

Personality and Intelligence in a High Ability Sample

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Abstract

In all 754 adults (518 males) in a high achieving school-leaver sample completed two intelligence tests (Ravens Progressive Matrices; Graduate Management Assessment Verbal and Numerical) and the 16PF. The study was concerned with the relationships between personality and intelligence. Correlational and regression analyses showed a few of the 16PF factors (particularly Reasoning and Sensitivity) to be related to the various cognitive ability test scores. The study shows that specific personality traits are modestly but consistently correlated with intelligence test scores. Implications are considered.

Keywords

Personality, Intelligence, Ravens, 16PF, High Ability

1. Introduction

There is a growing interest in the relationship between personality traits and intelligence (Furnham, 2008; O'Connor & Paunonen, 2007; Poropat, 2009; von Stumm, Chamorro-Premuzic, & Ackerman, 2011). Studies have looked at the relationship between personality and intelligence (Chamorro-Premuzic & Furnham, 2004, 2005, 2006; Chamorro-Premuzic, Furnham, & Moutafi, 2004; Furnham, Forde, & Cotter, 1998; Moutafi, Furnham, & Paltiel, 2005; Furnham & Moutafi, 2012).

Studies have been done using various measures of both personality and intelligence but the results tend to show correlations are low and that Neuroticism is negatively, and Conscientiousness and Openness positively, correlated with intelligence. There are however various differences as a function of which personality and intelligence tests are used, particularly the latter. This study aims to ex-

amine the relationship between the 16PF and three well established intelligence tests. It extends the analysis of [Furnham and Crump \(2013\)](#).

This study extends and replicates the work of [Djapo et al. \(2011\)](#) who tested the relationship between the 16PF, Ravens Advanced Progressive Matrices and the Mill Hill Vocabulary Scales on 105 Bosnian 3rd graders. Half of the 16 factors were (modestly but significantly) correlated with fluid intelligence (particularly *Reasoning* positively and *Sensitivity* negatively) but there were far fewer significant correlates (two only) of crystallised intelligence. The authors calculated the “big five” Cattellian higher order factors and performed regressions. Only the regression for fluid intelligence was significant and accounted for a quarter of the variance. Two higher factors (*Tough-Mindedness* and *Independence*) were positive predictors and two (*Extraversion* and *Anxiety*) were negative predictors of fluid intelligence.

This study advances this modest study *first* by having a large adult population of over 700 people, *second* by having three measures in intelligence including a numeric and vocabulary measure, and *third* by exploring the role of sex differences in the relationship between personality and intelligence. The 16PF is an unusual test in that one of the subscales is a 15 item ability measure labelled *Reasoning* that assesses abstract reasoning and problem solving. Many studies have demonstrated that it correlates in the region of $r = .5$ with other well established measures like the WAIS-R Full scale ([Abel & Brown, 1998](#); [O'Connor & Little, 2003](#)). Note that unlike intelligence tests, the 16PF is not timed, yet this factor (Reasoning) seems a good index of intelligence. As a consequence it was predicted that this 16PF factor is most highly correlated with (all and any) measures of intelligence and that in a regression the 16PF would account for more of the variance (>10%) than other studies which have regressed intelligence test scores on personality variables.

2. Method

2.1. Participants

There were 754 participants of which 543 were male. Their mean age was 29.74 years (SD = 2.67: Males 29.99, SD = 2.73; Females 29.17, SD = 2.44). Nearly all (92%) were Asian graduates. Just over three-quarters (77.1%) had studied in the science pre-university stream as opposed to the arts stream. They were all talented young people assessed as part of a high potential scheme in a government organisation that assessed people for promotion in the public sector. In all 426 males and 155 females had science degrees and 92 males and 81 females arts degrees. All had university standard English fluency.

2.2. Tests Used

2.2.1. Ravens Progressive Matrices (Raven, 1965)

This is a very well established “find the odd-man-out” test of logical reasoning. Participants are shown a block (3 × 3) of patterns with the final one missing. They are presented with 8 alternatives to find the “correct” one by working out

the relationship between the patterns. The alpha was .93.

2.2.2. The Graduate Management Assessment (GMA-A)

The GMA-A is a high level test of abstract reasoning ability. It measures the ability to think conceptually to discover underlying patterns within a set of information and to switch easily between contexts and levels of analysis. This test is composed of two parts: Verbal and Numerical. Each part takes 30 min to complete.

- A. The *Verbal* test presents candidates with a short piece of factual prose together with four statements. Respondents have to decide whether the statements are true, false or cannot tell, from the information provided. The participants are encouraged to detach themselves from their own beliefs and prejudices when answering the questions. The Alpha was .89.
- B. The *Numerical* test presents the subjects with a short scenario, followed by three questions. Respondents have to choose a right answer from a set of 16 possible responses. It aims at testing the problem-solving skills of the participants. The Alpha was .90.

2.2.3. Sixteen Personality Factor (5th Edition) Cattell, Cattell, & Cattell (1990)

This is an established 40 year old, 185 multiple choice item test that measures 16 dimensions of personality. Those scores can be combined into five global factors. The test has been used extensively over the years and is one of the most psychometrically validated of all personality tests (Kline, 1995).

2.3. Procedure

All participants were applicants for a high potential talent government scheme which offered free overseas tuition to successful candidates. They were all tested under exam condition over a two period. Tests were all given in the same order. They were all given feedback on their performance.

3. Results

3.1. Correlations

Table 1 shows the correlations between the three ability tests and the 16 PF traits. Overall there were relatively few significant correlations and none greater than $r = .19$. There was a consistent finding (i.e. significant positive correlations) for Factor B (Reasoning) which is to be expected. There were two other significant correlates of the Raven's test: Those who scored higher on Factor A (Warmth) and I (Sensitivity) scored lower on this test. There were four additional significant correlates of the GMA Numerical scale. Those who scored lower on Factors A (Warmth), I (Sensitivity), and O (Apprehensiveness) but higher on N (Privateness) scored higher on this test. In addition to Factor B, there were three significant correlates of the GMA Verbal test: those who scored higher on I (Sensitivity) and M (Abstractness) but lower on Q3 (Perfectionism) did better on this test.

Table 1. Correlations between the 16 factors and the three intelligence test scores.

	<i>RPM</i>	<i>GMA(N)</i>	<i>GMA(V)</i>
A. Warmth	–12*	–10**	–02
B. Reasoning	16**	19**	12**
C. Emotional Stability.	00	–02	00
E. Dominance.	00	00	07
F. Liveliness	–01	00	01
G. Rule Conscientiousness.	–03	03	–00
H. Social Boldness.	–04	–05	03
I. Sensitivity.	–12**	–12**	16**
L. Vigilance.	–03	03	00
M. Abstractness	00	07	11**
N. Privateness.	02	12**	03
O. Apprehensiveness	–06	00	–02
Q1. Open to Change.	01	–12**	04
Q2. Self-Reliance	05	05	05
Q3. Perfectionism.	–06	–06	–11**
Q4. Tension.	00	02	01

** $p < .01$, * $p < .05$. $N = 794$.

3.2. Regressions

Table 2 shows the results of three stage-wise regressions. All were significant although there was a different pattern. The regression for the Raven's test showed that overall only 4% of the variance was accounted for, and that was by Factor B (Reasoning) and Factor I (Sensitivity).

The regression with the GMA Numerical score as the criterion variable showed sex and age alone accounted for 9% of the variance with younger males doing best. When the 16 personality factors were included three accounted for another 5% of the variance. Those who scored higher on B (Reasoning) and N (Privateness) but lower on Q1 (Open to Change) did best. The regression for the GMA Verbal score showed older participants did better and that this accounted for 4% of the variance. Four 16PF factors accounted for an additional 5%: Those who scored higher on B (Reasoning), E (Dominance) and I (Sensitivity), but lower on Q3 (Perfectionism) did best. When the three ability tests were combined the results showed the two demographic factors accounted for 4% of the variance with younger males doing best. Three 16PF factors accounted for a further 7% of the variance: Those who scored high on B (Reasoning) and E (Dominance) but low on Q3 (Perfectionism) did best.

3.3. Higher Order Factors

Various reports suggest the 16 PF factored into a five factor solution. [Furnham](#)

Table 2. Regression results with intelligence tests as the criterion variables and sex, age and personality as the predictor variables.

	RPM		N		V		TOT	
	Beta	t	Beta	t	Beta	t	Beta	t
Gender	−02	0.51	−20	5.10***	02	0.45	−10	2.73**
Age	−02	0.62	−18	4.69***	−21	5.38***	−21	5.63***
A. Warmth	08	1.56	00	0.11	−06	1.24	−06	1.18
B. Reasoning	16	4.15***	18	4.87***	13	3.48***	21	5.89***
C. Emotional Stability.	00	0.12	05	1.10	03	0.68	06	0.82
E. Dominance.	05	1.06	08	1.69	12	2.66***	12	2.68**
F. Liveliness.	04	0.81	06	1.35	−02	0.39	03	0.76
G. Rule conscientious.	00	0.09	04	0.91	05	1.21	05	1.15
H. Social Boldness.	−06	1.18	−04	0.74	00	0.13	−04	0.74
I. Sensitivity.	−12	2.67**	−07	1.56	15	3.39***	00	0.74
L. Vigilance.	04	1.07	−01	0.37	−01	0.38	03	0.81
M. Abstractness.	−02	0.38	05	1.21	02	0.51	03	0.73
N. Privateness.	−03	0.76	10	2.28*	00	0.22	04	0.97
O. Apprehension.	−03	0.64	00	1.16	−01	0.20	−02	0.44
Q1.Open to Change.	03	0.67	−10	2.37**	02	0.36	−03	0.75
Q2. Self Reliance.	06	1.18	04	0.79	05	0.96	06	1.36
Q3. Perfectionism.	−05	1.08	−04	0.99	−13	3.17***	−10	2.64***
Q4. Tension.	00	0.38	00	0.14	−02	0.55	01	0.24
Step 1 (gender/age)								
	F(2,726)=		4.76**		36.56***		14.76***	
Adj	R ²		01		09		04	
Step 2 16P								
	(F,18,740)=		2.68***		7.02***		4.98***	
Adj	R ²		04		13		09	
							11	

*** $p < .001$, ** $p < .01$, * $p < .05$.

and Crump (2013) did an oblimin (oblique) rotation for this sample using the scree test to determine the number of factors. The factors were similar, but not identical to those in previous studies (Aluja & Blanch, 2004; Hofer, Horn, & Eber, 1997). They were labelled Extraversion, Anxiety, Self Control, Independence and Tough Mindedness. These higher order factors were then correlated with the three ability tests (see Table 3).

The results suggest Extraversion, Self Control and Independence are negatively associated with the three measures but that Tough Minded was positively associated particularly with the Ravens ($r = .13$). The same analysis was repeated for the five factors derived from the analysis. A similar set of correlation arose.

Table 3. Correlations between the 16PF higher order factors and the intelligence test scores.

	Mean	SD	E	A	Sc	I	Tm	RPM	ADV	V
Extraversion (E)	21.20	18.69								
Anxiety (A)	15.91	13.28	−32							
Self Control (Sc)	4.10	12.50	−23	−20						
Independence (I)	58.67	12.17	62	−22	−15					
Tough-Minded (Tm)	3.01	9.77	28	08	−33	20				
Ravens PM (RPM)	56.19	3.09	−07	−03	−03	−03	13			
Numerical (ADV)	21.89	4.29	−08	02	−04	−04	09	36		
Verbal (V)	36.85	4.50	−02	00	−09	−09	01	14	12	

Correlation > .15 are $p < .001$.

This factor 4 which is similar to the Self Control factor was significantly negatively correlated with all three ability tests scores ($-.09 > r < -.11$). Equally the fifth factor was negatively correlated the Ravens ($r = .10$) and GMA Numerical ($r = -.11$) but positively correlated with the GMA Verbal test score ($r = .13$).

Similarly the same regressions as in **Table 2** were run except this time with the five higher order scores. All regressions showed that Factor one, four and five were negative predictors of the intelligence test scores. The regression that accounted for most of the variance was that for GMA Verbal ($F(7,751) = 8.94$, $p > .001$; $\text{Adj}R^2 = .07$). The betas for the five factors in order were $-.21$, $-.08$, $.09$, $-.11$ and $.11$ showing three negative and two positive predictors. Thus the regressions of the Big Five derived from the 16PF accounted for about the same amount of variance as that of the analysis with the 16 factors.

4. Discussion

Correlations between the 16PF personality traits and the three intelligence test scores showed few significant correlations and only limited consistency across the three measures. As predicted, and found in previous studies, the correlation between Factor B (Reasoning) and the three intelligence tests was significant and positive but lower ($.12 > r < .19$) than in previous studies. The results for Factor I (Sensitivity) were also in accordance with the previous literature showing to be positively correlated with verbal/crystallized measures, but negatively correlated with fluid/numerical measures (Djapo et al., 2011). It is related to Neuroticism on the Big Five Model and Intuition in the MBTI literature which is confirmed by the description of High and Low scorers in the 16PF manuals.

Many previous studies in the area that examined the relationship between personality and intelligence showed that despite many significant correlations, regression showed that as little as 3% (only) of the variance could be accounted for even when there was large sample and robust and reliable tests were used. This study was no exception in that the 16PF factors could only account for 3%

of the variance (after sex and age were controlled) for the Ravens. This is much lower than the 26% accounted for in the study by Djapo et al. (2011). The regression results were however interesting for three reasons. First, gender and age accounted for between 1% and 9% of the variance. The results showed that younger people scored higher and that on numerical intelligence, males scored much higher than females. In fact, demographics accounted for more than the 16 personality factors in total. Second, as may be expected Factor B (Reasoning) was a consistent and the strongest predictor for all the regressions providing yet more evidence of the concurrent validity of this short 15 item scale. Third, the three regressions showed that different personality measures predicted different intelligence tests scores.

This study also provided concurrent evidence of the validity of the 16PF Reasoning scale which was modestly and significantly correlated with all three much longer ability measures. One explanation for the lower correlations in previous studies could be the potential restriction of range in this study, particularly for the intelligence tests. Previous studies using students however show similar scores to those found in this sample (Flynn & Rossi-Case, 2011), and students have been the overwhelmingly most common group on which to examine the relationship between personality traits and intelligence scores. Again, the results of the study illustrate the point that the precise nature of the relationship between personality and intelligence is dependent on the particular test used.

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