Personality and Individual Differences 134 (2018) 43–48

Contents lists available at ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid

Intelligence, personality and schizotypy as predictors of insight

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ARTICLE INFO

Keywords:
Insight
Problem solving
Schizotypy
Intelligence
Personality

ABSTRACT

Like divergent thinking tasks used in traditional creativity tests, insight problems require the subject to step out of his commonly employed cognitive framework and acquire novel representations of the problem's components. Although this process is believed to be influenced by individual differences, the relationship between insight, personality traits and other cognitive factors is still insufficiently researched and understood. This study sought to examine the contribution of fluid intelligence, Big Five personality traits and schizotypy in predicting creative problem solving (using 4 spatial, 3 mathematical and 3 verbal insight tasks). Multiple linear regression analyses showed that neither Big Five personality factors, nor dimensional schizotypy facets besides ImpuGlsive Nonconformity, are reliable predictors of insight. Only intelligence, gender (male), age and Impulsive Nonconformity were found to predict higher performance on such tasks. Further detailed analyses were carried out to account for meaningful differences between pure and hybrid problems of this nature, following Weisberg's (1995) suggestion that some commonly used insight problems do not require special automatic and associative cognitive processes, but simple analytical ones.

1. Introduction

Insight problems represent an early development within the realm of creativity research, anticipating by almost three decades G.P. Guilford's (1956) Structure of Intellect model and the classical divergent thinking tests created by Wallach and Kogan (1965) and E.P. Torrance (1966). Still, such tasks have received relatively low amounts of attention from the scientific community, with even comprehensive volumes dedicated to the field (e.g. Kaufman & Sternberg, 2010; Sternberg, 1999) only mentioning them in passing.

While at a fundamental theoretical level both divergent thinking tasks and insight problems are considered indexes of a person's creative potential (Finke, 1995), empirical evidence has now amassed pointing towards the possibility that these two measures involve quite distinct cognitive processes (Sternberg, Lubart, Kaufman, & Pretz, 2005; Wakefield, 1989). More explicitly, subjects' performances on these tasks are not strongly correlated (Webb, Little, Cropper, & Roze, 2017), nor are they apparently linked to the same cognitive factors, such as fluid intelligence (Sternberg et al., 2005) or working memory capacity to the same degree (Chein, Weisberg, Streeter, & Kwok, 2010; Lin & Lien, 2013). Correspondingly, even though not much is known about the role individual differences play in insight (but see Gilhooly & Fioratou, 2009; Lin, Hsu, Chen, & Wang, 2012), there is little reason to believe that the same personality traits are involved.

Until now, at least, studies based on the five-factor model or personality (Costa & McCrae, 1992) have established the existence of a positive relationship between Openness and performance in divergent thinking tasks (Batey, Chamorro-Premuzic, & Furnham, 2010; Batey & Furnham, 2006; Feist, 1998; Miller & Tal, 2007), as well as a negative relationship between such measures and Conscientiousness (Batey et al., 2010; Batey & Furnham, 2006). If creative problem solving and divergent thinking really do require and employ substantially different cognitive systems (Lin & Lien, 2013), it is to be expected that surface level personality traits will not coalesce into similar patterns. In the present study we investigated this general presumption, addressing thus what we believe to be an insufficiently explored area within the literature. Furthermore, following Feist's (2010) proposal that 'clinical' personality traits such as psychoticism (Eysenck & Eysenck, 1976) should also be assessed in research of this nature, we tried to establish if dimensional schizotypy (Claridge, 1997; Claridge & Beech, 1995) has any influence on insight in addition to the five factors, as studies on this topic have reached contradictory results (Karimi, Windmann, Güntürkün, & Abraham, 2007; Webb et al., 2017).

1.1. Insight problems as ill-defined, closed-solution tasks

Starting with Guilford's (1956) seminal paper on the subject, traditional divergent thinking (DT) tests have come to represent the gold standard in assessing a person's creative potential, focusing mostly on her ability to generate creative ideas (Silvia et al., 2008). As such, these

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https://doi.org/10.1016/j.paid.2018.05.043
Received 12 February 2018; Received in revised form 30 April 2018; Accepted 29 May 2018

tests emphasize the novelty aspect of creativity (Sternberg & Lubart, 1999; Horn & Salvendy, 2009), but not necessarily the usefulness part.

In contrast, following Wakefield's (1989) taxonomy of open- versus closed-solution and ill-versus well defined tasks, insight problems require the subject not only to navigate a novel solution space, but also to select a single adequate answer. This makes insight tasks ill-defined closed-solution problems (DeYoung, Flanders, & Peterson, 2008) that seem to require both divergent and convergent thinking capacities.

The main difficulty of such problems revolves around their capacity to misdirect the subject into thinking that the task at hand can be adequately solved through an algorithm (Chu & MacGregor, 2011; Ovington, Saliba, & Goldring, 2016). When it becomes clear that the usual approach does not lead to a feasible solution, people encounter impasse. Classical accounts of the phenomenology of insight discuss a subsequent unconscious period of incubation in which representations of the problem's components are then shuffled and recombined in order to arrive at an answer (Segal, 2004). While measuring such a subjective experience (i.e. the 'Aha!' moment) has proven to be a very difficult task (Ash, Cushen, & Wiley, 2009), more recent theoretical accounts have not completely abandoned this line of thinking.

Building on the foundation of dual-process theories of cognition (Sloman, 1996), Lin and Lien (2013), for example, suggested that a wide variety of factors might influence insight performance through the impact it has over the ease and choice of the processing mode. They believe that while divergent thinking tasks involve primarily the intuitive, heuristic System 1 of processing, insight problems also tax the rule-based, analytical, but resource-limited System 2. This position, however, is not well supported by empirical data (Benedek, Jauk, Sommer, Arendasy, & Neubauer, 2014; Silvia, 2008). Furthermore, some studies even suggest that System 1 is more important than System 2 in insight problem solving (Fleck, 2008; Gilhooly & Fioratou, 2009). Still, while Lee and Therriault (2013) showed that fluid intelligence and working memory play a crucial role in all creative thinking tasks, the data provided imply weaker links to DT test performance than to convergent tasks of creative potential.

At an intuitive level, the largely inconclusive literature on what 'insight' really is and how individual differences might impact performance on such problems seem to derive from the heterogeneous nature of the tasks that are commonly employed in the literature. Following Dow and Mayer's (2004) cluster analysis, insight problems do not seem to represent a unitary general category, but rather a collection of distinct types of problems, viz. spatial, mathematical, verbal or a combination of these. Addressing the issue of conceptual clarity, Weisberg (1995) introduced a distinction between hybrid and pure insight problems based primarily on the phenomenology of the 'Aha!' moment. On this account, only some tasks, such as Duncker's radiation problem (Gick & Holyoak, 1980) are true insight problems that tax System 1 processes. Tasks such as the 'pigs in the pen' (Gilhooly & Murphy, 2005) are believed to be fundamentally analytic in nature and solvable through trial and error.

1.2. Schizotypy and insight

Following the observation that insight problem solving seems to require some degree of loosened associational thinking, as well as the capacity to break frame (DeYoung et al., 2008), it is to be expected that subclinical psychotic traits and manifestations have a positive influence on performance. Studies centred on Eysenck's concept of psychoticism (Eysenck & Eysenck, 1976) have largely confirmed this assumption in what concerns divergent thinking tasks (Abraham, Windmann, Daum, & Güntürkün, 2005; Rawlings & Toogood, 1997), though empirical evidence is far from conclusive.

More recently, the similar construct of schizotypy (Claridge, 1997; Claridge & Beech, 1995) was introduced in the literature as a separate dimension of personality, having normally distributed traits in the human population. Of the various scales developed to assess this construct, the *Oxford-Liverpool Inventory of Feelings and Experiences* (Mason & Claridge, 2006; Mason, Claridge, & Jackson, 1995) is among the most popular and widely employed. Conceived as a personality-based questionnaire, O-LIFE does not focus on the specific symptoms or symptom clusters of schizophrenia.

In one of the few studies published on the relationship between schizotypy and insight, Karimi et al. (2007) found high schizotypy individuals to perform better in a small number of mathematical and verbal insight tasks. The authors suggested these results to be the product of a wider and wilder activation pattern of conceptual structures within the semantic networks of the subjects. Here, we started from a similar general presumption, adding that not all schizotypy traits should be beneficial to insight (e.g. cognitive disorganisation). This reserve is also in line with Carson's (2011) Shared Vulnerability Model which suggests that real-life creativity can capitalize on 'clinical' personality traits only when a high degree of intelligence buffers the 'negative' symptoms of psychosis. Still, it is important to note that Claridge's (1997) fully dimensional account of schyzotypy conceptualises psychosis-proneness on a distinct axis of 'health' that includes environmental factors.

2. Methods

2.1. Instruments

2.1.1. Fluid intelligence

Fluid intelligence (gf) was assessed through the Raven Advanced Progressive Matrices, set II (Raven, Raven, & Court, 2006). We chose this instrument due to its high "g-loading" values and independence from cultural factors.

2.1.2. Personality factors

Personality traits were conceptualized according to the Big Five model (Costa & McCrae, 1992) and were assessed through the Romanian version of the NEO-FFI questionnaire (Iliescu, Minulescu, Nedelcea, & Ispas, 2008).

2.1.3. Dimensional schizotypy

Dimensional schizotypy (Claridge, 1997) was assessed through O-LIFE (Mason et al., 1995). Comprising 104 items, O-LIFE follows the three-factor model of schizophrenia, adding cognitive disorganisation to the 'positive' and 'negative' dimensions of the disorder (Dembińska-Krajewska & Rybakowski, 2014). The instrument, however, contains a fourth component, namely Impulsive Nonconformity. This facet portrays anti-social and eccentric behaviours (Mason & Claridge, 2006).

The original instrument (104 items) was adapted for the Romanian population using a preliminary academic sample of 472 subjects (33.74% male). Psychometric properties of the Romanian version were found adequate, approximating those of the original instrument (e.g. Mason et al., 1995). Further description of the validation procedure, as well as comparisons with the UK norms can be found in Stanciu and Papasteri (2017).

2.1.4. Measures of insight

Insight was measured through an original instrument developed by the authors. The instrument contains ten domain-specific problems, each pertaining to one of three categories established by the cluster analysis performed by Dow and Mayer (2004): spatial (4 problems), verbal (3 problems), and mathematical (3 problems). Initially, fifteen problems were randomly selected from the literature (Gilhooly & Murphy, 2005). Sampling criteria were centred on the task's familiarity, difficulty level and the unambiguous nature of the task's requirements.

Following a pre-test trial, five insight problems from the initial fifteen were eliminated due to the subjects' familiarity with them. The instrument (*Supplementary material*) was then administered to 83 undergraduate students to assess its internal consistency ($\alpha = 0.72$ on