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Making creative metaphors: The importance of fluid intelligence for creative thought

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ABSTRACT

The relationship between intelligence and creativity remains controversial. The present research explored this issue by studying the role of fluid intelligence (Gf) in the generation of creative metaphors. Participants ($n = 132$ young adults) completed six nonverbal tests of Gf (primarily tests of inductive reasoning) and were then asked to create metaphors that described a past emotional experience. The metaphors were rated for creative quality. Latent variable models found that Gf explained approximately 24% of the variance in metaphor quality (standardized beta = .49), consistent with the view that creative ideation engages executive processes and abilities. The effect of Gf remained substantial after including personality (the Big Five factors) in the model. The discussion considers implications for the debate over intelligence and creativity as well as for the cognitive abilities involved in metaphor production.

1. Making creative metaphors: the role of fluid intelligence in creative thought

Are intelligent people more creative, or are intelligence and creativity independent abilities? This question is one of the enduring controversies in the psychology of creativity (Kaufman, 2009; Wallach & Kogan, 1965). In the present work, we take a new slant on this problem by examining the role of fluid intelligence (Gf) in the production of creative metaphors. This work extends studies of creative cognition to a new domain, provides further support for our view that intelligence is central to creative thought (Nusbaum & Silvia, 2011a), and contributes to the emerging literature on how people make metaphors (Chiappe & Chiappe, 2007).

2. The creativity-and-intelligence controversy

In the psychology of creativity, most reviews of the creativity-and-intelligence controversy have concluded that creativity and intelligence are distinct abilities with minor overlap (e.g., Batey & Furnham, 2006; Kaufman & Plucker, 2011; Kim, Cramond, & VanTassel-Baska, 2010; Runco, 2007). Since Wallach and Kogan's (1965) landmark work on this topic, research has typically found that creative cognition—usually measured with divergent thinking tasks—covaries modestly with intelligence. A recent meta-analysis of the relationship between intelligence and divergent thinking found an overall effect of $r = .17$ (Kim, 2005).

At the same time, many contemporary researchers have found that there are good reasons to expect stronger relationships between intelligence and creative cognition. Generating creative ideas—ideas that are both novel and appropriate to the purpose at hand—requires identifying and implementing strategies for idea generation (Gilhooly, Fioratou, Anthony, & Wynn, 2007; Nusbaum & Silvia, 2011a), exerting control over attention and thought (Vartanian, 2009; Zabelina & Robinson, 2010; Zabelina, Robinson, Council, & Bresin, 2012), making decisions and refining initial ideas (Finke, Ward, & Smith, 1992; Gabora, 2005; Vartanian, 2011), and inhibiting obvious and inapt ideas (Nusbaum & Silvia, 2011a).

If this view of creative cognition is right, then fluid and executive abilities should be central to the creative process. But

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past reviews and Kim's (2005) meta-analysis conclude otherwise, so an executive interpretation of creative thought is understandably controversial. We have suggested that some common methods in creativity research have obscured and deflated the true relationship between intelligence and creative cognition (Nusbaum & Silvia, 2011a; Silvia, 2008a, 2008b). First, analyzing latent variables instead of observed variables yields higher effects (Silvia, 2008a). Second, analyzing higher-order abilities—such as fluid intelligence (Gf) or *g*—yields stronger relationships than analyzing lower-order abilities and individual tasks (Silvia, 2008a). Third, and perhaps most important, newer methods of creativity assessment will yield larger effects. Our past work (Silvia, Martin, & Nusbaum, 2009; Silvia et al., 2008) has contended that the usual ways of assessing divergent thinking have serious problems. Divergent thinking tasks can be scored in many ways (see Plucker, Qian, & Wang, 2011), but the most common ways are to score the number of responses (fluency; e.g., Batey, Chamorro-Premuzic, & Furnham, 2009; Preckel, Holling, & Wiese, 2006; Preckel, Wermer, & Spinath, 2011) or to score the number of responses given by no one else (uniqueness or originality; Wallach & Kogan, 1965). Uniqueness is confounded with fluency (Silvia, 2008b), and it has an unusual sample dependency—it shrinks as the sample size rises (Silvia, 2011; Silvia et al., 2008)—that makes it poorly suited for large-sample research.

As an alternative, we have suggested subjective ratings of creativity, which have been widely used in past work (Amabile, 1982; Christensen, Guilford, & Wilson, 1957; Kaufman, Baer, Cole, & Sexton, 2008; Kaufman, Lee, Baer, & Lee, 2007). For divergent thinking tasks, several trained raters simply evaluate and score individual ideas (Silvia, 2011; Silvia & Kimbrel, 2010; Silvia et al., 2008) or the set of ideas (Silvia et al., 2009). Thus far, we have found that subjective ratings of creativity are unconfounded with fluency (Silvia et al., 2008) and that the relationships of creativity with intelligence are substantially larger (Nusbaum & Silvia, 2011a).

3. Cognitive abilities and metaphor production

Metaphor provides an interesting context for studying the role of intellectual abilities in creative cognition.[1] How people generate metaphors is fascinating in its own right—despite the large literature on how people understand metaphor (Gibbs, 1994; Glucksberg, 2001; Glucksberg, McGlone, & Manfredi, 1997), little is known about how people make metaphors. Creative metaphors are also good examples of real-world creativity, so metaphor provides a fruitful context for studying creative thought. Unlike divergent thinking, which many critics contend is unrealistic and artificial (Sawyer, 2006; Simonton, 1999), metaphors are a common and valued form of creativity in speech and writing (Plotnik, 2007).

[1] Consistent with usage in cognitive linguistics (Barnden, 2010; Grady, 2007), we use *metaphor* as a higher-order term that encompasses several kinds of figurative thought, such as metaphors, similes, and analogies. Although not alike in all respects, these share features that distinguish them from other classes of figurative thought, such as metonymy and irony (Gibbs, 1994; Panther & Thornburg, 2007).

We propose that producing creative metaphors, like producing creative responses to divergent thinking tasks, involves several executive processes. The mechanics of metaphor production are just beginning to receive attention (see Chiappe & Chiappe, 2007; Pierce & Chiappe, 2009), but models of metaphor comprehension provide insight into how people might compose metaphors. In the property attribution model of metaphor (Glucksberg, 2001; Glucksberg et al., 1997), metaphors entail attributing a property of a vehicle to a topic. In the metaphor "Some toddlers are tyrants," for example, the "demanding and domineering" feature of the vehicle ("tyrants") is attributed to the topic ("some toddlers"). To understand the metaphor, people create a superordinate "attributive category" ("things that are demanding and domineering") that the vehicle exemplifies and that can plausibly include the topic.

Using the property attribution model as a guide, we can see how creating a metaphor involves several executive processes. First, people must choose a property that they wish to attribute to the topic. For the topic "teaching," for example, people must select what they wish to say about teaching (e.g., that it is rewarding, stressful, challenging, or unpredictable). Second, people must then scan semantic knowledge for suitable vehicles that exemplify the abstract, higher-order attributive category (e.g., searching for "things that are stressful"). Doing so requires maintaining access to the category while inhibiting many kinds of knowledge: features of the topic and of possible vehicles that are irrelevant to the higher-order category (cf. Gernsbacher, Keysar, Robertson, & Werner, 2001); highly accessible but irrelevant semantic knowledge (e.g., adjectival descriptions of the topic); and the many accessible but trite possibilities, such as idioms, clichés, and dead metaphors. Finally, likely vehicles (e.g., "lion taming") must be evaluated according to abstract criteria (e.g., "Does this metaphor convey the desired meaning and emotional tone? Is it clever or interesting?"), revised, and then retained or discarded.

Consistent with our analysis, the small body of work on how people make metaphors suggests that several cognitive abilities—including executive abilities—are involved. Taylor (1947) conducted one of the earliest studies of cognitive abilities and metaphor production. He developed a similes task that presented incomplete metaphor stems (e.g., "His skin was as brown as _____") and required participants to complete the stem three different ways. The similes task loaded on ideational fluency and verbal versatility factors. Interestingly, Taylor suggested an executive mechanism for the verbal versatility factor (p. 251):

> "a person who is good in this ability can readily break the set of the first answer and produce a second answer, and then a third answer, that expresses the same general meaning. Others may find it difficult to break away from the first answer to restate the same idea in a somewhat different form."

Consistent with a role for interference management, the similes task had moderate correlations ($r = .32$ and $r = .37$) with measures of inductive reasoning.

Guilford and his research group developed several metaphor completion tasks (e.g., simile insertion and simile completion) as part of their research on verbal fluency (Christensen & Guilford, 1963; Merrifield, Guilford, Christensen, & Frick, 1963). Similar tests appear in the Kit of