CHAPTER 38

Intelligence and Creativity

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How are intelligence and creativity related? The question is of great interest because, in our schools and tests, we seem to value intelligence over creativity. In life, however, creativity is at least as important because it involves adapting to the novel situations that can lead people either to great success or stunning failure. Sternberg and O'Hara (1999) have argued that the relationship between creativity and intelligence "is theoretically important, and its answer probably affects the lives of countless children and adults" (p. 269).

Their point is well taken: Psychologists and educators frequently address issues related to either creativity *or* intelligence, but they often ignore the interplay between the two – or worse, they feel that intelligence and creativity are inversely related. This may explain why research has consistently shown that teachers prefer intelligent students over creative students (e.g., Westby & Dawson, 1995), as though students are unlikely to exhibit evidence of high (or low) levels of both constructs. In addition, the nature of the relationship could help identify aspects of each construct that are ignored in traditional classroom settings.

For example, Wallach and Kogan (1965) suggested that students with high creativity but low intelligence are more disadvantaged in the traditional classroom setting than students with low creativity and low intelligence. If accurate, this observation has considerable implications for how instruction, the curriculum, and assessment are differentiated in classroom settings. Subsequent research has largely supported Wallach and Kogan's observations (e.g., Beghetto, 2006, 2007; Brandau et al., 2007).

Plucker and Renzulli (1999) conclude that it is now a matter of uncovering not *whether* but *how* the two are related. Certainly, creativity has been an important part of many major theories of intelligence. For example, divergent thinking was an integral part of Guilford's (1967) Structure of the Intellect model. But in general, the research on this topic is murky if not seemingly in outright conflict. As an example of research and theories that seem to contradict each other, the threshold theory suggests that intelligence is a necessary but not a sufficient condition of creativity (Barron, 1969; Yamamoto, 1964), certification theory proposes that there are environmental factors that allow people to display both creativity and intelligence (Hayes, 1989), and the interference hypothesis suggests that very high levels of intelligence may interfere with creativity (Simonton, 1994; Sternberg, 1996).

The lack of clear conclusions about the nature of creativity-intelligence relationships is due, at least in part, to the dynamic yet at times underdeveloped constructs being studied. After all, we should not be surprised if conflicting results are observed when a notoriously ill-defined, complex construct (Plucker, Beghetto, & Dow, 2004), measured similarly for decades (Kaufman, Plucker, & Baer, 2008), is compared to another complex construct that has seen rapid theoretical and psychometric development (A. S. Kaufman, 2009). Researchers have often been aiming at two moving targets at the same time.

From an assessment perspective, the relationship of creativity to intelligence is of particular interest. First, the overlap (or lack thereof) between intelligence and creativity is an issue enduringly popular, controversial, and heavily dependent on psychometric issues. Second, creativity plays a major role in several theories of giftedness, and school districts struggle with the development of systems to identify gifted students, especially those with above-average creative abilities.

Roots of Creativity

The roots of creativity as a scientific discipline are planted in the intelligence literature. Many of the earlier scholars (such as Francis Galton, Lewis Terman, Alfred Binet, and Charles Spearman) who considered and discussed creativity were more primarily focused on intelligence. Indeed, it was an intelligence researcher, J. P. Guilford, who first publicly recognized the need for an independent study of creativity.

Guilford (1950, 1967) placed creativity into a larger framework of intelligence in his Structure of Intellect (SOI) model. He attempted to organize all of human cognition along three dimensions. The first dimension was called "operations," and simply meant the mental processes needed to complete almost any kind of task, such as cognition. The second dimension, "content," referred to the general subject matter, such as words. The third dimension, "product," represented the actual products that might result from different kinds of thinking in different kinds of subject matters, such as writing. With five operations, four contents, and six products, Guilford's (1967) model had 120 different possible mental abilities. Indeed, he later expanded the model to include 180 different abilities (Guilford, 1988), although the 120 abilities model is the one more often studied. This model was influential in educational circles (Meeker, 1969), and Renzulli (1973) developed an entire creativity curriculum based on the aspects of the SOI Model involving divergent thinking.

One of Guilford's operations (or thought processes) was divergent thinking – analyzing one's response to questions with no obvious, singular answer. Such questions might include "What would happen if we didn't need sleep?" This work, followed up by other researchers (most notably Torrance, 1974a), has often been used as a measure of creativity. Two of the most common ways of scoring these tests are fluency (the total number of responses given) and originality (how unique are the responses).

A Framework for Exploring the Research

Sternberg (1999) has provided a framework for examining the research on this topic. We find this framework to be helpful because it emphasizes that one's conclusions about the creativity-intelligence relationship will largely be determined by one's theoretical conceptualization of each construct. The Sternberg framework includes five possible intelligence-creativity relationships:

creativity as a subset of intelligence; intelligence as a subset of creativity; creativity and intelligence as overlapping sets; creativity and intelligence as coincident sets; and creativity and intelligence as disjoint sets. In the following sections, we provide examples of each type of relationship.[1]

Theories of Intelligence Which Encompass Creativity

As already discussed, Guilford placed creativity within the context of an intellectual framework. In doing so, he was the first of many to consider creativity to be part of intelligence. Some theories of intelligence include creativity as a subcomponent. Undoubtedly, the theory of intelligence that is most often applied to IQ tests is the CHC (Cattell-Horn-Carroll) theory, a combination of two earlier theories. The Cattell-Horn theory (e.g., Horn & Cattell, 1966) initially proposed two types of intelligence, crystallized (G_c) and fluid (G_f). G_c signifies what a person knows and has learned, and G_f represents how a person handles a new and different situation (i.e., problem solving). Horn expanded the theory to include more dimensions (known as Broad Abilities). Carroll's (1993) theory proposed a hierarchy of intellectual abilities. At the top of the hierarchy is general ability; in the middle of the hierarchy are various broad abilities (including learning and memory processes and the effortless production of many ideas). At the bottom of the hierarchy are many narrow, specific abilities such as spelling ability and reasoning speed.

The combined CHC theory incorporates both the concept of a general intelligence (all of the different aspects of intelligence are considered to be related to a common "g," although this aspect is not often emphasized; see Flanagan & Ortiz, 2002) and the concept of many different aspects of intelligence. Ten different broad factors of intelligence are proposed. These include G_f and G_c from the initial Cattell-Horn theory. They also include G_q (quantitative knowledge, typically math-related), G_{rw} (reading and writing), G_{sm} (short-term memory), G_v (visual processing), G_a (auditory processing), G_{lr} (long-term storage and retrieval), G_s (processing speed), and G_t (decision speed/reaction time). Of these 10, only 7 are directly measured by today's intelligence tests: G_q and G_{rw} are in the domain of academic achievement, and, therefore, are measured by achievement tests, and G_t is not measured by any major standardized test. Intelligence tests may indirectly measure some of these other skills, however. In addition, some of the components of each broad factor may not be well measured by either ability or achievement tests.

The Stanford-Binet 5 (SB5, Roid, 2003) and the Woodcock-Johnson-Revised (WJ-III; Woodcock, McGrew, & Mather, 2001) were the first intelligence tests to be built on Gf-Gc theory. Today, nearly every major intelligence test is founded either explicitly or implicitly on the current version of the theory, namely, CHC. In addition, largely because of the influence of CHC theory, all current IQ tests (including the Wechsler Intelligence Scale for Children – Fourth Edition; WISC-IV, Wechsler, 2003) have shifted the historical focus from a small number of part scores to a contemporary emphasis on anywhere from four to seven cognitive abilities (Sternberg, Kaufman, & Grigorenko, 2008).

Although in the early stages of the Cattell-Horn G_f-G_c theory, G_f (fluid intelligence) was hypothesized to be strongly linked to creativity (Cattell & Butcher, 1968), such a relationship is no longer explicitly part of the CHC theory. The current model, based on factor analytic studies by Carroll (1993) and others, includes originality/creativity as a component of long-term storage and retrieval (G_{lr}). According to the most recent presentation of CHC (McGrew, 2009), "Some G_{lr} narrow abilities have been prominent in creativity research (e.g., production, ideational fluency, or associative fluency)" (p. 6). In the detailed description

1 We do not include discussion of the coincident set and disjoint set categories, which in our view are much less common compared to the other categories and do not reflect current, major lines of inquiry within the field.

of the model, this sentence is the only mention of creativity, originality, or divergent thinking. Fluid intelligence (G_f) is discussed in terms of its relationship to problem-solving and coping with novel problems (both considered to be highly related to creativity), yet the emphasis is on G_{lr}.

Martindale (1999) proposed a differential relationship between G_s (processing speed) and creativity. According to Martindale's theory, people who are creative are selective with their speed of information processing. Early in the creative problem-solving stage, they widen their breadth of attention, allowing a larger amount of information to be processed (and thereby lowering their speediness). Later, when the problem is better understood, their attention span is shortened and their reaction time is quicker. This theory is reminiscent of Sternberg's (1981) distinction between global and local planning: Brighter people spend more time in initial global planning so that later they do not have to spend as much time in local planning.

Some have argued that the current CHC model shortchanges creativity (J. C. Kaufman, 2009). Placing all references to creativity and originality under G_{lr} seems quite narrow. The ability to draw selectively on past experiences is essential for creating something new. But the connection between fluid intelligence and creativity is minimized in new conceptions of the model.

An intriguing and fairly recent perspective in this category is Sternberg's (1996, 1997, 1999; Sternberg et al., 2008) theory of successful intelligence. This theory comprises three "subtheories": a *componential subtheory*, which relates intelligence to the internal world of the individual; an *experiential subtheory*, which relates intelligence to both the external and the internal worlds of the individual; and a *contextual subtheory*, which relates intelligence to the external world of the individual. The componential subtheory specifies the mental mechanisms responsible for planning, carrying out, and evaluating intelligent behavior. The experiential subtheory expands on this definition by focusing on those important behaviors that involve either adjustment to relative novelty, automatization of information processing, or both. The contextual subtheory defines intelligent behavior as involving purposeful adaptation to, selection of, and shaping of real-world environments relevant to one's life (Sternberg et al., 2008).

The experiential subtheory is directly related to creativity. Sternberg's application of creativity assessments to admissions data increased prediction of college success beyond that obtained with standard admissions tests; in addition, ethnic-group differences were significantly reduced (Sternberg, 2006; Sternberg & the Rainbow Project Collaborators, 2006). Gardner's well-known theory of multiple intelligences (1999) does not specifically address creativity. However, his eight intelligences (interpersonal, intrapersonal, spatial, naturalistic, linguistic, logical-mathematical, bodily-kinesthetic, and musical) certainly seem to apply to creativity. Gardner (1993) used case studies of eminent creative individuals to argue that creative people can shine as a function of embodying different intelligences. For example, he selected Freud as an example of intrapersonal intelligence; Einstein to represent logical-mathematical intelligence; Picasso, spatial intelligence; Stravinsky, musical intelligence; T. S. Eliot, linguistic intelligence; Martha Graham, bodily-kinesthetic intelligence; and Gandhi, interpersonal intelligence (naturalistic intelligence had not been added at this time).

Theories of Creativity That Encompass Intelligence

Systems Theories

In recent years, there has been an emphasis on creativity theories that incorporate factors that are interrelated (Kozbelt, Beghetto, & Runco, 2010). Some of these theories emphasize issues such as the environment or evolution and are less relevant here. Other theories emphasize a confluence of different elements and include intellectual and cognitive abilities in the equation. One such theory is Sternberg and Lubart's (1996) "investment" theory of creativity, in which the key to being creative is to buy low and sell high in the world of ideas. In this model, a creative person is like a talented Wall Street investor. A successful creator will generate ideas that may be initially unpopular or underappreciated (as in buying stocks with low price-earnings ratios) yet will persist and convince others of the ideas' merits. The creator will then know when to move on to pursue other ideas (as in selling high, when one divests oneself of stocks).

According to this model, six main elements contribute to creativity: intelligence, knowledge, thinking styles, personality, motivation, and the environment. Intelligence contributes using three elements drawn from Sternberg's triarchic theory (1988, 1996; later expanded into the theory of successful intelligence).

The first element is synthetic ability, which is the ability to generate ideas that are novel, high in quality, and high in task appropriateness. Because creativity is viewed as an interaction between a person, a task, and an environment, what is novel, high in quality, or task appropriate may vary from one person, task, or environment to another. Central to this ability is being able to redefine problems. Creative people may take problems that other people see, or they themselves may previously have seen, in one way, and redefine the problems in a different way. This synthetic ability includes three knowledge-acquisition components. The first, selective encoding, involves distinguishing relevant from irrelevant information. Selective combination, the second, involves combining bits of relevant information in novel ways. Finally, selective comparison involves relating new information to old information in a novel way.

The second element, practical ability, is needed to communicate creative ideas to other people (i.e., "selling" an idea). Good ideas do not always sell themselves – the creative person needs to devise strategies for and expend effort in selling those ideas.

The third component, analytical ability, is often measured by traditional intelligence tests. Yet this component is also related to creativity, as a successful creator must be able to judge the value of his or her own ideas and decide which ones to pursue. Such analytical ability can be used to evaluate the strengths and weaknesses of the idea and determine the best steps to improve upon the idea. People who are high in synthetic ability but low in analytical ability may need someone else to evaluate and judge their work for them. People who are able incisively to evaluate their own work may be said to be high in metacognition (which is related to planning, a key component of Luria's model).

There has been some empirical work on the role of metacognitive abilities in creativity. Runco and colleagues (Runco & Dow, 2004; Runco & Smith, 1992) found that people who tended to produce more original responses also were better at rating their most original responses to a divergent-thinking task. Silvia (2008a) asked people to pick their best responses to a similar divergent-thinking task, and then examined whether they were more likely to choose responses that outside raters considered creative. Silvia found that people were able to discern their more creative responses – and that people who were more open to experience were more likely to choose accurately. Researching the extremely creative end of the spectrum, Kozbelt (2007) analyzed Beethoven's self-critiques and found that the great composer was a reasonably accurate rater of his own work.

Another theory that views creativity as a mix of different abilities is Amabile's (1982, 1996) componential model of creativity. She argued that three variables were needed for creativity to occur: domain-relevant skills, creativity-relevant skills, and task motivation. Domain-relevant skills include knowledge, technical skills, and specialized talent (i.e., a creative mathematician should know basic algebra and geometry). Creativity-relevant skills are personal factors that are associated with creativity. These skills include tolerance for ambiguity, self-discipline, and risk-taking. Finally, Amabile singles out one's motivation toward the task at hand. Intelligence would primarily occur at the domain-relevant skill level.

A third theory that accounts for multiple variables and also takes a domain-specific approach is the Amusement Park theory (Baer & Kaufman, 2005a, 2005b; Kaufman & Baer, 2005). In an amusement park there are *initial requirements* (e.g., a ticket) that apply to all areas of the park. Similarly, there are initial requirements that, to varying degrees, are necessary to creative performance in all domains. One such key initial requirement is intelligence. Amusement parks also have *general thematic areas* (e.g., at Disney World one might select among EPCOT or Disney-MGM Studios), just as there are several different general areas in which someone could be creative (e.g., the arts, science). Once in one type of park, there are sections (e.g., Fantasyland and Adventureland are all found in the Magic Kingdom), just as there are *domains* of creativity within larger *general thematic areas* (e.g., physics and biology are domains in the *general thematic area* of science). These domains in turn can be subdivided into *micro-domains* (e.g., in Fantasyland one might visit Cinderella's Castle or It's a Small World; in the domain of psychology, one might specialize in cognitive psychology or social psychology).

Cognitive Theories of Creativity

The other group of theories that includes intellectual abilities as a key component is the set of cognitive theories of creativity. Guilford, as discussed earlier, pioneered these ideas, and his convergent versus divergent thinking dichotomy is still a key idea in creativity. Even before Guilford, however, Wallas (1926) proposed a model of the cognitive creative process. According to his five-stage model, you first use *preparation* to begin work on a problem. Next, there is *incubation*, in which you may work on other things while your mind thinks about the problem. In *intimation*, you realize you are about to have a breakthrough (this phase is sometimes dropped from the model), and then you actually have the insight in the *illumination* phase. Finally, with *verification*, you actually test, develop, and use your ideas.

More recently, the Geneplore model has two phases, generative and explorative, that are comparable to Guilford's convergent and divergent thinking distinction. In the generative phase, someone constructs a preinventive structure, or a mental representation of a possible creative solution (Finke, Ward, & Smith, 1992). For example, Elias Howe was working on his invention of the modern sewing machine. He couldn't quite get the needle correctly designed. Howe had an odd dream in which he was chased by savages who threw spears at him. The spears had a circle loop at the end – and Howe realized that adding the circle (or an "eye") to the end of the needle was the solution he needed (Hartman, 2000). The image of a spear with a circle at the end – the image that preceded Howe's insight – would be an example of one of these preinventive structures. They don't need to be as dramatic or sudden as the realization based on Howe's dream. Indeed, the generation of preinventive structures is only one part of the creative process, according to the Geneplore model. The thinker must then explore these different preinventive structures within the constraints of the final goal. There may be several cycles before a creative work is produced.

Although the model focuses on the creative process, most tests of the model have actually measured the creative product. In an experiment testing the model, people were shown parts of objects (such as a circle or a cube). They were then asked to combine these parts together to produce a practical object or device. The creativity (and practicality) of the items was then assessed (e.g., Finke, 1990; Finke & Slayton, 1988). Interestingly, people produced more creative objects when they were told which parts had to be combined than when they could pick the parts to be combined.

Other theories have also focused on cognitive-oriented components of the creative process. Michael Mumford and his colleagues (Blair & Mumford, 2007; Mumford, Longergan, & Scott, 2002; Mumford, Mobley, Uhlman, Reiter-Palmon, & Doares, 1991) have argued for an eight-part model, focusing on problem construction, information encoding, category selection, category combination and reorganization, idea generation, idea evaluation, implementation planning, and solution monitoring. Basadur, Runco, and Vega (2000) offer a simplified model centered around finding good problems, solving these problems, and then implementing these solutions. Mednick (1962, 1968) proposed the idea that creativity occurs when different elements are associated together to form new combinations. Creative individuals are assumed to be able to make meaningful, useful associations between disparate concepts and ideas to a greater extent than a relatively uncreative individual. The Remote Associates Test was developed based on this idea (Mednick & Mednick, 1967).

Overlapping Sets

The third category of theories includes conceptualizations in which the constructs of intelligence and creativity overlap but remain distinct, with one not subsuming the other. For example, Renzulli's (1978) three-ring conception of giftedness theorizes that giftedness – implicitly cast as high-level creative production – is caused by the overlap of high intellectual ability, creativity, and task commitment. From this perspective, creativity and intelligence are distinct constructs but overlap considerably under the right conditions. Renzulli distinguishes between two types of giftedness: schoolhouse (i.e., what would be measured by an ability or achievement test) and creative-production. Examples of his components of creativity include Guilford's divergent thinking components (fluency, flexibility, and originality), and being open to new experiences, curious, willing to take risks, and sensitive to aesthetic characteristics (Renzulli, 2002).

Another theory of intelligence that incorporates creativity is the PASS (Planning, Attention, Simultaneous, and Successive) cognitive processing theory based on the works of Luria (see Das, Naglieri, & Kirby, 1994, for an overview). Like the CHC model, Luria's model is frequently applied to intelligence tests. Luria's (1966, 1970, 1973) original neuropsychological model featured three Blocks or functional units. The first unit is responsible for focused and sustained attention. The second functional unit receives and stores information with both simultaneous and successive (or sequential) processing. Simultaneous processing involves integrating chunks of information together, largely in parallel; chunks are synthesized together simultaneously, much as one might appreciate a painting all at once. Successive processing is interpreting chunks of information separately, in sequential fashion, much as when one listens to a news broadcast reporting successive stories.

The third functional unit is responsible for planning, decision making, and self-monitoring behavior. It is this last ability, planning, that has been hypothesized to be related to creativity (Naglieri & Kaufman, 2001). For example, in a study of cognitive styles and creativity, the cognitive style emphasizing planning (called, appropriately enough, "the planner") was strongly linked to creative productivity (Guastello, Shissler, Driscoll, & Hyde, 1998). Also, people who spent time planning and replanning a project were more productive and more creative (Redmund, Mumford, & Teach, 1993).

Theories on How Intelligence and Creativity Are Related

The threshold theory argues that intelligence is a necessary but not a sufficient condition of creativity (Barron, 1969; Yamamoto, 1964). According to this view, creativity and intelligence are positively correlated up until an IQ of approximately 120; in people with higher IQs, the two constructs are said to show little relationship (e.g., Barron, 1963; Getzels & Jackson, 1962; Richards, 1976). The interference hypothesis suggests that very high levels of intelligence may interfere with creativity (Simonton, 1994; Sternberg, 1996).

Runco (2007) offers an interesting, alternative view of the threshold concept. He argues that traditional investigations of the creativity-intelligence relationship may be ignoring the presence of heteroscedasticity – the idea that levels of creativity may vary considerably at different levels of intelligence. Acknowledging that a minimal level of intelligence is probably necessary for optimal creative contributions, Runco notes research (e.g., Hollingworth, 1942) suggesting that people with extremely high IQs often exhibit low levels of creativity.

Empirical Work on Intelligence and Creativity

Most studies that investigate creativity and intelligence use divergent-thinking tests (such as the TTCT) or other related paper-and-pencil tests also scored for fluency, originality, or other divergent thinking-related methods of scoring (e.g., Plucker, 1999). The studies have generally found that creativity is significantly associated with psychometric measures of intelligence (especially verbally oriented measures, regardless of the type of creativity measured). This relationship is typically not a particularly strong one (Barron & Harrington, 1981; Kim, 2005; Wallach & Kogan, 1965), although Silvia (2008a, 2008b) argued that the relationship between the latent constructs of creativity and intelligence is underestimated because the analyses only look at observable scores (i.e., performance on an intelligence test). If it were possible to get a "true" measure of the constructs, there might be a higher relationship.

Most of these studies reinforce the threshold theory discussed earlier (e.g., Fuchs-Beauchamp, Karnes, & Johnson, 1993; Getzels & Jackson, 1962), but the threshold theory has come under fire. Runco and Albert (1986) found that the nature of the relationship was dependent on the measures used and the populations tested. Preckel, Holling, and Weise (2006) looked at measures of fluid intelligence and creativity (as measured through divergent thinking tests) and found modest correlations across all levels of intellectual abilities. Wai, Lubinski, and Benbow (2005), in a longitudinal study of gifted (top 1%) 13-year-olds, found that differences in SAT scores – even within such an elite group – predicted creative accomplishments 20 years later. Park, Lubinski, and Benbow (2007) examined intellectual patterns of ability and eventual creativity in different domains. Using math and verbal SAT scores of people at age 13, they then tracked the accomplishments of these same people 25 years later. Unsurprisingly, early prowess was associated with eventual success. However, a person's specific strengths (in this case, math vs. verbal) predicted patents (math) and literary publications (verbal). Park, Lubinski, and Benbow (2008) further extended their findings to demonstrate this link in the fields of science and technology. Kim (2005), in a meta-analysis of 21 studies, found virtually no support for the threshold theory, with small positive correlations found at all levels of ability between several different measures of intelligence and creativity.

It is notable, however, that nearly all of these studies do not use traditional, individually administered intelligence tests. In Kim's (2005) meta-analysis, many of the studies were more than 30 years old and, therefore, were conducted using intelligence tests that do not reflect current theories of intelligence. In addition, most of the studies used group intelligence tests. Although group intelligence tests serve a strong purpose in research studies, they are not used by most school psychologists for psychoeducational assessment (A. S. Kaufman & Lichtenberger, 2006).

One of the few research studies to use an individually administered, modern IQ test was Sligh, Conners, and Roskos-Ewoldsen (2005), who used the Kaufman Adolescent and Adult Intelligence Scale (Kaufman & Kaufman, 1993) and a creative invention task (in which people would use shapes to create a possible object, and then name and describe their invention; see Finke, 1990). Sligh et al. (2005) delved deeper into the intelligence-creativity relationship by specifically examining the relationship between Gf (novel problem solving) and

Gc (acquired knowledge) and a measure of actual creative innovation. Gc showed the same moderate and positive relationship to creativity as past studies, mentioned previously; in contrast, Gf showed the opposite pattern. Measured intelligence and creativity were significantly correlated for the high IQ group, but they were not significantly correlated for people with average IQs. This finding implies that students who receive high Gf scores may be more likely to be creative than students who receive high Gc scores.

The Sligh et al. study also addresses a second major weakness in this line of research: the overreliance on divergent thinking measures as the sole assessment of creativity. Few studies have been conducted that include measures of creative personality, creative products, and creative processes (other than divergent thinking).

An interesting suggestion posed by Batey and Furnham (2006) is that the role of Gf and Gc in creativity may shift across the life span of a creative person. Gf, they argue, might be more important in early stages of a career. Conversely, a later-career creator may rely more on Gc – and, we might postulate, Glr.

Given the existing studies, what do all of these results mean? Few studies contradict the idea that creative people tend to be fairly smart, and smart people are usually somewhat creative. But some of the tested-and-true ideas about the specific relationship are still unclear. If the threshold theory is correct, then there may be a certain point at which being smart stops helping creativity; recent psychometric studies, however, call the existence of the threshold effect into question. Given all of the weaknesses of this area of study, the threshold theory may be best viewed as largely untested.

Conclusion

Intelligence is strongly valued in schools, and extensive and popular measures are often used to measure it. There are usually hundreds of empirical studies about each intelligence test. Creativity may be theoretically desired in school, but it is often considered less important than intelligence; some teachers may even dislike creative students (Westby & Dawson, 1995). Creativity assessment is murkier than intellectual assessment. The Torrance Tests remain the most-used creativity tests despite extensive critiques (Kaufman et al., 2008).

Each of the five possible relationships in Sternberg's framework enjoys at least some empirical support (Sternberg & O'Hara, 1999), but the difficulty in interpreting empirical results illustrates the problems associated with reaching a consensus on the validity of any of these five relations (see Hattie & Rogers, 1986). For example, Haensly and Reynolds (1989) believe that Mednick's (1962) association theory supports the creativity as a subset of intelligence position, yet Sternberg and O'Hara (1999) feel that this body of work supports the overlapping sets position. In another example, if Gardner's work with creativity had come before his work with MI theory, we would be tempted to argue that his efforts fall within the intelligence as a subset of creativity category.

From our perspective, the complexity of possible intelligence-creativity relationships is not surprising. Whenever one compares two constructs, the way in which each construct is conceptualized and assessed will have a significant impact on any empirical results. Researchers and theorists do not believe that intelligence and creativity are completely orthogonal, but beyond that, the exact nature of that relationship remains an open question. The basic need for both creativity and intelligence, however, remains undisputed.

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