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Intelligence Compensation Theory: A Critical Examination of the Negative Relationship Between Conscientiousness and Fluid and Crystallised Intelligence

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This study investigates the negative relationship between fluid and crystallised intelligence and Conscientiousness subfactors within the New Zealand workplace. Fluid and crystallised intelligence were assessed via the General Reasoning Test Battery 2 (GRT2; *N* = 1629). Two personality inventories were employed: The Fifteen-Factor Questionnaire (15FQ; *N* = 546), and the Occupational Personality Profile (OPP; *N* = 1083). 15FQ subfactors of Conscientious and Disciplined negatively correlated with fluid and crystallised intelligence. OPP subfactors of Detail-Conscious and Conformity also negatively correlated with fluid and crystallised intelligence. Subfactors for both personality measures correlated more strongly with crystallised than fluid intelligence. This finding is contrary to an earlier finding that Conscientiousness negatively correlates with fluid, but not crystallised intelligence (Moutafi, Furnham, & Paltiel, 2004). An explanation for this difference is discussed and the Intelligence Compensation Theory is introduced as an explanation for the observed relationships.

■ **Keywords:** intelligence, personality, conscientiousness, compensation

The benefits of selecting employees based upon differences in intelligence and personality was discussed by Plato 2,400 years ago (Plato, trans. 1999). A large body of modern research has since built upon Plato's dialogue by examining how individual differences in both personality and intelligence can affect job performance (e.g., Ones & Viswesvaran, 2001; Schmidt, Ones, & Hunter, 1992). Yet relatively little research has examined the relationship between these factors.

Most research into the relationship between intelligence and personality has focused on the Big Five personality trait of Openness-to-Experience. Norman (1963) originally called this trait Culture and others have called it Intellect (Digman & Takemoto-Chock, 1981). Most of this research has suggested a positive relationship between Openness-to-Experience and intelligence (e.g., Bates & Shieles, 2003; Van der Zee, Zaal, & Piekstra, 2003). This positive relationship comes as little surprise as Openness-to-Experience is the personality trait considered to be most conceptually similar to intelligence (Barrick & Mount, 1991; Eysenck, 1992; McCrae & Costa, 1997).

Other investigations have focused on the relationship between intelligence and Conscientiousness. Such investigations have not always yielded significant results (Ackerman & Heggestad, 1997; Austin et al., 2002). Yet some research has consistently established the existence of a significant negative relationship between

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intelligence and Conscientiousness (Moutafi, Furnham, & Crump, 2003; Moutafi, Furnham, & Paltiel, 2004). Although the relationship between Conscientiousness and intelligence is one of the least investigated of relationships between personality traits and intelligence, it is the most relevant to fields such as Industrial/Work/Organisational (IWO) psychology. Intelligence is widely recognised as the single most important factor in predicting future job performance (e.g., Grubb, Whetzel, & McDaniel, 2004; Ones, Viswesvaran, & Dilchert, 2005). Furthermore, Conscientiousness is the single best predictor of job performance among personality traits (e.g., Barrick & Mount, 1991; Kroeck & Brown, 2004). The value of both Conscientiousness and intelligence in predicting job performance makes them a common combination to increase predictive validity in selection decisions.

Combining personality traits and intelligence in order to increase the accuracy of selection decisions relies upon the assumption that there is no relationship, or very little relationship between these factors (Kanfer, Ackerman, Murtha, & Goff, 1995). Findings that suggest scores on tests of Conscientiousness and intelligence have a moderate to strong significant negative relationship with each other contradict this assumption of low-nil covariance. This in turn brings into question estimates of incremental gains in predictive validity derived by combining scores for Conscientiousness and intelligence. It also suggests greater gains in the accuracy of performance predictions might occur through combining subfactors of Conscientiousness rather than all aspects of Conscientiousness. Knowledge of which subfactors of Conscientiousness and which components of intelligence relate to job performance but not each other will enable practitioners to determine which factors are most relevant in selection rounds. This knowledge will also allow practitioners to create and use composite batteries of tests that combine those aspects of Conscientiousness and intelligence most likely to explain unique variance in future job performance.

Moutafi et al. (2004) have sought to clarify the negative relationships found between Conscientiousness and intelligence by distinguishing between fluid (gf) and crystallised (gc) intelligence correlations with Conscientiousness. The importance of the fluid and crystallised intelligence distinction in investigations into correlations between personality trait and intelligence lies in its ability to help clarify the process responsible for explaining these relationships. The fluid/crystallised intelligence model of intelligence is a ubiquitous and conceptually simple model of intelligence encompassing all principle domains of intellectual functioning (Carroll, 1993; Cattell, 1987).

The theory of fluid and crystallised intelligence contends that primary intellectual abilities are organised at a general level into two principal dimensions or classes (Horn & Cattell, 1966). Fluid intelligence concerns an individual's innate intellectual resources. It is the chief measurable outcome of the influence of biological factors on intellectual development (e.g., heredity, central nervous system, and basic sensory structures). Abstract reasoning tests measure fluid intelligence (Carroll, 1993). Crystallised intelligence refers to an individual's intelligence acquired via acculturation. It is the major manifestation of the unitary nature of the impact of experiential, educative, and acculturation influences. Vocabulary tests measure crystallised intelligence (Cattell, 1998).

Moutafi et al.'s (2004) investigation has found Conscientiousness to be more highly correlated with fluid than crystallised intelligence. This is consistent with their theory that the negative relationship between Conscientiousness and intelligence is reflective of a causal relationship where intelligence affects the development of Conscientiousness. This is an acceptable assumption as a plausible hypothesis for conscientiousness affecting the development of innate intelligence appears unlikely (Moutafi et al., 2004). According to this theory, relatively less intelligent individuals may become more methodical, organised, thorough, and persistent (i.e., conscientious) to compensate for their relative lack of intelligence. Alternatively, relatively more intelligent people may tend to get by on their cognitive efficiency rather than effort or procedure (Moutafi et al. 2003). The idea that Conscientiousness acts as a coping strategy for relatively less intelligent people is subsequently referred to as the Intelligence Compensation Theory (ICT).

The goal of the current investigation is to provide a cross-cultural replication of Moutafi et al.'s (2004) research. In doing so it intends to provide support for the ICT. The second is to determine whether all subfactors of Conscientiousness correlate negatively with intelligence. Moutafi et al. (2004) attribute Conscientiousness's stronger relationship with fluid than crystallised intelligence to fluid intelligence's biological basis and crystallised intelligence developing through cultural and educational experiences. Moutafi et al. suggest that this temporal difference in development makes fluid intelligence the most likely to influence personality development. This is because crystallised intelligence would not have fully developed at the early period in which personality development occurs. Furthermore, conscientious individuals are likely to be more thorough, persistent, organised, and methodical students than those low in Conscientiousness during their school years. As crystallised intelligence increases through education, conscientious students are likely to develop relatively greater levels of crystallised intelligence (Brody, 1992).

On this basis Moutafi et al. (2004) hypothesised that Conscientiousness would more strongly correlate with fluid than crystallised intelligence. This was because the positive effect Conscientiousness would have on the acquisition of crystallised intelligence would counterbalance negative relationships between fluid intelligence and Conscientiousness. Moutafi et al. (2004) found Conscientiousness to negatively correlate with abstract (fluid intelligence) but not verbal reasoning (crystallised intelligence). They also found the 15FQ subfactors of Conscientious and Disciplined significantly negatively correlated with fluid and crystallised intelligence.

The hypotheses of the current investigation are developed on the basis of Moutafi et al.'s (2004) findings, but with a relatively greater focus upon Conscientiousness subfactors. The decision to focus upon subfactors of Conscientiousness is influenced by the criticism that the Big Five approach to trait classification fails to provide the same degree of predictive value as the subfactors of which the Big Five are comprised (Boyle, Stankov, & Cattell, 1995; Kline, 1995; Mershon & Gorsuch, 1988). Another reason for this focus is the argument that the subfactors of Conscientiousness do not necessarily fit together to define a single personality trait (Hough, 1992; Paunonen & Jackson, 1996; Tett, Jackson, & Rothstein, 1991). As the opinions of test developers often vary at the facet level regarding what subfactors will be used to describe Big Five traits such as Conscientiousness, it was decided that an examination of the relationship between Conscientiousness and fluid and crystallised intelligence also needed to be undertaken across personality measures.

As previously mentioned, knowledge of the ways in which individual Big Five subfactors correlate with intelligence will also provide direction for further research into incremental gains in the predictive validity of future job performance via the combination of these constructs. Furthermore, the practical utility of personality models in the workplace also reinforces the importance of focusing upon subfactors rather than the Big Five level of Conscientiousness. This is because behavioural prediction is often more accurate when those involved in selection or development focus upon the finer-grained subfactors of personality. The reason for this is straightforward. If one knows someone's position on the behavioural continuum in relation to the Big Five factor of Conscientiousness, they can make predictions based upon all the behaviours associated with the subfactors comprising Conscientiousness. For example, this individual is likely to follow rules, have high standards, good attention to detail, exercise control over their behaviour and expression of emotion, and work in a systematic and orderly way. The problem with accuracy here is that someone's placement on the Conscientiousness continuum could be inflated or deflated due to a greater or lesser propensity in the behaviours measured by any one of these subfactors. For example, the individual might be very likely to attend to detail and follow rules, but still act impulsively and have emotional outbursts. For this reason, behavioural prediction in the workplace has greatest utility when one drills down to the subfactors of personality.

The first hypothesis (H1) of this investigation predicts that subfactors of Conscientiousness will be significantly negatively correlated to both fluid and crystallised intelligence. More specifically, H1 predicts the 15FQ Conscientiousness subfactors of Conscientious, Disciplined, Tense-driven, and Restrained will negatively correlate with both fluid and crystallised intelligence. The second hypothesis (H2) predicts a negative relationship between fluid and crystallised intelligence and the OPP Conscientiousness subfactor of Conformity, and positive relationships between fluid and crystallised intelligence and the OPP subfactors of Flexible and Phlegmatic (these are the bipolar opposites of OPP Conscientiousness subfactors Detail-Conscious and Emotional respectively). The third hypothesis (H3) is that there will be a stronger negative correlation for fluid than crystallised intelligence on the subfactors of Conscientiousness for both the 15FQ and OPP.

Method

PARTICIPANTS

All participants were job applicants who had undergone psychometric testing in New Zealand within an organisational context. The 15FQ sample of participants was 546 individuals, 263 of these were male and 279 female (four did not specify gender). Their age ranged from 17 to 56, with a mean of 30.2 and a standard deviation of 7.9. The OPP sample of participants was 1083 individuals, 489 of these were male and 589 female (five did not specify gender). Their age ranged from 17 to 60, with a mean of 28.4 and a standard deviation of 7.9.

In order to avoid the possibility that any negative relationships found between intelligence and Conscientiousness could be the result of conscientious individuals failing to complete the timed intelligence measure, only individuals who completed all intelligence items were included in these samples. This resulted in approximately 50% of the original two samples been excluded from analysis. This did not result in any notable change in either the significance or strength of significance amongst correlations (Wood, 2004). Furthermore, participants who scored more than three standard deviations outside the mean on distortion scales were not included in the analysis. This was to reduce the possibility that some individuals (e.g., more intelligent individuals) might systematically skew their profiles towards Conscientiousness.

MATERIALS

Fifteen-Factor Questionnaire (15FQ)

The 15FQ is a normative personality test specifically developed for use in research and organisational settings (Barrett & Paltiel, 1993). The model of personality conceptualised by Cattell and measured most commonly in the Sixteen Personality Factor Questionnaire (16PF) serves as the basis for the 15FQ. The 15FQ comprises 191 items, assessing 15 bipolar personality traits, and three administration scales. 15FQ dimensions generally have internal-consistency reliability coefficients above $r > .7$ (.65 to .79). Comparisons against a wide range of alternative measures of personality have demonstrated the validity of 15FQ scales (Budd, 1992). Budd also details research into the construct validity of inferences based upon global/Big Five scores of these 15FQ scales. The reported relationship between 15FQ global factors and NEO global factors support 15FQ global validity ($N = 108$). Correlations between the 15FQ global traits of Extraversion ($r = 0.77$), Agreeableness ($r = 0.64$), and Anxiety ($r = 0.71$) indicate that these broad personality constructs are measuring comparable constructs across these tests. Although slightly lower, correlations between the global factors of Openness-to-Experience ($r = 0.55$) and Control ($r = 0.36$) remain reasonable. These correlations support the broad equivalence of the 15FQ global factors and the Big Five personality factors as defined by Costa and McCrae (1988).

The 15FQ subfactors that comprise the Big Five factor of Conscientiousness are Conscientious, Disciplined, Tense-driven, and Restrained. The subfactor of Conscientious is a measure of conformity and conscientiousness. High scorers present themselves as persevering, meticulous, and persistent. They tend to focus on the detailed requirements of tasks, be inclined to do things 'by the book', and have high standards for work and behaviour. Low scorers tend to be more flexible and concerned with broad issues rather than details. The items used to assess these tendencies ascertain such things as whether people like to see things through to the end, like to double check everything they do, or focus on the aims and objectives of a task rather than the detail.

The subfactor of Disciplined is a measure of self-control and compulsivity. High scorers tend to concern themselves with adhering to conventions of protocol and decorum. They also tend to place emphasis on exercising control over their behaviour and expression of emotion. Low scorers do not generally feel bound by the constraints of protocol or social expectations. Unlike high scorers, inner urges rather than external values are likely to drive their behaviour. The items assessing this trait examine things such as tendencies towards environmental order (irritated by the slight of a messy/untidy room?), inherent respect for hierarchy, and the value placed upon the manifestation of self-discipline.

The subfactor of Tense-Driven measures tension and nervous energy. High scorers tend to be more emotionally charged and easily frustrated. Low scorers tend to be able to disregard petty inconveniences and take things in their stride. The items assessing this trait examine such things as the propensity for hurrying and getting irritated, and the ability to readily relax and unwind.

The final subfactor of Restrained looks at people's propensity towards diplomacy, interpersonal caution, and having an awareness and concern for the likely impact of their behaviour. High scorers tend to be careful to moderate what they do or say in line with the social demands of a situation. By contrast, low scorers tend to be direct and forthright with little or no concern about the impression they create. The items measuring this dimension assess such things as people's consideration for the feelings of others, been described by others as blunt or tactless, and whether they hold back from making critical comments.

Occupational Personality Profile (OPP)

The OPP is a personality test specifically designed for use in organisational settings. It measures nine personality dimensions and two distortion scales, which comprise 98 items. OPP dimensions have reliability coefficients above .65 for internal consistency, and validity supported via comparisons with alternative personality measures (Budd, 1991).

The OPP subfactors that comprise the Big Five factor of Conscientiousness are Detail-Conscious, Phlegmatic, and Conformity. The subfactor of Detail-Conscious is a measure of procedural conformity and attention to detail. High scorers present themselves as rigidly following rules and procedures, and fastidiously attending to detail. They tend to be well-organised individuals who dislike change and innovation, and support traditional values. They tend to have a good eye for detail and be tidy in their habits. Low scorers tend to be more spontaneous, impromptu, and casual in their attitude to rules and procedures. They tend to have difficulty persevering with tedious or repetitive tasks, and have poor attention to detail. The items used to assess these tendencies ascertain such things as whether people like to follow routines, dislike working in an untidy environment, or are attracted to new and innovative ideas.

The subfactor of Phlegmatic measures anxiety, composure, and self-confidence. High scorers tend to have a mature outlook on life and be emotionally stable. They are less easily upset, more self-assured, and better able to cope with pressure. Low scorers tend to be emotionally charged and more easily frustrated. Low scorers are more prone to self-doubt and feelings of uncertainty. They are less predictable in demanding or stressful situ-

ations and more inclined to take constructive criticism personally rather than in the spirit intended. The items assessing this trait examine such things as propensity for mood swings, anxiety about the future, and the tendency to dwell on past mistakes.

The subfactor of Conformity is a measure of social desirability. This scale assesses the desire to present oneself in an unrealistically positive or favourable light. It contains questions that inquire into one's faults and foibles. For example, has the respondent ever talked about someone behind that person's back, told a lie, or disobeyed a parent. High scores are generally associated with deliberate distortion. However, genuine altruism, highly principled belief systems, or self-delusion can also cause high scores.

General Reasoning Test 2 (GRT2)

The GRT2 is a timed test designed to determine the psychometric intelligence of the general population. It comprises three subscales: verbal reasoning (VR2), which functions as a measure of crystallised intelligence; numerical reasoning (NR2), which loads on both fluid and crystallised intelligence; and abstract reasoning (AR2), which functions as a measure of fluid intelligence. Numerical reasoning was excluded from analyses as it loads on both fluid and crystallised intelligence (Moutafi et al., 2004). Budd (1993) reports the alpha coefficients for the verbal and abstract reasoning subscales as (N = 135) VR2 r = .83 and AR2 r = .83. This demonstrates a high level of reliability. Furthermore, relatively good correlations between each subscale and equivalent scales of other like tests support the GRT2's construct validity (Budd, 1993).

The verbal reasoning scale of the GRT2 primarily assesses an individual's understanding of language, subtleties of meaning, and relationships between words. The verbal assessment uses a variety of different item types to ensure content validity (e.g., odd one out, synonymous, antonyms, and class membership). On the other hand, the abstract reasoning scale assesses the ability to identify logical relationships between abstract spatial relationships and geometric patterns that require no prior knowledge or educational experience. Items used to assess this ability include those that require people to identify which shape comes next, perform mental rotations, and draw inferences.

PROCEDURE

The Directors of OPRA Consulting Group granted permission for this research to utilise archival, cross-sectional data sets acquired by OPRA within the context of its commercial practice. The data comprised individuals who had completed both the 15FQ and GRT2, or OPP and GRT2 in the New Zealand workplace between June of 1998 and April of 2003.

Results

Correlation coefficients were calculated for the relationship between intelligence scales and the 15FQ and OPP personality factors. The results of these analyses are presented in Tables 1 and 2 respectively. The probability value with which these analyses were undertaken was $p <$ .001. The decision to focus upon such a restrictive alpha value reflects recognition of the increased risk of Type I errors accompanying multiple analyses (Licht, 2003).

A series of multiple regressions were also calculated. The predictor variables in these multiple regressions were the OPP and 15FQ Conscientiousness subfactors identified as significantly correlated with fluid or crystallised intelligence. Abstract and verbal reasoning were both utilised as criterion variables.

A number of calculations were also made to determine the significance of differences among relevant correlation coefficients. These computations were based on Streiger's (1980) recommendations for both large sample sizes and Type I error control.

CORRELATIONS

Table 1 details correlations between the 15FQ subfactors of conscientiousness and the two intelligence measures. Conscientiousness was significantly negatively correlated with abstract (r = –0.17, $p <$ .0001) and verbal reasoning (r = –0.29, $p <$ .0001). Disciplined was significantly negatively correlated with abstract (r = –0.17, $p <$ .0001) and

TABLE 1

Correlation Matrix for 15FQ Subfactors and GRT2

Trait	Abstract	Verbal
Outgoing	0.01	0.04
Calm–stable	–0.01	0.04
Assertive	0.11	0.05
Enthusiastic	0.05	0.01
Conscientious	–0.17**	–0.29**
Socially bold	–0.10	–0.05
Intuitive	–0.13	0.10
Suspicious	–0.04	–0.14*
Conceptual	0.05	0.19**
Restrained	–0.07	–0.09
Self-doubting	–0.02	–0.03
Radical	0.10	0.07
Self-sufficient	0.09	0.03
Disciplined	–0.17**	–0.29**
Tense-driven	–0.07	–0.11
Social desirability	0.03	–0.05
Central tendency	0.10	0.08
Random responding	–0.01	–0.06

Note: Correlations marked *are significant at $p <$ .001, correlations marked ** remain significant after Bonferroni adjustment (are significant at $p <$ .0001; N = 546).

verbal reasoning (r = –0.29, p < .0001). Tense-driven and Restrained were found to lack any significant relationships with the two intelligence scales.

Correlations between the OPP subfactors of Conscientiousness and the two intelligence measures are presented in Table 2. Conformity significantly negatively correlated with abstract (r = –0.13, p < .0001) and verbal reasoning (r = –0.18, p < .0001). Flexible significantly positively correlated with abstract (r = 0.27, p < .0001) and verbal reasoning (r = 0.38, p < .0001). Phlegmatic had no significant correlations with the two intelligence measures.

MULTIPLE REGRESSIONS

The first regression model presented in Table 3 combined the 15FQ personality traits of Conscientiouness and Disciplined. The decision to use the personality traits Conscientiouness and Disciplined in this model was based on these being the only two Big Five Conscientiousness subfactors retaining significance after the Bonferroni adjustment. This suggests they are the 15FQ subfactors with the strongest relationships with intelligence scales.

The second and fourth regression models combined all 15FQ and OPP personality traits identified as significantly correlated with intelligence scales (see Tables 1 and 2). The need to examine these combinations of traits was based upon the importance of determining the degree to which the relationship among these traits and intelligence scales was due to unique variance. The relationships between many of the personality traits combined within this second and fourth model were weaker than the relationships for the personality traits combined in the first and third model. However, this has no inherent bearing on the degree to which variance accounted for by predictors is shared or unique. In order to identify the extent to which 15FQ and OPP traits were able to predict the variation in intelligence scales, it was therefore important to examine all significant 15FQ and OPP traits in combination.

TABLE 2

Correlation Matrix for OPP Subfactors and GRT2

Trait	Abstract	Verbal
Assertive	0.01	0.00
Flexible	0.27**	0.38**
Trusting	0.06	0.15**
Phlegmatic	0.07	0.05
Gregarious	–0.06	–0.09
Persuasive	0.09	0.14**
Contesting	–0.10	–0.19**
External Locus of Control	–0.29**	–0.38**
Pragmatic	–0.03	–0.21**
Conformity	–0.13**	–0.18**
Central Tendency	–0.00	–0.00

Note: Correlations marked *are significant at p <. 001, correlations marked ** remain significant after Bonferroni adjustment (are significant at p <. 0001; N = 1083).

The third regression model combined the OPP personality traits of Flexible and Conformity. As with the first model, the third regression model combined Conscientiousness subfactors retaining significance after the Bonferroni adjustment. As a result the third model contains those OPP subfactors exhibiting the strongest correlations with intelligence scales.

Abstract reasoning was a criterion variable in the four regression models. The first model used the two 15FQ dimensions that surpassed the r > 0.18 level of salience as predictor variables (see Table 1). This combination of variables was weakly significant, accounting for 2% of the variance in abstract reasoning scores. Significant predictors were the personality traits Conscientious (β = –0.08), and Disciplined (β = –0.09).

The second model used the eight 15FQ dimensions that were significantly correlated with intelligence as predictor variables (see Table 1). This combination of predictor variables was weakly significant, accounting for 5% of the variance in abstract reasoning scores. Significant predictors were the personality traits Conscientiousness (β = –0.09), Intuitive (β = –0.14), Conceptual (β = 0.107), Self-Sufficient (β = 0.104), and Disciplined (β = –0.07).

The third model used as predictor variables the three significant OPP Conscientiousness subfactors (see Table 2). This combination of predictor variables was weakly significant, accounting for 6% of the variance in abstract reasoning scores. Significant predictors were the personality traits Flexible (β = 0.169), Phlegmatic (β = 0.137), and Conformity (β = –0.12).

The fourth model's predictor variables were the nine OPP dimensions significantly correlated with intelligence (see Table 2). This combination of predictor variables was moderately significant, accounting for 10% of the variance in abstract reasoning scores. Significant predictors were the personality traits Flexible (β = 0.129), Phlegmatic (β = 0.059), Persuasive (β = 0.044), Contesting (β = 0.067), External locus of Control (β = –0.23), and Conformity (β = –0.11).

The verbal reasoning scale was also a criterion variable in the four regression models. The first model used the two 15FQ dimensions that surpassed the r > 0.18 level of salience as predictor variables (see Table 1). This combination of predictor variables was weakly significant, accounting for 8% of the variance in verbal reasoning scores. Significant predictors were the personality traits Conscientiousness (β = –0.16), and Disciplined (β = –0.17).

The predictor variables in the second model were the eight 15FQ dimensions significantly correlated with

TABLE 3

β values for Multiple Regression Coefficients of 15FQ and OPP on GRT2 Intelligence Scales

Trait	Abstract β	Verbal β
Conscientious (15FQ)	–0.08*	–0.16*
Disciplined (15FQ)	–0.09*	–0.17*
Regression model	$F(2,1576)=17.15$	$F(2,1576)=67.12$
Adj. R^2	**0.02**	**0.08**
Conscientious (15FQ)	–0.09*	–0.15*
Intuitive (15FQ)	–0.14*	0.06*
Suspicious (15FQ)	–0.03	–0.06*
Conceptual (15FQ)	0.107*	0.087*
Restrained (15FQ)	–0.01	0.021
Self-sufficient (15FQ)	0.104*	0.117*
Disciplined (15FQ)	–0.07*	–0.14*
Tense-driven (15FQ)	–0.05	–0.04
Regression model	$F(8,1570)=10.38$	$F(8,1570)=23.60$
Adj. R^2	**0.05**	**0.1**
Flexible (OPP)	0.169*	0.294*
Phlegmatic (OPP)	0.137*	0.124*
Conforming (OPP)	–0.12*	–0.13*
Regression model	$F(3,2540) = 57.40$	$F(3,2600) = 126.46$
Adj. R^2	**0.06**	**0.13**
Flexible (OPP)	0.129*	0.179*
Trusting (OPP)	–0.04	0.011
Phlegmatic (OPP)	0.059*	–0.00
Persuasive (OPP)	0.044*	0.042*
Contesting (OPP)	0.067*	–0.02
External locus (OPP)	–0.23*	–0.26*
Pragmatic (OPP)	0.010	–0.12*
Conforming (OPP)	–0.11*	–0.13*
Middle response (OPP)	–0.01	0.005
Regression model	$F(9,2552) = 32.63$	$F(9,2597) = 73.12$
Adj. R^2	**0.1**	**0.2**

Note: βs' marked * are significant at $p < .05$; (adapted from multiple regression table in Moutafi et al., 2003).

intelligence (see Table 2). This combination of predictor variables was moderately significant, accounting for 10% of the variance in verbal reasoning scores. Significant predictors were the personality traits Conscientiousness (β = –0.15), Intuitive (β = 0.06), Suspicious (β = –0.06), Conceptual (β = 0.087), Self-Sufficient (β = 0.117), and Disciplined (β = –0.14).

The predictor variables used in the third model were the three significant OPP Conscientiousness subfactors (see Table 2). This combination of predictor variables was moderately significant, accounting for 13% of the variance in verbal reasoning scores. Significant predictors were the personality traits Flexible (β = 0.294), Phlegmatic (β = 0.124), and Conformity (β = –0.13).

The fourth model used nine OPP dimensions significantly correlation with intelligence as predictor variables (see Table. 2). This combination of predictor variables was moderately significant, accounting for 20% of the variance in verbal reasoning scores. Significant predictors were the personality traits Flexible (β = 0.179), Persuasive (β = 0.042), External locus of Control (β = –0.26), Pragmatic (β = –0.12), and Conformity (β = –0.13).

SIGNIFICANCE OF CORRELATION COEFFICIENT DIFFERENCES

The first *t* distributions calculated involved the significant correlation coefficients for the 15FQ personality traits Conscientiousness and Disciplined detailed in Table 1. These traits were found to have significant differences in correlations for both fluid and crystallised intelligence. For the trait of Conscientiousness this difference was $t(543) = 2.95$, $p < .003$. For the trait of Disciplined the difference was $t(543) = 2.95$, $p < .003$.

The second *t* distributions calculated involved the significant correlation coefficients for the OPP personality traits Flexible and Conformity detailed in Table 2. The trait of Flexible was found to have a significant difference in correlations for both fluid and crystallised intelligence, $t(1080) = 4.36$, $p < .001$. However, the difference for trait of Conformity was $t(1080) = 1.87$, $p < .06$, which fails to meet the minimum requirements of *p* for significance.

Discussion

The goal of this investigation was to replicate the negative correlations between Conscientiousness and intelligence found in Moutafi et al.'s (2004) investigation. The first and second hypotheses were that Conscientiousness subfactors in both personality assessments would negatively correlate with both fluid and crystallised intelligence. These hypotheses were partially supported. What significant relationships were found, did indeed demonstrate negative relationships between Conscientiousness subfactors and fluid and crystallised intelligence for both the 15FQ (Conscientiousness and Disciplined) and OPP (Flexibility, Phlegmatic, and Conformity). These subfactors accounted for between 2–13% of variance in fluid and crystallised intelligence scores. However, not all Conscientiousness subfactors were found to correlate significantly with fluid and crystallised intelligence for either the 15FQ (Tense-driven and Restrained) or OPP (Phlegmatic). In keeping with the rationale provided in Moutafi et al. (2004), numerical reasoning was not included in the hypothesis because of ambiguity over whether it is more highly related to crystallised (Kaufman, 2000) or fluid intelligence (Lohman, 2000).

The third hypothesis was that negative correlations between Conscientiousness subfactors would be stronger for fluid than crystallised intelligence. Nearly all significant correlations for both personality measures contradicted this hypothesis. The only correlation that didn't clearly contradict this hypothesis concerned the relationship between the Conformity trait (OPP) and the intelligence scales. This lack of clarity was due to the difference between these correlations not reaching an acceptable level of statistical significance. In all other cases crystallised intelligence correlated more strongly with Conscientiousness subfactors than did fluid intelligence across both personality assessments. Furthermore, Conscientiousness subfactors were able to account for 8–13% of crystallised intelligence variance, but only 2–6% of variance in fluid intelligence. The finding that Conscientiousness subfactors explain more crystallised than fluid intelligence variance is contrary to Moutafi et al.'s (2004) findings.

Moutafi et al. (2004) consider confirmation of this third hypothesis important support for the Intelligence Compensation Theory. If Conscientiousness was more strongly correlated with fluid than crystallised intelligence, it indicated that the direction of causality in the relationship between intelligence and Conscientiousness must be that intelligence affects the development of Conscientiousness. This was because fluid intelligence represents a biologically based measure of intelligence, which makes it less environmentally influenced than the experience dependent crystallised intelligence. However, this investigation has found correlations between Conscientiousness subfactors and intelligence to be considerably stronger for crystallised than fluid intelligence.

In seeking an explanation for these apparently contrary findings it is important to keep in mind a fundamental difference between the samples employed in these respective investigations. Moutafi et al. (2004) used an 'educated and need-achieving' sample. This investigation employed a sample largely without university qualifications applying for premanagement level jobs. This difference in samples can account for the contrary findings if the interaction between intelligence and conscientious behaviour is a multifaceted one. Multifaceted in that the compensatory mechanism varies depending upon what it is one is trying to achieve, and which aspect of ability one is attempting to compensate for. Is one trying to pass a paper? Or is one trying to perform well at work? Does one need to compensate for not learning new information as quickly as others? Or does one need to compensate for not knowing or understanding as much as others?

Moutafi et al. (2004) position crystallised intelligence as a dependent variable by attributing its increase to differences in fluid intelligence or conscientious behaviour. Another way to look at this is that knowledge (greater crystallised intelligence) is the desired outcome, and conscientious behaviour is the way someone can compensate for not learning new information as quickly as others (less fluid intelligence). It is both reasonable and intuitive that within the context of a 'highly educated' cohort there would be relatively little variation in crystallised intelligence. This is because progression through the current and preceding curriculum would necessitate a restriction of difference in such an educationally dependent component of intelligence. For this reason it also appears reasonable and intuitive that those engaged in higher education would have greater cognisance of comparative deficiencies in learning ability than actual knowledge. Moutafi et al.'s finding that the negative relationship between conscientious behaviour and intelligence is restricted to fluid intelligence within this cohort suggests that participants of lesser fluid ability have successfully compensated for this through more studious behaviour (i.e., conscientious behaviour). Such a finding is evidence of the Intelligence Compensation Theory in action.

Within the context of the current investigation the desired outcome and aspect of intelligence compensated for has changed. The desired outcome is now increased job performance. The ability requiring compensation is now lesser knowledge or understanding (i.e., crystallised intelligence). The way to compensate for knowing or understanding less within this context is through working harder. This attempt to compensate for less crystallised intelligence through more conscientious behaviour in a general job-applying sample adds further support to the fundamental nature of compensatory mechanisms in human behaviour, and the ICT in particular.

Conscientiousness in both work and school will be an adaptive strategy to compensate for lesser intelligence. Yet only Conscientiousness in school will be likely to result in a greatly increased crystallised intelligence. As a consequence, those who leave school earlier than their peers will have the greatest need to compensate for the crystallised component of intelligence. While those who stay in school will have a greater need to compensate for fluid intelligence. The hypothesis that the counterbalancing effect between Conscientiousness and intelligence will vary according to cohorts is consistent with the overarching concept of compensations proposed by Moutafi et al. (2004). This study extends the compensation theory by identifying the multifaceted nature of the interactions between Conscientiousness and intelligence. It suggests that compensation is likely to occur as both a function of what the desired outcome is, and what component of ability is deficient and requires compensation. Such an explanation is also consistent with Austin et al.'s (2002) hypothesis that variations in the strength of an associa-

tion between personality traits in subgroups of different ability level are likely.

PRACTICAL IMPLICATIONS

The findings of this investigation have a number of implications for applied IWO Psychologists and Human Resource practitioners. Firstly, incremental validity gains previously reported in respect of the addition of Conscientiousness ratings to cognitive ability scores (Schmidt & Hunter, 1998) may be overstated and overly simplistic. Such calculations are based upon an assumption of positive covariance and this investigation has suggested a moderate negative level of covariance. The relationships found suggest that greater gains in incremental validity are achievable through determining the relationship between Conscientiousness subfactors and performance, and then placing greater weight upon those subfactors loading most upon performance and least upon intelligence. Moreover, this study suggests that the mechanism of compensation is likely to vary across cohorts. Just as it is too simplistic to conceptualise Conscientiousness as a single construct, so it is too simplistic to think of mental ability as a unitary structure in the prediction of behaviour.

Practitioners can most simply determine how much weight to place upon Conscientiousness subfactors for specific roles by gathering job performance data and relevant psychometric scores. Multiple regression calculations can then determine how much variance in job performance different combinations of these factors can explain. Once this is established practitioners can create composite batteries of the most predictive subfactors of Conscientiousness and intelligence. Yet even the predictive nature of these factors will vary across roles, at least in part due to cohort variation amongst the people applying for different positions. The first challenge for those using personality and cognitive ability instruments to predict job performance thus becomes determining how some traits or abilities can compensate for weaknesses in others. The second challenge then becomes determining whether such compensations lead to successful job performance, and how applicable this is across roles.

A second implication of these findings and the Intelligence Compensation Theory concerns the use of cognitive ability scores for screening purposes. A common practice within the testing industry is to use a first hurdle approach to testing. This involves making decisions around progression through the selection round according to minimum threshold cognitive ability scores. This sometimes employs explicit "cut-scores", which state what minimum score a candidate must reach to progress further. Yet this hurdling also often uses implicit assumptions around how smart a candidate must be to perform the hard tasks associated with a role. The results of this investigation suggest that some of those excluded from progression on the basis of such practices would have been likely to compensate for relatively lower cognitive ability scores through behaving with greater diligence and structure.

Some might argue that mistakenly excluding Conscientious individuals of lower intelligence is not as problematic when a relatively large number of applicants are applying for positions. The problem with this hypothesis is that it fails to take into account the importance of contextual performance in the effective and efficient operation of an organisation (Penney & Borman, 2005). Conscientiousness is an important predictor of contextual performance, which concerns 'extrarole' or peripheral behaviours that are important components of job performance but often not explicitly part of a job description (Chan, 2005). Nor does this argument take into account the well-known and closely related law of diminishing returns associated with cognitive ability when it comes to job performance ratings and other measures of success (Jensen, 2003). On this basis organisations are sure to benefit from carefully considering the possible inclusion of Conscientiousness assessments in any first hurdle testing process.

LIMITATIONS

A potential limitation of this research's implications for practitioners is its failure to take into account the interactive nature of individual differences on job performance. Conscientiousness and intelligence appear to be able to account for largely unique aspects of job performance (Schmidt and Hunter, 1998). However, there is considerable research emerging suggesting that the ability of Conscientiousness and intelligence to account for performance may be dependent upon their interaction with other personality traits or cognitive processes. For example, results suggest that highly conscientious employees who lack the interpersonal sensitivity associated with higher scores on the personality trait of Agreeableness are often ineffective in roles requiring cooperation with others (Witt, Burke, Barrick, & Mount, 2002). Other research suggests combinations of personality traits such as Extraversion and Neuroticism can compromise motivation and performance (Robinson, Wilkowski, & Meier, 2008). As a consequence of such interactions the applicability of the current investigation's findings and implications may be limited until further exploration into how such interactions with Conscientiousness and intelligence affect performance.

Another potential limitation of this and other recent investigations into the relationship between Conscientiousness and intelligence is the exclusive use of applicant as opposed to non-applicant data. Research by Brown and Barrett (1999) has suggested that there is a difference in the factor structure of personality traits across applicant and non-applicant groups attributable to

applicant distortion. Such applicant distortion can be either systematic, wherein scores are elevated across all candidates, or nonsystematic, wherein certain candidates elevate their scores while others remain static. The danger of applicant distortion posed within investigations into relationships between intelligence and Conscientiousness is that nonsystematic distortion of Conscientiousness scores by participants of lower intelligence may have artificially created the appearance of a negative relationship between these factors. Future research investigating the Intelligence Compensation Theory would thus benefit from examining both applicant and nonapplicant data sets. This would allow researchers to ensure that the negative relationship between Conscientiousness and intelligence is a consequence of less intelligent individuals employing conscientious behaviour as a coping strategy, not less intelligent job applicants employing extreme distortion of Conscientiousness scores as a strategy for gaining employment.

In Summary

Like previous research this investigation found a negative relationship between Conscientiousness and intelligence. However, unlike previous research this investigation found the relationship to be stronger for crystallised than fluid intelligence. An explanation for this finding and the negative relationship between Conscientiousness and intelligence is contained within the Intelligence Compensation Theory. The Intelligence Compensation Theory hypothesises that those who have relatively less intellectual ability are able to compensate for this within the workplace by exhibiting relatively more conscientious behaviour. This suggests Human Resource practitioners and applied IWO Psychologists may benefit from including assessments of Conscientiousness subfactors when using a hurdle-based approach to assessment testing in selection. This will help ensure potential assets in respect of high levels of diligence, good task competition, and more general contextual performance are not unnecessarily excluded from progressing further within selection rounds.

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References

Ackerman, P.L., & Heggestad E.D. (1997). Intelligence, personality and interests: Evidence for overlapping traits. *Psychological Bulletin, 121*, 219–245.

Austin, E.J., Deary, I.J., Whiteman, M.C., Fowkes, F.G.R., Pedersen, N.L., Rabbitt, P., et al. (2002). Relationships between ability and personality: Does intelligence contribute positively to personal and social adjustment? *Personality and Individual Differences, 32*(8), 1391–1411.

Barrett, P. R., & Paltiel, L. (1993). The concurrent validity of the fifteen-factor personality questionnaire. Recruitment, *Selection & Retention, 2*(3), 30-36.

Barrick, M.R., & Mount, M.K. (1991). The big five personality dimensions and job performance: A meta-analysis. *Personnel Psychology, 44*, 1–26.

Bates, T.C., & Shieles, A. (2003). Crystallized intelligence as product of speed and drive for experience: the relationship of inspection time and openness to g & gc. *Intelligence, 31*(3), 275–287.

Boyle, G.J., Stankov, L., & Cattell, R.B. (1995). Measurement and statistical models in the study of personality and intelligence. In D.H. Saklofske & M. Zeidner (Eds.), *International handbook of personality and intelligence* (pp. 417–446). New York: Plenum Press.

Brody, N. (1992). *Intelligence* (2nd ed.). New York: Academic Press.

Brown, R., & Barrett, P. (1999). Differences between applicant and non-applicant personality questionnaire data: Some implications for the creation and use of norm tables. In *BPS Test User Conference Proceedings* (pp. 76–86). Leicester, UK: British Psychological Society.

Budd, R. (1991). *OPP technical manual*. Letchworth, UK: Psytech International Ltd.

Budd, R. (1992). *15FQ technical manual.* Letchworth, UK: Psytech International Ltd.

Budd, R. (1993). *Manual for the technical test battery*. Letchworth, Herts UK: Psytech International Ltd.

Carroll, J.B. (1993). *Human cognitive abilities: A survey of factor-analytic studies.* New York: Cambridge University Press.

Cattell, R.B. (1987). The discovery of fluid and crystallized general intelligence. In R.B. Cattell (Ed.), *Intelligence: Its structure, growth and action* (pp. 87–121). New York: North-Holland.

Cattell, R.B. (1998). Where is intelligence?: Some answers from the triadic theory. In J.J. McArdle & R.W. Woodcock (Eds), *Human cognitive abilities in theory and practice* (pp. 29-38). New Jersey: Lawrence Erlbaum Associates.

Chan, D. (2005). Current directions in personnel selection research. *Current Directions in Psychological Science, 14,* 220–223.

Costa, P.T., & McCrae, R.R. (1988). Personality in adulthood: A six-year longitudinal study of self reports and spouse ratings on the NEO personality inventory. *Journal of Personality and Social Psychology, 54*, 853–863.

Digman, J.M, & Takemoto-Chock, N.K. (1981). Factors in the natural language of personality: Re-analysis, comparison, and interpretation of six major studies. *Multivariate Behavioral Research, 16*, 149–170.

Eysenck, H.J. (1992). Four ways five factors are not basic. *Personality and Individual Differences, 6*, 667–673.

Grubb, W.L., Whetzel, D.L., & McDaniel, M.A. (2004). General mental ability tests in industry. In J.C. Thomas (Ed.), *Comprehensive handbook of psychological assessment: Vol. 4, Industrial and organizational assessment* (pp. 7–21). New Jersey: John Wiley & Sons.

Horn, J.L., & Cattell, R.B. (1966). Refinement & test of the theory of fluid and crystallized general intelligences. *Journal of Educational Psychology, 57*, 253–270.

Hough, L.M. (1992). The 'big five' personality variables —construct confusion: Description versus prediction. *Human Performance, 5,* 139–155.

Jensen, A. (2003). Regularities in Spearman's Law of Diminishing Returns. *Intelligence, 31*, 95–105.

Kanfer, R., Ackerman, P.L., Murtha, T., & Goff, M. (1995). Personality and intelligence in industrial and organisational psychology. In D.H. Saklofske & M. Zeidner (Eds.), *International handbook of personality and intelligence* (pp. 577–602). New York: Plenum Press.

Kaufman, A.S. (2000). Tests of intelligence. In R. Sternberg (Ed.), *Handbook of intelligence* (pp. 445–476). New York: Cambridge University Press.

Kline, P. (1995). A critical review of the measurement of personality and intelligence. In D.H. Saklofske & M. Zeidner (Eds.), *International handbook of personality and intelligence* (pp. 505–524). New York: Plenum Press.

Kroeck, K.G., & Brown, K.W. (2004). Work applications of the big five model of personality. In J.C. Thomas (Ed.), *Comprehensive handbook of psychological assessment: Vol. 4, Industrial and organizational assessment* (pp. 109–130). New Jersey: John Wiley & Sons, Inc.

Licht, M.H. (2003). Multiple regression and correlation. In L.G. Grimm & P.R. Yarnold (Eds.), *Reading and understanding multivariate statistics* (pp. 19–65). Washington, DC: American Psychological Association.

Lohman, D.F. (2000). Complex information processing and intelligence. In R. Sternberg (Ed.), *Handbook of intelligence* (pp. 285–340). New York: Cambridge University Press.

McCrae, R.R., & Costa, P.T. (1997). Conceptions and correlates of openness to experience. In R. Hogan, J. Johnson & S. Briggs (Eds), *Handbook of Personality Psychology* (pp. 826-849). San Diego: Academic Press.

Mershon, B., & Gorsuch, R.L. (1988). Number of factors in the personality sphere: Does increase in factors increase predictability of real-life criteria? *Journal of Personality and Social Psychology, 55*(4), 675–680.

Moutafi, J., Furnham, A., & Crump, J. (2003). Demographic and Personality Predictors of Intelligence: A study using the Neo Personality Inventory and the Myers-Briggs Type Indicator. *European Journal of Personality, 17,* 79–94.

Moutafi, J., Furnham, A., & Paltiel, L. (2004). Why is Conscientiousness negatively correlated with intelligence? *Personality and Individual Differences, 37*, 1013–1022.

Norman, W.T. (1963). Toward and adequate taxonomy of personality attributes: Replicated factor structure in peer nomination personality ratings. *Journal of Abnormal and Social Psychology, 66*, 574–583.

Ones, D.S., & Viswesvaran, C. (2001). Personality at work: Criterion-focused occupational personality scales used in personnel selection. In R.W. Roberts & R. Hogan (Eds.), *Personality psychology in the workplace* (pp. 63–92). Washington, DC: American Psychological Association.

Ones, D.S., Viswesvaran, C., & Dilchert, S. (2005). Cognitive ability in selection decisions. In O. Wilhelm & R.W. Engle (Eds.), *Handbook of understanding and measuring intelligence* (pp. 431–468). Thousand Oaks: Sage Publications.

Paunonen, S.V., & Jackson, D.N. (1996). The Jackson personality inventory and the five-factor model of personality. *Journal of Research in Personality, 30,* 42–59.

Penney, L.M., & Borman, W.C. (2005). The prediction of contextual performance. In A. Evers, N. Anderson & O. Voskuijl (Eds.), *The Blackwell handbook of personnel selection* (pp. 377–396). Malden, MA: Blackwell Publishing.

Plato. (1999). Republic (translated by P. Shorey). In E. Hamilton & H. Cairns (Eds.), *The collected dialogues of Plato: Including the letters*. New Jersey: Princeton University Press.

Robinson, M.D., Wilkowski, B.M., & Meier, B.P. (2008). Approach, avoidance, and self-regulatory conflict: An individual differences perspective. *Journal of Experimental Social Psychology, 44*, 65–79.

Schmidt, F.L., & Hunter, J.E. (1998). The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings. *Psychological Bulletin, 124,* 262–274.

Schmidt, F.L., Ones, D.S., & Hunter, J.E. (1992). Personnel selection. *Annual Review of Psychology, 43*, 627–670.

Steiger, J.H. (1980). Tests for comparing elements of a correlation matrix. *Psychological Bulletin, 87*, 245–251.

Tett, R.P., Jackson, D.N., & Rothstein, M. (1991). Personality measures as predictors of job performance: A meta-analytic review. *Personnel Psychology, 44,* 703–42.

Van der Zee, K.I., Zaal, J.N., & Piekstra, J. (2003). Validation of the multicultural personality questionnaire in the context of personnel selection. *European Journal of Personality, 17*(1), s77–s100

Witt, L.A., Burke, L.A., Barrick, M.R., & Mount, M.K. (2002). The interactive effects of conscientiousness and agreeableness on job performance. *Journal of Applied Psychology, 87*, 164–169.

Wood, P., (2004). *Personality correlates of fluid and crystallised intelligence in the New Zealand workplace.* Unpublished master's thesis, Massey University, Palmerston North, New Zealand.