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Personality and Intelligence: Examining the Associations of Investment-related Personality Traits with General and Specific Intelligence

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In this study, we examine the associations of the scales of the California Psychological Inventory (CPI; a measure of personality traits) with intelligence measured by four cognitive ability tests, completed by a sample of 4876 working adults. We framed our analyses of the correlations around the investment perspective on the personality-intelligence relationship that proposes traits are associated with investment in intellectual activity, which develops cognitive abilities over time. In particular, we report associations between investment-related scales (Intellectual Efficiency, Flexibility, Achievement via Independence, Psychological-mindedness, and Tolerance) and a higher-order personality factor (Originality) of the CPI with intelligence measured at broad and narrow levels of abstraction. We found positive associations between investment-related scales, and Originality with observed ability test scores and factor *g* extracted from test scores. We found positive associations of traits with unique variance in verbal ability measures, but negative with measures of quantitative and visuo-spatial abilities. Our study extends the literature on investment theories of intelligence-personality relations, is the first study to examine the associations of multiple scales of the CPI with intelligence measures, and adds much needed data to the literature from a working adult sample.

Keywords: Personality Traits, Intelligence, Intellectual Investment, California Psychological Inventory

Introduction

Traditionally, intelligence and personality have been conceptualised and treated as separate entities (Eysenck, 1994; Zeidner & Matthews, 2000). However, contemporary theory on intelligence-personality relations proposes mechanisms by which intelligence and personality are linked. Arguably the most influential of these is investment theory (e.g. von Stumm & Ackerman, 2013), which proposes that intelligence and personality are associated at the conceptual level, whereby personality traits determine where, when and how people apply and invest their abilities and thus, their development of intelligence across the lifespan. In this study, our main contribution is to extend the literature on investment perspectives on intelligence-personality relations by examining associations of investment-related personality traits at the facet and higher-order level, with intelligence also modelled at broad and narrow levels. To do this, we report associations of scales of the California Psychological Inventory with four tests of cognitive ability. Our study further contributes data from a non-student (working adult) sample.

The investment perspective on personality and cognitive ability is based on the observation that personality traits that refer to the tendency to seek out, engage in and pursue learning opportunities, such as Openness to Experience from the Five Factor Model (Costa & McCrae, 1992) or Need for Cognition (Cacioppo & Petty, 1982), have been shown to be associated with markers of adult intelligence (von Stumm & Ackerman, 2013; Ziegler et al., 2012). Elevated investment traits may influence intelligence by promoting greater engagement with a wider range of activities and stimuli, which could enhance intellectual abilities (Arteche, Chamorro-Premuzic, Ackerman, & Furnham, 2009). For example, Openness from the Big Five model is associated with artistic and intellectual job preferences (Ackerman & Heggestad, 1997), and may influence motivation to attempt tasks in those domains of activity and work (e.g. Woods & Hampson, 2010), with higher ability

determining likely success in those tasks. Success could consequently influence motivation to attempt further tasks, increasing the variety and complexity of experience, reciprocally deepening corresponding investment traits, reinforcing interests, and developing intellectual capabilities. This reasoning is in line with recent theory in the personality and development literature (e.*g*. the Dynamic Developmental Model of Woods, Lievens, De Fruyt & Wille, 2013), and longitudinal research on the interplay of investment-related traits and intelligence (Ziegler, Danay, Heene, Asendorpf & Bühner, 2012).

Most previous research on intelligence-personality associations has focused on studying personality traits either from the Five Factor Model (e.g. Austi, Deary, & Gibson, 1997; Wolf & Ackerman, 2005; Zeidner & Matthews, 2000; Wainwright et al., 2008) or narrowly defined investment-related personality traits (DeYoung et al., 2005; von Stumm & Ackerman, 2013). Example investment traits that have been found to correlate positively with intelligence include judging and perceiving from the Myers-Briggs Type Indicator, and the facet Openness to Ideas from the NEO PIR (Furnham et al., 2007), the Tough-mindedness (comprising Conceptual, Intuitive, and Radical) scales of the Fifteen Factor Questionnaire (Moutafi, Furnham & Paltiel, 2005) and Culture (see studies of Reeve, Meyer & Bonaccio, 2006, and Major, Johnson & Deary, 2014), and Openness from the Big Five (von Stumm & Ackermann, 2013).

Examination of the patterns of reported correlations between investment traits and intelligence at different levels of abstraction provides further insight into the nature of the relations of these individual differences. At a general level (i.e. with factor *g*) investment traits demonstrate a rather consistent positive association in the studies highlighted previously. However, there is variation across facets of intelligence, with studies reporting higher correlations with crystallized ability (e.g. Reeve et al., 2006), and in particular verbal reasoning (Furnham et al., 2007; Moutafi et al., 2005). This pattern of associations supports

the developmental explanation of the relations of investment traits and intelligence. Given that crystallized intelligence represents acquired and learned abilities (e.g. Woods & West; 2014; Carroll, 1993), greater investment in intellectual pursuits and verbal education, logically would lead to greater developed crystallized ability. Further examination of correlations in these studies also shows some differences in the relations for men and women (e.g. Reeve et al., 2006 reported stronger correlations for women compared to men).

With respect to fluid ability, the picture is less clear. Some studies report correlations of investment traits with fluid and visuo-spatial abilities as zero (e.g. von Stumm et al., 2009) or even negative (Reeve et al., 2006). Yet in other studies, longitudinal data suggest that Openness to Experience does predict development of fluid ability in children (e.g. Asendorpf & Van Aken, 2003), and in later life stages (e.g. Soubelet & Salthouse, 2011; Zimprich, Allemand, & Dellenbach, 2009; Ziegler, Cengia, Mussell, & Gerstof, 2015). Ziegler and colleagues (Ziegler, Danay, Heene, Asendorpf, & Buhner, 2012; Ziegler et al., 2015) have proposed a developmental theoretical model to explain the possible pathways (the Openness-Fluid-Crystallized-Intellignece; OFCI model). In this model, Openness and fluid ability are proposed to interact when people have opportunity to experiment and act openly and freey. Openness promotes environmental experimentation, with fluid ability promoting success in problem solving and task activity, in turn prompting greater curiosity. The reciprocal interplay is similar to developmental mechanisms proposed for personality development generally (e.g. Woods et al., 2013), and fosters development of crystallized ability. Ziegler and colleagues have proposed that the mechanism may apply at certain critical time periods when people experience lower environment constraints (e.g. in childhood and adolescence). Without some contradiction among data in the literature, and based on the emergent nascent nature of these theoretical explanations, the continuing need for new data is underlined.

To further add to the literature on intelligence-personality associations, we report here associations between scales of the California Psychological Inventory (CPI; Gough, 1987; Gough & Bradley, 1996) and a battery of intelligence tests completed by a sample of working adults. The CPI is a widely used personality inventory that offers a compelling prospect for examining a broader range of investment-related personality traits than in previous studies. For example, the inventory has distinct features as compared to the Big Five (McCrae, Costa & Piedmont, 1993; Soto & John, 2009). Von Stumm and Ackerman (2013) included the CPI scale Intellectual Efficiency as a marker of intellectual investment in their meta-analysis reporting an association with *g* of .31 (fixed effect model; .42 random effects model) across 11 studies. However, here we propose that the CPI contains a wider range of investment-related traits. Rushton and Irwing (2009) presented an analysis of the higher-order factors of the CPI, with one extracted component (labelled Originality) being particularly potentially relevant to examining personality-intelligence relations from an investment perspective.

The CPI scales loading most strongly on the Originality Factor were Intellectual Efficiency (comfort with conceptual or intellectual thinking), Flexibility (adaptability and openness to change), Tolerance (open-mindedness and openness of attitudes), Achievement via Independence (preference and motivation for unstructured, independent settings), and Psychological-mindedness (intuition and insight into the thoughts of others). The scales capture various aspects of intellectual investment and cultural openness in a broad way. For example in Woods and Anderson's (2016) Periodic Table of Personality, Psychological-mindedness, Intellectual Efficiency and Achievement via Independence were found to cluster together based on their pattern of Big Five loadings under a facet labelled *Efficiency of Thought/Inquisitiveness.* Flexibility was located (and negatively correlated) with other personality scales related to lack of spontaneity or inflexibility, and Tolerance was clustered with scales relating to Calmness, but with a small loading on Openness/Intellect, reflecting

the theme of the scale of open-mindedness, and psychological adjustment (i.e. emotional stability) with respect to acceptance of alternative attitudes and values. Interpreting the scales, people higher on Originality and its associated scales are therefore more likely to invest time in inquisitive, flexible, critical and more complex thinking about concepts generally, their work and social environment. We propose that these tendencies ultimately represent greater investment in intellectual activity and conceptual thinking, consistent with the investment perspective of personality-intelligence relations.

Following the investment perspective, we reason that these personality traits are related to intellectual development, manifesting in observed positive associations with intelligence, leading us to hypothesize:

Hypothesis 1: Investment related traits are positively associated with intelligence.

We moreover expect that investment-related traits will be more strongly associated with intelligence than non-investment traits. Although we set no formal hypothesis, the pattern of correlations among traits and intelligence will be examined.

As previously discussed, in studies of personality and intelligence, it has been informative to examine associations at various levels specificity of personality traits and ability facets (e.g. Djapo et al., 2011). Such examination is informative from both conceptual and empirical points of view. From a conceptual perspective, facet-level associations clarify more specific relations of narrow personality and ability constructs (De Young, 2012). On the other hand, from an empirical perspective, partialing *g* from observed facet-level associations helps to clarify more precisely the magnitude and nature of personality-intelligence relations (Reeve, Meyer & Bonaccio, 2006; von Stumm, Chamorro-Premuzic, Quiroga, & Colom, 2009).

Following this line, in our study, we examined associations of facet-level and higher-order personality traits, with specific facets of ability, and higher-order *g*. Following Reeve et

al. (2006) and von Stumm et al. (2009), we approach these analyses based on data from observed test scores, but also by separating unique variance in cognitive ability test scores from general variance represented in factor *g*. We present these analyses in order to explore personality-intelligence relations in more depth. We expect the general trend of positive associations between investment-related traits and intelligence to be maintained across levels of construct specificity, but that following past findings (e.g. Reeve et al., 2006) the associations will be strongest for crystallized ability:

Hypothesis 2: Investment related personality traits measured in the CPI are related to intelligence at general (higher-order) and specific (i.e. scale) levels of specificity.

We tested our hypotheses in a sample of working adults, who completed the CPI and a battery of four cognitive ability tests that measured verbal, visuo-spatial and quantitative abilities.

Method

Participants and Procedure

Participants for this study were 4876 adults included in a data archive obtained from test publishing consultancy Personnel Development International (PDI). The anonymized archive contained demographic data of each participant along with each participant's raw test score on each measure (the 23 CPI scales, two of the Employee Aptitude Survey tests, the Watson-Glaser Critical Thinking Appraisal Form A and the Wesman Personnel Classification Test). Of these participants, 30.4% were female and 69.0% were male, with 0.6% of participants not reporting their gender. The mean age of participants was 39.6 years (SD = 8.0 years, Range = 18 – 62 years). 73.8% of participants listed their ethnic background as White/Caucasian, 3.3% as Black/African, 1.7% as Hispanic, 1.1% as Oriental/Asian, 0.4% as 'other', 0.2% as Amerind/Aleutian and 19.6% did not report their ethnic background. Of the total participants, 54.9% held managerial level posts, 23.5% professional/technical posts,

1.5% clerical/administrative posts and 18.5% did not report their occupation background. The remaining 1.7% was made up by participants who held posts identified as skilled trade, unskilled trade, home maker or 'other'.

Not all participants completed all measures so the number of participants in each of the analyses varies slightly. However, each of the measures was completed by a minimum of 4750 or more participants. Incomplete data rows (i.e. cases with one or more missing values for the 20 CPI folk scales and the 4 measures of cognitive ability) were deleted listwise from the dataset and excluded from analyses. After this screening, data for 4705 participants remained in the dataset. Note that because only scale-level data were available for analysis (not uncommon in data of proprietary assessment instruments; e.g. Woods & Hardy, 2012), we consulted alpha reliability data in the technical manuals of all measures in the study (which we report in our descriptions of measures below).

Measuring Personality Traits

California Psychological Inventory (CPI-462; Gough, 1987; Gough & Bradley, 1996): The CPI is a personality inventory that measures a candidate's personality on 20 "folk" scales and 3 "vector" scales. The version of the CPI used for this study is made up of 462 true/false items. The folk scales all measure aspects of personality easily understood by laypeople across different cultures. The vector scales attempt to classify people's personality as being in one sector of a 3-dimensional grid. Evidence of the structural properties and validity of the instrument is reported by Rushton and Irwing (2009) and Soto and John (2009). Although not included in our paper, exploratory factor analyses of our data indicated a conceptually sensible five-factor structure underlying the 20 folk scales (available on request from the second author). The reliabilities of the CPI scales from a standardization sample of the instrument, are shown in Table 2 in the diagonal of the correlation matrix. We noted that two of the scales measuring investment-related traits had reliabilities below 0.70

(Flexibility and Psychological-mindedness). To check that these scales did not confound our higher-order findings, we ran analyses removing each and both of these scales, finding no substantive difference in the correlations of the Originality factor with the cognitive ability tests or *g*. We therefore leave them in our analyses for completeness and to enable integration of our findings against other studies that include the CPI.

Measuring Intelligence

General intelligence (*g*) was measured based on a combination of different ability tests, as described below.

Wesman Personnel Classification Test (PCT; Wesman, 1965; α = .78-89; Pearson Talent Lens, 2007): The PCT is a test designed to measure a candidate's verbal reasoning skills. It is administered online in supervised conditions and takes 20 minutes to complete. The test is made up of 45 items. Candidates are required to be fluent in English to be able to complete the test. Research has shown the test to display acceptable levels of reliability and validity for a variety of occupational group samples (Pearson Talent Lens, 2007).

Watson-Glaser Critical Thinking Appraisal Form A (W-GCTA; Watson & Glaser, 2008; split-half r = .80-85): The W-GCTA is a test designed to assess critical thinking skills and high-level reasoning in graduates and managers. Candidates are presented with problems, statements, interpretations and arguments and are required for each one to assess the logical validity of its propositions. The test is made up of 80 questions and is administered in supervised conditions in no more than 50 minutes.

Employee Aptitude Survey (EAS; Ruch et al., 1994): The EAS is a battery of tests measuring specific aspects of cognitive ability. Participants in this study completed two tests: EAS 5 – Space Visualisation (α = .89; Ruch et al., 1994), which measures the ability to visualise forms and objects in space, and to mentally rotate and manipulate them, and EAS 6

– Numerical Reasoning (α = .81; Ruch et al., 1994), which measures the ability to perform basic mathematical operations quickly and accurately.

Analyses

We analysed our data following a systematic approach to examine patterns of associations between investment-related traits and intelligence at different levels of specificity. Firstly, we computed a correlation matrix of all individual CPI scales and the ability tests to provide context to our results. Next, we used Principal Axis Factoring to extract general factors from the four ability tests (i.e. to extract *g*) and the five investment-related personality scales (i.e. to extract the Originality factor). In the case of extracting *g*, standardized residuals of the individual test scores regressed onto factor *g* were saved as variables to represent the unique variance in each ability test (following Reeve et al., 2006, and von Stumm et al., 2009). We examined the associations of *g* with the facet-level investment-related personality traits in two ways; first by correlating the personality scales with extracted factor *g*, second by following von Stumm et al. (2009) and averaging the correlations of each personality scale across the four ability tests. To examine the associations of unique variance in each test with investment-related personality traits, we correlated the standardized residuals for each with personality scale scores and the extracted Originality factor. Finally, to examine the higher-order association of Originality and *g*, we used a confirmatory factor analysis to test the correlation of the latent constructs.

Results

Descriptive Statistics and Scale-level Correlations

Means, standard deviations, skewness, kurtosis, and correlations of all study variables are shown in Tables 1 and 2. None of the variables for inclusion in the higher-order analyses were affected by skewness or kurtosis. All five of the investment-related personality traits

(Achievement via Independence, Intellectual Efficiency, Psychological-mindedness, Flexibility and Tolerance) were associated with the ability measures (ranging from r = .07 to .37). To check for discriminant correlations, we computed the average of the correlations of the ability tests separately with the investment-related scales and all other scales of the CPI. The averages correlations with the PCT, W-GCTA, EAS 5 and EAS 6 were .28, .30, .11, and .12 for the investment-related traits compared to .11, .11, .05 and .05 for the other scales of the CPI. Investment-related personality traits measured by the CPI were markedly more strongly correlated with the ability measures.

Notably, the investment-related traits were more strongly correlated with the W-GCTA and PCT than with the EAS 5 and EAS 6. Both the W-GCTA and PCT are measures of verbal reasoning, a point we return to in the discussion.

Examining Higher Order Personality and Intelligence Factors

The five investment-related personality traits were entered into principal axis factoring (PAF) to extract the Originality factor. One factor was extracted, with an eigenvalue of 3.049 explaining 61.0% of variance. The factor loadings for each of the CPI scales onto this factor are shown in Table 3.

PAF was next conducted on the four ability test score variables to extract *g*. A one-factor solution was extracted based on both eigenvalues and the resultant scree plot (first extracted factor eigenvalue of 2.345 explaining 58.6% of the variance). Factor loadings are shown in Table 4. The *g* factor score was saved via the regression method. Each ability test score was then individually regressed onto these factor scores and standardised residuals saved. These new variables represented unique variance for each test.

Table 5 reports correlations of the five investment-related traits, and higher-order Originality with *g*. These were computed in two ways; first as the average of correlations between each personality construct with the four ability tests, and second as correlations with

extracted (i.e. regression-scored) factor *g* from the factor analysis of the four ability tests. We computed these statistics for the full sample and for men and women in the sample separately.

Examining the patterns of correlations with *g* shows consistent positive associations of the facet-level investment-related traits with intelligence. Comparing the two methods of computing these correlations shows that correlations were stronger with extracted *g*. This confirms the observation of Reeve et al. (2006) that relying on individual observed test scores as proxies for *g* in the study of personality-intelligence relations typically underestimates the magnitude of the relationship.

Examining the association of the Originality factor with the observed ability test scores and the unique variances after extracting factor *g*, our findings demonstrated three notable points. First, Originality was associated positively with all ability test scores. Second, associations were stronger for the measures of verbal ability, than quantitative and visuo-spatial ability. Third, correlations of Originality with unique variances in the tests were generally weaker than with the observed test scores, however like von Stumm et al. (2009), we observed reversal of direction in two of the correlations (i.e. Originality was negatively correlated with unique variance in the quantitative and visuo-spatial ability tests). This effect is consistent with correlations of the unique variances with the facet-level traits (i.e. personality scale scores). We return to this point in our discussion.

Comparing the results for men and women, we found significant differences in the correlations of Originality, Achievement via Independence, and Originality with unique variance in the EAS 6. The relationships were significantly more strongly negative for women compared to men.

Finally, we examined the correlation between the latent *g* and Originality factors. To estimate this, a CFA model was constructed in which the four ability measures were made to

load onto a single latent factor to represent *g* (χ^2 = 28.129; *df* = 2; *p* < .0001; CFI = .989; TLI = .968; RMSEA = .052; SRMR = .015). The CPI scales were made to load onto a second latent factor representing Originality (χ^2 = 112.455; *df* = 5; *p* < .0001; CFI = .988; TLI = .977; RMSEA = .067; SRMR = .017). These two latent factors were then correlated in the CFA model (see Figure 1). We used this CFA approach because it avoids the potential problem of factor score indeterminacy associated with this family of techniques (Grice, 2001). Model fit was judged using a number fit indices. Though the χ^2 test (χ^2 = 773.877; *df* = 26; *p* < .0001) indicated poor model fit, this must be interpreted in the context of this test's tendency towards Type I Error for large samples such as this one (Bentler & Bonnett, 1980). Interpreting the other fit indices generated by the analysis, the CFI (CFI = .941), TLI (TLI = .919), RMSEA (RMSEA = .078) and SRMR (SRMR = .057) all indicated acceptable model fit by the criteria of Hu and Bentler, 1999. The standardised model correlation between the latent factors representing *g* and Originality was found to be .37

Study Hypotheses

Interpreting the results in the context of our hypotheses, we may conclude that hypothesis 1 was supported. Investment-related personality traits were consistently positively associated with intelligence (factor *g*) in our data. Our findings partially support our hypothesis 2 (that the associations would be positive across different levels of measurement specificity). While most of the correlations we observed were positive, and stronger for crystallized abilities, correlations of the investment-related personality variables with the unique variances of the numerical and visuo-spatial ability tests were negative.

Discussion

In order to add to the body of existing empirical evidence on personality-intelligence relations, in this study, we examined associations of investment-related personality traits of

the CPI with a number of ability tests, and higher-order *g*, analysing the relations at different levels of specificity.

The investment perspective proposes that certain personality traits lead people to invest in intellectual and educational activity that improves intelligence over the course of the lifespan. This mechanism is consistent with a long-term developmental and interactive view of individual differences in personality and intelligence. Consistent with this perspective, we hypothesized firstly that investment related traits of the CPI (Intellectual Efficiency, Flexibility, Tolerance, Achievement via Independence, and Psychological-mindedness), and an underlying factor extracted from them (Originality), would be positively associated with intelligence, and secondly that the relations would be exhibited at different levels of specificity.

Our first hypothesis was supported, and we found positive associations of the Originality factor and its constituent facet-level scales with *g*. This was the case when analysed as the average of correlations of personality across ability tests and as extracted *g* from factor analysis. However, comparing these methods, we echo the conclusions of Reeve et al. (2006), that reliance on individual test scores as proxies of *g* is likely to underestimate the strength of personality-intelligence relations. We found that correlations of the personality variables were stronger for extracted *g* than when taking the average of correlations across the tests (such as might be done in meta-analyses).

The Originality factor in essence concerns independence, depth, and flexibility of thinking. People high on the constituent scales of the factor are, among other related characteristics, autonomous in the way they work on things, efficient intellectually, tend to consider how others might perceive or think through experiences, permissive and tolerant of others' ideas, and are flexible in the way they problem solve. These characteristics are highly consistent with the investment perspective. People with high Originality (and higher scores

on the constituent scales) are more likely to engage in intellectually challenging activity, take time to reason with information and ideas, be comfortable with competing ideas or beliefs, yet sufficiently flexible in their thinking to arrive at their own conclusions. Engaging in these behaviours could result in intellectual growth over time (e.g. Ziegler et al., 2012). It is also possible that these traits and intelligence are linked reciprocally, with success in intellectual pursuits attributable to intelligence, which in turn promotes greater future engagement with such activity. We absolutely acknowledge that our data do not offer a test of this proposition, which would rather require longitudinal data (De Young, 2012). However, our observed correlations are consistent with accumulating research evidence for the associations of investment-related traits and intelligence.

Turning to our hypothesis 2 (that the positive associations would hold across levels of specificity), we noted broad supporting evidence, but some interesting contradictory findings also. Whilst the associations of investment-related traits with *g* and observed test scores were all positive, we observed changes to the direction of associations with unique variance in the quantitative and visuo-spatial tests (once *g* was partialled from the scores). This is consistent with previous studies (e.g. von Stumm et al., 2009). Our data do not permit us to determine why this may be observed. However, it is notable that positive associations were maintained with unique variance in verbal ability tests. One possible implication is that investment-related traits exert effects differentially across facets of ability.

If a developmental perspective is adopted, this would indicate that such traits have positive relations with the development of some ability facets, but negative relations with others. Verbal ability is a central aspect of crystallized ability. Given that crystallized ability represents acquired and learned abilities, the developmental explanation is conceptually logical. That is, investment traits may relate most strongly to verbal and crystallized ability because investment in verbal education and intellectual activity is likely to influence

specifically those aspects of intelligence. What is not explainable easily by the developmental argument is the consistent negative associations of the investment traits with unique variance (i.e. with *g* variance partialled) of, in particular, the numerical test (EAS 6) in the study. If the developmental explanation is similarly applied to this finding, it appears that investment in intellectual activity may lead to higher verbal ability and *g*, but lower numerical ability after the effects of *g* increases are controlled, especially so for women in our sample.

One possible explanation is that numerical reasoning ability has been argued to comprise elements of both crystallized and fluid ability (Johnson & Bouchard, 2005), and investment traits may develop the crystallized variance, but not the fluid component. Greater reliance on crystallized numerical abilities could trade-off against a decline in fluid numerical ability. Although such an explanation would run counter to developmental theory in the area (e.g. Ziegler et al., 2015), which proposes rather that investment-related traits develop (i.e. serve to increase) fluid ability, the possibility nevertheless remains an intriguing prospect to address in future research, For example, note that our sample and analytic approach are different from previous contributions, and indeed Ziegler et al (2015) proposed that in order for the development to play out, people need sufficient degrees of freedom in their environment to learn, which may be less so in our working age adult sample, than in educational or early career samples.

Alternatively, the focus on analysing unique variance (residualized scores) in our study might mean that the variance in the ability variables entered into our analyses may represent something conceptually distinct from fluid ability, consequently influencing the observed effects. Sex differences in numerical ability may also explain why the relationship is more marked for women (Kimura, 1999; Halpern; 2000). In future studies, it would be interesting to examine fluid and abstract abilities in future research to see if a similar result is observed for other non-verbal and non-crystallised forms of ability. For example, we also

found investment traits to be negatively correlated with unique variance in visuo-spatial ability in our data. Clearly, future research should consider and test mechanisms by which the interplay of various aspects of intelligence and investment related traits may unfold across the whole lifespan.

Limitations and Strengths

One limitation of our study was its cross-sectional nature, which prevented testing theoretical pathways of the investment perspectives that require longitudinal data. Secondly, our extraction of factor *g* is restricted to the specific tests included in data we analysed. The breadth and representativeness of the factor could be improved by addition of a greater number of more varied assessment components. That said, our study also has notable strengths, most notably a comparatively large dataset comprising working adults, addressing common sampling limitations in this literature, which relies heavily on student samples.

Conclusions

Our findings add to the existing body of empirical evidence that demonstrated robust associations between intelligence and personality traits. In particular, the current results lend additional support to investment theories that suggest personality traits determine when, where and how people apply their intelligence, thereby contributing to cognitive growth, especially, it would appear in our data, for crystallized verbal abilities. In line with this, we showed here that investment-related traits relating to Originality, a dimension associated with flexible and independent thinking, were related to cognitive ability in various ways. This result echoes previous research outcomes and highlights that intelligence-personality associations replicate reliably across investment-related traits from different personality models.

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Table 1

Descriptive statistics for all CPI scales and measures of cognitive ability.

	Mean (S.D)	Skewness	Kurtosis
Ability Measures			
EAS 5	25.46 (9.28)	-0.21	-0.02
EAS 6	12.05 (3.08)	-0.52	0.68
PCT	26.06 (6.21)	-0.36	-0.23
W-GCTA	64.78 (7.88)	-0.88	0.69
CPI Folk Scales			
Dominance	28.65 (3.87)	-1.01	1.41
Capacity for Status	20.35 (2.66)	-0.50	0.53
Sociability	24.01 (3.58)	-0.88	1.07
Social Presence	27.90 (3.71)	-0.41	0.35
Self-acceptance	20.57 (2.56)	-0.60	0.75
Independence	21.56 (2.71)	-0.66	1.27
Empathy	25.41 (3.84)	-0.43	0.23
Responsibility	28.08 (3.24)	-0.64	0.49
Socialization	34.04 (3.76)	-0.64	0.50
Self-control	25.36 (5.02)	-0.35	0.06
Good Impression	24.69 (5.67)	-0.14	-0.20
Sense of Well-being	35.13 (2.54)	-1.70	5.80
Tolerance	24.60 (3.16)	-0.76	0.74
Achievement via Conformance	32.31 (3.01)	-0.76	0.86
Achievement via Independence	27.39 (3.60)	-0.54	0.27
Intellectual Efficiency	33.05 (3.39)	-0.64	0.76
Psychological-mindedness	18.99 (2.66)	-0.35	0.35
Flexibility	14.62 (3.73)	-0.12	-0.33
Femininity/Masculinity	14.32 (3.74)	0.17	-0.19
Communality	36.46 (1.60)	-3.05	30.51
CPI Vector Scales			
V1: Internality	12.81 (4.28)	0.37	0.04
V2: Norm-favouring	24.53 (4.20)	-0.27	-0.25
V3: Self-realization	46.51 (6.02)	-0.80	0.70

Note: S.E. (Skewness) = 0.04; S.E. (Kurtosis) = 0.07

Table 2

Correlations of all CPI scales with measures of cognitive ability.

	Ability Measures				CPI Folk Scales																		Vector Scales		
	1	2	3	4	DO	CS	SY	SP	SA	IN	EM	RE	SO	SC	GI	WB	TO	AC	AI	IE	PY	FX	MF	CM	V1	V2	V3
1. EAS 5		42	38	33	04	04	-02	05	03	11	01	02	01	01	-01	12	08	-01	12	12	13	07	-24	07	-02	-03	09
2. EAS 6			47	44	05	04	00	08	08	08	04	02	02	-04	-09	04	12	00	13	14	08	12	-10	05	-04	-04	08
3. PCT				63	12	21	04	14	17	15	13	16	03	-06	-13	05	28	05	34	36	22	20	-05	06	-10	-07	19
4. W-GCTA					13	18	04	15	18	20	12	15	04	-04	-11	10	30	04	37	34	23	25	-06	06	-08	-09	23
DO					**83**	42	50	38	54	55	39	34	14	-12	10	23	10	34	16	23	21	-01	-24	16	-69	30	23
CS						**72**	58	51	48	43	62	32	08	00	17	25	36	26	48	48	46	28	-06	02	-44	08	49
SY							**77**	69	61	37	61	17	10	-21	10	20	18	22	25	30	21	18	-10	11	-61	17	32
SP								**71**	57	42	52	01	-07	-40	-12	16	19	-01	33	34	28	38	-16	08	-61	-09	32
SA									**67**	43	40	11	-06	-39	-20	04	09	10	24	25	15	20	-10	12	-61	-02	15
IN										**74**	30	19	-01	-03	11	32	19	16	32	35	38	27	-27	-05	-42	-02	36
EM											**63**	29	14	02	24	27	38	27	46	41	35	34	-02	06	-46	08	53
RE												**77**	38	44	44	39	52	53	37	42	37	01	08	04	-03	44	52
SO													**78**	43	39	37	20	49	07	16	16	-15	07	11	07	63	27
SC														**83**	77	48	34	45	19	20	26	-13	07	-10	51	35	47
GI															**81**	55	29	50	20	20	26	-14	-05	-15	17	46	57
WB																**84**	40	40	32	40	40	07	-24	13	00	29	60
TO																	**79**	26	64	59	52	35	05	01	04	02	70
AC																		**78**	19	29	26	-22	-01	14	-09	55	42
AI																			**80**	65	59	49	01	-05	-07	-13	70
IE																				**79**	51	34	-06	04	-12	00	64
PM																					**62**	35	-12	-05	-07	00	61
FX																						**64**	04	-13	-12	-49	39
MF																							**73**	-05	24	-06	-06
CM																								**71**	-09	14	-05
V1																									-	-08	-05
V2																										-	12
V3																											-

N=4705; r>0.03, p<0.05; r>0.04, p<0.01Note: DO = Dominance; CS = Capacity for Status; SY = Sociability; SP = Social Presence; SA = Self-acceptance; IN = Independence; EM = Empathy; RE = Responsibility; SO = Socialization; SC = Self-control; GI = Good Impression; WB = Sense of Well-being; TO = Tolerance; AC = Achievement via Conformance; AI = Achievement via Independence; IE = Intellectual Efficiency; PM =

Psychological-mindedness; FX = Flexibility; MF = Femininity/Masculinity; CM = Communality. Reliability coefficients from Rushton and Irwing (2009) in bold face in the CPI diagonal (note data not reported for the vector scales V1, V2 and V3).

Table 3.

Loadings for each of the CPI Originality scales onto the first factor extracted by PAF.

CPI Scale	Loading on Originality Factor
Achievement via Independence	.880
Intellectual Efficiency	.749
Tolerance	.746
Psychological-mindedness	.685
Flexibility	.507

Table 4.

Loadings for each measure of ability onto the first factor extracted by PAF.

Ability Test	Loading on factor *g*
Wesman PCT	.789
Watson-Glaser CTA	.727
EAS 6	.639
EAS 5	.522

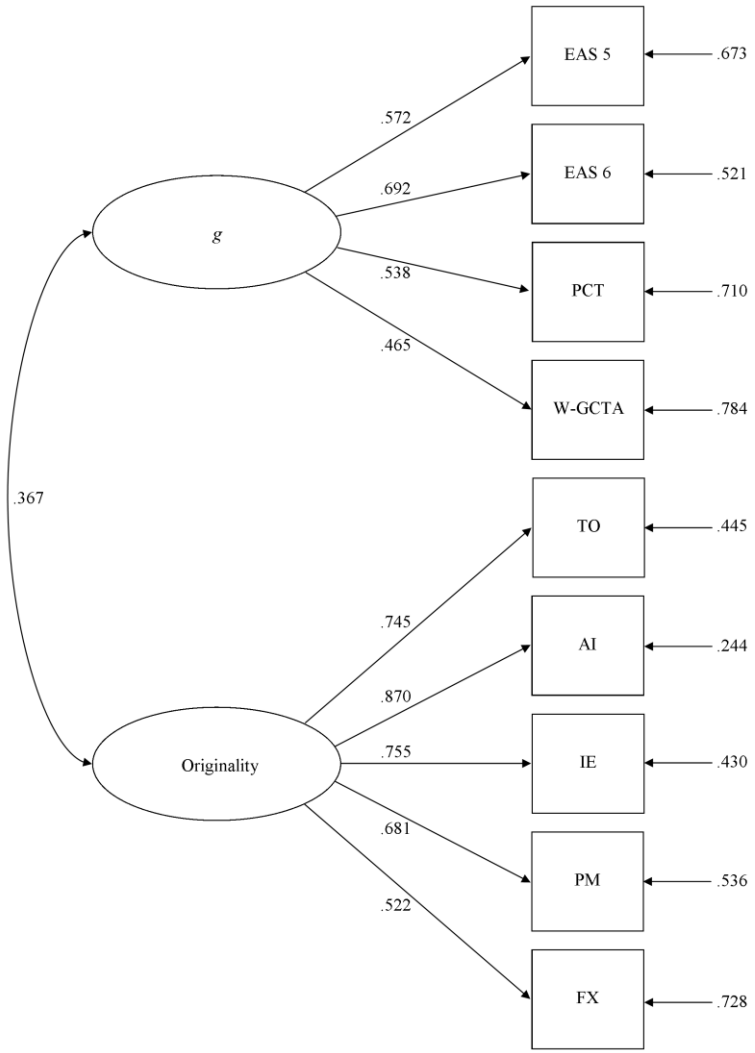
Table 5

Correlations of CPI investment-related scales and Originality with unique variance in ability tests and factor g for male participants (M) female participants (F), and full sample.

	Tolerance			Achievement Via Independence			Intellectual Efficiency			Psychological-mindedness			Flexibility			Originality		
	M	F	Full	M	F	Full	M	F	Full	M	F	Full	M	F	Full	M	F	Full
EAS 5	-.09	-.07	-.10	-.11	-.09	-.11	-.10	-.11	-.10	-.00	-.06	-.01	-.06	-.07	-.08	-.10	-.10	-.10
	(.10)	(.12)	(.08)	(.13)	(.13)	(.12)	(.14)	(.11)	(.12)	(.13)	(.11)	(.13)	(.10)	(.08)	(.08)	(.15)	(.14)	(.13)
EAS 6	-.11	-.13	-.12	**-.14**	**-.21**	-.16	-.15	-.18	-.16	-.12	-.14	-.12	***-.04***	***-.12***	-.07	-.16	-.21	-.17
	(.13)	(.12)	(.12)	(***.16***)	(***.08***)	(.13)	(.16)	(.10)	(.14)	(.07)	(.07)	(.08)	(**.15**)	(**.08**)	(.12)	(**.17**)	(**.11**)	(.15)
Wesman	.06	.06	.06	.07	.08	.07	.10	.13	.11	.04	.06	.04	-.02	.02	.00	.07	.09	.08
PCT	(.28)	(.31)	(.28)	(.35)	(.33)	(.34)	(.37)	(.36)	(.36)	(.21)	(.24)	(.22)	(.20)	(.21)	(.20)	(.37)	(.37)	(.37)
W-GCTA	.11	.10	.12	.14	.18	.16	.09	.11	.10	.08	.10	.08	.10	.14	.12	.14	.16	.15
	(.30)	(.30)	(.30)	(.38)	(.37)	(.37)	(.35)	(.34)	(.35)	(.22)	(.27)	(.24)	(.26)	(.27)	(.26)	(.40)	(.40)	(.40)
Extracted *g*	.29	.30	.28	.36	.32	.35	.37	.33	.35	.22	.24	.23	.24	.23	.23	--	--	--
g (Average correlation)	.20	.21	.19	.25	.23	.24	.26	.23	.24	.16	.17	.17	.18	.16	.16	.27	.26	.26

Correlations with observed ability test scores are presented in parentheses. N=4705; r>0.03, p<0.05; r>0.04, p<0.01. Note: Significant differences in magnitude between correlations for male and female participants are flagged: **bold** = $p < .05$; ***bold italics*** = $p < .01$

Figure 1. CFA model examining association of higher order *g* with Originality.


EAS 5
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.244
.430
.536
.728
.367