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How are conscientiousness and cognitive ability related to one another? A re-examination of the intelligence compensation hypothesis

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ABSTRACT

Previously, negative associations between intelligence and conscientiousness have been reported and explained in terms of an 'intelligence compensation hypothesis' (ICH) whereby higher conscientiousness develops in order to compensate for lower cognitive ability. We argue that conscientious traits, especially those related to achievement, are just as likely to be reinforced by cognitive ability. We evidence this by showing that previous negative associations may be attributable to a compensatory sample selection effect arising because of the use of research samples comprised of participants with achievement above certain thresholds. The associations between conscientiousness and ability in the samples of adolescents and their parents from the Sibling Interaction and Behaviour Study (SIBS) and Minnesota Twin Family Study (MTFS) – which were not selected in this way – were either zero or positive. Further, artificially introducing selection on achievement into these samples biased the associations in the negative direction. Together, these results are consistent with the hypothesis that the true association between these constructs may be zero or positive at the population level but that the use of selected research samples has sometimes resulted in the appearance of a negative association.

A number of studies have reported negative correlations between cognitive ability and conscientiousness-related personality traits (e.g., Furnham, Dissou, Sloan, & Chamorro-Premuzic, 2007; Furnham & Moutafi, 2012; Furnham, Moutafi, & Chamorro-Premuzic, 2005; Moutafi, Furnham, & Crump, 2003, 2006; Moutafi, Furnham, & Paltiel, 2004; Soubelet & Salthouse, 2011; Wood & Englert, 2009). Moutafi et al. (2004) proposed an intelligence compensation hypothesis (ICH) to explain this negative association, with subsequent replications often being interpreted as support for the hypothesis. The hypothesis states that individuals of lower cognitive ability become more conscientious in striving for similar levels of achievement to their peers with higher cognitive ability. Individuals higher in cognitive ability are proposed not to increase in conscientiousness because their higher cognitive ability allows them to accomplish more with the same or less effort. Thus, there is no incentive for them to invest in approaching life more conscientiously. However, the evidence for ICH is mixed. Counter to the hypothesis, positive associations between cognitive ability and conscientiousness have been observed (e.g., Baker & Bichsel, 2006; Lounsbury, Welsh, Gibson, & Sundstrom, 2005; Luciano et al., 2006) and other studies have yielded associations that were close to zero or non-significant (e.g., Bartels et al., 2012; Chamorro-Premuzic, Moutafi, & Furnham, 2005; Furnham et al., 2005). Not all studies reporting an association between cognitive ability and conscientiousness did so with the explicit aim of testing the ICH but they nonetheless contribute to the pool of evidence to be considered in evaluating the hypothesis.

A feature which partially distinguishes those studies supporting the ICH from those which do not is sample composition. The majority of studies supporting ICH have been conducted in samples which may be selected with respect to occupational or academic achievement. For example, the studies of Moutafi et al. (2004) and Furnham and Moutafi (2012) used samples of junior to middle managers attending staff development centres, whilst other studies have utilised samples of managerial grade job applicants attending assessment centres (Furnham et al., 2007; Wood & Englert, 2009). Development and assessment centres are costly (Eurich, Krause, Cigularow, & Thorton, 2009). As such, in selection situations, organisations tend only to invite small percentages of the total applicant pools to attend these centres and in training contexts, their use is more common amongst managerial and

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professional populations (Meriac, Hoffman, Woehr, & Fleisher, 2008; Pepermans, Vloeberghs, & Perkisas, 2003). Another study finding a negative IQ–conscientiousness association used a sample of undergraduate students (Furnham et al., 2005) and entry to university involves selection on prior academic achievement (e.g., Hägglund & Larsson, 2006). Similarly, a study by Soubelet and Salthouse (2011) analysed data from participants who had an average of almost 16 years of education and were approximately 2/3 to 1 standard deviation above the national norms on cognitive ability.

The selected compositions of these samples raises the possibility that the apparent negative association between intelligence and conscientiousness-related traits is due not to individual calibration of conscientiousness levels to ability level as stated in the ICH, but to compensatory *selection* into the populations from which the research samples investigating the question are taken (see Sackett, Lievens, Berry, & Landers, 2007). To enter the population of individuals employed in professional jobs or the population of individuals undertaking university level education, a certain level of achievement (educational or occupational) is necessary. Compensatory selection refers to a process whereby selection into these populations through meeting these achievement conditions can be done through combinations of ability and hard work (i.e., Conscientiousness), but hard work can compensate for relatively low ability and high ability can compensate for relatively less hard work. Thus, one could think of selection into the research sample being based on a composite of IQ and Conscientiousness. Whenever IQ is relatively low, a large enough value on the composite to reach the occupational or educational achievement level necessary for selection into the relevant population can only be achieved by having high Conscientiousness. Conversely, when Conscientiousness is relatively low, IQ must be high to obtain a high enough composite score for selection. Thus, a higher score on one trait necessarily compensates for a lower score on the other. A research sample based on a population selected in this way could yield a negative correlation between IQ and Conscientiousness even if they are un- or positively correlated in the population because it will tend to have a greater proportion of people with discrepant IQ–Conscientiousness scores than the general population.

Such compensatory selection on occupational or educational achievement would be expected to have much more powerful effects on the Conscientiousness–IQ association than would selection on either one of the traits alone (Sackett et al., 2007). This makes compensatory selection effects potentially difficult to detect because it does not necessarily require dramatic range restriction on either or both of Conscientiousness and IQ to have a substantial effect on their association.

Compensatory selection mechanisms differ from the processes implied by the ICH which suggests that there is a causal impact of IQ on conscientiousness. Compensatory *selection* invokes no such causal effect – it merely refers to sample selection that creates non-representative sub-samples of the population in whom negative associations will be observed even if this negative association is not present in the whole population.

Further, compensatory selection should be distinguished from moderation of the Conscientiousness–IQ relation by achievement. In a moderated Conscientiousness–IQ association, the association might change from positive to negative across individuals ranging from low to high achievement. However, in compensatory selection, the Conscientiousness–IQ association would track the degree of selectivity of the sample, not the level of achievement per se. Although, both compensatory selection and moderation by achievement could lead to similar patterns in real data, the latter may be more difficult to justify from a theoretical standpoint. This is because it ascribes causal precedence to achievement, which is more likely to be an outcome of conscientiousness and/or cognitive ability than a determinant.

We aimed to assess these hypotheses regarding the nature of the association between Conscientiousness and IQ. Our aim was to do so in samples for which there was little evidence of selection on educational and occupational achievement and which could, therefore, be considered free of compensatory selection. We also assessed the extent to which a negative association between Conscientiousness and IQ could be induced by artificially introducing compensatory selection on educational or occupational achievement into the sample. The purpose of this was to simulate the processes we argue may have occurred during the selection of many of the samples previously employed to assess the Conscientiousness–IQ relation. We tested this compensatory selection hypothesis against a moderated association hypothesis in order to assess whether any apparent effects of compensatory selection simply reflected moderation of the effect of IQ on conscientiousness by achievement. We hypothesised that (1) we would not find significant negative association between Conscientiousness and IQ in the whole samples and (2) that negative associations could be induced by selection on educational achievement (in an adolescent sample) and occupational achievement (in a parent sample) and (3) we would not find significant moderation of the effect of IQ on Conscientiousness by achievement.

1. Method

1.1. Participants

We analysed data from the Minnesota Twin Family Study (MTFS) and Sibling Interaction and Behavior Study (SIBS).

MTFS is a community-based longitudinal study of same sex twins and their parents recruited using a population-based method (for a full description see Iacono, Carlson, Taylor, Elkins, & McGue, 1999). MTFS consists of two cohorts, one recruited originally when the twins were aged 11 years, and the other recruited originally when the twins were aged 17. Both cohorts have been followed longitudinally. Based on comparability to US Census data for Minnesota, the MTFS sample is generally representative of families with children living at home (Holdcraft & Iacono, 2004). Approximately 20% of invited participants declined to participate but more than 80% of this group agreed to complete a brief mail or telephone survey, allowing partial comparison of those who agreed to participate with those who did not. This comparison suggested a small difference in educational level, with the parents in participating families having on average an additional 0.3 years of education (for additional comparisons see Iacono et al., 1999).

SIBS is a community-based sample of pairs of adoptive and biological siblings and their parents recruited through adoption agencies. The families comprising the adoptive sample were selected to include an adolescent between the ages of 10 and 21 who was adopted before the age of 2 and a second adolescent who was not biologically related and was no more than 5 years older or younger. The parents in these families were generally representative of those accepting infant placements, but compared with Minnesota parents in the general population they were overall of higher socioeconomic status. The families in the biological families were recruited using birth records from the same area as the adoptive families. Fifty-seven percent of eligible biological families agreed to participate and 63% of eligible adoptive families agreed to participate but 90% of the mothers from the remaining families completed a brief telephone interview, allowing comparison of those who did and did not participate. These groups did not differ on either educational or occupational level among the adoptive families but mothers from the participating biological families were more likely to have a college degree than those from non-participating families (44% compared with an estimate of 39% for the comparison population of mothers in the geographical region).