Are openness and intellect distinct aspects of openness to experience? A test of the O/I model.

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Abstract:

The Openness/Intellect (O/I) model proposes that Openness to Experience has two major facets−Openness and Intellect−that can be measured with the Big Five Aspect Scales (BFAS). Thus far, however, research has not shown distinct, unique relationships between the Openness and Intellect aspects and other outcomes. The present research evaluated the relationships between Openness and Intellect with two outcomes: creative behavior and achievement (conceptually closer to Openness) and fluid intelligence (conceptually closer to Intellect). Young adults completed the BFAS, several measures of fluid intelligence, and several measures of creative achievement. Latent variable models indicated that the Openness aspect significantly predicted creativity but not fluid intelligence; the Intellect aspect, in contrast, significantly predicted fluid intelligence but not creativity. The findings thus offer support for the validity of the O/I model.

Keywords: openness | intellect | creativity | fluid intelligence | psychology | personality

Article:

1. Introduction

Of the 17,953 terms that describe personality (Allport and Odbert, 1936 and De Raad et al., 1998), two have been the source of much debate between psychologists. The fifth factor of personality — known by some as Openness to Experience and others as Intellect — is perplexing.1 Whereas other personality traits are identified by specific, observable traits like talkativeness or organization, the fifth factor is marked by less concrete traits such as broad interests, preference for novelty, inquisitiveness, and imagination. Given the wide range of traits that this personality factor encompasses, some disagreement on the best name for the factor is to be expected.

Because both terms connote different meanings, research in the field of personality psychology has split into two different traditions. The first — Intellect — describes the fifth factor in terms of aspects like intellectual curiosity and quick thinking. Supported in literature by Goldberg, 1981 and Goldberg, 1992, the name Intellect is derived from lexical studies that use factor analysis to pool similar personality descriptors into groups. These studies suggest that Intellect is the most appropriate name for the fifth factor.

But as other researchers point out, lexical studies of Openness are associated with a number of issues. First, lexical studies encounter problems with translation to different languages and cultural ideals that influence word choice. For example, Dutch studies emphasized temperament descriptors and excluded intellect or capability descriptors, German studies included intellect descriptors but not attitude descriptors, and American studies included many attitude and intellect descriptors (John, Naumann, & Soto, 2008). Second, McCrae, 1994 and McCrae and Sutin, 2009 also cites problems with the term "Intellect" being associated with intelligence and intellectual ability in the general public, despite studies showing a correlation (about $r = .30$) between the fifth factor and intelligence scales that is insufficient to warrant such an association. As an alternative, McCrae suggests that Openness to Experience more fittingly describes the fifth factor.

While creating the NEO-PI-R (Costa & McCrae, 1992), McCrae and Costa (1987) reevaluated Cattell, 1943, Cattell, 1945a and Cattell, 1945b early lexical work in personality to derive a fifth factor that was much broader than the Intellect factor arrived at through lexical studies (John et al., 2008). In its original sense, McCrae's fifth factor — known as Openness to Experience — included traits like intelligence, curiosity, political liberalism, imagination, and emotional and aesthetic sensitivity. Today, those traits are facets of Openness to Experience: Fantasy, Aesthetics, Feelings, Actions, Ideas, and Values.

Recently, DeYoung et al. (2007) have created a diplomatic solution to reconcile the two sides. In their Openness/Intellect (O/I) model, Openness to Experience is divided into two "related but separable trait dimensions" (DeYoung et al., 2007, p. 883): openness and intellect. By selecting items from the IPIP (Goldberg et al., 2006) that best represent the Openness to Experience domain and the two aspects within it, DeYoung et al. created an instrument called the Big Five Aspects Scales (BFAS) that measures the two dimensions within each Big Five domain — in this case, the openness and intellect aspects of Openness to Experience.

Preliminary evidence is provided for the O/I model in a recent study that reanalyzed data from an fMRI study assessing working memory (DeYoung, Shamosh, Green, Braver, & Gray, 2009). Based on earlier work on the neurocognitive correlates of Openness to Experience (DeYoung et al., 2005), DeYoung et al. (2009) hypothesized that brain regions associated with working memory would predict the intellect facets but not the openness facets. Using the NEO-PI-R, DeYoung et al. correlated personality traits with working memory capacity and found that Ideas — the most intellectual of the NEO-PI-R's Openness to Experience facets — was modestly correlated with working memory ($r = .23$) and intelligence ($r = .27$).

Evidence for the O/I model is suggestive, but it is limited in several respects. First, past studies have examined intellectual aspects of Openness to Experience (DeYoung et al., 2005 and DeYoung et al., 2009), but they have done so with instruments (e.g., the NEO-PI-R) that were not designed to capture the O/I structure proposed by DeYoung et al. (2007). Second, research has found effects for one aspect but not for the other, such as effects of intellect but not openness on working memory and intelligence (DeYoung et al., 2009). A more compelling test would show significant effects of openness and intellect on different outcomes. Showing distinct effects of openness and intellect would provide evidence for the validity of both constructs. For example, Kaufman et al. (2010) demonstrate that while openness predicts implicit learning ($r = .30$), intellect predicts working memory and general intelligence, g ($r = .35$ and .55, respectively).

In the present work, we sought to test the O/I model by evaluating relationships with creativity and fluid intelligence. First, we expected that the intellect aspect would be more closely linked to fluid intelligence. Past work on Openness to Experience has found that it is the most closely linked to intelligence of the five factors, and DeYoung (in press) has argued that the intellect aspect is primarily responsible for the relationship between global Openness to Experience and intelligence.

Second, we expected that the openness aspect would be more closely linked to creativity. Because creative people tend to be intellectually curious, imaginative, open-minded, aesthetically sensitive, and interested in a wide variety of things, it is not surprising that they are also high in Openness to Experience, which shares many of these traits. For example, a meta-analysis of personality and creativity found a moderate effect size of Openness to Experience on creativity in scientists (mean $d = .40$; Feist, 1998), and many studies have found medium and large effects of Openness to Experience on measures of divergent thinking and creative achievement (McCrae, 1987 and Silvia et al., 2009).

In the present research, we assessed creativity with several measures of creative activity, behavior, and achievement, and we assessed fluid intelligence with a set of timed tests of fluid cognitive abilities. We used the BFAS (DeYoung et al., 2007) to measure the openness and intellect aspects of Openness to Experience. Using latent variable models, we thus can evaluate whether openness and intellect are significantly and uniquely related to creativity and intelligence, respectively.

2. Method

2.1. Participants

The sample consisted of 188 people—139 women, 49 men—who volunteered to participate as part of a research option in one of their psychology courses. The sample's self-reported ethnicity was primarily Caucasian (58%) and African American (30%). On average, participants were 18.66 years old (min 18, max 28, SD = 1.25) and had completed 1.68 semesters of college (min 0, max 9, SD = 1.5). Ninety two percent of the participants were native English speakers.

2.2. Procedure

The data were collected as a part of a larger study on individual differences in cognitive abilities. People completed a wide range of tasks and questionnaires; the present analyses focus on the relations of creativity, intelligence, and personality, which have not been previously analyzed or reported (see Nusbaum & Silvia, 2011, Study 2).

We assessed fluid intelligence with four tasks: (1) the odd numbered items from the Raven's Advanced Progressive Matrices (12 min); (2) a paper folding task, in which people must imagine how a square paper would look if it were folded, punched with holes, and then unfolded (4 min); (3) a letter sets task, in which people are given five sets of four letters and must inductively determine which set violates a rule followed by the other four (4 min); and (4) a cube comparisons task (3 min), in which people see two cubes with letters and symbols and must decide whether the cubes could be the same or must be different (3 min). The first three tasks have been successfully used in our past work (Silvia, 2008 and Silvia and Sanders, 2010).

We assessed creativity with three self-report measures of creative achievement and activity that have performed well in our past work (Silvia and Kimbrel, 2010 and Silvia et al., 2009) and that

have been recommended in a recent review of creativity assessment (Silvia, Wigert, Reiter-Palmon, & Kaufman, in press). The Creative Behavior Inventory (CBI; Dollinger, 2007) is a 28-item scale that asks people to report how often they have done various creative acts, with an emphasis on the visual and performing arts, writing, and crafts. Each item is completed using a 4-point scale (1 = Never did this, 2 = Did this once or twice, 3 = Did this 3–5 times, and 4 = More than 5 times). The Biographical Inventory of Creative Behaviors (BICB; Batey, 2007) is a 34-item scale that lists a variety of creative activities and asks people to check which ones they have done in the past year, using a binary no/yes response format (see Batey & Furnham, 2008). The Creative Achievement Questionnaire (CAQ; Carson, Peterson, & Higgins, 2005) assesses high-level creative achievements in 10 domains (e.g., visual art, music, writing), with an emphasis on publicly observable accomplishments. The complex scoring of the CAQ yields highly skewed scores (see Silvia, Kaufman, & Pretz, 2009). As in past work, we averaged the 10 domains and log-transformed the overall score.

Personality was assessed with the 100-item Big Five Aspects Scale (DeYoung et al., 2007), which measures each of the Big Five factors with two aspects. Each item is completed with a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*). For Openness to Experience, the two aspects are openness (α = .734) and intellect (α = .803).

3. Results and discussion

The models were estimated with maximum likelihood with robust standard errors, using Mplus 6.1. All reported effects are standardized. Fluid intelligence, creativity, openness, and intellect were specified as latent variables. For fluid intelligence, the four tasks served as indicators; the path to the Ravens was fixed to 1. For creativity, the three self-report measures served as indicators; the path to the CAQ was fixed to 1. For openness and intellect, the 10-item scales were split into four parcels, and each factor's variance was fixed to 1. Table 1 reports the factor loadings for each indicator. All indicators were centered. A confirmatory factor analysis of this model found evidence for good fit, $\chi^2(84\ df) = 121.75$, $p = .0045$; $\chi^2/df = 1.45$; CFI = .946; RMSEA = .049 (90% CI = .028, .067); SRMR = .055. For the regression relationships, we specified a multivariate structural equation model: openness and intellect were predictors, and creativity and fluid intelligence were outcomes.

Table 1. Latent variable factor loadings.

	β	SE
Fluid intelligence factor		
Ravens	.609	.081

	β	SE
Paper folding	.598	.067
Letter sets	.628	.076
Cube comparisons	.418	.092
Creativity factor		
CAQ	.657	.053
BICB	.721	.058
CBI	.832	.052
Openness		
Parcel 1	.701	.051
Parcel 2	.726	.055
Parcel 3	.603	.058
Parcel 4	.558	.067
Intellect		
Parcel 1	.781	.046
Parcel 2	.731	.054
Parcel 3	.576	.063
Parcel 4	.707	.047

Note. All loadings are standardized and are significant at $p < .001$.

Did openness and intellect uniquely predict creativity and intelligence? Openness and intellect covaried significantly ($\beta = .36$, $p < .001$) and at a level consistent with past work (DeYoung et al., 2007, p. 890). For creativity, openness had a significant effect ($\beta = .62$, $p < .001$) but intellect did not ($\beta = .07$, $p = .470$). For fluid intelligence, intellect had a significant effect ($\beta = .46$, $p < .001$) but openness did not ($\beta = .01$, $p = .961$). The standardized residual

covariance between fluid intelligence and creativity was β = .27, p = .045. Overall, the model explained 41.4% of the variance in creativity and 20.8% of the variance in fluid intelligence.

The present research thus offers strong support for the O/I model of Openness to Experience. Openness and intellect, measured using the BFAS, had significant relationships with creativity and fluid intelligence. In particular, openness but not intellect predicted creativity, and intellect but not openness predicted fluid intelligence. This pattern provides good evidence for the distinction between openness and intellect, particularly because most past work has generally shown effects of one aspect but not the other (e.g., DeYoung et al., 2009).

In addition to informing the O/I model of Openness to Experience, the present work suggests some fruitful directions for future work on personality, creativity, and intelligence. An extensive literature examines how these three domains relate. Openness to Experience is the most closely linked of the five factors to both intelligence (DeYoung, in press) and to creativity (Silvia, Nusbaum et al., 2009), and intelligence and creativity in turn relate at least modestly (Kim, 2005 and Kim et al., 2010), although this remains controversial (Nusbaum and Silvia, 2011 and Silvia, 2008). Differentiating Openness to Experience into openness and intellect aspects might shed some light on this network of relationships.

One limitation of the present work is that the participants were young adults and thus early in their creative development. Between-person variability in creative accomplishment should increase over early adulthood, and it is possible that personality's relationships with creativity shift across the lifespan (e.g., Feist & Barron, 2003). Furthermore, we should point out that creativity was measured with self-report scales, so the personality scales shared a method with creativity but not with intelligence. Although it is doubtful that this overlap could explain the pattern of results we found, future work should include performance measures of creativity, such as divergent thinking tasks (Silvia et al., 2008) and consensual assessment of creative products (Kaufman, Plucker, & Baer, 2008).

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1 Throughout this article we use "Openness to Experience" to refer to the global fifth factor of personality and "Openness" and "Intellect" to refer to the two facets of Openness to Experience that are identified by DeYoung (DeYoung et al., 2005 and DeYoung et al., 2007).