guides their development away from creativity. In a way, this reasoning actually is in line with some of what we know from research. For example, research has shown that creativity can easily be inhibited by evaluation and rewards (we will return to this below, in the section on the creative environment), and that even young children who 'learn' to do a creative task (such as making a drawing) in order to gain a reward (such as a piece of candy or the opportunity to play with an attractive toy) often perform less creatively, and enjoy the task less (see Amabile, 1996, for an overview). However, whether this means that children are more creative than adults in a direct comparison, or whether such a direct comparison even makes sense to begin with, is far from clear.

Older Adults and Creativity

In general, older people are confronted with a variety of negative stereotypes (Cuddy, Norton, & Fiske, 2005; Fiske, Cuddy, Glick, & Xu, 2002; Lamont, Swift, & Abrams, 2015), and creativity is no exception. Young age tends to be associated with curiosity, flexibility, energy, and creativity, whereas old age tends to be associated with a lack of flexibility, lower motivation, decreased cognitive abilities, and a lack of openness to change (Ng & Feldman, 2012; Shearring, 1992). Whether this is a specific lay belief about age and creativity or simply an extension of the general belief that old age comes with a general decline in physical and

psychological abilities is difficult to say, but it is clear that older people are generally thought to be less creative than their younger counterparts.

Empirical research in fact does not show a clear disadvantage of old age for creativity. In a recent review article on the relation between age and creativity at work, Rietzschel et al. (2016) reviewed two meta-analyses and seven further primary studies on the relation between age and creativity and innovation at work. They conclude that most research shows no direct relation between age and creativity. For example, a meta-analysis by Ng and Feldman (2008) found no significant relationships between age and either self-reported or supervisor-rated creativity and innovation. Further, a more recent meta-analysis by Ng and Feldman (2013) on the relation between age, job tenure, and innovation-related behaviors showed no relations between age and innovation-related behaviors, with the exception of a weak positive relation between age and self-rated innovative behavior. As a concrete example, Rietzschel et al. (2016) also give a short summary of research on age and scientific creativity. Again, research suggests that older people (in this case, scientists) are no less creative than their younger colleagues; although there is evidence for a curvilinear relation between age and scientific productivity (peaking around the age of 40–45; Stroebe, 2010; also see Simonton, 1997), this seems to have changed in the last two decades. For example, a study by Gingras, Lariviere, Macaluso, and Robitaille (2008) failed to find a significant decrease in productivity even after the age of 50 years.

Lay Theories About the Creative Process

As explained earlier, lay beliefs often assume that creativity is a matter of innate talent that only a few people possess. Most creativity researchers, however, agree that highly eminent creativity (Big-C creativity) is *not* fundamentally different from ordinary creativity (little-c creativity), that is, they rely on a continuity principle (Guilford, 1950). For example, the creative cognition approach defines creativity as the product of 'ordinary' cognitive processes that are used to produce something extraordinary (e.g., Smith, Ward, & Finke, 1995; Nijstad & Stroebe, 2006; Ward, 1994). Using models and concepts from 'ordinary' cognitive psychology, studies in the creative cognition tradition have been able to study, predict, and explain creative performance quite well (e.g., Smith et al., 1995; Nijstad & Stroebe, 2006; Ward, 1994). Basal examples for the inborn talent to create are the flexible use of language—through which we can generate a tremendous variety of novel constructions (Chomsky, 1972; Pinker, 1984)—the ability to combine concepts to generate more complex ones, and the capacity to map properties analogically across different domains (Finke, Ward, & Smith, 1992). These processes are, in themselves, creative and, moreover, they underlie all forms of creativity—from the most mundane to the most extraordinary. Important to notice, although creative thinking skills are considered normal cognitive functions, individual differences in creativity exist, for example, due to variations in the use of specific processes, deviation in the

intensity of process use, and differences in the combination of processes. Moreover, many researchers agree that creative skills can, to some extent, be nurtured (Ritter, Strick, Bos, van Baaren, & Dijksterhuis, 2012c; Scott et al., 2004).

Divergent and Convergent Creativity

A common lay belief is that creative thought equals *divergent* thought. This seems to stem from the belief that creativity is fundamentally different from 'ordinary' behavior and cognition, and that those kinds of cognitions and behaviors that get formally taught and rewarded in society must, by extension, be incompatible with creativity. Although the creative process involves divergent thought, they are not synonymous. In fact, the creative process entails both divergent thought and convergent thought (Guilford, 1967; Maier, 1967; Simon, Newell, & Shaw, 1962). *Divergent thought* involves producing multiple or alternative answers from available information by making unexpected combinations, recognizing links among remote associates, or transforming information into unexpected forms. A typical example of divergent creativity is idea generation (e.g., during a brainstorming session). There is strong evidence which suggests that divergent thinking represents a distinct ability necessary for many forms of creative performance (Bachelor & Michael, 1991, 1997; Mumford, Marks, Connelly, Zaccaro, & Johnson, 1998; Plucker & Renzulli, 1999; Scott et al., 2004; Scratchley & Hakstian, 2001; Sternberg & O'Hara, 1999; Vincent, Decker, & Mumford, 2002). However, although important, divergent thought is only one component of the creative process. Many scholars emphasize the need for an additional cognitive ability, *convergent thinking*. Convergent thought is the cognitive process of deriving the single best, or most correct, answer to a problem or question (Fasko, 2001; Nickerson, 1999; Treffinger, 1995). Convergent thought emphasizes accuracy and logic, and applies conventional search, recognition, and decision-making strategies, and as such can easily be considered to be 'uncreative,' but it may actually still require creativity as well. Convergent thought, for example, is required in tasks where seemingly unrelated concepts have to be related, as measured in the *Remote Associates Test* (Mednick, 1962). In this task one has to generate a fourth word, which connects three seemingly unrelated words (example: bar—dress—glass, fourth word: cocktail; cocktail bar, cocktail dress, cocktail glass). Further, convergent thought and divergent thought are often combined. A creative activity that requires the strong interplay of divergent and convergent thought is *creative problem-solving*—the cognitive process of searching for a novel and inconspicuous solution to a problem. For example, in the two-string problem, participants are required to tie together two strings hanging from the ceiling. However, the strings are arranged so far apart that they cannot be reached at the same time. The solution requires the use of one of the objects available in the room so that one string can be set in motion as a pendulum. This swinging string can then be caught, while holding the other string, and thus they can be tied together. To solve this problem,

divergent thought is needed to come up with the idea to use the displayed object in an unfamiliar manner, and convergent thought is needed to verify the problem solution.

Creativity and Flexibility

In a recent study, Baas et al. (2015) asked laypeople which processes they believed to be beneficial to creativity. Across the board, their participants strongly believed that the likely process leading to creativity is flexible thought (associative, broadly oriented thinking), rather than systematic thought (deliberate, persistent thinking). Indeed, several studies have shown that flexibility and the ability to break mental sets are related to creativity (e.g., Duncker, 1945; Smith & Blankenship, 1991). The idea that creative thinking *only* stems from flexibility is, however, too narrow. Flexibility is only one way in which people can arrive at creative ideas. There are two pathways toward creative performance: the (well known) flexibility pathway, and a *persistence* pathway (De Dreu, Baas, & Nijstad, 2008).

The *flexibility* pathway entails the ability to switch among different perspectives, involves associative thinking and requires adaptive switching among categories and approaches (Ashby, Isen, & Turken, 1999; Rowe, Hirsh, & Anderson, 2007). The flexibility pathway can, for example, be facilitated by mind wandering (Baird et al., 2012) and incubation (Dodds, Ward, & Smith, 2003; Sio & Ormerod, 2009); it is also related to positive, activating mood states, such as happiness. The *persistence* pathway, in contrast, involves effortful in-depth exploration of a few possibilities and perspectives (Chermahini & Hommel, 2010; De Dreu et al., 2008; Nijstad, De Dreu, Rietzschel, & Baas, 2010; Sagiv, Arieli, Goldenberg, & Goldschmidt, 2010). It relies on focused attention (De Dreu, Nijstad, Baas, Wolsink, & Roskes, 2012; Oberauer, Süß, Wilhelm, & Wittmann, 2008) and requires deliberate and systematic searching (Rietzschel, De Dreu, & Nijstad, 2007a). The persistence pathway can be facilitated by focused attention (De Dreu et al., 2012; Oberauer et al., 2008) and by systematic probing of a few possibilities and perspectives (Rietzschel, Nijstad, & Stroebe, 2007b), and has been found to relate to negative activating mood states, such as anger. Thus, in contrast to lay theories, which suggest that creativity is always the result of flexible thought, research has shown that multiple cognitive pathways to creativity exist.

Does Creativity Come Unexpectedly?

Laypeople tend to believe that creativity, rather than being the result of deliberate and conscious work, comes unexpectedly—for example, when traveling or with relaxing activities (Baas et al., 2015). The lay theory that creativity comes unexpectedly might, at least partially, be the result of a mystification of the creative

process by highly creative people (Van Strien, 2012). For example, Van Strien (2012) notes that many of the classic examples of sudden and unexpected insight were usually recorded years or even decades after the event supposedly took place, and do not always fit other, more contemporary accounts. Nevertheless, these stories resonate strongly with the general audience, probably because they are also in line with the previously mentioned theory about the creative individual as somehow different and beyond ordinary understanding.

Anecdotal accounts of creative individuals oftentimes report that creative discoveries resulted from a process whereby initial conscious thought is followed by an incubation phase: one is working on a problem, the problem cannot be solved, one leaves it aside for some time (i.e., the incubation period), and when returning to the problem one suddenly has some new insight into how to solve the problem.

The idea that a period of incubation might facilitate creativity has not only been suggested by lay theories and by creative people, it has also been stressed in creativity models. For example, Wallas (1926) proposed that the creative process entails four stages: preparation (acquisition of knowledge to some task, and defining the task or problem one aims to work on), incubation (unconscious task-related processing that occurs when conscious attention is diverted away from the task), illumination (a creative idea flashes into sight), and verification (the creative idea is subjected to evaluation and elaboration). Tremendous attempts have been made to scientifically investigate incubation effects. A Google Scholar search (Sio & Ormerod, 2009)—with the search restricted to the years 1997–2007 the term *incubation* along with either *creativity, insight*, or *problem*—yielded more than 5000 articles. Meta-analytic reviews have shown that a period of incubation indeed helps creativity (Dodds et al., 2003; Sio & Ormerod, 2009). However, it is not yet clear *why* incubation is helpful. The central discussion between different theories is about whether during an incubation period it is merely the *absence* of conscious thought that drives creativity (for example, due to relaxation, facilitating cues from the environment, forgetting of fixating elements, and mental set-shifting), or whether unconscious processes actively contribute to creative thought. Several studies provide empirical support for the idea that it is not merely the absence of conscious thought that drives creativity, but that during an incubation period unconscious processes can contribute to the generation of ideas and solutions (Ritter, van Baaren, & Dijksterhuis, 2012b; for a review, see Ritter & Dijksterhuis, 2014).

Certainly a creative idea may be found *before* a decrease in conscious effort, that is, before the incubation stage. However, during some (prolonged) creative thought processes conscious and unconscious periods alternate, and a period of incubation seems to precede creative breakthroughs.

Is Creativity Uniquely Human?

Another common lay belief is that creativity is uniquely human. Very few non-human animals are thought to have creative capabilities (behaviors that might be

interpreted as creative in humans are usually explained as instinctive or learned when it comes to nonhumans), and even if they do, these are thought to be very limited (e.g., Byrne, 1998). In fact, Guilford (1950) explicitly mentioned creativity as one of the last domains in which humans would be likely to retain superiority over machines. Many, perhaps even most, human activities could be programmed and automatized, which might raise the fear of humanity becoming obsolete somehow. Creativity might be the last stronghold of humanity: "Presumably, there would still be need for human brains to operate the machines and to invent better ones" (Guilford, 1950, p. 446). However, Artificial Intelligence (AI) can model some specific aspects of creativity, for example, transformation, exploration, and combination (Boden, 2009).

Transformational creativity entails that the space or style of an idea are transformed by altering or dropping one or more defining dimensions, allowing the generation of ideas that simply *could not* have been generated before the change.

Explorational creativity is what most creative individuals, even on the most eminent level, do—it is about exploring the spaces created by their (relatively rare) moments of transformation. Interestingly, computers can come up with exploratory processes that are comparable—sometimes even superlative—to those of highly competent human professionals (Boden, 2009, p. 27). Examples can be found in various domains, such as physics (e.g., Zytkow, 1997), music (e.g., Cope, 2006), architecture (e.g., Hersey & Freedman, 1992), and visual art (e.g., Cohen, 2002). In the visual arts, a nice example is Harold Cohen's program, AARON (Cohen, 1995). Art made by AARON has been exhibited at major art galleries around the world. Cohen's quote "I am a first-class colorist. But AARON is a world-class colorist" demonstrates that a computer program can surpass its programmer in creative performance.

Combinational creativity entails producing unfamiliar combinations of familiar ideas by making associations between ideas that were previously not, or only indirectly, related. For example, the creative idea of a roll-on sun cream can emerge by combining the idea of 'sun cream' with 'ballpoint pen.' The advantage of AI programs is that they can make various new combinations of familiar (already stored) concepts. What is extremely difficult for AI, however, is recognizing which combinations are valuable and, thus, useful. What is missing—as compared with the human mind—is the rich store of world knowledge and concepts (Boden, 2009). AI programs can have access to databases such as Google and, hereby, may have increased associative and inferential powers, but "using huge databases sensibly, and aptly, […] is a tall order. Not impossible in principle, […] but extremely difficult to achieve" (Boden, 2009, p. 26).

Thus, AI and computers can—to a certain extent—perform creatively. However, the question whether a computer could ever be 'really' creative is difficult to answer and may be more philosophical than psychological in nature.

Is Creativity Only About Generating Ideas?

Lay theories, as well as many scientific studies on creativity, mostly focus on the idea generation part of the creative process (West, 2002). Many popular creativity techniques, such as brainstorming (see below) focus on stimulating people's ideational output, and on ways to reduce 'blocks' that hinder people from coming up with creative ideas. However, important as idea generation is, for actual implementation of creative ideas, the most creative ideas must be recognized and selected for further development and realization. Contrary to common beliefs, the available evidence consistently demonstrates that success in idea generation does not predict success in idea selection, and that people perform at a suboptimal level (and often not better than chance) when selecting creative ideas (Rietzschel, Nijstad, & Stroebe, 2006, 2010). People tend to favor the selection of mainstream rather than creative ideas (Rietzschel et al., 2010), and research shows that even when people explicitly say that they value and endorse creativity, they can still have an implicit bias against creative ideas (Mueller, Melwani, & Goncalo, 2012). Apart from the fact that people often do not seem to value creativity, the degree to which they do also seems to vary between situations and individuals. For example, Herman and Reiter-Palmon (2011) have shown that participants with a strong *promotion focus* (i.e., a focus on growth, attaining desired outcomes, and realizing ambitions; Higgins, 1997) gave more accurate assessments of the originality of ideas. In contrast, participants with a strong *prevention focus* (i.e., a focus on safety and security, on avoiding undesirable outcomes, and fulfilling one's responsibilities) gave more accurate assessments on idea 'quality' (in this case, how coherent and 'workable' the idea was). Moreover, Mueller, Wakslak, and Krishman (2014) demonstrated that the evaluation of creative ideas can be improved by manipulating participants' construal level mindset, that is, the extent to which people's thinking is abstract or concrete (Trope & Liberman, 2010). Participants with a high-level construal (i.e., abstract) mindset rated a creative idea higher on creativity than participants with a low-level construal (i.e., concrete) mindset. Whereas these studies focused on the evaluation of ideas, De Buisonjé and colleagues (under review) went one step further—they investigated how idea selection performance can be facilitated. They have shown that idea selection performance can be enhanced by the combined effect of self-affirmation, promotion focus, and positive mood.

In sum, whereas in most creativity research the focus is on creative *idea generation*, in real-world creativity another process—*idea evaluation and selection*—is of crucial importance. Idea evaluation and selection is an essential but overlooked step in the creative process, and unless more attention is paid to this process, our understanding of creativity and innovation will remain incomplete.

Lay Theories About the Creative Place

Beside lay theories about *who* is most likely to be creative and *how* creativity works, there are several pervasive beliefs about *where* we are most likely to find creative performance; in other words, which kinds of environments and settings are most conducive to creativity. These issues have been studied particularly extensively (but not exclusively) in the field of social and especially organizational psychology. In the following, we will focus on three lay theories about the 'creative place': (i) the so-called three B's (Bath, Bus, Bed) of creative ideas, (ii) productivity in brainstorming groups, and (iii) the role of freedom versus constraints in creativity.

The Three B's of Creative Ideas

A common belief about environmental influences on creativity is that we are especially likely to get creative ideas or insights when taking a bath or a shower, when traveling, or when relaxing in general. In the creativity literature, these environmental influences are sometimes summarized as the 'three B's' of creative ideas, with the three B's referring to Bath, Bus, and Bed (Boden, 2004; Dart, 1989): places where we are in a more or less relaxed state, not actively thinking about the task or problem we were working on, and not really preoccupied with anything in particular. There are many famous anecdotes of creative discoveries made in such circumstances. One well-known example is Henri Poincaré, who experienced a major mathematical insight (which he had been searching for a long time) the moment he stepped on a bus (see, e.g., Ghiselin, 1952). Another often-described example is Friedrich von Kekulé, who discovered the ring-shaped structure of the benzene molecule while dozing by the fireside (Ghiselin, 1952). These examples appear to have contributed to several lay beliefs about creativity, such as the belief that creativity is characterized by spontaneous insights rather than deliberate thought (see our previous discussion of this issue), the notion that creativity can benefit from *incubation*, and the belief that ideas are most likely to come to us in environments where we relax, rather than work.

Most evidence for the 'three B's' belief is anecdotal, and to our knowledge no systematic research has actually been done to see whether people are indeed more likely to come to creative ideas in these places, but there is research that indirectly bears on this belief. Work on the role of incubation has already been discussed in this chapter. In addition, however, the role of traveling has been studied by De Bloom, Ritter, Kühnel, Reinders, and Geurts (2014), who found that recreational travel increased participants' flexibility (also see Gurman, 1989). Further, Maddux and Galinsky (2009) found that living abroad was associated with higher creative performance on a variety of measures, and that this relationship was mediated by the degree to which people had adapted to different cultures. Seeking out a new

environment has been suggested to work as a 'stimulation tactic' (Smith, 1998, a practice that can support the creative process (rather than being idea generation tools per se): exposure to a new environment can literally help people to 'see a problem in a new light,' or break away from habitual thoughts. Ritter et al. (2012a) demonstrated that 'diversifying experiences' such as unusual and unexpected events, or events that violated pre-existing schemas, stimulated participants' cognitive flexibility. However, research by Gocłowska, Baas, Crisp, and De Dreu (2014) suggests that not everybody will be stimulated by such experiences: for people with a high need for structure, schema violations may even be detrimental for creativity.

Brainstorming and Group Creativity

In the 1950s, Alex Osborn, an advertising executive, published his book Applied Imagination. In this book, he described what he saw as the most common obstacle on the road to creativity: premature criticism and the resulting 'holding back' of ideas. To help people overcome such obstacles and generate more ideas, Osborn recommended using a procedure he called *brainstorming*. In a brainstorming session, participants are not allowed to criticize each other's (or their own) ideas, are expected to mention every idea they can think of, no matter how weird, and are supposed to try to 'build upon' each other's ideas to come up with even more creative solutions. Although brainstorming is not necessarily a group technique, Osborn recommended a group setting because of the potential for *cognitive stimulation*: by listening to other group members' ideas, people would be stimulated to come up with new ideas they would not have thought of by themselves. Accordingly, Osborn originally predicted that "the average person can think up twice as many ideas when working with a group than when working alone" (Osborn, 1957, p. 229), and this image seems to have stuck: a large majority of people believe that group brainstorming is more effective than individual brainstorming, and people who have brainstormed in a group tend to be more satisfied with their performance than people who have worked alone (e.g., Nijstad, Stroebe, & Lodewijkx, 2006; Paulus, Dzindolet, Poletes, & Camacho, 1993; Paulus, Larey, & Ortega, 1995). In fact, brainstorming is often seen as a group technique by definition, although it is perfectly possible to brainstorm by oneself.

However, when it comes to productivity, group brainstorming is not that effective at all: groups of people brainstorming together consistently generate fewer ideas, and fewer high-quality ideas, than the same number of people working alone whose nonoverlapping ideas are pooled (so-called nominal groups). This was first demonstrated by Taylor, Berry, and Block (1958), and has since then been replicated numerous times (see Mullen, Johnson, & Salas, 1991 for an overview). Several explanations have been put forward for this productivity loss in brainstorming groups (see Stroebe, Nijstad, & Rietzschel, 2010, for an historical overview of brainstorming research), such as social loafing (people often invest less

effort in group tasks than they are capable of doing) and evaluation apprehension (people may 'hold back' for fear of being judged negatively by others). While such processes do seem to play a role, the strongest explanation for productivity loss is *production blocking* (Lamm & Trommsdorff, 1973), which basically comes down to cognitive interference. When brainstorming in a group, people have to take turns in expressing their ideas. If we have to wait for somebody else to stop speaking, not only can we easily forget an idea we have just come up with, but it is also difficult to continue thinking about the problem to come up with new ideas, since our cognitive resources are engaged in listening to the other person (Nijstad & Stroebe, 2006).

Nevertheless, cognitive stimulation effects have been demonstrated. For example, Dugosh, Paulus, Roland, and Yang (2000) found that individual brainstormers' productivity was enhanced by simultaneously (while generating ideas) listening to a tape recording with another persons' ideas. Further, Nijstad, Stroebe, and Lodewijkx (2002) found that participants generated more diverse ideas when they were presented with 'stimulation ideas' from a broad range of semantic categories.

The challenge, then, is to get the best of both worlds: cognitive stimulation without production blocking. There are some possibilities to achieve this. For example, the *Nominal Group Technique* (NGT; Delbecq & Van de Ven, 1971) has participants first engage in individual idea generation, followed by a sharing stage. During the sharing stage, participants are encouraged to write down and contribute any new ideas that may arise from seeing other people's ideas. Another possibility is the use of *electronic brainstorming systems* (EBS). In an EBS, participants are seated individually behind computers, and type in their ideas individually. However, at some location on the screen, other participants' ideas are displayed as well. Thus, both the NGT and EBS have the advantage of allowing people to generate ideas without being blocked by others, while allowing for cognitive stimulation when necessary. Research suggests that such techniques may indeed lead to productivity gains (e.g., Dennis & Valacich, 1993; Valacich, Dennis, & Connolly, 1994).

Freedom and a Lack of Constraints

Another common belief about environmental influences on creativity is the belief that creativity flourishes under circumstances of total freedom, a lack of external control, and the absence of constraints. Thus, for example, Michel de Montaigne referred to "the disposition of nature so impatient of tedious and elaborate premeditation, that if it do not go frankly and gaily to work, it can perform nothing to purpose" (De Montaigne, 1685/2012), whereas contemporary musician Lady Gaga reportedly claimed that "When you make music or write or create, it is really your job to have mind-blowing, irresponsible, condomless sex with whatever idea it is you are writing about at the time" (Goodreads.com, n.d.). What these quotes have in common is the belief that creativity requires spontaneity and freedom, rather than

control and constraints. This belief also seems to be related to the belief that young children are most creative, since they have not yet learned to focus on rewards and approval, and as such this could be considered to be at least some sort of internal consistency (Furnham, 1988) in the lay theory of creativity: freedom and an absence of constraints are considered to be essential for creativity, and young children are thought to be most free and unconstrained—and hence most creative.

Broadly speaking, this belief is largely in line with scientific findings. A substantial amount of research, again mostly done in organizational psychology, has shown that people (often: employees) are most creative when they feel autonomous and supported by their (work) environment. When people work in an environment that is supportive, nonthreatening, and challenging, they will invest more effort, are more willing to take risks (an important precondition for creativity), are more open to new ideas and opinions, and adopt a more explorative thinking style, that is, they are actively seeking out possible alternatives and improvements (e.g., Amabile, 1996; Shalley & Zhou, 2008).

Much of this work has been done from the perspective of Self-Determination Theory (SDT; e.g., Deci & Ryan, 2002). According to SDT, humans have three basic and fundamental needs: the need for autonomy, the need for competence, and the need for relatedness. Well being and motivation (particularly *intrinsic motivation*, the motivation to engage in a task for its own sake) are thought to be a function of the degree to which these basic needs are fulfilled or violated. When people perceive external control, the need for autonomy is violated, which in turn will lead to lower motivation and lower creativity (e.g., Amabile, 1996; Shalley & Perry-Smith, 2001; also see Shalley & Zhou, 2008, for an overview).

That external control can indeed kill creativity is most clearly shown in the research conducted by Teresa Amabile and colleagues (see Amabile, 1996; Hennessey & Amabile, 2010, for overviews). Most of this research has focused on the role of rewards and evaluations on creative performance. What emerges from these studies is that creativity indeed suffers when people perceive external control or pressure. Thus, for example, providing people with *controlling feedback* (e.g., telling them that their performance will be judged in order to see whether they performed as they should have) leads to lower motivation and lower creative performance than *informational feedback* (telling people that their performance will be evaluated and that they can use this evaluation to learn and to improve their future performance; Shalley & Perry-Smith, 2001). Similarly, in the domain of organizational creativity, it is generally found that contextual factors (such as organizational or team climate, leadership style, feedback and evaluation, etc.) are conductive to creativity as long as they provide support, autonomy, and challenge (Shalley & Zhou, 2008), rather than make employees feel controlled and monitored. Thus, in general, the belief that creativity requires freedom is supported by research. However, this view must be qualified in two ways.

Individual Differences

First, the general lay theory of creativity and freedom does not take into account the role of *individual differences*. Although Self-Determination Theory assumes the existence of fundamental needs that all humans share, other research has demonstrated that psychological needs differ between individuals, and that these differences can moderate the effects of contextual factors such as autonomy. Thus, for example, although job autonomy is widely considered to be an important predictor of job motivation and satisfaction, this relation has been found to depend on such individual differences as growth need strength (Hackman & Oldham, 1976), the need for autonomy and achievement (Langfred & Moye, 2004), and Personal Need for Structure (PNS; Rietzschel, Slijkhuis, & Van Yperen, 2014). In the field of creativity research, individual differences seem to make a difference as well. On the whole, autonomy contributes to creativity for those people who have the discipline and experience to work on a task independently (Chang, Huang, & Choi, 2012), who are eager to learn and feel supported to do so (Shalley, Gilson, and Blum, 2009), and who are not easily overwhelmed by a lack of structure (Rietzschel et al., 2014).

Task Complexity

Second, the problem with autonomy is that it implies complexity. That is, the more freedom people receive in how to do a task, the more they will have to figure out for themselves. The risk here is that people will respond to this cognitive load by adopting mental shortcuts that diminish complexity but may not be compatible with the demand for creativity. In this context, Ward (1994; Finke et al., 1995) formulated the *path-of-least-resistance-* hypothesis: in a creative task, people tend to generate those responses that come to mind most easily, but unfortunately those often are the least creative responses. For example, when asked to generate creative ideas as to how people can improve their health, the first things to come to mind are the suggestions all of us are confronted with every day (e.g., eat more vegetables, stop smoking). Since creativity requires ideas, solutions, or products that are novel, original, or unusual, anything that makes it difficult to leave the path of least resistance can be a hindrance to creative performance. Research suggests that task complexity can indeed increase reliance on mental heuristics (e.g., Bodenhausen & Lichtenstein, 1987; Branscombe & Cohen, 1991; Ford & Kruglanski, 2005; Simon, 1955; Van Prooijen & Van de Veer, 2010), probably because complex tasks put a heavy load on working memory (WM), especially the *central executive* component of WM (Baddeley, 1996). Since WM capacity has been linked repeatedly to creative performance (De Dreu et al., 2012; Benedek, Jauk, Sommer, Arendasy, & Neubauer, 2014; Lee & Therriault, 2013), it seems plausible that the complexity associated with high autonomy can inhibit creative performance through a reliance on mental shortcuts, such as the path of least resistance.

Lay Theories About the Creative Product

Creative ideas and products can be extremely varied, from musical masterpieces, to paintings, to literary work, to scientific and technological breakthroughs, and to creative solutions for problems. Often, lay beliefs about creativity suggest that the term creativity only applies to revolutionary ideas, for example, ideas we give Pulitzer and Nobel prizes for, and not to ideas that enhance and enrich our lives, for example, creating a new recipe. As described earlier (see 'Lay theories about the creative person'), most creativity experts, however, rely on a continuity principle and assume that highly eminent creativity (e.g., Big-C creativity) is *not* fundamentally different from ordinary creativity (e.g., little-c creativity). This implies that revolutionary ideas as well as ideas that enhance and enrich our lives can be considered creative—what differs is the level of creativity.

Is 'Creativity' Always Subjective?

Irrespective of the level of creativity, the question rises whether the creativity of an idea or product can be evaluated with sufficient reliability and validity, or whether it merely depends on 'the eye of the beholder.' Indeed, we expect that most creativity researchers share our experience of having people, both in lay or student audiences and among noncreativity researchers, coming up to us and asking somewhat scepticaly how it is possible to measure creative performance, 'since it is all subjective, anyway.' Is it possible to measure creativity at all? Whereas some researchers see the evaluation of creativity as inherently subjective (e.g., Kilgour, Sasser, & Koslow, 2013), or even as depending on zeitgeist (i.e., the sociocultural environment an idea or product is born into; Simonton, 1999), others assume that within a certain time and group, people tend to agree on whether an idea or product can be considered more or less creative (e.g., Amabile, 1982; Guilford, 1967; Lim & Plucker, 2001; Runco, 1999; Runco & Johnson, 2002). The judgment of creativity is, to a certain degree, subjective; this subjectivity, however, does not have to be problematic, as long as different people get to (more or less) the same subjective judgment. Therefore, instead of striving for 'objectivity' in creativity judgment, we should strive for *consensus* in creativity judgment. The challenge is to identify relevant criteria of an idea's or product's creativity.

Creativity researchers have tried to define the characteristics that lead to an idea or product being judged as 'creative.' There is strong agreement (also see our earlier explanation on the definition of creativity) that a creative idea or product has to be original (i.e., novel) and useful (i.e., effective; e.g., Amabile, 1996; Campbell, 1960; Feldman, Csikszentmihalyi, & Gardener, 1994; Runco, 2004). As we have seen, these two criteria are part of the commonly used definition of creativity, but the question is whether people also use these two dimensions to judge whether something is creative. Empirical research supports this idea by showing that

creativity evaluations strongly depend on the perceived novelty, and, to a lesser degree, on the perceived usefulness (Caroff & Besançon, 2008; Dietrich & Haider, 2015; Runco & Charles, 1993).

The evaluation of an idea or product on specific criteria usually entails asking judges to evaluate the idea or product on a dichotomous or continuous scale (Benedek, Mühlmann, Jauk, & Neubauer, 2013; Kaufman, Plucker, & Baer, 2008; Silvia et al., 2008). This method is rooted in the *Consensual Assessment Technique* (CAT; Amabile, 1982; Hennessey & Amabile, 1999)—by far the most common method in creativity research, due to its relative simplicity and the consistently high levels of inter-rater reliability for various kinds of creative products. The assessment of ideas or products based on the CAT is particularly useful in the study of 'little-c' (everyday) creativity, and it can be applied to the creativity evaluation of any kind of idea or product.

Using the CAT technique, the ideas generated by participants are generally scored for fluency, flexibility, elaboration, and originality. Fluency is operationalized as the number of ideas generated. Flexibility is operationalized as the number of unique categories the ideas can be assigned to. Elaboration is operationalized as the amount of detail that is provided (Guilford, 1968). Originality is operationalized as the uniqueness of the idea generated (Runco, 1999).

Consequences of Lay Theories on Creativity

In this final section, we will focus on the possible negative consequences of incorrect lay theories of creativity. Why is it a problem if people hold false or incomplete beliefs about creative persons, processes, places, or products? We will discuss three reasons: stereotype threat, lack of developmental opportunities, and self-selection.

Stereotype Threat

Some of the lay theories we have discussed take the form of stereotypes (e.g., about older people). Although stereotypes need not be negative in content (for example, some social groups may be stereotyped as 'smart' or 'very trustworthy'), they have been linked extensively to prejudice and discrimination (e.g., Bar-Tal, Graumann, Kruglanski, & Stroebe, 2013). Another way in which stereotypes can be problematic is by eliciting so-called *stereotype threat* (Steele & Aronson, 1995). When members of a certain social group are aware of the existing stereotype of their group, the fear of confirming this stereotype may cause them to underperform in exactly the kinds of situations the stereotype relates to. Thus, stereotype threat can cause stereotypes to become a self-fulfilling prophecy.

Stereotype threat effects have also been demonstrated in creativity research. For example, Seibt and Förster (2004, Study 4) found that participants performed worse on a creative idea generation task when they had first been confronted with a negative stereotype concerning their own group (i.e., that students from their major typically performed badly on these tasks) than when they had been confronted with a positive stereotype. Thus, some people's creative performance might suffer if they do not fit the stereotype of the creative individual, but rather are stereotyped as dull and unimaginative. For example, people who clearly do *not* have the traits commonly associated with creativity (e.g., people who are emotionally stable, not impulsive, highly systematic, not flexible, etc.) might a priori be seen as uncreative and might be exposed to such stereotypes, thus causing stereotype threat and lower creative performance. This could prevent them from realizing or developing the creative potential they may actually have (e.g., because they might be well suited to performing creatively in a more systematic fashion) and, over time, confirm their self-image of not being creative.

Lack of Developmental Opportunities

If people hold incorrect beliefs about the abilities and processes underlying creativity, or about the contextual factors that stimulate or inhibit creativity, interventions to stimulate creativity may be less effective or even fail completely. For example, creativity trainings can be effective, but how effective they are depends on the type of training offered. In a meta-analysis of studies on creativity training, Scott et al. (2004) concluded that "successful training courses devote less time and resources to techniques that stress unconstrained exploration" (p. 377). Instead, trainings that provide people with concrete and specific techniques and heuristics (such as the use of brainstorming rules, checklists, or feature comparisons) appear to be significantly more effective. The relation with creativity beliefs lies in the fact that, as we have seen, creativity is often particularly associated with unconstrained exploration, rather than with systematic work. This could easily lead people to prefer training methods or content (or other interventions) that fit this association, even though such trainings tend to be less effective.

A more general problem in this context is that, as also addressed earlier in this chapter, some lay beliefs about creativity seem to imply an *entity theory* (Dweck et al., 1993) of creative potential, that is, the belief that people are either creative or not, and that creativity cannot be developed (e.g., Furnham, 2014). Research shows that entity theories (as compared with *incremental* theories) can be quite detrimental for learning and performance in a variety of settings and domains (see Burnette et al., 2013, for a meta-analysis). For example, Plaks and Chasteen (2013) found that older adults performed worse on a variety of memory tasks if they had entity beliefs than if they had incremental beliefs. In a study among math teachers, Rattan, Good, and Dweck (2012) found that teachers holding entity theories tended to use feedback strategies that were comforting (e.g., reassuring underperforming students

that 'not everybody can be good at maths'), but also demotivating. As we have seen, creative skills can be developed (Scott et al., 2004), but if people hold entity theories about creativity, they are less likely to seek out such development opportunities (or to offer such opportunities to others, e.g., in the case of supervisors) and are less likely to attain optimal learning outcomes.

Self-selection

If creativity is consistently associated with certain traits or environments, some people may opt out of the creative process, or certain environments, because of a perceived lack of fit. When it comes to work, for example, the attraction-selection-attrition (ASA) framework (Schneider, 1987) describes how only a subset of people will be *attracted* to certain jobs or organizations, how only a subset of these people will actually be *selected* for a job within the organization, and, finally, how only a subset of those people will *remain* within the organization over time. One consequence of this is that organizations run the risk of becoming more homogeneous over time, and hence losing out on potentially valuable diversity. Thus, some people might not feel attracted to organizations with a reputation for creativity or innovation, or to professions that are known (or thought) to require creativity. If such self-selection happens on the basis of misconceptions, both the organization and the individual might be worse off.

Conclusion

In this chapter, we have attempted to outline and discuss several of the lay theories that people hold about creativity. Some of these lay theories concern the characteristics of creative persons, such as the 'mad genius' belief, others revolve around the creative process itself (such as the 'flexibility' belief) or the environmental factors that are thought to contribute to (or hinder) creative performance (such as group collaboration). As we have seen, these lay theories are not always in line with scientific findings; many are completely false, and even the ones that have a basis in fact are only *partially* correct. This is important, because misconceptions and incorrect (or incomplete) assumptions about creativity can be harmful, for a variety of reasons (such as stereotype threat and a lack of development opportunities). Given the importance of creativity for all domains of life, including such diverse endeavors as science, technology, design, sports, medicine, and art, we cannot afford to let our lay theories guide our creative efforts without empirical scrutiny.

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