Openness to Experience and Intellect differentially predict creative achievement in the arts and sciences

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Abstract

Objective—The Big Five personality dimension Openness/Intellect is the trait most closely associated with creativity and creative achievement. Little is known, however, regarding the discriminant validity of its two aspects— Openness to Experience (reflecting cognitive engagement with perception, fantasy, aesthetics, and emotions) and Intellect (reflecting cognitive engagement with abstract and semantic information, primarily through reasoning)— in relation to creativity.

Method—In four demographically diverse samples totaling 1035 participants, we investigated the independent predictive validity of Openness and Intellect by assessing the relations among cognitive ability, divergent thinking, personality, and creative achievement across the arts and sciences.

Results and Conclusions—We confirmed the hypothesis that whereas Openness predicts creative achievement in the arts, Intellect predicts creative achievement in the sciences. Inclusion of performance measures of general cognitive ability and divergent thinking indicated that the relation of Intellect to scientific creativity may be due at least in part to these abilities. Lastly, we

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found that Extraversion additionally predicted creative achievement in the arts, independently of Openness. Results are discussed in the context of dual-process theory.

Keywords

The five factor model or *Big Five* provides a useful taxonomy of personality traits, and these traits predict many important life outcomes, including achievement in school and work, physical and mental health, and social behavior (Ozer & Benet-Martinez, 2006). The Big Five factor labeled *Openness/Intellect* predicts outcomes in all of these categories (DeYoung, 2014) and is also the only factor consistently and broadly related to creativity, predicting creative achievement and divergent thinking, as well as creative hobbies, personal goals, and thinking styles (Batey & Furnham, 2006; Carson, Peterson, & Higgins, 2003; Feist, 1998; Feist & Barron, 2003; King, Walker, & Broyles, 1996; McCrae, 1987; Silvia, Nusbaum, Berg, Martin, & O'Connor, 2009; Silvia et al., 2008). As its compound label suggests, however, Openness/Intellect is not monolithic; it can be divided into sub-traits, which may have differential relations to creativity. Given the centrality of this domain of personality to creative functioning, it is crucial to investigate more finely differentiated associations of its component traits with various forms of creativity.

Although Openness/Intellect can be generally characterized as a dimension of personality reflecting the tendency toward cognitive exploration, it can also be meaningfully separated into distinct (but correlated) subtraits of *Openness to Experience* and *Intellect* (DeYoung, 2014; DeYoung, Quilty, & Peterson, 2007). This conclusion helps reconcile an old debate about how to characterize this factor of personality. Although it was suggested 20 years ago that Openness and Intellect characterize distinct but equally central aspects of the factor (Johnson, 1994; Saucier, 1992), the empirical demonstration that these are the two major subfactors was relatively recent (DeYoung et al., 2007; Woo et al., 2013). Intellect reflects cognitive engagement with abstract and semantic information, primarily through reasoning, whereas Openness reflects cognitive engagement with perception, fantasy, aesthetics, and emotions (DeYoung, Grazioplene, & Peterson, 2012). These factors appear to be genetically as well as phenotypically distinct (DeYoung, 2014; DeYoung et al., 2007).

The identification of separable Openness and Intellect factors enabled the development of scales specifically designed to measure these factors, which are included in the Big Five Aspect Scales (BFAS; DeYoung et al., 2007). (Previous Big Five measures labeled "Openness to Experience" or "Intellect" typically measured the same general Openness/ Intellect factor; DeYoung, Peterson, & Higgins, 2005.) Openness and Intellect demonstrate discriminant validity for many phenomena, including IQ, academic performance, industrial performance, mental health, and brain function (for a review see DeYoung, 2014).

Investigating Openness and Intellect separately appears promising in the attempt to clarify the association of personality with creativity, particularly in the arts the sciences. Nusbaum and Silvia (2011) found that Openness significantly predicted total creative achievement but not fluid reasoning, whereas Intellect predicted fluid reasoning but not total creative achievement. This result might suggest a unique relation between Openness and creativity.

However, this research did not distinguish between different domains of creative achievement, and their assessment of creative achievement was weighted heavily toward artistic creativity.

Both the differing trait content of Openness and Intellect and theories of their underlying mechanisms suggest that Openness should predict creativity in the arts, but that Intellect should predict creative achievement in the sciences. Openness encompasses artistic interests, whereas Intellect encompasses interest in ideas. The sources of these differences may lie in basic cognitive mechanisms. Openness is associated with cognitive processes like implicit learning that are involved in the detection of correlational patterns in sensory experience. Intellect, in contrast, is associated with cognitive processes like working memory that aid in analyzing causal and logical patterns (DeYoung, 2014; Kaufman et al., 2010).

Kaufman (2013a) placed these findings in the dual-process theoretical framework (Epstein, 1991, 2014; Evans, 2008; Evans & Frankish, 2009; Kahneman, 2011; Kaufman, 2011, 2013a; Stanovich & West, 2000). *Type 1* processes consist of a variety of (not necessarily correlated) processes that operate automatically and are not dependent on input from high-level control systems, including affect, intuition, implicit learning, latent inhibition, and spreading activation among learned associations (Evans, 2008; Stanovich & Toplak, 2012). In contrast, *Type 2* processes require limited voluntary attentional resources and are associated with general cognitive ability (*g*) and executive functioning. Within this framework, artistic creativity should be more strongly influenced by the experiential, Type 1 processes associated with Openness, whereas scientific creativity should be more strongly influenced by the rational, Type 2 processes associated with Intellect (Epstein, 2013).

We hypothesized, therefore, that whereas Openness should predict creative achievement in the arts, Intellect should predict creative achievement in the sciences. We focused on creative achievement—that is, formally recognized creative production—rather than on creativity more generally. This focus has the advantage of allowing assessment in terms of life history; however, it is possible that our results might not entirely generalize to day-to-day creativity that does not lead to publically recognized products. It is also possible that traits related to hard work and perseverance, such as Conscientiousness, might influence creative achievement independently of Openness and Intellect, and we were able to examine that possibility as well.

Consistent with our hypothesis, Kaufman (2013a) investigated the relations among a four-factor model of Openness/Intellect and creative achievement in the arts and sciences among a sample of English Sixth Form students (equivalent to the final two years of American high school). Two factors relating to Openness (affective engagement and aesthetic engagement) were significantly associated with creative achievement in the arts, whereas two factors relating to Intellect (explicit cognitive ability and intellectual engagement) were significantly associated with creative achievement in the sciences.

The present study reexamined these data using the BFAS Openness and Intellect scales and also extended the analysis to creative achievement in three additional samples. Because Openness and Intellect are correlated subfactors of the same broader Big Five trait, we used

them as simultaneous predictors in regression to assess their independent contributions to creative achievement. This procedure is important because, if Openness were correlated with achievement in the sciences or Intellect with achievement in the arts, this might simply be due to the variance shared between the two aspects, rather than to an independent association. Two additional strengths make this study more than a mere replication of Kaufman's (2013a) prior work. First, Kaufman (2013a) did not specifically test the prediction of creative achievement by Openness and Intellect, but rather focused on a 4-factor solution of the Openness/Intellect domain, which is less well established than the basic distinction between Openness and Intellect. Second, Kaufman (2013a) analyzed a sample of adolescents at a very selective school (which could restrict the range of relevant variables), whereas the present analyses include a diverse set of adult samples, yielding a much larger and more representative total sample.

A further question that we were able to examine in these samples was the extent to which Openness and Intellect predict creative achievement independently of *g* and divergent thinking—two relevant cognitive variables that are substantially related to Openness/ Intellect (DeYoung, 2014). Divergent thinking is a commonly used construct in the study of creativity, referring to the ability to generate numerous unusual answers to problems such as, "What are all the uses you can think of for a brick?" Divergent thinking is typically contrasted with convergent thinking, in which reasoning is used to identify a single correct answer to a problem. Most standard measures of *g*, such as IQ tests, are primarily tests of convergent thinking (as their items require participants to provide a single correct answer). Nonetheless, it is possible to use individually administered IQ tests to extract some information about an individual's divergent thinking ability (Kaufman, Kaufman, & Lichtenberger, 2011), and, using latent variable modeling, *g* moderately predicts divergent thinking (Beaty & Silvia, 2012; Silvia, 2008a; Silvia, 2008b). Because both *g* and divergent thinking have been shown to predict creative achievement (Carson, Peterson, & Higgins, 2005; Kaufman, 2013a; Mar, DeYoung, Higgins, & Peterson, 2006), it is of interest to test whether the relation between personality and creative achievement is independent of them.

Finally, we were able to test whether Openness and Intellect predict creative achievement independently of other Big Five traits. Because past research suggests that creative achievement is likely to be influenced by multiple traits (Feist, 1998, Kaufman, 2013b, Simonton, 1994), we were interested not only in testing our main hypothesis, but also whether or not other personality traits emerged as consistent predictors.

In sum, the primary aim of the current investigation was to assess the relations between the two major aspects of Openness/Intellect (Openness to Experience and Intellect) and creative achievement in the arts and sciences. The secondary aim was to assess the extent to which these relations held, controlling for the rest of the Big Five, *g* and divergent thinking. To increase generalizability, we report on the results from four independent samples across a range of age, gender, and ethnicity.

Method

Participants

Sample 1 consisted of 177 students (56 males, 121 females) who attended a selective sixth-form college (which takes high-achieving students who are in their last two years of secondary education) in Cambridge, England. They ranged in age from 16 to 19 years ($M = 16.9$, $SD = 0.6$). While creative achievement scores were collected for 177 participants, there were missing scores for other variables presented in this study. This was due to the fact that there were three testing sessions, with some attrition in the later sessions (creative achievement and cognitive ability were assessed in the first testing session, other measures not relevant to this analysis were assessed in the second testing session, and personality measures were assessed in the third testing session). Therefore, the results presented below include only 166 participants.

Sample 2 consisted of 239 White men recruited in and around New Haven, Connecticut, primarily through Internet sites (restrictions by race and gender were designed to facilitate genetic analyses unrelated to the present study; e.g., DeYoung et al., 2011; Shehzad et al., 2012; creative achievement data have not previously been reported). They ranged in age from 18 to 40 years ($M = 23.6$, $SD = 5.0$). About half of the sample (124) were students, with 48 attending Yale University and the others attending nearby colleges and universities. The rest of the sample had a range of mostly lower- and middle-class occupations, with 20 indicating that they were currently unemployed. All participants were given monetary compensation for their participation.

Sample 3 consisted of 329 students (177 males, 147 females, 5 unreported) in universities in southern Ontario, Canada, who completed the relevant measures online for course credit in the context of several different studies (creative achievement data have not previously been reported). They ranged in age from 17 to 61 years ($M = 20.59$, $SD = 3.25$, 4 unreported age). A variety of ethnicities were represented in the sample, including East Asians (46.8%), Whites (30.7%), and South Asians (11.9%), along with a smaller number of Black, Hispanic, Middle Eastern, and Native American students (10.6%).

Sample 4 consisted of 305 people (154 females) between the ages of 20 and 40 ($M = 26.25$, $SD = 5.06$) recruited from the community around Minneapolis and St. Paul, Minnesota, primarily by internet advertisements. The sample consisted of a variety of professions, including relatively few students (11.8%; 10.8% did not report profession). The ethnicity of this sample was predominantly White/Caucasian (72.4%); other ethnicities represented were 6.6% Black or African American, 2.6% Hispanic or Latino, 3.9% Asian or Asian American, 13.1% Mixed Heritage, and 1.0% Native American.

Creative Achievement

All four samples completed the Creative Achievement Questionnaire (CAQ; Carson et al., 2005), in which creative achievements are assessed in 10 domains: visual arts, music, dance, architectural design, creative writing, humor, inventions, scientific discovery, theater and film, and culinary arts. The CAQ has been well-validated and predicts many other performance and questionnaire measures of creativity (Carson et al., 2005; Silvia, Wigert,

Reiter-Palmon, & Kaufman, 2012). Points are awarded in each domain based on seven levels of achievement, with greater points awarded for higher levels, yielding skewed scores that reflect the fact that relatively few people reach the highest levels of creative achievement. (Based on advice from one of the authors of the CAQ, we did not use the optional scoring method of multiplying some levels by the number of achievements at that level; Carson, personal communication, 2006.) Scores across domains were summed to create a total creativity score. Although the CAQ relies on self-report, the concreteness of the response structure reduces the likelihood of self-enhancement, relative to trait-rating scales. For example, in the creative writing domain, options include, "My work has won an award or prize" (level 2) and "My work has been reviewed in national publications" (level 7). We followed Carson et al. (2005) in creating a two-factor breakdown of the CAQ, in which creative achievement in the arts is represented as the sum of scores for visual arts, music, dance, creative writing, humor, and theater and film, while creative achievement in the sciences is represented as the sum for inventions and scientific discovery.

Big Five Personality Traits

All four samples completed the BFAS, which measures a level of personality structure between the Big Five and their many facets (DeYoung et al., 2007). It was derived from factor analyses of 15 facet scales within each of the Big Five, in which the minimum average partial (MAP) test indicated the presence of just two subfactors for each broader dimension. Ten scales to measure these factors were then created by examining factor-score correlations with over 2000 items from the international personality item pool (IPIP) and selecting balanced numbers of positively and negatively keyed items from among the strongest correlates. The BFAS is well validated, converging strongly with other standard measures of the Big Five, including the NEO PI-R and the Big Five Inventory (DeYoung et al., 2007), and is one of the only measures of an empirically derived substructure for the Big Five (lists of facets have typically been derived intuitively or algorithmically rather than empirically). The two aspects of each Big Five domain are, therefore, likely to provide important differentiations for assessing discriminant validity within each domain. Total Big Five scores can be derived by averaging the scores for the two aspects. The Openness scale includes items like, "See beauty in things that others might not notice," and "Seldom daydream" (reversed), whereas the Intellect scale includes items like, "Am quick to understand things," and "Avoid philosophical discussions" (reversed).

General Cognitive Ability (*g*)

Sample 1—Participants completed three markers of general cognitive ability: one *verbal* analogical reasoning test, one *perceptual* reasoning test, and one mental *rotation* test, to cover the three subfactors of *g* identified by Johnson and Bouchard in their VPR model (2005). Perceptual reasoning was measured with the Raven's advanced progressive matrices test, set II (Raven, Raven, & Court, 1998), verbal analogical reasoning was measured with the verbal reasoning section of the Differential Aptitudes Test (The Psychological Corporation, 1995), and mental rotation ability was measured with the Mental rotations test, set A (Vandenberg & Kruse, 1978). Correlations among the three tests ranged from .43 to .57. To combine the three markers of general cognitive ability into a unitary estimate of *g*, scores were standardized and averaged.

Sample 2—Participants completed four subtests from the Wechsler Adult Intelligence Scale, third edition (WAIS-III; Wechsler, 1997): Matrix Reasoning, Block Design, Vocabulary, and Similarities. Scaled scores for all four subtests were averaged to create an estimate of *g*. Correlations among the subtests ranged from .23 to .55 (DeYoung et al., 2014).

Sample 3—Only a subset of Sample 3 (*n* = 124; 91 female, 33 male) completed a brief assessment of cognitive ability in the lab (because only one of the studies from which this sample was compiled involved the lab component; DeYoung et al., 2014). They ranged in age from 17 to 38 (*M* = 19.47; *SD* = 3.0). Scaled scores from the Matrix Reasoning and Vocabulary subtests of the WAIS-III were averaged to estimate *g*. The correlation between the two subtests was *r* = .24.

Sample 4—Participants completed the same four subtests from the WAIS as in Sample 2, but from the fourth edition (WAIS-IV; Wechsler, 2008). Correlations among the subtests ranged from .29 to .63.

Divergent Thinking

Samples 2 and 4, and the subset of Sample 3 just described, completed the same measure of divergent thinking, three tests derived from the Torrance Tests of Creative Thinking (Torrance, 1972). Participants were given 3 minutes per problem to generate as many answers as they could for three problems: (1) "Suppose that all humans were born with six fingers on each hand instead of five. List all the consequences or implications that you can think of;" (b) "List as many white, edible things as you can;" (2) "List all the uses you can think of for a brick." Scores were based on three indices: fluency, originality, and flexibility. Fluency is the total number of responses given. Originality is scored with reference to all valid responses in the sample, with one point being awarded to responses given by between 3% and 10% of respondents, two points to responses given by 3% or fewer, and three points to unique responses. Flexibility is the number of times participants switch categories as they list answers (categories for problem 2, for example, included fruits, vegetables, meat, dairy, baked goods, seafood, and other). These three indices, which correlate very highly with each other (mean *r* = .79) were standardized and averaged to create a single divergent thinking score.

Results

Table 1 provides distributional information regarding the main variables of interest for our hypotheses. CAQ scores were skewed, as expected based on theory and prior research (Carson et al., 2005; Eysenck, 1995; Silvia, Wigert, Reiter-Palmon, & Kaufman, 2012; Simonton, 1999, 2005), and we therefore report the median as well as the mean.

Table 2 shows correlations of the BFAS, *g*, and divergent thinking with creative achievement pooled across all four samples (*n*-weighted correlations). (Correlation matrices for each sample are available on request.) Creative achievement in the arts and sciences were uncorrelated in Samples 1 and 2 (Spearman's ρ = -.05, *p* = .54, and ρ = .10, *p* = .14, respectively), and positively correlated in Samples 3 and 4 (ρ = .21, *p* < .01, and ρ = .39, *p*

< .01, respectively). Openness/Intellect showed the strongest correlations with creative achievement across both the arts and sciences. At the aspect level, Openness was more strongly associated with creative achievement in the arts than the sciences, whereas Intellect was more strongly correlated with creative achievement in the sciences than the arts. The only other personality trait that consistently demonstrated significant correlations with creative achievement was Extraversion, which was positively correlated with creative achievement in the arts (but not the sciences) in all four samples.

Consistent with prior research, *g* and divergent thinking were substantially correlated with each other (Beaty & Silvia, 2012; Silvia, 2008a; Silvia, 2008b). Also consistent with prior research, *g* was more strongly related to Intellect than Openness (DeYoung, Quilty, Peterson, & Gray, 2013). Because our measures of *g* differed across samples, Table 3 presents the correlations of *g* with the variables involved in our hypotheses, separated by sample. Only for creative achievement in the arts did correlations with *g* differ significantly across samples, and even there, only marginally, $\chi^2(3) = 7.84$, $p = .05$.

Tables 4-7 show the results of the regression analyses predicting creative achievement in the arts and sciences. The first block of the analysis, designed to test our primary hypothesis, included age, sex (except in Sample 2, which was all male), Intellect, and Openness. In the second block, we added the rest of the Big Five personality traits (Neuroticism, Agreeableness, Conscientiousness, and Extraversion). Finally, to investigate the robustness of the Intellect and Openness findings when controlling for cognitive ability, we included *g* and divergent thinking (where available) in the last block of the regression analyses.

Because the distribution of creative achievement was skewed right with many zero scores, we employed Poisson regression, using the robust Huber-White sandwich estimator to account for over-dispersion (Silvia & Kimbrel, 2010; Silvia et al., 2012). Note that the regression weights are unstandardized values and thus less easily interpreted than standardized weights. There is no equivalent to the R^2 statistic for Poisson regression.

There were no consistent effects of age on creative achievement (although there were some sample-specific effects). In the three samples that had variance in gender, being female consistently negatively predicted creative achievement in the sciences (when all measures of personality and cognition were included in the regression). When controlling for the rest of the Big Five, Openness consistently predicted creative achievements in the arts (but not the sciences), whereas Intellect consistently predicted creative achievement in the sciences (but not the arts). Extraversion was consistently an additional independent predictor of artistic creativity. We do not interpret the inconsistent effects that appeared in one or two samples for Conscientiousness and Agreeableness. However, future research may want to investigate the possibly more nuanced relations among Conscientiousness, Agreeable, and creative achievement across domains.

When *g* and divergent thinking were added to the regression analysis, Openness and Extraversion remained significant independent predictors of artistic creativity in all four samples. Intellect, however, remained a significant predictor of scientific creativity only in Sample 1 (which included *g* but not divergent thinking) and Sample 4 (which included both

g and divergent thinking). For Samples 2 and 3, Intellect was no longer a significant predictor of creative achievement in the sciences. This suggests that Intellect's prediction of creative achievement in the sciences may be due, at least in part, to its association with general cognitive ability and divergent thinking.

Discussion

Consistent with prior research, Openness/Intellect emerged as the most robust and consistent Big Five predictor of creative achievement across the arts and sciences (e.g., Carson et al., 2005; Feist, 1998; Silvia et al., 2009; Batey & Furnham, 2006). The primary aim of the current investigation, however, was to clarify the relations between the two major aspects of Openness/Intellect and creative achievement in the arts and sciences. In multiple regression, Openness to Experience independently predicted creative achievement in the arts (but not the sciences), whereas Intellect independently predicted creative achievement in the sciences (but not the arts). These results held even after controlling for the other Big Five personality traits. This result highlights the importance of separating Openness and Intellect, as well as considering different domains of creativity.

Although we had not predicted it, Extraversion also emerged as a consistent predictor of creative achievement in the arts, independent of the effects of other Big Five traits, general cognitive ability, and divergent thinking. This result is reminiscent of the finding of an association between Plasticity (the shared variance of Extraversion and Openness/Intellect; see DeYoung, Peterson, & Higgins, 2002; Hirsh, DeYoung, & Peterson, 2009) and overall CAQ scores, which are weighted toward artistic creativity (Silvia et al., 2009). Also consistent with our findings, Silvia et al. (2009) did not find an association between Plasticity and math-science creativity. Plasticity appears to reflect a general exploratory tendency in both behavior and cognition (DeYoung, 2013; Hirsh et al., 2009), with Extraversion reflecting more behavioral forms of exploration. It seems, therefore, that a behavioral exploratory tendency is more relevant to creativity in the arts than the sciences. This may be particularly true in performing arts that require expressiveness in a public setting.

Whereas Extraversion appears to be more relevant to creative achievement in the arts than in the sciences, cognitive abilities appear to be more relevant to creative achievement in the sciences. For two out of the three samples that included performance measures of both *g* and divergent thinking, Intellect no longer predicted achievement in the sciences after controlling for the two cognitive ability measures. (We conducted a follow-up analysis assessing the verbal and nonverbal components of *g* separately, and found that both displayed the same pattern of association, as each other, with creative achievement, and both had the same effect on other predictors in the regression as *g*.) Further, in 3 out of 4 samples *g* or divergent thinking was a significant additional predictor of achievement in the sciences.

These results suggest that both ability and motivation components of Intellect are likely to be important for creative scientific achievement. The ability component is at least partially captured by *g* and divergent thinking (which is consistent with the theory that general cognitive ability is an important component of Intellect; DeYoung, 2011; 2014; DeYoung et

al., 2012), whereas the motivation component of Intellect, reflecting intellectual curiosity, drive, and engagement, is presumably what remains after controlling for ability. The more basic cognitive processes underlying g and divergent thinking might include verbal and ideational fluency, mental flexibility, working memory, and the strategic retrieval and manipulation of knowledge (Beaty & Silvia, 2012; DeYoung, Flanders, & Peterson, 2008; Gilhooly, Fioratou, Anthony, & Wynn, 2007; Nusbaum & Silvia, 2011; von Stumm, Benedikt, & Chamorro-Premuzic, 2011). These abilities appear to be more important for creative achievement in the sciences, which requires application of reasoning and semantic ideation to an existing rational system, than for creative achievement in the arts, which requires aesthetic, affective, fantasy, imagination, and perceptual engagement (see Kaufman, 2013a).

Our results are consistent with the dual-process framework and suggest that artistic creativity draws more heavily on experiential Type 1 processes associated with Openness (e.g., perceptual, aesthetic, and implicit learning processes), whereas scientific creativity relies more heavily on Type 2 processes associated with Intellect and divergent thinking. Our finding of discriminant validity for the prediction of creative achievement by Openness and Intellect is consistent with a previous finding of double dissociation, in which Openness but not Intellect predicted implicit learning, whereas Intellect but not Openness predicted working memory capacity (Kaufman et al., 2010).

The present study is not without limitations, one being the range of creative domains that were investigated. Whereas the current study focused on the arts and sciences, prior research has investigated a wider range of domains, including everyday, humanities, mechanical, business, realistic, and social/interpersonal forms of creativity (Kaufman, 2012; Kaufman, Pumaccahua, & Holt, 2013; Ivcevic & Mayer, 2009; Park, Lubinski, & Benbow, 2007). Assessing a wider range of domains can help inform the domain general/domain specific debate (Baer & Kaufman 2004; Kaufman & Baer, 2005; Silvia, Kaufman, & Pretz, 2009), as domains of cognition (e.g., verbal, nonverbal, divergent) and personality (e.g., Intellect, Openness) may show both domain general and domain specific contributions across a wider swath of creativity. Another potential limitation is the fact that the CAQ relies on formal recognition of creative products (such as publication, sales, and awards) to determine creative achievement. One might argue that public success is not a guarantee of creative quality. It would, therefore, be interesting to test whether our results hold for other modes of assessment of creative achievement.

Conclusion

In four demographically different samples, we found that Openness to Experience and Intellect differentially predicted creative achievement in the arts and sciences, respectively. These effects may stem from differing demands of artistic and scientific creativity for Type 1 vs. Type 2 processing. We hope these findings lead the way toward productive new hypotheses and more nuanced tests of the complex relations among personality, cognition, and creativity.

Acknowledgments

References

Ackerman PL, Heggestad ED. Intelligence, personality, and interests: Evidence for overlapping traits. Psychological Bulletin. 1997; 121:219–245. [PubMed: 9100487]

Baer J, Kaufman JC. Bridging generality and specificity: The Amusement Park Theoretical (APT) Model of creativity. Roeper Review. 2005; 27:158–163.

Batey M, Furnham A. Creativity, intelligence, and personality: A critical review of the scattered literature. Genetic, Social, and General Psychology Monographs. 2006; 132:355–429.

Beaty RE, Silvia PJ. Why do ideas get more creative across time? An executive interpretation of the serial order effect in divergent thinking tasks. Psychology of Aesthetics, Creativity, and the Arts. 2012; 6:309–319.

Carson SH, Peterson JB, Higgins DM. Decreased latent inhibition Is associated with increased creative achievement in high-functioning individuals. Journal of Personality and Social Psychology. 2003; 85:499, 506. [PubMed: 14498785]

Carson SH, Peterson JB, Higgins DM. Reliability, validity, and factor structure of the creative achievement questionnaire. Creativity Research Journal. 2005; 17:37, 50.

Corporation, TP. DAT for selection-verbal reasoning (European adaptation). Orlando, FL: Harcourt Brace and Company; 1995.

DeYoung, CG. Intelligence and personality. In: Sternberg, RJ.; Kaufman, SB., editors. The Cambridge handbook of intelligence. New York: Cambridge University Press; 2011.

DeYoung CG. The neuromodulator of exploration: A unifying theory of the role of dopamine in personality. Frontiers in Human Neuroscience. 2013; 7 article 762. 10.3389/fnhum.2013.00762

DeYoung, CG. Openness/Intellect: A dimension of personality reflecting cognitive exploration. In: Cooper, ML.; Larsen, RJ., editors. APA Handbook of Personality and Social Psychology, Volume 3, Personality Processes and Individual Differences. 2014.

DeYoung CG, Cicchetti D, Rogosch FA, Gray JR, Eastman M, Grigorenko EL. Sources of cognitive exploration: Genetic variation in the prefrontal dopamine system predicts Openness/Intellect. Journal of Research in Personality. 2011; 45:364–371. [PubMed: 21804655]

DeYoung CG, Grazioplene RG, Peterson JB. From madness to genius: The Openness/Intellect trait domain as a paradoxical simplex. Journal of Research in Personality. 2012; 46:63–78.

DeYoung CG, Peterson JB, Higgins DM. Higher-order factors of the Big Five predict conformity: Are there neuroses of health? Personality and Individual Differences. 2002; 33:533–552.

DeYoung CG, Peterson JB, Higgins DM. Sources of openness/intellect: Cognitive and neuropsychological correlates of the fifth factors of personality. Journal of Personality. 2005; 73:825–858. [PubMed: 15958136]

DeYoung CG, Quilty LC, Peterson JB. Between facets and domains: 10 aspects of the Big Five. Journal of Personality and Social Psychology. 2007; 93:880–896. [PubMed: 17983306]

DeYoung CG, Quilty LC, Peterson JB, Gray JR. Openness to Experience, Intellect, and cognitive ability. Journal of Personality Assessment. 2014; 96:46–52. [PubMed: 23795918]

Epstein, S. Cognitive-experiential self- theory: An integrative theory of personality. In: Curtis, R., editor. The relational self: Convergences in psychoanalysis and social psychology. New York, NY: Guilford Press; 1991. p. 111-137.

Epstein, S. Cognitive-experiential theory: An integrative theory of personality. New York, NY: Oxford University Press; 2014.

Evans, JStBT. Dual-processing accounts of reasoning, judgment, and social cognition. Annual Review of Psychology. 2008; 59:255–278.

Evans, JSBT.; Frankish, K. In two minds: Dual processes and beyond. New York, NY: Oxford University Press; 2009.

Eysenck, HJ. Creativity as a product of intelligence and personality. In: Saklofske, D.; Zeidner, M., editors. International handbook of personality and intelligence: Perspectives on individual differences. New York, NY: Plenum Press; 1995. p. 231-247.

Feist GJ. A meta-analysis of personality in scientific and artistic creativity. Personality and Social Psychology Review. 1998; 2:290–309. [PubMed: 15647135]

Feist GJ, Barron FX. Predicting creativity from early to late adulthood: Intellect, potential, and personality. Journal of Research in Personality. 2003; 37:62–88.

Gilhooly KJ, Fioratou E, Anthony SH, Wynn V. Divergent thinking: Strategies and executive involvement in generating novel uses for familiar objects. British Journal of Psychology. 2007; 98:611–625. [PubMed: 17535464]

Hirsh JB, DeYoung CG, Peterson JB. Metatraits of the Big Five differentially engagement and restraint of behavior. Journal of Personality. 2009; 77:1085–1102. [PubMed: 19558442]

Ivcevic Z, Mayer JD. Mapping dimensions of creativity in the life-space. Creativity Research Journal. 2009; 21:152–165.

Johnson JA. Clarification of factor five with the help of the AB5C model. European Journal of Personality. 1994; 8:311–334.

Johnson W, Bouchard TJ Jr. The structure of human intelligence: It's verbal, perceptual, and image rotation (VPR), not fluid crystallized. Intelligence. 2005; 33:393–416.

Kahneman, D. Thinking, fast and slow. New York, NY: Farrar, Straus and Giroux; 2011.

Kaufman JC. Counting the muses: Development of the Kaufman Domains of Creativity Scale (K-DOCS). Psychology of Aesthetics, Creativity, and the Arts. 2012; 6:298–308.

Kaufman, JC.; Baer, J. Creativity across domains: Faces of the muse. New York, NY: Psychology Press; 2004.

Kaufman JC, Baer J. The Amusement Park Theoretical (APT) Model of creativity. Korean Journal of Thinking and Problem Solving. 2004; 14:15–25.

Kaufman JC, Kaufman SB, Lichtenberger EO. Finding creative potential on intelligence tests via divergent production. Canadian Journal of School Psychology. 2011; 26:83–106.

Kaufman, SB. Intelligence and the cognitive unconscious. In: Sternberg, RJ.; Kaufman, SB., editors. The Cambridge Handbook of Intelligence. Cambridge, UK: Cambridge University Press; 2011. p. 442-467.

Kaufman SB. Opening up Openness: A four-factor model of openness to experience and creative achievement in the arts and sciences. Journal of Creative Behavior. 2013a; 47:233–255.

Kaufman, SB. Ungifted: Intelligence redefined. New York, NY: Basic Books; 2013b.

Kaufman SB, DeYoung CG, Gray JR, Jimenez L, Brown JB, Mackintosh N. Implicit learning as an ability. Cognition. 2010; 116:321–340. [PubMed: 20573341]

Kaufman JC, Pumaccahua TT, Holt RE. Personality and creativity in realistic, investigative, artistic, social, and enterprising college majors. Personality and Individual Differences. 2013; 54:913–917.

King LA, Walker LM, Broyles SJ. Creativity and the five-factor model. Journal of Research in Personality. 1996; 30:189–203.

Mar RA, DeYoung CG, Higgins DM, Peterson JB. Self-liking and self-competence separate self-evaluation from self-deception: Associations with personality, ability, and achievement. Journal of Personality. 2006; 74:1–32. [PubMed: 16451223]

McCrae RR. Creativity, divergent thinking, and openness to experience. Journal of Personality and Social Psychology. 1987; 52:1258, 1263.

Muthén, LK.; Muthén, BO. Mplus user's guide. 4th. Los Angeles: Muthen & Muthen; 1998. 4th Ed

Nusbaum EC, Silvia PJ. Are openness and intellect distinct aspects of openness to experience? A test of the O/I model. Personality and Individual Differences. 2011; 51:571–574.

Nusbaum EC, Silvia PJ. Are intelligence and creativity really so different? Fluid intelligence, executive processes, and strategy use in divergent thinking. Intelligence. 2011; 39:36–45.

Ozer DJ, Benet-Martinez V. Personality and the prediction of consequential outcomes. Annual Review of Psychology. 2006; 57:201–221.

Park G, Lubinski D, Benbow CP. Contrasting intellectual patterns predicts creativity in the arts and sciences: Tracking intellectually precocious youth over 25 years. Psychological Science. 2007; 18:948–952. [PubMed: 17958707]

Plucker, JA. Why creativity is domain general, why it looks domain specific, and why the distinction does not matter. In: Sternberg, RJ.; Grigorenko, EL.; Singer, JL., editors. Creativity: From potential to realization. Washington, DC: American Psychological Association; 2004. p. 153-167.

Raven, J.; Raven, JC.; Court, JH. Manual for raven's progressive matrices and vocabulary scales. Oxford, UK: Oxford Psychologists Press; 1998.

Saucier G. Openness versus Intellect: Much ado about nothing? European Journal of Personality. 1992; 6:381–386.

Shehzad Z, DeYoung CG, Kang Y, Grigorenko EL, Gray JR. Interaction of *COMT* Val^{158}Met and externalizing behavior: Relation to prefrontal brain activity and behavioral performance. NeuroImage. 2012; 60:2158–2168. [PubMed: 22306803]

Silvia PJ, Kaufman JC, Pretz JE. Is creativity domain-specific? Latent class models of creative accomplishments and creative self-descriptions. Psychology of Aesthetics, Creativity, and the Arts. 2009; 3:139–148.

Silvia PJ, Nusbaum EC, Berg C, Martin C, O'Connor A. Openness to experience, plasticity, and creativity: Exploring lower-order, higher-order, and interactive effects. Journal of Research in Personality. 2009; 43:1087–1090.

Silvia PJ, Wigert B, Reiter-Palmon R, Kaufman JC. Assessing creativity with self-report scales: A review and empirical evaluation. Psychology of Aesthetics, Creativity, and the Arts. 2012; 6:19–34.

Silvia PJ, Winerstein BP, Willse JT, Barona CM, Cram JT, Hess KI, Martinez JL, Richard CA. Assessing creativity with divergent thinking tasks: Exploring the reliability and validity of new subjective scoring methods. Psychology of Aesthetics, Creativity, and the Arts. 2008; 2:68–85.

Silvia PJ. Another look at creativity and intelligence: Exploring higher-order models and probably confounds. Personality and Individual Differences. 2008a; 44:1012–1021.

Silvia PJ. Creativity and intelligence revisited: A reanalysis of Wallach and Kogan (1965). Creativity Research Journal. 2008b; 20:34–39.

Silvia PJ, Kimbrel NA. A dimensional analysis of creativity and mental illness: Do anxiety and depression symptoms predict creative cognition, creative accomplishments, and creative self-concepts? Psychology of Aesthetics, Creativity, and the Arts. 2010; 4:2–10.

Simonton, DK. Greatness: Who makes history and why. New York, NY: Guilford Press; 1994.

Simonton DK. Talent and its development: An emergenic and epigenetic model. Psychological Review. 1999; 106:435–457.

Simonton DK. Giftedness and genetics: The emergenic-epigenetic model and its implications. Journal for the Education of the Gifted. 2005; 28:270–286.

Stanovich KE, Toplak ME. Defining features versus incidental correlates of Type 1 and Type 2 processing. Mind and Society. 2012; 11:3–13.

Stanovich KE, West RF. Individual differences in reasoning: Implications for the rationality debate? Behavioral and Brain Sciences. 2000; 23:645–726. [PubMed: 11301544]

Torrance EP. Predictive validity of the Torrance Tests of Creative Thinking. Journal of Creative Behavior. 1972; 6:236–252.

Vandenberg SG, Kruse AR. Mental rotations: Group tests of three-dimensional spatial visualization. Perceptual and Motor Skills. 1978; 47:599–604. [PubMed: 724398]

von Stumm S, Benedikt H, Chamorro-Premuzic T. The hungry mind: Intellectual curiosity is the third pillar of academic performance. Perspectives on Psychological Science. 2011; 6:574–588. [PubMed: 26168378]

Wechsler, D. WAIS-III administration and scoring manual. San Antonio, TX: Harcourt Brace & Company; 1997.

Wechsler, D. Wechsler Adult Intelligence Scale-Fourth Edition. San Antonio, TX: Pearson Assessment; 2008a.

Woo SE, Chernyshenko OS, Longley A, Zhang ZX, Chiu CY, Stark SE. Openness to experience: Its lower level structure, measurement, and cross-cultural equivalence. Journal of Personality Assessment. 2014; 96:29–45. [PubMed: 23795950]

Table 1

Distributional information for creative achievement

	Sample 1 (N = 166)				Sample 2 (N = 239)				Sample 3 (N = 329)				Sample 4 (N = 305)			
	M (SD)	Mdn	Sk	Ku	M (SD)	Mdn	Sk	Ku	M (SD)	Mdn	Sk	Ku	M (SD)	Mdn	Sk	Ku
CAQ Total	15.96 (13.24)	12.00	1.60	2.57	22.74 (18.29)	18.00	1.63	3.69	11.17 (11.02)	8.00	2.21	6.76	9.23 (5.95)	8.00	1.14	1.55
CAQ Arts	13.43 (12.96)	10.00	1.86	3.49	16.99 (15.33)	13.00	1.39	1.80	8.98 (9.77)	6.00	2.45	7.95	6.58 (4.95)	5.00	1.09	1.23
CAQ Sciences	1.61 (2.38)	1.00	2.66	9.22	4.15 (5.67)	2.00	2.37	7.41	1.56 (2.70)	.00	2.57	7.77	1.64 (1.49)	1.00	1.83	6.02

Note: CAQ = Creative Achievement Questionnaire; Mdn = Median; Sk = Skewness; Ku = Kurtosis

Table 2

Relations among predictor variables and creative achievement pooled across four samples (n-weighted mean correlations).

	g	Div. Think	Visual Arts	Music	Dance	Architectural Design	Creative Writing	Humor	Inventions	Scientific Discovery	Theatre /Film	Culinary Arts	CAQ Total	CAQ Arts	CAQ Sciences
g	-	**.37**	.03	.11	-.09	.01	.04	-.01	.11	**.27**	.11	-.08	.11	.06	**.24**
Divergent Thinking	**.37**	-	.10	.11	-.10	.03	**.16**	.06	**.15**	**.17**	**.16**	.09	**.19**	**.15**	**.20**
Openness/Intellect	**.32**	**.27**	**.18**	**.19**	.03	.01	**.31**	.13	**.15**	**.21**	**.19**	.12	**.36**	**.33**	**.21**
Intellect	**.36**	**.27**	.03	.09	-.02	.00	**.24**	.10	**.15**	**.29**	.10	.10	**.22**	**.16**	**.27**
Openness	**.16**	**.18**	**.26**	**.23**	.07	.02	**.28**	.13	.11	.07	**.22**	.09	**.38**	**.39**	.10
Neuroticism	-.08	-.10	.01	-.01	-.01	.02	.00	-.01	-.09	-.10	.01	-.08	.00	.03	-.10
Volatility	-.12	-.08	.02	-.01	.01	.01	.02	.03	-.08	-.12	.05	-.05	.03	.07	-.11
Withdrawal	-.01	-.10	.00	-.02	-.02	.01	-.02	-.06	-.08	-.05	-.03	-.10	-.02	.00	-.07
Agreeableness	.06	.02	.07	.01	.08	-.05	.02	-.07	-.04	-.05	.01	-.02	.01	.03	-.06
Compassion	.10	.11	.09	.05	.06	-.02	.07	.04	.02	-.05	.10	.04	.10	.12	-.02
Politeness	.00	-.07	.04	-.02	.08	-.05	-.05	**-.15**	-.08	-.04	-.07	-.07	-.07	-.06	-.08
Conscientiousness	-.13	.02	-.01	-.05	.07	.01	-.02	-.12	-.07	-.02	-.09	.06	-.06	-.07	-.05
Industriousness	-.11	.03	-.04	-.02	.05	-.02	.00	-.06	-.01	.00	-.07	.08	-.04	-.05	-.01
Orderliness	-.11	-.01	.01	-.07	.07	.01	-.04	-.14	-.13	-.04	-.08	.03	-.08	-.07	-.09
Extraversion	-.02	.11	.01	.05	.08	-.03	.13	**.22**	.08	-.02	**.17**	**.16**	**.17**	**.17**	.03
Enthusiasm	-.03	.04	-.01	.03	.06	-.05	.05	.13	.00	-.06	.11	.08	.07	.10	-.05
Assertiveness	-.01	**.14**	.02	.06	.08	.01	**.18**	**.24**	.12	.02	**.19**	**.18**	**.21**	**.20**	.09

Note: $N = 1035$, except for correlations involving *g* ($N = 844$) and divergent thinking ($N = 671$). Correlations with the CAQ are Spearman's rho, all others are Pearson correlations. All correlations > .14 were bolded.

Table 3

Correlations of *g* with measures in each sample.

	Sample 1	Sample 2	Sample 3	Sample 4
Intellect	.39	.34	.35	.37
Openness	.19	.13	.24	.13
CAQ Arts	-.04	-.03	.18	.14
CAQ Sciences	.27	.30	.11	.22
DT	–	.33	.42	.38

Note: Correlations with the CAQ are Spearman's rho, all others are Pearson correlations. Sample 1: *N*=166; Sample 2: *N*=239; Sample 3: *N*=124; Sample 4: *N*=305.

Table 4

Robust poisson regressions predicting creative achievement in the arts and sciences in Sample 1 (Cambridge)

	Arts					Sciences				
	b	SE	95% CI	Wald χ^2	*p*	*b*	SE	95% CI	Wald χ^2	*p*
Block 1										
Age	-0.11	0.11	(-0.33, 0.10)	1.08	.30	-0.09	0.17	(-0.43, 0.25)	0.29	.59
Sex	0.26	0.16	(-0.05, 0.58)	2.70	.10	**-0.81**	**0.22**	**(-1.24, -0.38)**	**13.50**	**<.01**
Intellect	0.10	0.12	(-0.13, 0.34)	0.74	.39	**0.50**	**0.15**	**(0.20, 0.80)**	**10.60**	**<.01**
Openness	**0.41**	**0.10**	**(0.21, 0.61)**	**16.60**	**<.01**	-0.06	0.18	(-0.41, 0.30)	0.10	.75
Block 2										
Age	-0.06	0.11	(-0.27, 0.15)	0.34	.56	-0.10	0.17	(-0.44, 0.24)	0.35	.56
Sex	0.17	0.15	(-0.13, 0.47)	1.20	.27	**-0.69**	**0.24**	**(-1.17, -0.22)**	**8.06**	**.01**
Intellect	-0.00	0.11	(-0.21, 0.22)	0.00	.98	**0.56**	**0.20**	**(0.17, 0.95)**	**7.96**	**.01**
Openness	**0.42**	**0.12**	**(0.18, 0.66)**	**12.21**	**<.01**	-0.06	0.22	(-0.49, 0.38)	0.07	.79
Neuroticism	-0.04	0.07	(-0.18, 0.09)	0.42	.52	-0.10	0.08	(-0.26, 0.06)	1.47	.23
Agreeableness	0.09	0.08	(-0.06, 0.24)	1.28	.26	0.01	0.12	(-0.23, 0.24)	0.00	.96
Conscientiousness	0.08	0.06	(-0.02, 0.26)	2.23	.13	-0.05	0.09	(-0.23, 0.13)	0.27	.60
Extraversion	**0.14**	**0.06**	**(0.02, 0.26)**	**5.12**	**.02**	-0.10	0.08	(-0.23, 0.05)	1.52	.22
Block 3										
Age	-0.06	0.11	(-0.27, 0.15)	0.34	.56	-0.11	0.17	(-0.44, 0.21)	0.47	.49
Sex	0.17	0.15	(-0.14, 0.47)	1.17	.28	**-0.65**	**0.26**	**(-1.15, -0.14)**	**6.25**	**.01**
Intellect	0.01	0.12	(-0.23, 0.24)	0.00	.96	**0.49**	**0.20**	**(0.10, 0.87)**	**6.10**	**.01**
Openness	**0.42**	**0.12**	**(0.18, 0.66)**	**12.19**	**<.01**	-0.11	0.23	(-0.57, 0.35)	0.23	.64
Neuroticism	-0.04	0.06	(-0.18, 0.09)	0.42	.52	-0.09	0.08	(-0.25, 0.07)	1.30	.25
Agreeableness	0.09	0.08	(-0.06, 0.24)	1.29	.26	0.01	0.12	(-0.23, 0.24)	0.00	.96
Conscientiousness	0.08	0.06	(-0.03, 0.19)	2.25	.13	-0.04	0.09	(-0.22, 0.14)	0.18	.68
Extraversion	**0.14**	**0.06**	**(0.02, 0.26)**	**4.88**	**.03**	-0.07	0.07	(-0.21, 0.07)	0.89	.35
g	-0.01	0.08	(-0.16, 0.15)	0.00	.95	0.16	0.17	(-0.17, 0.48)	0.88	.35

Note. N = 166. Significant effects (p < .05) are in bold. Sex was coded: 0= Male, 1= Female.

Table 5

Robust poisson regressions predicting creative achievement in the arts and sciences in Sample 2 (New Haven)

	Arts					Sciences				
	b	SE	95% CI	Wald χ^2	p	b	SE	95% CI	Wald χ^2	p
Block 1										
Age	-0.01	0.01	(-0.03, 0.01)	0.88	.35	0.01	0.01	(-0.02, 0.04)	0.26	.61
Intellect	0.01	0.09	(-0.17, 0.18)	0.01	.93	**0.43**	**0.15**	**(0.13, 0.73)**	**7.84**	**.01**
Openness	**0.60**	**0.10**	**(0.40, 0.81)**	**33.50**	**<.01**	0.00	0.17	(-0.33, 0.33)	0.00	1.0
Block 2										
Age	-0.01	0.01	(-0.03, 0.01)	0.80	.37	0.01	0.02	(-0.03, 0.03)	1.00	.76
Intellect	0.00	0.11	(-0.21, 0.21)	0.00	.99	**0.50**	**0.19**	**(0.13, 0.87)**	**6.97**	**.01**
Openness	**0.64**	**0.11**	**(0.42, 0.85)**	**33.58**	**<.01**	0.11	0.18	(-0.25, 0.47)	0.35	.56
Neuroticism	0.13	0.09	(-0.05, 0.31)	1.92	.17	-0.20	0.15	(-0.50, 0.09)	1.81	.18
Agreeableness	**-0.39**	**0.11**	**(-0.60, -0.18)**	**13.05**	**<.01**	**-0.48**	**0.18**	**(-0.84, -0.13)**	**7.09**	**.01**
Conscientiousness	0.01	0.09	(-0.17, 0.20)	0.02	.90	-0.08	0.15	(-0.38, 0.22)	0.29	.59
Extraversion	**0.32**	**0.11**	**(0.11, 0.53)**	**8.77**	**<.01**	-0.28	0.21	(-0.68, 0.13)	1.81	.18
Block 3										
Age	-0.02	0.01	(-0.04, 0.01)	2.10	.15	0.01	0.02	(-0.02, 0.04)	0.39	.54
Intellect	0.11	0.13	(-0.13, 0.36)	0.87	.35	0.22	0.19	(-0.14, 0.59)	1.46	.23
Openness	**0.64**	**0.11**	**(0.42, 0.85)**	**33.90**	**<.01**	0.12	0.17	(-0.21, 0.45)	0.49	.49
Neuroticism	0.16	0.10	(-0.02, 0.34)	2.93	.09	-0.18	0.15	(-0.48, 0.12)	1.38	.24
Agreeableness	**-0.35**	**0.10**	**(-0.54, -0.16)**	**12.83**	**<.01**	**-0.50**	**0.18**	**(-0.86, -0.13)**	**7.22**	**.01**
Conscientiousness	-0.03	0.10	(-0.23, 0.16)	0.12	.73	0.00	0.16	(-0.30, 0.31)	0.00	.99
Extraversion	**0.30**	**0.11**	**(0.09, 0.51)**	**7.54**	**.01**	-0.22	0.19	(-0.60, 0.15)	1.34	.25
g	**-0.11**	**0.04**	**(-0.18, -0.04)**	**8.85**	**<.01**	0.11	0.05	(0.00, 0.21)	3.83	.05
Divergent Thinking	0.09	0.05	(-0.02, 0.19)	2.76	.10	**0.26**	**0.13**	**(0.01, 0.52)**	**4.23**	**.04**

Note. $N = 236$, except for Block 3 ($N = 235$). Significant effects ($p < .05$) are in bold.

Table 6

Robust poisson regressions predicting creative achievement in the arts and sciences in Sample 3 (Southern Ontario)

	Arts					Sciences				
	b	SE	95% CI	Wald χ²	*p*	*b*	SE	95% CI	Wald χ²	*p*
Block 1										
Age	**-0.05**	**0.02**	**(-0.08, -0.01)**	**5.14**	**.02**	0.00	0.03	(-0.05, 0.05)	0.01	.94
Sex	-0.08	0.11	(-0.30, 0.14)	0.50	.48	-0.22	0.19	(-0.60, 0.16)	1.32	.25
Intellect	0.15	0.10	(-0.05, 0.34)	2.05	.15	**0.62**	**0.16**	**(0.30, 0.94)**	**14.50**	**<.01**
Openness	**0.38**	**0.10**	**(0.20, 0.57)**	**16.33**	**<.01**	-0.17	0.20	(-0.55, 0.22)	0.73	.39
Block 2										
Age	-0.04	0.02	(-0.09, 0.00)	3.97	.05	-0.01	0.02	(-0.06, 0.04)	0.11	.74
Sex	-0.06	0.11	(-0.28, 0.16)	0.28	.60	-0.23	0.19	(-0.61, 0.16)	1.35	.25
Intellect	0.07	0.12	(-0.17, 0.31)	0.34	.56	**0.58**	**0.19**	**(0.20, 0.95)**	**9.03**	**<.01**
Openness	**0.41**	**0.10**	**(0.21, 0.61)**	**16.18**	**<.01**	-0.06	0.22	(-0.49, 0.37)	0.07	.79
Neuroticism	0.17	0.09	(0.00, 0.34)	3.90	.05	-0.28	0.20	(-0.68, 0.13)	1.83	.18
Agreeableness	-0.08	0.11	(-0.29, 0.13)	0.53	.47	-0.27	0.22	(-0.71, 0.17)	1.42	.23
Conscientiousness	**0.23**	**0.10**	**(0.03, 0.43)**	**5.06**	**.02**	0.00	0.17	(-0.33, 0.33)	0.00	.99
Extraversion	**0.20**	**0.09**	**(0.03, 0.38)**	**5.31**	**.02**	-0.21	0.20	(-0.59, 0.18)	1.08	.30
Block 3										
Age	**-0.07**	**0.03**	**(-0.13, -0.01)**	**5.21**	**.02**	-0.03	0.05	(-0.12, 0.07)	0.33	.56
Sex	-0.06	0.18	(-0.42, 0.29)	0.12	.73	**-0.82**	**0.28**	**(-1.36, -0.28)**	**8.93**	**<.01**
Intellect	-0.07	0.18	(-0.43, 0.29)	0.15	.70	0.27	0.21	(-0.14, 0.68)	1.64	.20
Openness	**0.43**	**0.14**	**(0.16, 0.71)**	**9.56**	**<.01**	-0.09	0.24	(-0.57, 0.39)	0.14	.71
Neuroticism	0.12	0.12	(-0.10, 0.35)	1.13	.29	-0.27	0.23	(-0.71, 0.17)	1.42	.23
Agreeableness	-0.06	0.16	(-0.37, 0.25)	0.14	.71	**-0.82**	**0.27**	**(-1.34, -0.30)**	**9.53**	**<.01**
Conscientiousness	**0.36**	**0.14**	**(0.08, 0.63)**	**6.23**	**.01**	-0.08	0.20	(-0.47, 0.32)	0.16	.69
Extraversion	**0.32**	**0.12**	**(0.07, 0.56)**	**5.56**	**.01**	-0.05	0.23	(-0.50, 0.39)	0.06	.81
g	**0.02**	**0.02**	**(-0.02, 0.06)**	1.02	.31	-0.02	0.02	(-0.06, 0.03)	0.37	.54
Divergent Thinking	-0.07	0.12	(-0.30, 0.16)	0.38	.54	**0.76**	**0.17**	**(0.41, 1.10)**	**18.73**	**<.01**

Note. N = 323, except for Block 3 (*N* = 123). Significant effects (*p* < .05) are in bold. Sex was coded: 0 = Male, 1 = Female.

Table 7

Robust poisson regressions predicting creative achievement in the arts and sciences in Sample 4 (Minnesota)

	Arts					Sciences				
	b	SE	95% CI	Wald χ^2	*p*	*b*	SE	95% CI	Wald χ^2	*p*
Block 1										
Age	-0.02	0.01	(-0.02, 0.02)	0.06	.81	-0.01	0.01	(-0.03, 0.01)	1.95	.16
Sex	**-0.25**	**0.08**	**(0.10, 0.41)**	**10.30**	**<.01**	**-0.36**	**0.11**	**(0.15, 0.57)**	**10.99**	**.00**
Intellect	-0.01	0.07	(-0.15, 0.12)	0.04	.84	**0.42**	**0.10**	**(0.23, 0.61)**	**18.22**	**.00**
Openness	**0.51**	**0.07**	**(0.37, 0.65)**	**51.39**	**<.01**	-0.01	0.10	(-0.19, 0.17)	0.01	.93
Block 2										
Age	0.00	0.01	(-0.02, 0.02)	0.02	.89	-0.01	0.01	(-0.03, 0.01)	1.14	.29
Sex	**-0.25**	**0.09**	**(0.09, 0.42)**	**8.71**	**<.01**	**-0.35**	**0.11**	**(0.13, 0.56)**	**9.90**	**<.01**
Intellect	-0.03	0.08	(-0.18, 0.12)	0.16	.69	**0.44**	**0.11**	**(0.22, 0.66)**	**15.59**	**<.01**
Openness	**0.46**	**0.08**	**(0.31, 0.61)**	**35.08**	**<.01**	-0.09	0.11	(-0.30, 0.12)	0.67	.41
Neuroticism	0.09	0.07	(-0.05, 0.23)	1.52	.22	0.06	0.09	(-0.13, 0.24)	0.34	.56
Agreeableness	0.03	0.09	(-0.14, 0.21)	0.13	.72	0.09	0.11	(-0.12, 0.29)	0.63	.43
Conscientiousness	-0.08	0.07	(-0.23, 0.06)	1.25	.26	**-0.20**	**0.10**	**(-0.39, -0.01)**	**4.04**	**.04**
Extraversion	**0.21**	**0.07**	**(0.07, 0.35)**	**8.35**	**<.01**	0.08	0.12	(-0.15, 0.31)	0.47	.50
Block 3										
Age	0.00	0.01	(-0.02, 0.02)	0.07	.79	-0.01	0.01	(-0.03, 0.01)	0.92	.34
Sex	**-0.26**	**0.09**	**(0.09, 0.43)**	**9.34**	**<.01**	**-0.35**	**0.11**	**(0.14, 0.56)**	**10.71**	**<.01**
Intellect	-0.10	0.08	(-0.25, 0.05)	1.62	.20	**0.32**	**0.11**	**(0.11, 0.53)**	**8.69**	**<.01**
Openness	**0.45**	**0.08**	**(0.30, 0.60)**	**33.90**	**<.01**	-0.08	0.10	(-0.28, 0.12)	0.60	.44
Neuroticism	0.09	0.07	(-0.04, 0.23)	1.79	.18	0.05	0.09	(-0.13, 0.24)	0.32	.57
Agreeableness	0.04	0.09	(-0.14, 0.22)	0.20	.66	0.07	0.10	(-0.13, 0.28)	0.51	.47
Conscientiousness	-0.08	0.07	(-0.22, 0.07)	1.10	.29	-0.15	0.10	(-0.35, 0.04)	2.41	.12
Extraversion	**0.23**	**0.07**	**(0.09, 0.37)**	**10.68**	**<.01**	0.14	0.11	(-0.08, 0.35)	1.50	.23
g	0.06	0.06	(-0.05, 0.18)	1.12	.29	**0.18**	**0.08**	**(0.03, 0.34)**	**5.54**	**.02**
Divergent Thinking	**0.04**	**0.02**	**(0.01, 0.07)**	**5.29**	**.02**	0.02	0.04	(-0.05, 0.09)	0.38	.54

Note. N = 305. Significant effects (*p* < .05) are in bold. Sex was coded: 0 = Male, 1 = Female.