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Is creativity without intelligence possible? A Necessary Condition Analysis

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ABSTRACT

This article extends the previous studies on the relationship between intelligence and creativity by providing a new methodology and an empirical test of the hypothesis that intelligence is a necessary condition for creativity. Unlike the classic threshold hypothesis, which assumes the existence of a curvilinear relationship between intelligence and creativity, the Necessary Condition Analysis (Dul, 2016) focuses on and quantifies the overall shape of the relationship between intelligence and creativity. In eight studies (total $N = 12{,}255$), using different measures of intelligence and creativity, we observed a consistent pattern that supports the necessary-but-not-sufficient relationship between these two constructs. We conclude that although evidence concerning the threshold hypothesis on the creativity–intelligence relationship is mixed, the "necessary condition hypothesis" is clearly corroborated by the results of appropriate tests.

1. Introduction

It is hardly possible to make an impact in any domain of human functioning, especially in the creative domain (Simonton, 2013), without a substantial amount of intelligence (Cox, 1926; Plucker, Esping, Kaufman, & Avitia, 2015; Simonton, 2014). It is equally obvious, however, that intelligence alone is not a sufficient condition for creative achievement (Feist & Barron, 2003; Plucker, 1999). To achieve creative accomplishments, one has to start by making a decision to engage in creative activity as such (Sternberg, 2002), possess high and adequate creative self-efficacy (Beghetto, 2006; Karwowski, 2011), be open (Feist, 1998; Jauk, Benedek, & Neubauer, 2014), invest time in training (Ericsson, 2014; Simonton, 2014), and – last but not least – function in a supportive environment (Dul & Ceylan, 2011; Karwowski & Lebuda, 2013).

Creativity scholars usually agree in defining creativity as a human capacity to produce ideas and products that are both novel and useful or appropriate (Amabile, 1996; Sternberg & Lubart, 1999). Even if sometimes other creativity criteria are added, including the expectation that a creative product will be surprising (Simonton, 2012) or characterized by an esthetic value and authenticity (Kharkhurin, 2014), the combination of originality and value/usefulness is most often seen as essential criteria for a product to be considered creative (Runco & Jaeger, 2012).

Although different taxonomies of creativity have been proposed over the decades (see Glăveanu, 2010, 2014 for a discussion), the crucial distinction from the perspective we take in this article is that between creative potential (Runco, 2003) and creative achievement (Carson, Peterson, & Higgins, 2005; Eysenck, 1995; Robertson, Smeets, Lubinski, & Benbow, 2010; Wai, Lubinski, & Benbow, 2005). Creative potential is usually treated as a synonym of creative ability and measured using so-called creativity tests — mainly divergent thinking tasks (Runco, 1991). On the other hand, there are convincing arguments (see Weisberg, 2006 for a discussion) that creative ability is more than divergent thinking alone (Baer, 1993; Guilford, 1967; Runco, 1991) or vividness of imagination (Jankowska & Karwowski, 2015). It also involves deductive and inductive thinking (Dunbar, 1997; Vartanian, Martindale, & Kwiatkowski, 2003; Weisberg, 2006) as well as the ability to use specific problem solving strategies (Finke, Ward, & Smith, 1992) to generate novel and appropriate solutions and outcomes. Creative achievement refers to observable and socially recognized accomplishments in one or more domains (Simonton, 1994). Previous studies have demonstrated that creative ability predicts creative achievement (Feist & Barron, 2003; Plucker, 1999; Runco, Millar, Acar, & Cramond, 2010) and that creative activity (i.e., time devoted to creative training and creative behavior) mediates this relationship (Jauk et al., 2014). Both, classic (i.e., Feist, 1998) and more recent works (S. Kaufman

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et al., 2016) have also shown that not only cognitive characteristics, but also personality traits predict creative potential, activity and achievement. Openness to experience forms the most consistent personality predictor of creativity: it is important not only for everyday creative engagement (Conner & Silvia, 2015; Silvia et al., 2014), but also for creative activity (Jauk et al., 2014), creative self-beliefs (Karwowski & Lebuda, 2015) and creative achievement (Silvia, Nusbaum, Berg, Martin, & O'Connor, 2009). Importantly, recent works have demonstrated that two distinct aspects of openness trait – Openness and Intellect (DeYoung, 2015) influence creativity differently: while Openness predicts creative achievement in the arts, Intellect predicts creative achievement in science-related domains (S. Kaufman, 2013; S. Kaufman et al., 2016). Another study (Nusbaum & Silvia, 2011a) also found that while Openness predicts overall creative achievement, Intellect is more closely related to fluid intelligence.

Although the relationship between intelligence and creativity forms one of the classic problems researchers have examined over the decades (Guilford, 1967; Torrance, 1962), a widely accepted answer to this question is yet to come (Batey & Furnham, 2006; Silvia, 2015). The authors of early theories (Guilford, 1967) perceived intelligence as a necessary-but-not-sufficient condition for creativity, operationally defined in terms of the so-called "threshold hypothesis" (TH; see Jauk, Benedek, Dunst, & Neubauer, 2013; Karwowski & Gralewski, 2013; Preckel, Holling, & Wiese, 2006; Runco & Albert, 1986). The TH assumes that the correlation between intelligence and creative ability depends on the level of intelligence and expects a positive relationship only in the groups of individuals whose intelligence level is below an IQ of 120. Above this hypothetical threshold, the correlation is expected to weaken and/or to become statistically insignificant (Guilford, 1967). Hence, the TH assumes, on average, a curvilinear inverted J-shaped relationship between intelligence and creativity. However, classic works that define intelligence as a necessary-but-not-sufficient condition for creativity usually exemplified this relationship with the use of a characteristic scatterplot that takes the shape of a triangle (Guilford, 1967; Runco, 2007) (Fig. 1).

Such a distribution of these two variables of interests shows that individuals with high intelligence (X axis) attain almost any range of creativity (Y axis) scores, including low levels of creativity, while those with

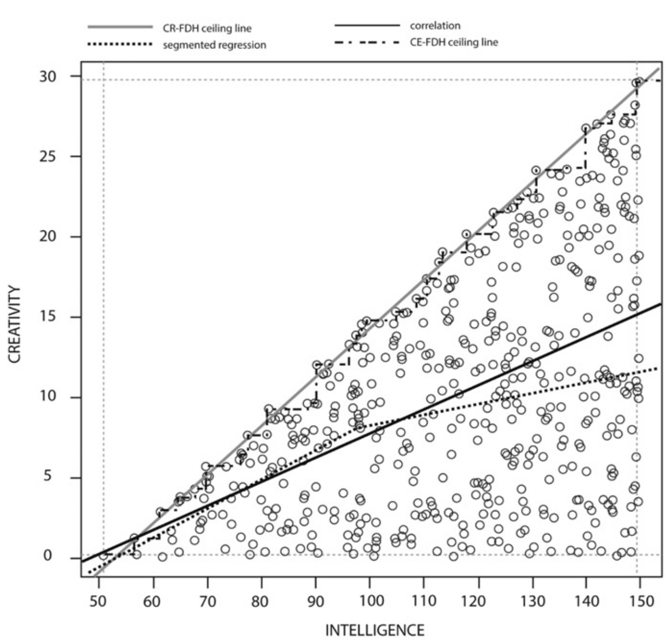

Fig. 1. Schematic illustration of the relationship between intelligence and creativity. Solid black line denotes a linear relationship; dotted black line denotes a relationship assessed using segmented regression analysis; solid gray line denotes a necessary condition relationship (CR-FDH), while broken stepped black line denotes CE-FDH Necessary Condition Analysis (see text for details and further explanations).

low intelligence are generally not so creative. Even more importantly, almost nobody is characterized by low intelligence and high creativity, so the upper-left corner of this distribution chart is usually empty. Although this visual pattern resembles exactly what the necessary condition hypothesis proposes, serious doubts exist about whether previous studies of these relationships tested it appropriately. Going further, is it really possible to analyze the hypothesized "necessary-but-not-sufficient" relationship between creativity and intelligence really in a correlational or regression (even polynomial; see Jauk et al., 2013; Karwowski & Gralewski, 2013) manner? In this paper we argue that such hypotheses require alternative analytical approaches that go beyond correlation or regression models. Consequently, in this article we propose that this classic problem may be better resolved by using more appropriate analytical methods, developed specifically to test the necessary-but-not-sufficient conditions. We present details of this approach in the last part of the introduction. Before, we start by briefly summarizing the long history of intelligence–creativity relationship and recent findings.

1.1. A look at the intelligence–creativity relationship

Although creativity researchers over the years have postulated that intelligence and creativity are independent psychological phenomena (e.g., Torrance, 1972; Wallach & Kogan, 1965), a recent movement in the creativity literature leads to the conclusion that these constructs are "pretty similar after all" (Silvia, 2015). Using advanced statistical methods, especially those that make it possible to control for measurement error (Benedek, Jauk, Sommer, Arendasy & Neubauer, 2014; Nusbaum & Silvia, 2011b), and a differentiated measurement of creativity, not limited to divergent thinking tasks (Silvia & Beaty, 2012), recent studies have shown that correlations between intelligence and creativity may be much higher than creativity scholars are used to believing. These findings provide arguments that the true (latent) correlation between intelligence and creativity is .40 to .50 (Nusbaum & Silvia, 2011b) or even higher (Jauk et al., 2014). Although a correlation at this level supports the discriminant validity of both these constructs (Brown, 2015), it also shows that they are in fact more closely related than creativity researchers would like to admit.

Unlike creativity researchers, intelligence researchers usually consider creative ability simply as part of intelligence (Carroll, 1993). Both classic (Jäger, 1984; Guilford, 1967) and contemporary models of intelligence (Carroll, 1993; McGrew, 2009) place creativity within the broad range of subcomponents of intelligence. In the Carroll–Horn–Cattell intelligence model (CHC; Carroll, 1993; Keith & Reynolds, 2010; McGrew, 2009), long-term storage and retrieval ability (*Glr*) is responsible not only for storing and consolidating new information in long-term memory, but also for the fluent retrieval of the stored information: a psychological mechanism crucial for creativity (Nusbaum & Silvia, 2011b) as well as for several other types of fluency: ideational, associational, expressional, verbal, or figural. Also, figural flexibility, sensitivity to problems, and originality are theorized to be subcomponents of intelligence (Carroll, 1993; McGrew, 2009).

The TH, postulating stronger average associations observed between intelligence and creativity among less intelligent individuals than among more intelligent ones, which creativity scholars perceive as an argument for the conceptual distinctiveness of these characteristics, is differently explained by intelligence researchers. Intelligence literature tends to present such a finding as coherent with the Spearman Law of Diminishing Returns (SLODR) (Spearman, 1927) — that is, the conviction that a lower g saturation of cognitive tests comes along with the increasing level of ability (Karwowski & Gralewski, 2013; Preckel et al., 2006). The pattern observed in the case of TH – lower correlations between g and creativity at the higher levels of g – is exactly what the SLODR postulates.

If the theoretical positions held by creativity and intelligence researchers regarding the relationship between intelligence and creativity differ so radically, can research results provide a more clear-cut