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Personality and Intelligence: A Meta-Analysis

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This study provides a comprehensive assessment of the associations of personality and intelligence. It presents a meta-analysis (N = 162,636, k = 272) of domain, facet, and item-level correlations between personality and intelligence (general, fluid, and crystallized) for the major Big Five and HEXACO hierarchical frameworks of personality: NEO Personality Inventory–Revised, Big Five Aspect Scales, Big Five Inventory–2, and HEXACO Personality Inventory–Revised. It provides the first meta-analysis of personality and intelligence to comprehensively examine (a) facet-level correlations for these hierarchical frameworks of personality, (b) item-level correlations, (c) domain- and facet-level predictive models. Age and sex differences in personality and intelligence, and study-level moderators, are also examined. The study was complemented by four of our own unpublished data sets (N = 26,813) which were used to assess the ability of item-level models to provide generalizable prediction. Results showed that openness (ρ = .20) and neuroticism (ρ = −.09) were the strongest Big Five correlates of intelligence and that openness correlated more with crystallized than fluid intelligence. At the facet level, traits related to intellectual engagement and unconventionality were more strongly related to intelligence than other openness facets, and sociability and orderliness were negatively correlated with intelligence. Facets of gregariousness and excitement seeking had stronger negative correlations, and openness to aesthetics, feelings, and values had stronger positive correlations with crystallized than fluid intelligence. Facets explained more than twice the variance of domains. Overall, the results provide the most nuanced and robust evidence to date of the relationship between personality and intelligence.

Public Significance Statement

This meta-analysis provides a comprehensive examination of the relationship between personality traits and general intelligence. It is the first to meta-analytically compare how intelligence relates to domains, facets, and items on the major hierarchical measures of personality. In so doing, it provides a robust empirical basis for informing discussion of the reciprocal pathways through which personality and intelligence interact.

Keywords: general mental ability, Big Five personality, intelligence, cognitive ability, narrow traits

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Personality and intelligence represent two of the most fundamental domains of individual differences (Deary, 2012; John & Srivastava, 1999; Neisser et al., 1996; Ozer & Benet-Martínez, 2006; Roberts et al., 2007; Roberts & Yoon, 2022). Personality traits capture the stable patterns in how people think, feel, and behave, whereas intelligence represents a general cognitive capacity that manifests most prominently as the common factor of performance on a diverse set of cognitive tests (Carroll, 1993; Jensen, 1998; Johnson et al., 2004; Spearman, 1904). Both personality and intelligence are influenced by genetic factors (Deary et al., 2006; Neisser et al., 1996; Plomin & von Stumm, 2018; Tucker-Drob et al., 2013) and show substantial stability (Deary, 2012; Sanchez-Roige et al., 2018), yet both also develop and change over the life course (Ackerman, 2014; Roberts & Yoon, 2022). Personality and

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intelligence also predict major life outcomes including academic outcomes (Poropat, 2009), vocational pursuits (Ackerman & Heggestad, 1997; Barrick et al., 2003; Pässler et al., 2015), job performance (Schmidt & Hunter, 1998), economic prosperity (Ceci & Williams, 1997), psychopathology (Castellanos-Ryan et al., 2016), and subjective well-being (Anglim, Horwood, et al., 2020; Steel et al., 2008).

Given the central importance of personality and intelligence to understanding human behavior, researchers have long sought to understand how they are related (Ackerman & Heggestad, 1997; Cattell, 1963; Chamorro-Premuzic & Furnham, 2014; DeYoung, 2020; DeYoung et al., 2005; Humphreys & Revelle, 1984; Stanek, 2014; von Stumm & Ackerman, 2013; Wechsler, 1975). Indeed, various theoretical models have been proposed for how personality and intelligence may reciprocally influence each other and how these relationships vary based on whether the focus is on the capacity to learn (i.e., fluid intelligence) or acquired knowledge (i.e., crystallized intelligence). Although a growing body of research suggests that intelligence and personality traits are related in nuanced ways, a comprehensive and detailed mapping of these relationships is needed to provide the empirical basis to evaluate and constrain the propositions of such developmental theories.

Beginning in the 1990s, most research on personality and intelligence has focused on the Big Five traits (Goldberg, 1981, 1990; McCrae & Costa, 1987) of neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. Emerging from decades of research, the widespread adoption of the Big Five has provided a powerful means of synthesizing research on personality correlates (for reviews, see Anglim & O'Connor, 2019; John & Srivastava, 1999; Roberts & Yoon, 2022). Nonetheless, the Big Five was intended only to represent one broad level of the personality hierarchy. Indeed, the major frameworks of personality incorporate a range of lower level traits, including the NEO model with 30 facets (Costa & McCrae, 1992, 2008), the Big Five Inventory–2 (BFI-2) with 15 facets (Soto & John, 2017), and the intermediate-level Big Five Aspect Scales (BFAS) with 10 aspects (DeYoung et al., 2007). In parallel, the six-factor HEXACO model—which reconfigures the Big Five, adds an honesty–humility factor, and has 25 facets—has become a popular alternative to the Big Five (Ashton et al., 2004; Lee & Ashton, 2004, 2008). There is also emerging interest in examining item-level correlates of personality to better understand why traits correlate with criteria (Elleman et al., 2020; Mõttus et al., 2017, 2020; Revelle & Condon, 2015). Similarly, although general intelligence represents the large general factor that emerges from the correlations between a diverse battery of cognitive ability measures (Carroll, 1993; Jensen, 1998; Johnson et al., 2004; Spearman, 1904), cognitive ability is also multifaceted (e.g., Cattell–Horn–Carroll model, McGrew, 2009; Schneider & McGrew, 2012). In particular, the distinction between two broad categories of abilities that have been labeled fluid intelligence (see also nonverbal, abstract reasoning, and performance IQ) and crystallized intelligence (see also verbal ability) is often invoked in theoretical discussions regarding the relationships between personality and intelligence.

Overall, a growing body of research suggests that the relationship between personality and intelligence can best be understood at the facet level rather than domain level (e.g., DeYoung et al., 2005; Kretzschmar et al., 2018; Moutafi et al., 2003; Rammstedt et al., 2018). To consolidate this rapidly growing research literature, we sought to undertake the most comprehensive meta-analytic investigation of the relations of intelligence with personality to date. In so doing, we aimed to obtain robust estimates of domain-, facet-, and item-level correlates of general, fluid, and crystallized intelligence. Although many hierarchical personality frameworks and measures exist, in this investigation, we focused on the four contemporary hierarchical measures of personality identified above (i.e., NEO, BFAS, BFI-2, and HEXACO) because these are widely used in academic research. Indeed, focusing on a specific set of instruments enables us to obtain the first truly precise meta-analytic estimates of facet-level differences in intelligence correlations, using widely accepted and consistent facet structures. We complemented this analysis with an examination of third-variables and study moderators that might explain the obtained relationships and regression models to assess overlap of personality and intelligence at different levels of the personality hierarchy.

Theoretical Connections Between Personality and Intelligence

To explain the observed associations between personality and intelligence, numerous theories have been proposed (i.e., Ackerman, 2018; Cattell, 1963; Chamorro-Premuzic & Furnham, 2004; DeYoung, 2020; Rammstedt et al., 2018; von Stumm & Ackerman, 2013; Ziegler et al., 2012). In particular, openness has received the most theoretical attention given that it is the Big Five trait with the largest correlation with intelligence and appears to correlate more with crystallized than fluid intelligence (Ackerman & Goff, 1994; Ackerman & Heggestad, 1997; Gignac et al., 2004; MacCann et al., 2017; Reeve et al., 2006; von Stumm et al., 2009; Ziegler et al., 2012). Several researchers have proposed that traits related to openness to experience, such as typical intellectual engagement (Goff & Ackerman, 1992) and need for cognition (Cacioppo & Petty, 1982), cause people to invest more effort in intellectual pursuits. Such traits are captured in many hierarchical measures of personality as facets of openness (e.g., openness to ideas, intellectual curiosity, inquisitiveness). Building on Cattell's (1963) investment theory, intellectual effort is theorized to direct the application of one's fluid intelligence and lead to the acquisition of knowledge and greater crystallized intelligence. Ackerman's PPIK theory (i.e., intelligence-as-Process, Personality, Interests, and intelligence-as-Knowledge) represents a particularly well-developed articulation of these ideas (Ackerman, 1996; von Stumm & Ackerman, 2013).

Equally, most theories, including PPIK, posit that intelligence causes people to take greater enjoyment from intellectual pursuits. Put simply, people tend to like what they are good at (Ackerman & Rolfhus, 1999; Denissen et al., 2007; Rolfhus & Ackerman, 1996). Interests are related to comprehensibility and optimal complexity (Silvia, 2008), making intellectual activities more engaging for those who are more intelligent. These propositions are also consistent with various theories of person–environment fit (Nye et al., 2012); in particular, society rewards people who focus on their strengths with social and economic rewards. More generally, although interests routinely lead to the allocation of effort and the development of domain-specific skills and knowledge (Ackerman & Kanfer, 2020; Ericsson et al., 1993), increasing a trait as broad as intelligence is a much more challenging undertaking. Gains observed in more modest interventions aimed at increasing intelligence, like brain training, rarely show sustained benefits or generalization outside the specific skills practiced in the training (Simons et al., 2016). Instead, raising intelligence appears to require dramatic structural changes to lifestyles, especially during childhood (Pietschnig & Voracek, 2015; Ritchie & Tucker-Drob, 2018).

A variation on the idea that intelligence causes intellectual interests is that intelligence should be conceptualized as a component of personality. For instance, DeYoung (2020) proposed that intelligence should be understood as a component of openness (see also Connelly et al., 2014; von Stumm & Ackerman, 2013). DeYoung (2020) noted how the overlap between intelligence and personality as constructs is often obscured by the different measurement approaches that are typically adopted. For instance, meta-analytic research indicates that self-reported and ability-based intelligence assessments only correlate around $r = .33$ (Freund & Kasten, 2012). Embodying this perspective, DeYoung et al. (2007) developed the BFAS measure of the Big Five which includes an Intellect scale as an aspect of openness with items measuring self-rated intellect (see also Goldberg, 1992). Nonetheless, the dominant perspective captured in the NEO, HEXACO, and BFI-2 measures is that intelligence is best conceptualized as a separate construct, and that hierarchical representations of personality should avoid self-rated assessments of intelligence. From this perspective, intellectual interests become the most direct interface between intelligence and the facets of openness. Importantly, these debates help to clarify the difference between construct and measurement and encourage thinking about how intellectual and other abilities may be expressed in personality traits.

It is also theoretically important to understand how personality–intelligence correlations vary across openness facets and across fluid and crystallized intelligence. In particular, if intellectual investment causes crystallized intelligence to develop, we might expect to see stronger correlations for crystallized intelligence with facets assessing intellectual interests. In contrast, if being stronger in crystallized intelligence leads to more artistic and literary interests, we might expect to see stronger correlations between crystallized intelligence and more aesthetic and emotional facets of openness.

In addition to openness, meta-analyses have also highlighted neuroticism as a negative correlate of intelligence. Some researchers argue that neuroticism causes test anxiety which in turn leads observed intelligence scores to underestimate latent ability (Cassady & Johnson, 2002; Hembree, 1988). Such an explanation emphasizes measurement and methodological processes, but there are plausible reasons for why this correlation may reflect substantive processes. In particular, the deficits model of test anxiety (Sommer & Arendasy, 2014) suggests that although neuroticism does contribute to test anxiety, the causal direction is mostly from low ability to test anxiety. Furthermore, most research on personality and intelligence showing a negative correlation between neuroticism and intelligence is conducted in confidential, low-stakes research settings, not in high-stakes settings where anxiety is more likely to induce underperformance in some people. There are also a range of substantive processes which might explain the correlation. In addition to the biological processes that may lead to cognitive deficits and elevated neuroticism (Kliegel & Zimprich, 2005), it is also possible that intelligence is a resource that can make coping with some aspects of life less stressful (Moutafi et al., 2003).

Next, given the fundamental importance of conscientiousness for academic and occupational achievement, the fact that conscientiousness tends to be uncorrelated with intelligence would seem to challenge the investment hypothesis embedded in many theories of intellectual development. One idea is that task-related effort (e.g., self-discipline, deliberation) associated with conscientiousness may be used to compensate for lower intelligence in some domains (DeYoung, 2020; Moutafi et al., 2006). Less intelligent people may also have a greater preference for order, structure, and routine (Moutafi et al., 2006).

Finally, extraversion tends to not correlate with general intelligence, although correlations seem to vary across particular facets of extraversion. There is a body of research showing various performance differences such as extraverts doing better on timed tasks and introverts doing better on tasks requiring reflection (e.g., Rawlings & Carnie, 1989). Wolf and Ackerman (2005) also found a tendency for traits related to dominance to be positively related and traits related to sociability to be negatively related to intelligence.

Altogether, a common theme is that the most theoretically important relationships between personality and intelligence likely occur at the facet level. Such relationships are obscured when focusing only on major personality dimensions. Understanding the pattern of facet-level correlations and how they vary across fluid and crystallized intelligence provides an important basis for disentangling the complexity of the various causal mechanisms that have been proposed.

Empirical Research on Personality–Intelligence Associations

To date, in addition to a large primary research literature, there have been three main meta-analyses of personality–intelligence relations (i.e., Ackerman & Heggestad, 1997; Judge et al., 2007; Stanek, 2014). Ackerman and Heggestad (1997) provided an early seminal meta-analysis of personality, interests, and intelligence that largely preceded the widespread adoption of dedicated Big Five measures. For instance, correlations of general intelligence with agreeableness, conscientiousness, and openness were based on just 3–6 studies. Subsequently, Judge et al. (2007) provided a meta-analysis of correlations between the Big Five and general intelligence ($38 \leq k \leq 61$; $11{,}190 \leq n \leq 21{,}602$) as part of a study focused on the prediction of self-efficacy and job performance. They found reliability-corrected correlations with intelligence of −.09 (neuroticism), .02 (extraversion), .22 (openness), .00 (agreeableness), and −.04 (conscientiousness). More recently, Stanek (2014) completed a doctoral thesis which provided a meta-analysis of the relations of personality and intelligence using a custom-built taxonomy for categorizing measures of cognitive ability and both broad and narrow personality traits. Other meta-analyses, narrower in focus, have examined relationships between intelligence and extraversion (Wolf & Ackerman, 2005), intelligence and intellect (von Stumm & Ackerman, 2013), intelligence and openness (Woo et al., 2014), self-rated and objectively scored intelligence (Freund & Kasten, 2012), and whether impression management in high-stakes assessment situations (or simulations thereof) moderates the relationship between intelligence and Big Five personality (Schilling et al., 2021). Finally, beyond the meta-analytic literature, there is an emerging body of primary studies examining how intelligence is related to personality facets of the Big Five (e.g., Ashton et al., 2000; DeYoung et al., 2005, 2009; Goff & Ackerman, 1992; Kretzschmar et al., 2018;

Moutafi et al., 2003, 2006; Rammstedt et al., 2018; Wainwright et al., 2008) and HEXACO personality frameworks (de Vries et al., 2021; Dunlop et al., 2017; Fiori, 2015; Kajonius, 2014; MacCann et al., 2017; Oh et al., 2014).

In summary, despite a large and expanding body of primary research and some important initial meta-analytic work, a fine-grained and meta-analytically robust understanding of the relationship between personality and intelligence at the facet-level has not yet been realized. The meta-analysis by Ackerman and Heggestad (1997) predated the widespread adoption of the Big Five, and the meta-analysis by Judge et al. (2007) was never intended to be a comprehensive examination of the topic. Most importantly, neither meta-analysis investigated facet-level relations. The impressive doctoral thesis of Stanek (2014) provided an assessment of facet-level correlates; however, in doing so, it grouped together narrow traits from a very diverse set of personality measures (e.g., 16PF, CPI, Hogan, Eysenck, 15FQ, test anxiety scales). Although such an approach grants access to data from a wider array of personality measures, it poses similar challenges to those that arose in the early days of the Big Five, where researchers were forced to manually categorize measures that predated the Big Five rather than only combining truly equivalent measures (Block, 1995). While such an approach is understandable when primary data sources are limited, it necessarily results in the combining of measures that differ in potentially important ways. In particular, it is theoretically important to get precise estimates of how correlations between personality and intelligence vary across facets and between fluid and crystallized intelligence.

The approach we adopt in this study is to meta-analyze, separately, relations of intelligence with four of the most widely used hierarchical personality frameworks as operationalized through the NEO-PI-R (5 domains, 30 facets), the BFAS (5 domains, 10 aspects), the BFI-2 (5 domains, 15 facets), and the HEXACO-PI-R (6 domains, 25 facets). Indeed, the proliferation of research using these measures, particularly over the last 10 years, provides the wealth of primary studies necessary to allow a more precise and definitive assessment of how personality relates to intelligence. Furthermore, most studies that provide facet-level measurement using one of these frameworks have administered the full measure. Thus, by identifying and combining these studies, it becomes possible to undertake robust meta-analytic comparisons of domain- and facet-level correlations with intelligence. The widespread use of these measures combined with an emerging culture of data sharing (Atherton et al., 2021) also provides the basis for conducting the first large-scale item-level meta-analysis. Even though facet-level correlations may be the most theoretically relevant, examining correlations of intelligence with personality *items* may further help to explain differences in correlations across measures. It may also reveal whether correlations with intelligence generalize across items from a common facet or if the patterns of item-level correlations are more idiosyncratic, possibly suggesting that there might be value in examining relations of intelligence with personality nuances. Finally, we also sought to improve the precision with which differences in correlations between fluid and crystallized intelligence were estimated. By comparing these correlations across only studies that had measured both fluid and crystallized intelligence, we sought to better control for extraneous factors that might confound this comparison (e.g., the nature of personality scales, the degree to which openness is intellect-laden, the reliability of measures, the context of data collection, the degree of range restriction).

Research Question 1: What are the meta-analytic correlations of the *domains, facets, and items* of the NEO, BFAS, BFI-2, and HEXACO personality frameworks with general, fluid, and crystallized intelligence?

Third-Variables That May Induce Personality–Intelligence Associations: Age and Sex

Beyond reciprocal theories, so-called "third-variables" have also been proposed to explain observed correlations (Gottfredson & Deary, 2004; Johansen et al., 2013; Moutafi et al., 2003). For instance, various factors that have causal effects on both personality and intelligence such as sex, age, education, race, culture, and health (Hunt, 2010; Neisser et al., 1996) may induce zero-order correlations between personality and intelligence. Notably, age and sex represent two highly salient factors. Sex differences in personality are fairly substantial with composites of facets yielding differences of around 1 *SD* (e.g., Lee & Ashton, 2020). In general, males tend to score lower on agreeableness (especially tender-mindedness) and neuroticism (Costa et al., 2001; Hyde, 2014), and higher on openness facets related to intellectual curiosity, unconventionality (e.g., Costa et al., 2001; Lee & Ashton, 2020), and intellect (Syzmanowicz & Furnham, 2011).

Literature on sex differences in cognitive ability has a long and contentious history (Hyde, 1990; Neisser et al., 1996). Surprisingly, although there have been meta-analyses of spatial ability (Voyer et al., 1995), verbal ability (Hyde & Linn, 1988), verbal working memory (Voyer et al., 2021), visual–spatial working memory (Voyer et al., 2017), Raven's progressive matrices (Lynn & Irwing, 2004), mathematical achievement (Hyde et al., 1990; Lindberg et al., 2010), and academic grades (Reilly et al., 2015; Voyer & Voyer, 2014), we are not aware of a meta-analysis of sex differences in general intelligence. From the existing literature, it is well established that sex differences vary across component abilities with some tests favoring males and others favoring females (Hyde, 2005; Neisser et al., 1996; Nisbett et al., 2012) and that males show greater variance than females in many abilities (Johnson et al., 2008). Although Lynn's developmental theory (Lynn, 1999), which is not without criticism, proposed that small differences favoring males emerge in late adolescence and plateau in early adulthood at approximately 2–5 IQ points, most reviews conclude that there are no sex differences in general intelligence between males and females.

With respect to age, there is evidence that neuroticism declines over adulthood while honesty–humility, conscientiousness, agreeableness, and some aspects of extraversion increase (Ashton & Lee, 2016; Roberts & Yoon, 2022). Indicators of crystallized intelligence including verbal ability and general knowledge tend to rise until mid-adulthood and remain fairly stable, only declining at very old age, while measures of fluid intelligence tend to decline from around the mid-20s (Roberts & Yoon, 2022; Verhaeghen & Salthouse, 1997).

Importantly, there has never been a meta-analytic investigation that has examined the extent to which age and sex differences could potentially explain the relationship between personality and intelligence. Sex differences in neuroticism and intellectual aspects of openness align and thus may partially explain observed correlations. Similarly, age-related declines in both neuroticism and intelligence may reduce the observed association between neuroticism and intelligence. More generally, the comprehensiveness of the current meta-analysis also contributes evidence regarding the relationship of age and sex with intelligence (general, fluid, and crystallized) and personality (domains and facets).

> *Research Question 2:* To what extent do age and sex differences in personality and intelligence explain the relationship between personality and intelligence?

Study-Level Moderators

Theory and research also suggest that the relationship between personality traits and intelligence varies based on study characteristics (e.g., Rammstedt et al., 2016). Several potential moderators include methodological factors related to the validity of measurement, the nature of measurement, and range restriction. Examining moderators is important for assessing assumptions about the extent to which empirically obtained correlations are attenuated by measurement and sampling limitations. Other moderators allow for the examination of how the relationship between personality and intelligence varies in different populations. In this investigation, we focus on five potential moderating factors: personality measurement, intelligence measurement, the measurement context (high-stakes vs. low-stakes), the mean age of the sample, and the gender composition of the sample.

First, the nature of the personality measurement should impact the relationship between personality and intelligence. The reliability of the measure as indexed by internal consistency and test–retest correlations should influence obtained correlations. We note, however, that we are focusing on very well-validated measures that have at least 10 items per domain and thus would anticipate that reliability will be generally high and not a major source of variation between studies. Of greater relevance is the emphasis of a given personality measure. Whereas the NEO and HEXACO inventories avoid items describing self-rated intellect, the BFAS includes a narrow trait of openness called Intellect which includes many items that reflect self-rated intellect. As such, BFAS openness is likely to correlate more with intelligence than do other measures of openness.

Second, the nature of general intelligence measurement should influence the correlation between personality and intelligence. In general, cognitive ability scores can be broadly decomposed into variance associated with general intelligence, component abilities, the specific test, and measurement error. In particular, the validity of measurement depends on not just test–retest reliability but also the extent to which the latent score is aligned with general intelligence. This is usually aided by administering a broad range of cognitive tests and taking an appropriately weighted composite. Such an approach is best embodied in "gold standard" measures, such as the WAIS, and is approximated in studies that include large batteries of measures drawing from both verbal and nonverbal domains. In contrast, studies that use measures of intelligence that sample from fewer domains, have component tests lower in reliability, and that have fewer component tests are expected to show weaker relationships of personality and intelligence.

Third, the relationship between personality and intelligence is expected to be most accurate when conscientious and effortful measurement is obtained. Mostly, it is difficult to assess the extent to which personality and ability measures were administered in appropriate and controlled conditions in any given study. Nonetheless, intelligent people may be better at identifying socially desirable responses and they may be more effective at engaging in impression management in settings where it may be rewarded or encouraged (e.g., personnel selection or simulations thereof). A meta-analysis by Schilling et al. (2021) found that correlations in real and experimentally simulated selection situations were slightly higher for conscientiousness (r = .07), agreeableness (r = .06), and extraversion (r = .06) than has been obtained in past meta-analyses, although correlations for openness (r = .14) and neuroticism (r = −.10) were of either a smaller or similar magnitude to past meta-analyses. Nonetheless, some of these associations were amplified in studies of simulated job applicant settings where participants are more likely to see impression management as a task requirement. There may also be other administrative aspects to data collection in applied settings that lead to greater noise in measurement related to the diverse testing contexts.

Fourth, the age of the sample may also be relevant to assessing the relationship between personality and intelligence. In particular, older adults are more likely to be experiencing mild cognitive impairment, strokes, and dementia that are associated with depression (Curtis et al., 2015; Korczyn & Halperin, 2009). These factors could potentially lead to stronger relationships between intelligence and neuroticism.

Finally, it is interesting to consider whether the gender composition of the sample influences the relationship between personality and intelligence. If the correlation between neuroticism and intelligence is driven by sex differences, then this correlation should decline in samples composed mostly of all males or all females. If, as seems more likely, the correlation reflects substantive processes, then the correlation should be equally strong for males and females.

> *Research Question 3:* Is the relationship between personality and intelligence moderated by (a) the type of personality measure, (b) the type of intelligence measure, (c) whether measures were obtained in a high-stakes or low-stakes context, (d) the age of the sample, and (e) the gender composition of the sample?

Overlap of Intelligence and Personality at Domain, Facet, and Item Levels

Beyond examining bivariate associations, there is value in assessing the extent to which personality and intelligence overlap at different levels of the personality hierarchy. In particular, although many of the facet-level correlations between personality and intelligence are small, the combined effect of these smaller relationships can represent something larger (Götz et al., 2022). Furthermore, showing that facets provide substantial incremental prediction is relevant to justifying the complexity of investigating personality–intelligence associations at the facet level. There is now a large body of primary research where intelligence and hierarchical measures of personality have been measured, and a subset of this literature has examined regression models comparing domain and facet prediction (e.g., DeYoung et al., 2005; Kretzschmar et al., 2018; Moutafi et al., 2003; Rammstedt et al., 2018). There is also theoretical interest in understanding the conditions under which facets provide more, or less, incremental prediction (Anglim & Grant, 2014; Ashton et al., 2014; Christiansen & Robie, 2011; Paunonen, 1998; Salgado et al., 2013). For instance, a common perspective is that broad traits predict broad criteria and narrow traits predict narrow criteria. This perspective has been articulated in discussions of the bandwidth–fidelity dilemma (Cronbach & Gleser, 1957) and Brunswick symmetry (Ackerman, 2018; Kretzschmar et al., 2018; Rammstedt et al., 2018), but theorizing has mostly moved beyond the available empirical evidence in this area.

There are several reasons to expect that personality facets will, together, provide substantial incremental prediction of intelligence. First, a key feature of incremental prediction is that it occurs when facet–criterion correlations vary substantially within domains. As discussed earlier, this variation appears to be highly likely in the case of intelligence. Second, although, aside from the BFAS, the measures of personality we study here were written with an explicit goal to exclude intelligence from their conceptual focus, a close reading of personality items can highlight how cognitive ability might nonetheless inform the expression of personality (e.g., items capturing social skills, stress management, creative ability, and leadership). Third, both intelligence and personality are fundamental characteristics of people that are influenced by major social, cultural, and demographic factors and have causal effects on thoughts, feelings, and behavior. As such, there is likely to be a broad and diverse range of correlations of facets with intelligence, but it does not follow that these facets must all share a common factor.

Altogether, meta-analytic research on incremental facet prediction is in its infancy. This is partly because included studies need to provide a complete facet-level correlation matrix, and publication of these matrices is rare. In particular, the absence of a full facet-level correlation matrix precludes the accurate modeling of multicollinearity between personality facets and can lead to inaccurate and exaggerated estimates of incremental prediction (for discussion, see Anglim & Grant, 2014; Cheung & Chan, 2005; Sheng et al., 2016). Fortunately, in recent years, a sufficient literature has arisen where complete hierarchical measures of personality have been administered, combined with a growing culture of data sharing. Taking advantage of these trends, the current meta-analysis investigates the following research question:

> *Research Question 4:* To what extent do personality facets provide incremental prediction over and above personality domains?

There is also now an emerging interest in examining the ability of personality nuances, typically operationalized as personality items, to predict criteria (Mõttus et al., 2017, 2019; Speer et al., 2022; Stewart et al., 2022). For instance, Mõttus and Rozgonjuk (2021), in a sample of 22,931, obtained a multiple correlation predicting age from personality domains, facets, and items that increased from .28 (Big Five domains) to .44 (30 facets) to .65 (300 items). In the context of intelligence, there are several reasons to expect item-level prediction to be strong. For instance, just as items within a trait may vary in the degree to which they are endorsed by older versus younger people (Mõttus & Rozgonjuk, 2021), items may vary in how they capture aspects of personality expression supported by cognitive ability. For example, some items may assess intellectual engagement or intellectual interest more than others. Some items may also better index social, cultural, and demographic covariates that are related to intelligence; for example, "I like attending the ballet" may relate to aesthetic interests but also to socioeconomic status.

Given the large number of items in hierarchical personality assessments (e.g., 100 or 200 for HEXACO-PI-R; 240 for NEO-PI-R), investigation of item-level prediction requires very large sample sizes (10,000 or more). Furthermore, predictive models should be developed in a training set and evaluated in a validation set. Although there exists some early exploratory research with small samples (e.g., Gough, 1953), to our knowledge, there has not yet been a large-sample examination of the capacity of personality items to predict intelligence. Similarly, another unanswered question is whether such models generalize beyond the original sample characteristics and testing context (e.g., high-stakes vs. low-stakes testing, different countries, university students vs. community samples, translations). For example, how well does a model that predicts intelligence from items derived from a sample of professional workers from one country perform when used to predict intelligence in an international sample of students or in a sample of applicants to firefighter positions? As part of our investigation, we examined our own unpublished data of over 20,000 participants who had completed the HEXACO-PI-R and measures of intelligence. We then evaluated the ability of this item-level model to predict intelligence in three other large data sets that we collected, as well as another that was obtained as part of the meta-analytic process.

> *Research Question 5:* To what extent do personality items provide generalizable incremental prediction over and above personality facets?

Summary

Altogether, the current meta-analysis sought to comprehensively assess the relationship between personality and intelligence and substantially advance the study of these associations. Providing up-to-date estimates of domain-level correlations using four well-used personality measures provides a general context for understanding personality–intelligence relations at the higher level. However, the facet-level correlations we estimate provide the most important contribution in clarifying the nature of the overlap between personality and intelligence, advancing theoretical understanding of how the two influence one another. Indeed, comparing facet-level correlates across crystallized and fluid intelligence is also necessary for assessing various theoretical models of how personality and intelligence develop and reciprocally influence each other and represents another major contribution of this work. We also examined a set of study-level moderators, shedding new light onto the methodological conditions that may attenuate observed correlations. In particular, examination of age and sex covariates also helps to assess the weight that should be given to third-variable explanations for observed relationships. Our predictive models further highlight the relative importance of different levels of the personality hierarchy for understanding the overlap between personality and intelligence. And finally, for completeness, we present numerous additional analyses in the online Supplemental Material including an examination of quadratic relationships and of correlations with the general factor of personality. Altogether, a strength of our approach is that we sought and obtained *raw* data, or failing that, complete correlation matrices for a large number of studies in the meta-analysis. This approach supported a range of novel analyses including estimating item-level correlations, study-level regression models, and estimating personality–intelligence associations covarying for age and sex. As such, we sought to apply several innovations in meta-analytic approach to provide unique insights into the relationship between personality and intelligence.

Method

Transparency and Openness

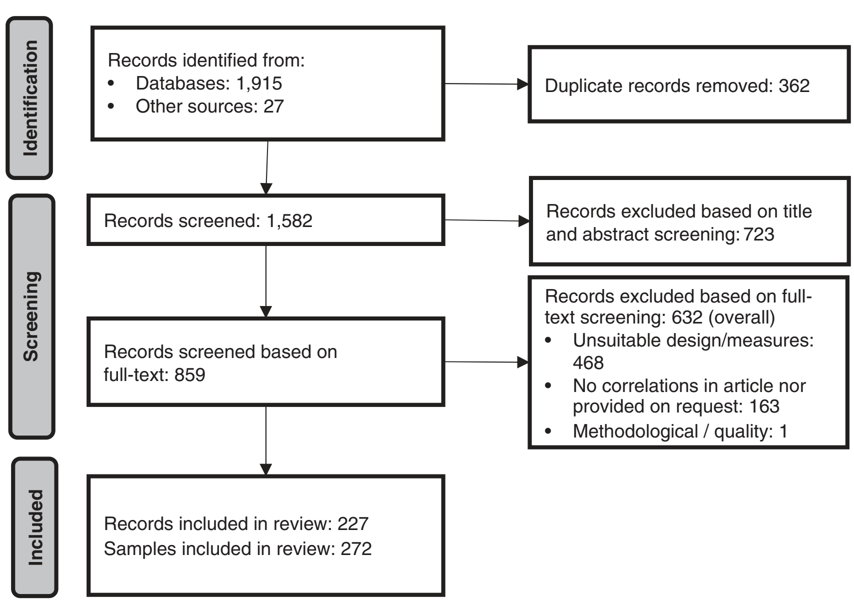
Data, analysis scripts, and study materials are available on the Open Science Framework (OSF) at https://osf.io/72zp3 (Anglim et al., 2022). Aside from the raw data that were shared with us by other researchers, all data in this investigation are shared. Where available or where computable, complete correlation matrices between study variables are also provided in the online repository. The meta-analysis in this study is based on analysis of correlation matrices rather than raw data, and the online scripts for these analyses are fully reproducible.

Literature Search

The meta-analysis sought to identify all studies with correlations of the domains or facets of NEO, BFAS, BFI-2, and HEXACO personality with measures of general intelligence or component scales from which general intelligence could be derived. First, the primary strategy involved conducting searches in Scopus and PsycINFO on April 2021. We searched the databases for articles and dissertations that satisfied two sets of criteria: one set for personality and one for intelligence. The personality search criteria required the article to (a) include a relevant personality keyword in the abstract (e.g., "NEO," "BFAS," "Big Five Aspects," "BFI-2," "HEXACO," "honesty–humility," "facets"), (b) cite one of the standard references that accompany descriptions of the NEO, BFAS, BFI-2, or HEXACO (i.e., test manuals and canonical references; Scopus specific), or (c) the Tests and Measures field, in PsycINFO, indicated that the NEO, BFAS, BFI-2, or HEXACO were measured. The intelligence search criteria required the article to (a) include an intelligence-related keyword (e.g., "intelligence," "general mental ability," "cognitive ability," "test battery," "Wonderlic," "WAIS," "ICAR") or (b) the Tests and Measures field, in PsycINFO, indicated that intelligence was measured. Second, we identified several past meta-analyses and narrative reviews and searched them for additional references (i.e., Ackerman & Heggestad, 1997; Curtis et al., 2015; DeYoung, 2020; Judge et al., 2007; Lee et al., 2019; Mammadov, 2022; Rikoon et al., 2016; Stanek, 2014). Third, a small number of additional studies were identified by other researchers in response to our request for additional information on their studies. These additional studies generally did not appear in the primary database search because they were either unpublished studies or the published study did not mention that the relevant variables were measured. Fourth, we also included four of our own unpublished data sets.

Figure 1 outlines the flow of articles through the phases of the meta-analysis. After merging the above sources and removing duplicates, the combined data set consisted of 1,582 articles. Following title and abstract screening, the full text was examined for 859 (54.3%) articles. Of these, 193 articles reported one or more relevant correlations, and a further 198 articles measured relevant personality and intelligence variables but did not report relevant correlations. The corresponding authors of each article (i.e., the 193 reporting correlations and the 198 not reporting correlations) were sent an email inviting them to provide additional information. We requested either the correlation matrix or the anonymized raw data for personality, intelligence, age, and sex. Our preferred format was item-level personality data, scale-level intelligence data including measures related to crystallized and fluid intelligence, and age and sex.

Figure 1
Flow of Reports Into the Review



If an article provided some relevant data (e.g., correlations for domains but not facets), we enquired about the availability of more data. Although pairwise correlations between personality and intelligence permitted estimation of meta-analytic correlations, full correlation matrices permitted regression analysis, and scale-level raw data allowed for the examination of quadratic effects. In addition, some studies that did report correlations did not report on age, sex, facets, domains, or subtests. When a working corresponding author's email could not be found, another author or the thesis supervisor was emailed. Several studies that initially appeared to meet inclusion criteria were ultimately excluded (see exclusion criteria below). The final database consisted of 272 samples from 227 articles with a combined sample size of 162,636. Literature search, correlation extraction, study feature extraction, and data analysis were performed by the first author in consultation with the other authors and checked by the fifth author.

Eligibility Criteria and Data Coding Procedures

Several criteria needed to be satisfied for inclusion in the study. First, the study needed to include one or more scales from a relevant self-report personality measure, which were (a) NEO (e.g., NEO-FFI, NEO-PI-R, NEO PI 1985, NEO PI 3, NEO FFI3; Costa & McCrae, 2008; McCrae et al., 2005), (b) 100-item BFAS (DeYoung et al., 2007), (c) 60-item BFI-2 (Soto & John, 2017), or (d) HEXACO (i.e., 60, 100, and 200 item versions of the HEXACO-PI-R and their variants; Ashton & Lee, 2009; Lee & Ashton, 2018). Official versions and their translations were included. Unofficial versions (e.g., IPIP HEXACO and IPIP NEO measures) were excluded (e.g., DeFalco et al., 2019) because (a) they were very rarely used, (b) while highly correlated with their official equivalents they differed substantially from the originals in terms of item content, (c) they often employed self-rated ability items in the openness domain, whereas the official NEO and HEXACO measures do not, and (d) in general, the meta-analysis was executed with the goal of focusing on four well-used frameworks, thus avoiding any ambiguities with respect to manually classifying "similar" facets. Short forms (i.e., 10 and 15 item versions) of the BFI-2 were also excluded.

Second, to be included, the measure of general intelligence in the study needed to be objectively measured and not self- or other-report (e.g., Judges, 2015). The measure also needed to be sufficiently broad to capture general intelligence. This broad measurement was typically achieved in the primary studies by including (a) a battery of discrete measures that sample from at least two broad ability domains (e.g., verbal, abstract reasoning, numeric, spatial ability), (b) having a single measure (e.g., WAIS, Culture Fair, Wonderlic, ICAR, Stanford–Binet) with items or subtests that draw from a range of cognitive ability domains, or (c) a measure that loads highly on general intelligence such as Raven's progressive matrices (Gignac, 2015).

Third, for inclusion, correlations between personality traits and intelligence needed to be available (i.e., reported in the article, provided by the author, or derived from data). If only correlations based on latent variables or standardized regression coefficients were available, the study was excluded (e.g., Faura, 2016). Fourth, if a sample was included in multiple articles, the study with the more complete set of correlations and larger sample size was retained. Fifth, if data were available, then correlations and sample statistics were derived from the data rather than from the article. Sixth, although almost all studies were cross-sectional, in the few longitudinal studies, we typically used the correlations of the wave with the largest sample size. However, in cases where raw data were available, we sampled the first wave where a participant provided complete personality and intelligence data.

Finally, for a study to be included in the comparison of crystallized and fluid intelligence, it needed to include measures of both abilities. Studies explicitly labeled crystallized and fluid intelligence were included. In addition, crystallized intelligence measures also included vocabulary, WAIS subscales such as similarities and information, and verbal reasoning ability. Fluid intelligence measures included abstract reasoning, matrix reasoning, performance IQ, block design, culture fair tests, and related scales.

Further detail about the ways that samples overlap across analyses is described in the online Supplemental Material.

Data Extraction

For each study, we extracted the following study features: sample size, personality measure, number of items per personality facet, whether the full personality measure was administered, whether a full set of personality correlations is available, proportion female, mean age, standard deviation of age, country of the sample, type of sample (workers, students, community, clinical, other), whether participants were financially compensated (e.g., Mechanical Turk), whether personality assessment was high-stakes (e.g., personnel selection; note that role play and instructed faking samples were excluded, cf. Schilling et al., 2021), the source of the correlations (i.e., from article, from author, from data), reference details, and additional notes. Because we sought to perform meta-analytic regression analyses (Sheng et al., 2016), we sought to obtain complete correlation matrices, including correlations between personality traits. To further identify data entry errors, reporting errors by original authors, problematic studies (i.e., studies that on closer inspection did not meet inclusion criteria or had an overall pattern of results that suggested obvious issues with data validity [as noted in online Supplemental Material]), we examined absolute z-scores greater than 2.5 for each correlation for a given pair of variables (e.g., extraversion and intelligence, neuroticism and intelligence). Besides correcting data entry and coding errors, and excluding problematic studies, outliers were retained in all analyses.

When raw data were available, we computed correlations, sample size, and demographic features directly from the data rather than extracting information from the associated publication. In some cases, intelligence, crystallized intelligence, and fluid intelligence were obtained as a composite of component measures (i.e., subtests) which involved taking the sum of z-score standardized subtest scores. Personality items were standardized to a 1–5 scale and, where necessary, domain and facets were scored as the item mean after relevant reversal and domains were scored as the mean of relevant facets. The OSF repository includes a spreadsheet for each raw data set explaining how composite variables were derived and how original data variable names were mapped to a common data dictionary. Listwise deletion was performed over personality and intelligence scale scores.

Additional Primary Studies

This study also incorporates four new primary data sets labeled (a) industry, (b) massive open online course (MOOC), (c) student, and

(d) firefighter (see online Supplemental Material for full details). Each sample provided a measure of general intelligence and a measure of HEXACO personality. The *industry sample* (n = 20,939; 59% female, M_{age} = 38.6 years, SD = 10.9) comprised applicants to various jobs in various sectors in Australia, who completed the 200-item HEXACO-PI-R and ACER measures of verbal, numerical, and abstract reasoning ability. The *MOOC sample* (n = 4,286; 69% female; M_{age} = 34.7 years, SD = 10.1) was an international sample (131 countries, especially the United States, India, the United Kingdom, Australia, and Canada) of psychology students who completed the HEXACO-100 and the 16-item ICAR (Condon & Revelle, 2014) as part of an online Coursera MOOC run by an Australian university. The *student sample* comprised 647 psychology students (83% female, 17% male, 1% other; M_{age} = 28.61 years, SD = 9.37) enrolled in an Australian university who completed 100-item HEXACO-PI-R, 50-item IPIP NEO, and the 16-item ICAR. The *firefighter sample* (n = 941; M_{age} = 29.42, SD = 5.76; 8% male) completed the 200-item HEXACO-PI-R and a battery of ability measures as part of application to firefighter academy positions in Australia. Some data from the firefighter sample (Holtrop et al., 2021) and the student sample (Wood et al., 2022) have been previously reported. The four data sets were also used in conjunction with a preexisting Dutch sample (de Vries et al., 2021) to assess item-level predictive models. The *Dutch sample* was obtained as part of the previously mentioned requests for data and consisted of 1,330 (75% female; M_{age} = 20.64 years, SD = 2.84) Dutch-speaking university students who completed the official Dutch translation of the HEXACO-208 and a 24-item version of the ICAR.

Data Analytic Approach

Meta-analytic correlations were estimated using a random-effects model with the *metafor* package in *R* (Viechtbauer, 2010). The standard deviation of the estimated population correlations (i.e., τ) was estimated using restricted maximum-likelihood estimation. Meta-analytic estimates were obtained using both observed correlations and correlations corrected for measurement error. Reliability estimates for personality traits for a given measure and number of items per scale were generally obtained from test manuals and related materials. The mean estimated reliability was 0.85 (SD = 0.05) for personality domains and 0.77 (SD = 0.07) for personality facets. Reliability of ability measures were derived from Stanek (2014) with .88 for general intelligence, 0.87 for verbal fluid intelligence, and 0.78 for nonverbal crystallized intelligence. The online Supplemental Material provides details for alphas and their sources. Where a study reported correlations separately for fluid and crystallized intelligence, raw data were not available, and the correlation between personality and general intelligence was not reported, the correlation between personality and general intelligence was calculated as the average of the component correlations. The study also made substantial use of the *lavaan* (Rosseel, 2012) and *psych* (Revelle, 2017) packages.

Consistent with past meta-analyses (e.g., Ackerman & Heggestad, 1997; Judge et al., 2007; Stanek, 2014), we did not perform a correction for range restriction (Sackett & Yang, 2000; Thorndike, 1949). Sample variance in intelligence and personality is influenced by the broad range of sampling strategies used in studies (e.g., university students, general population, Mechanical Turk, workers, older adults). Even though some samples show less variance on intelligence (e.g., university students, workers in a particular occupation), this reduction in variance in intelligence is likely small (see Sackett & Ostgaard, 1994). In general, the information required to perform corrections to estimate the correlations in a hypothetical representative population is rarely available and would require making various subjective assumptions. Instead, we sought to model range restriction in the context of study moderators.

Several strategies were employed to compare the magnitude of personality–intelligence correlations across traits. The statistical significance of a difference between two correlations depends on (a) the size of the two correlations, (b) the standard errors of the two correlations, (c) the extent to which the sample comes from the same set of studies, (d) if the correlations come from a common set of studies, the correlation between the two traits being compared, and (e) the significance threshold. When comparing correlations that are derived from different sets of studies, differences in correlations greater than approximately 2.8, 3.6, and 4.7 standard errors are significant at α = .05, .01, and .001, respectively (Revelle, 2017).

In order to statistically compare correlations drawn from overlapping sets of studies (e.g., the correlation of extraversion and intelligence to the correlation of openness and intelligence), we conducted multilevel meta-analysis using the *metafor* package in *R* (Viechtbauer, 2010). A vast majority of studies provided correlations between personality traits, which enabled computation of study-specific variance–covariance matrices of sampling error (Olkin & Finn, 1995). Where correlations between traits were not available, the average personality intercorrelation matrices were used. Further details of the rationale behind our approach are provided in the online Supplemental Material, along with a table of key pairwise comparisons of correlations. The results of multilevel modeling presented in the online Supplemental Material also provided a robustness check of the univariate meta-analytic estimates reported in the body. In particular, there is extensive discussion in the meta-analytic literature of the implications of analyzing dependent effect sizes (Cheung, 2014, 2019; Hedges et al., 2010; Scammacca et al., 2014). Of note, however, we found that the meta-analytic point estimates and standard errors of correlations from the multilevel model were almost identical to the univariate estimates reported in the body of this article (i.e., the majority were the same to two decimal places). This is consistent with the fact that although most samples in this meta-analysis contributed many correlations to the meta-analysis (e.g., a full set of correlations between the Big Five and intelligence), each meta-analytic estimate (e.g., openness and intelligence) analyzes a set of correlations, where each correlation comes from a different sample. Accordingly, modeling the dependency is most relevant when seeking to compare correlations to one another.

Supplemental analyses examining quadratic relationships between personality and intelligence (Ackerman, 2018; Austin et al., 1997, 2002; Eysenck & White, 1964; Major et al., 2014) and the correlation between intelligence and the general factor of personality (Dunkel, 2013; Dunkel et al., 2014; Irwing et al., 2012; MacCann et al., 2017; Schermer & Vernon, 2010) were also conducted and are presented in the online Supplemental Material. In summary, we found minimal evidence of quadratic relationships, and that the correlation between intelligence and the general factor of personality was r = .06 (95% CI [.04, .08], k = 76, n = 55,169).

Meta-analytic correlation matrices between personality, intelligence (general, crystallized, and fluid), and sex are also presented in the online Supplemental Material for the Big Five and separately for the NEO, BFAS, BFI-2, and HEXACO. Given the large number of complete facet and domain-level correlation matrices, these meta-analytic correlation matrices may be useful for researchers seeking to understand domain- and facet-level correlations of popular measures. Of interest, mean correlations between facets within a given domain were $r = .40$ (NEO), $r = .46$ (BFAS), $r = .57$ (BFI-2), and $r = .40$ (HEXACO). Mean within-domain facet-level intercorrelations for neuroticism, extraversion, openness, agreeableness, and conscientiousness, respectively, were as follows: .50, .37, .30, .35, .51 (NEO); .60, .46, .34, .45, .44 (BFAS); and .67, .52, .51, .54, .61 (BFI-2). Although there is variation across measures, there was a trend by which openness facets had weaker facet intercorrelations and neuroticism had larger facet intercorrelations. Mean facet intercorrelations for HEXACO were .35 (honesty–humility), .34 (emotionality), .47 (extraversion), .44 (agreeableness), .39 (conscientiousness), .40 (openness).

Results

Study Characteristics

Details for each included study are tabled in the online Supplemental Material (sorted by author and personality measure); additional study details are provided in the OSF repository. Table 1 presents a summary of study characteristics. Understandably, given its long history, the most commonly used personality measure was the NEO, followed by the HEXACO, BFAS, and the recently developed BFI-2. Overall, the number of relevant studies grew dramatically in recent years with only 15 articles pre-2000, and more than half the included studies published since 2010. The mean and standard deviation of the age of samples are consistent with the most common sample types: high school students, university students, workers, job applicants, targeted older adult samples, paid online panels, and community samples. In general, only a small number of studies showed standard deviations for age greater than 10 years, which would be consistent with the standard deviation of the adult population in most developed countries. The sex composition of the studies included a relatively even mix of balanced (defined as 40%–59% female), male-majority, and female-majority samples. Contrary to our expectations, females were not more likely to be research participants. While there were fewer male-majority studies than female-majority studies, the male-majority studies tended to have larger sample sizes than the female-majority studies. In particular, small-scale studies of psychology students generally had female-majority samples, whereas large-sample studies were more likely to have either balanced samples (e.g., large well-funded studies seeking representative samples or workers in gender-balanced occupations) or male-majority samples (e.g., workers in traditionally male-majority domains including management and the military).

Table 1
Combined Sample Size and Number of Studies by Study Characteristic

Category	*n*	*k*
Entire sample	162,636	272
Personality framework		
NEO	121,289	217
BFAS	6,683	23
BFI-2	1,848	6
HEXACO	32,816	26
Publication year		
Pre-2000	3,389	15
2000–2004	8,552	25
2005–2009	22,553	48
2010–2014	35,885	76
2015–April 2021	92,257	108
Sample size		
Under 100	2,605	37
100–199	12,884	87
200–299	11,026	46
300–499	17,452	44
500–999	23,617	35
1,000 or more	95,052	23
Percentage female		
0%–19%	30,565	23
20%–39%	26,576	31
40%–59%	71,466	99
60%–79%	25,047	84
80%–100%	4,170	19
Mean age of sample		
Under 18	28,289	41
18–29	47,131	138
30–59	71,678	56
60 or over	3,380	8
SD age of sample		
Under 2.0	39,654	77
2.0–4.9	16,981	70
5.0–9.9	27,048	41
10 or more	38,044	27
Data type		
Pairwise correlations	27,392	46
Correlation matrix	79,294	145
Mixed	210	2
Data	55,740	79
Verbal/fluid intelligence		
Not available	100,719	189
Available	61,917	83

Note. Mixed data type involved correlation matrices for domains and pairwise correlations for facets. Some samples did not provide age or sex information. BFAS = Big Five Aspect Scales; BFI-2 = Big Five Inventory–2.

Personality and Intelligence Correlations

Various meta-analytic correlations were estimated to assess the relationship between personality traits and intelligence (Research Question 1). Observed correlations are presented in the article and reliability-corrected correlations are presented in the online Supplemental Material. Big Five correlations are presented in Table 2 with the Big Five analysis being based on correlations from all three eligible Big Five measures (i.e., NEO, BFAS, and BFI-2). Domain and facet-level correlations are presented for each measure in Table 3 (NEO), Table 4 (BFAS), Table 5 (BFI-2), and Table 6 (HEXACO). Meta-analytic correlations between personality items and intelligence are presented in the online Supplemental Material for the NEO-PI-R 240, BFAS 100, BFI-2 60, and HEXACO 200 items. Finally, Table 7 reports the meta-analytic correlations between Big Five domains and NEO facets with measures of crystallized (*Gc*) and fluid (*Gf*) intelligence (see online Supplemental Material for BFAS and HEXACO). Because all of the relevant studies included measures of both *Gf*

Table 2
Meta-Analytic Correlations Between Big Five Personality and General Intelligence

Trait	k	N	$\bar{r}$	(SE)	95% CI LL	95% CI UL	$\tau_{\bar{r}}$	(SE)	Q	I^2
Neuroticism	203	116,515	−.08**	(.007)	−.09	−.06	.08	(.031)	843.11**	78.15
Extraversion	198	110,673	−.01*	(.006)	−.03	.00	.06	(.027)	622.43**	68.97
Openness	209	112,737	.17**	(.008)	.15	.18	.10	(.038)	1366.74**	85.73
Agreeableness	196	109,984	.00	(.007)	−.01	.02	.08	(.032)	738.92**	77.87
Conscientiousness	214	120,885	−.02*	(.007)	−.03	.00	.08	(.031)	854.10**	77.15

Note. Includes studies measuring the Big Five with NEO, BFAS, and BFI-2. k is the number of studies. $\bar{r}$ is mean observed correlation estimated from random-effects model and inverse-variance weighting. $\tau_{\bar{r}}$ is the estimated standard deviations of true correlations. Significance tests of pairwise differences between correlations and reliability-corrected correlations are presented in the online Supplemental Material. BFAS = Big Five Aspect Scales; BFI-2 = Big Five Inventory–2; CI = confidence interval; UL = upper limit; LL = lower limit.
* $p < .05$. ** $p < .001$.

and *Gc*, we were also able to perform a meta-analysis of the difference between trait–*Gf* and trait–*Gc* correlations (*Gc* − *Gf*). Standard errors for the difference between these dependent correlations in each study were obtained using a modified version of the *paired.r* function in the *psych* package (Revelle, 2017). Calculating standard errors for the difference between dependent correlations requires knowing the correlation between the common variables (i.e., *Gf* − *Gc*); we used study-level correlations between *Gf* and *Gc*

Table 3
Meta-Analytic Correlations of Domains and Facets of NEO Personality With General Intelligence

Trait	k	N	$\bar{r}$	(SE)	95% CI LL	95% CI UL	$\tau_{\bar{r}}$	(SE)	Q	I^2
NEO domains										
Neuroticism	186	110,579	**−.08*** **	(.007)	−.09	−.06	.08	(.033)	827.51***	80.26
Extraversion	181	104,737	−.01	(.006)	−.03	.00	.06	(.028)	589.28***	70.20
Openness	188	106,052	**.17*** **	(.008)	.15	.18	.10	(.039)	1271.90***	86.41
Agreeableness	179	104,048	.00	(.007)	−.01	.02	.08	(.033)	679.70***	77.87
Conscientiousness	197	114,949	−.02	(.007)	−.03	.00	.08	(.032)	827.68***	77.15
NEO facets										
N1. Anxiety	28	30,026	**−.09*** **	(.015)	−.12	−.06	.06	(.041)	101.29***	74.89
N2. Angry hostility	28	30,026	−.06***	(.012)	−.08	−.04	.03	(.029)	46.97**	49.12
N3. Depression	29	30,192	−.06**	(.019)	−.10	−.02	.09	(.053)	132.00***	85.81
N4. Self-consciousness	28	30,026	−.03	(.017)	−.06	.01	.07	(.044)	91.78***	78.45
N5. Impulsiveness	31	31,308	−.02	(.014)	−.05	.01	.06	(.039)	112.30***	72.10
N6. Vulnerability	29	30,192	−.06**	(.020)	−.10	−.02	.09	(.055)	179.55***	87.09
E1. Warmth	28	30,779	−.05***	(.012)	−.07	−.02	.04	(.032)	47.95**	58.09
E2. Gregariousness	28	30,779	**−.08*** **	(.012)	−.10	−.06	.04	(.032)	77.20***	58.60
E3. Assertiveness	29	30,945	.04**	(.016)	.01	.07	.07	(.044)	121.28***	79.07
E4. Activity	28	30,779	.00	(.012)	−.02	.03	.04	(.032)	58.67***	59.47
E5. Excitement seeking	29	31,260	−.01	(.017)	−.04	.03	.07	(.046)	122.44***	81.80
E6. Positive emotions	28	30,779	.01	(.014)	−.02	.03	.05	(.037)	73.32***	70.32
O1. Fantasy	35	32,731	**.13*** **	(.015)	.10	.16	.06	(.041)	120.47***	75.61
O2. Aesthetics	35	32,731	.06***	(.016)	.03	.09	.07	(.044)	159.43***	78.79
O3. Feelings	35	32,731	.06***	(.016)	.03	.09	.07	(.046)	123.05***	80.83
O4. Actions	35	32,731	**.07*** **	(.013)	.05	.10	.05	(.035)	65.65***	65.17
O5. Ideas	36	33,135	**.25*** **	(.015)	.22	.28	.07	(.044)	180.90***	81.45
O6. Values	35	32,731	**.16*** **	(.018)	.13	.20	.08	(.050)	211.66***	84.74
A1. Trust	26	28,635	.04***	(.006)	.02	.05	.00	(.012)	26.40	0.42
A2. Straightforwardness	26	28,635	−.01	(.016)	−.04	.02	.06	(.042)	67.47***	74.31
A3. Altruism	26	28,635	**−.07*** **	(.013)	−.09	−.04	.04	(.032)	46.52**	55.32
A4. Compliance	26	28,635	.00	(.010)	−.02	.02	.02	(.023)	35.49	29.56
A5. Modesty	26	28,635	**−.08*** **	(.015)	−.10	−.05	.05	(.038)	62.87***	67.92
A6. Tender-mindedness	26	28,635	−.05***	(.013)	−.08	−.03	.04	(.033)	46.68**	58.23
C1. Competence	30	32,006	.05**	(.017)	.01	.08	.08	(.048)	146.31***	83.14
C2. Order	30	32,006	−.04*	(.018)	−.08	−.01	.08	(.048)	118.81***	83.57
C3. Dutifulness	30	32,006	−.01	(.013)	−.04	.01	.05	(.035)	69.36***	65.17
C4. Achievement striving	31	32,172	−.02	(.014)	−.05	.01	.06	(.039)	98.25***	72.51
C5. Self-discipline	33	34,262	−.04*	(.015)	−.07	−.01	.06	(.042)	108.76***	78.60
C6. Deliberation	31	32,487	−.01	(.015)	−.04	.02	.06	(.042)	100.13***	77.00

Note. Absolute correlations greater than or equal to .07 are bolded. CI = confidence interval; UL = upper limit; LL = lower limit.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 4
Meta-Analytic Correlations of Domains and Aspects of Big Five Aspect Scales (BFAS) Personality With General Intelligence

Trait	*k*	*N*	$\bar{r}$	(*SE*)	95% CI *LL*	95% CI *UL*	$\tau_{\bar{r}}$	(*SE*)	*Q*	I^2
BFAS domains										
Neuroticism	13	4,459	**−.07*****	(.015)	−.10	−.04	.00	(.032)	10.93	0.02
Extraversion	13	4,459	−.03	(.025)	−.08	.02	.07	(.057)	30.79**	60.91
Openness	16	4,994	**.25*****	(.024)	.20	.30	.07	(.057)	43.71***	65.21
Agreeableness	13	4,459	.06**	(.024)	.02	.11	.06	(.055)	27.24**	57.21
Conscientiousness	13	4,459	−.06**	(.019)	−.10	−.02	.04	(.043)	16.41	33.57
BFAS aspects										
N1. Volatility	10	3,044	**−.09****	(.033)	−.16	−.03	.08	(.072)	23.37**	67.13
N2. Withdrawal	10	3,044	−.04	(.024)	−.08	.01	.04	(.051)	14.16	36.2
E1. Enthusiasm	10	3,044	−.02	(.031)	−.08	.04	.07	(.066)	23.57**	59.98
E2. Assertiveness	10	3,044	−.01	(.027)	−.06	.05	.06	(.059)	17.84*	50.12
O1. Intellect	20	5,311	**.26*****	(.027)	.21	.32	.11	(.070)	82.27***	77.54
O2. Openness to experience	19	5,070	**.13*****	(.021)	.09	.17	.06	(.052)	38.05**	52.59
A1. Compassion	10	3,044	**.10****	(.038)	.03	.18	.10	(.082)	38.66***	75.29
A2. Politeness	10	3,044	.03	(.026)	−.02	.08	.05	(.055)	15.43	43.8
C1. Industriousness	10	3,044	−.06*	(.027)	−.12	−.01	.06	(.057)	16.41	47.35
C2. Orderliness	10	3,044	**−.07****	(.022)	−.11	−.03	.03	(.045)	10.84	22.84

Note. Absolute correlations greater than or equal to .07 are bolded. The canonical variable name for BFAS Openness is "Openness/Intellect." CI = confidence interval; UL = upper limit; LL = lower limit.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

where available or not available, we used the average correlation observed across the studies (i.e., $r = .41$).

Consistent with the meta-analyses of Judge et al. (2007) and Stanek (2014), openness was the strongest Big Five correlate of intelligence, and neuroticism was the only other notable Big Five correlate. Our results in combination with those of Stanek (2014) also suggest that the typical empirically obtained relationship between openness and intelligence is closer to .20 than .30. While Ackerman and Heggestad (1997) obtained a reliability-corrected correlation of .33, this result was based on only three studies, whereas our meta-analysis (ρ = 20) and that of Stanek (2014; ρ = .23) were each based on over 200 studies. Finally, the standard

Table 5
Meta-Analytic Correlations of Domains and Facets of BFI-2 Personality With General Intelligence

Trait	*k*	*N*	$\bar{r}$	(*SE*)	95% CI *LL*	95% CI *UL*	$\tau_{\bar{r}}$	(*SE*)	*Q*	I^2
BFI-2 domains										
Neuroticism	4	1,477	**−.09*****	(.026)	−.14	−.04	.00	(.047)	3.38	0.14
Extraversion	4	1,477	−.05	(.026)	−.10	.00	.00	(.047)	1.74	0.01
Openness	5	1,691	**.17*****	(.030)	.11	.23	.04	(.056)	6.38	36.35
Agreeableness	4	1,477	.03	(.045)	−.06	.11	.07	(.082)	9.64*	66.96
Conscientiousness	4	1,477	−.03	(.035)	−.10	.03	.05	(.063)	5.35	44.79
BFI-2 facets										
N1. Anxiety	4	1,477	**−.08**	(.055)	−.18	.03	.10	(.099)	13.45**	77.83
N2. Depression	4	1,477	−.06*	(.026)	−.11	−.01	.00	(.047)	3.14	0.04
N3. Emotional volatility	4	1,477	**−.10*****	(.026)	−.15	−.05	.00	(.047)	1.54	0.05
E1. Sociability	4	1,477	**−.08****	(.026)	−.13	−.03	.00	(.047)	1.08	0.05
E2. Assertiveness	4	1,477	.01	(.033)	−.05	.08	.04	(.060)	4.84	37.52
E3. Energy level	4	1,477	−.04	(.031)	−.10	.02	.03	(.056)	4.00	28.07
O1. Intellectual curiosity	5	1,634	**.21*****	(.030)	.15	.27	.04	(.057)	5.95	37.6
O2. Aesthetic sensitivity	5	1,634	**.12*****	(.028)	.07	.17	.03	(.052)	4.77	20.34
O3. Creative imagination	5	1,634	**.14*****	(.024)	.09	.19	.00	(.045)	1.50	0.02
A1. Compassion	4	1,477	.01	(.051)	−.09	.11	.09	(.092)	12.47**	73.96
A2. Respectfulness	4	1,477	.04	(.051)	−.06	.14	.09	(.092)	12.23**	73.88
A3. Trust	4	1,477	.02	(.026)	−.03	.07	.00	(.047)	2.16	0.08
C1. Organization	4	1,477	**−.07**	(.052)	−.17	.04	.09	(.095)	13.18**	75.59
C2. Productiveness	4	1,477	−.06*	(.026)	−.11	−.01	.00	(.047)	2.61	0.02
C3. Responsibility	4	1,477	.05*	(.026)	.00	.10	.00	(.047)	0.05	0.08

Note. Absolute correlations greater than or equal to .07 are bolded. The canonical variable name for BFI-2 neuroticism is "negative emotionality" and for openness is "open-mindedness." BFI-2 = Big Five Inventory-2; CI = confidence interval; UL = upper limit; LL = lower limit.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 6
Meta-Analytic Correlations Between HEXACO Personality and General Intelligence

					95% CI					
Trait	*k*	*N*	$\bar{r}$	(*SE*)	*LL*	*UL*	$\tau_{\bar{r}}$	(*SE*)	*Q*	I^2
HEXACO domains										
Honesty–humility	23	32,165	.02	(.014)	−.01	.04	.04	(.036)	42.09**	59.56
Emotionality	20	31,677	**−.07******	(.006)	−.08	−.06	.00	(.012)	24.80	0.04
Extraversion	21	31,894	−.02	(.016)	−.05	.01	.05	(.039)	52.31***	67.69
Agreeableness	20	31,677	.00	(.015)	−.03	.03	.04	(.037)	73.68***	64.48
Conscientiousness	21	31,894	.00	(.013)	−.02	.03	.03	(.031)	47.94***	49.00
Openness	22	32,180	**.10******	(.016)	.07	.14	.05	(.041)	58.28***	71.72
HEXACO facets										
H1. Sincerity	12	29,846	.00	(.015)	−.03	.03	.03	(.031)	21.61*	56.11
H2. Fairness	12	29,846	.01	(.011)	−.01	.03	.02	(.022)	19.59	29.13
H3. Greed avoidance	12	29,846	.06**	(.018)	.02	.09	.04	(.038)	31.55***	70.61
H4. Modesty	12	29,846	.01	(.020)	−.03	.05	.05	(.045)	28.60**	79.08
E1. Fearfulness	11	29,659	**−.09******	(.020)	−.13	−.05	.05	(.042)	50.28***	77.32
E2. Anxiety	11	29,659	−.06***	(.006)	−.07	−.05	.00	(.013)	3.11	0.43
E3. Dependence	11	29,659	−.05*	(.022)	−.10	−.01	.06	(.047)	46.44***	81.82
E4. Sentimentality	11	29,659	−.04**	(.015)	−.07	−.01	.03	(.031)	22.43*	58.05
X1. Social self-esteem	11	29,659	.03*	(.015)	.00	.06	.03	(.031)	18.43*	58.13
X2. Social boldness	11	29,659	.02	(.020)	−.02	.06	.05	(.043)	55.59***	78.18
X3. Sociability	11	29,659	−.06**	(.020)	−.10	−.03	.05	(.042)	35.69***	76.86
X4. Liveliness	11	29,659	−.02**	(.006)	−.03	−.01	.00	(.013)	12.57	0.14
A1. Forgiveness	11	29,659	.01	(.016)	−.02	.04	.04	(.034)	30.88***	63.45
A2. Gentleness	11	29,659	−.01	(.021)	−.06	.03	.05	(.046)	112.74***	81.13
A3. Flexibility	11	29,659	−.05***	(.012)	−.07	−.02	.02	(.024)	15.08	36.34
A4. Patience	11	29,659	.06***	(.016)	.03	.10	.04	(.034)	31.11***	64.71
C1. Organization	11	29,659	**−.07******	(.019)	−.11	−.03	.05	(.041)	54.12***	76.34
C2. Diligence	11	29,659	.02**	(.008)	.01	.04	.01	(.016)	9.12	10.45
C3. Perfectionism	11	29,659	.04	(.022)	−.01	.08	.06	(.046)	49.50***	81.36
C4. Prudence	11	29,659	.05**	(.020)	.02	.09	.05	(.042)	45.42***	76.85
O1. Aesthetic appreciation	11	29,659	.01	(.024)	−.04	.06	.07	(.053)	51.66***	85.84
O2. Inquisitiveness	11	29,659	**.14******	(.017)	.10	.17	.04	(.035)	39.03***	68.07
O3. Creativity	13	29,910	.04***	(.006)	.02	.05	.00	(.013)	15.32	0.15
O4. Unconventionality	11	29,659	**.11******	(.020)	.07	.15	.05	(.042)	48.20***	77.69
I. Altruism	11	29,659	−.01*	(.006)	−.02	.00	.00	(.013)	7.06	0.30
I. Proactive	3	1,873	−.05	(.041)	−.13	.03	.05	(.073)	4.48	54.60

Note. Absolute correlations greater than or equal to .07 are bolded. CI = confidence interval; UL = upper limit; LL = lower limit.
* $p < .05$. ** $p < .01$. *** $p < .001$.

deviations of the correlations between personality and intelligence were moderate (e.g., .10 for openness) and consistent with the presence of study-level moderators.

In examining the facet-level correlations in Tables 4–7, there was clear evidence that they varied substantially within domains and often varied across crystallized and fluid intelligence (Table 7). These patterns are described below with emphasis on the NEO facets given that this measure contributed the largest number of studies.

Openness

Consistent with the close connection between intellectual interests and intellectual ability, the openness facets with the largest correlations concerned intellectual interests (i.e., openness to ideas, intellectual curiosity, inquisitiveness) and self-rated intellect (i.e., BFAS Intellect). The second strongest correlate related to having liberal and unconventional views (i.e., NEO openness to values and HEXACO unconventionality). In contrast, facets relating to openness to feelings and aesthetics still correlated positively with intelligence, but the relationships were weaker. Although openness correlated significantly more strongly with crystallized intelligence than it did with fluid intelligence, the differential pattern varied considerably across the facets of openness. Consistent with crystallized intelligence being related to artistic and literary interests, openness to feelings, values, and aesthetics all correlated more strongly with crystallized intelligence than with fluid intelligence. Contrary to predictions implied by investment theories of intelligence, openness to ideas (i.e., having intellectual interests) correlated similarly with crystallized and fluid intelligence.

Neuroticism

For the neuroticism domain, facets of anxiety, angry/hostility, depression, and vulnerability showed stronger negative correlations with intelligence than did self-consciousness and impulsiveness. Although HEXACO emotionality differs from Big Five neuroticism, the two facets most similar to Big Five neuroticism—fearfulness and anxiety—correlated more strongly (and negatively) with intelligence than the other two emotionality facets. In contrast to openness, neuroticism correlated slightly more strongly with fluid than it did with crystallized intelligence, although the difference was not statistically significant.

Table 7
Meta-Analytic Correlations of Big Five Personality (NEO, BFAS, BFI-2) With Crystallized and Fluid Intelligence

			Crystallized			Fluid			Difference		
Trait	k	N	$\bar{r}$	SE	$\tau_{\bar{r}}$	$\bar{r}$	SE	$\tau_{\bar{r}}$	$\overline{\Delta r}$	SE	$\tau_{\Delta\bar{r}}$
Big Five											
Neuroticism	62	35,790	−.075***	(.014)	.087	−.102***	(.014)	.084	.021	(.011)	.054
Extraversion	64	36,884	−.041***	(.011)	.062	.008	(.010)	.054	−.045***	(.009)	.041
Openness	69	36,833	.247***	(.014)	.093	.170***	(.013)	.088	.079***	(.012)	.069
Agreeableness	62	35,790	.024	(.014)	.087	.037**	(.012)	.068	−.012	(.011)	.051
Conscientiousness	62	35,790	−.019	(.010)	.051	−.008	(.012)	.073	−.014	(.011)	.054
NEO facets											
N1. Anxiety	12	14,648	−.060*	(.026)	.076	−.086***	(.024)	.068	.026	(.027)	.074
N2. Angry hostility	12	14,648	−.041	(.026)	.073	−.065**	(.020)	.048	.022	(.027)	.075
N3. Depression	12	14,648	−.029	(.038)	.118	−.075*	(.031)	.092	.040	(.031)	.090
N4. Self-consciousness	12	14,648	−.008	(.031)	.095	−.036	(.020)	.048	.023	(.024)	.064
N5. Impulsiveness	13	15,129	−.019	(.023)	.066	−.034	(.021)	.059	.009	(.017)	.037
N6. Vulnerability	12	14,648	−.054*	(.026)	.075	−.070**	(.022)	.060	.015	(.027)	.075
E1. Warmth	13	15,421	−.034	(.019)	.048	−.026*	(.010)	.011	−.017	(.015)	.028
E2. Gregariousness	13	15,421	−.114***	(.012)	.018	−.063***	(.016)	.035	−.047***	(.013)	.020
E3. Assertiveness	13	15,421	.048	(.028)	.087	.034	(.018)	.046	.012	(.022)	.060
E4. Activity	13	15,421	.011	(.020)	.055	.010	(.017)	.040	−.002	(.017)	.039
E5. Excitement seeking	14	15,902	−.103***	(.022)	.068	.020	(.021)	.063	−.120***	(.029)	.093
E6. Positive emotions	13	15,421	−.014	(.017)	.041	.019	(.013)	.024	−.034	(.019)	.047
O1. Fantasy	19	14,715	.143***	(.023)	.076	.136***	(.020)	.061	.019	(.017)	.039
O2. Aesthetics	19	14,715	.116***	(.020)	.062	.063**	(.021)	.064	.047***	(.009)	.001
O3. Feelings	19	14,715	.096***	(.027)	.095	.026	(.020)	.060	.074***	(.012)	.016
O4. Actions	19	14,715	.076***	(.016)	.037	.096***	(.019)	.053	−.012	(.018)	.043
O5. Ideas	20	15,119	.271***	(.029)	.113	.253***	(.020)	.069	.018	(.027)	.100
O6. Values	19	14,715	.223***	(.030)	.111	.153***	(.024)	.083	.069**	(.025)	.085
A1. Trust	11	13,277	.024	(.022)	.053	.028*	(.013)	.015	−.012	(.026)	.066
A2. Straightforwardness	11	13,277	.021	(.032)	.091	.009	(.020)	.046	.011	(.032)	.088
A3. Altruism	11	13,277	−.078***	(.024)	.058	−.027	(.014)	.020	−.043*	(.022)	.048
A4. Compliance	11	13,277	−.035	(.018)	.037	.023	(.024)	.058	−.059*	(.029)	.075
A5. Modesty	11	13,277	−.038	(.030)	.085	−.052**	(.019)	.040	.005	(.023)	.054
A6. Tender-mindedness	11	13,277	−.032	(.021)	.049	−.041***	(.012)	.012	−.005	(.016)	.024
C1. Competence	12	13,823	.082**	(.030)	.088	.059***	(.016)	.033	.026	(.018)	.039
C2. Order	12	13,823	−.029	(.024)	.066	−.016	(.021)	.052	−.013	(.026)	.072
C3. Dutifulness	12	13,823	.019	(.022)	.055	.008	(.018)	.038	.013	(.016)	.027
C4. Achievement striving	12	13,823	−.004	(.022)	.059	−.020	(.016)	.030	.013	(.019)	.039
C5. Self-discipline	15	16,079	−.021	(.021)	.063	−.025	(.017)	.044	.003	(.018)	.046
C6. Deliberation	13	14,304	.004	(.021)	.056	.023	(.019)	.049	−.019*	(.009)	.002

Note. All studies included in this analysis included measures of both crystallized and fluid intelligence. Comparisons of remaining scales are presented in online Supplemental Material. $\Delta\bar{r}$ represents crystallized correlation minus fluid correlation. Meta-analyses of the difference in correlation were based directly on study-level differences and thus differ slightly from the difference between the difference between meta-analyses of crystallized and fluid intelligence. BFAS = Big Five Aspect Scales; BFI-2 = Big Five Inventory–2.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Conscientiousness

In the conscientiousness domain, a desire for organization (i.e., order, routine, structure) showed a consistent negative correlation with intelligence across measures. In contrast, the associations of intelligence with most other conscientiousness facets were close to zero. The small positive correlation for the competence facet of the NEO is consistent with some of the items reflecting self-rated achievement in domains of life that correlate with intelligence.

Extraversion

For extraversion, gregariousness and warmth exhibited negative correlations with intelligence, whereas assertiveness had positive correlations and the other facets had correlations close to zero. Extraversion showed a small negative correlation with crystallized intelligence but a correlation close to zero with fluid intelligence. This overall pattern was largely driven by the extraversion facet of excitement seeking and to a lesser extent gregariousness. That is, crystallized intelligence is related to being less sociable and engaging in fewer activities characterized by sensation seeking and risk taking.

Agreeableness/Honesty–Humility

Facet-level correlations for agreeableness were generally small and less consistent across measures. For NEO agreeableness, altruism, modesty, and tender-mindedness each showed small negative correlations with intelligence, whereas the remaining agreeableness facets showed near-zero correlations. For HEXACO honesty–humility, correlations were very close to zero, with only greed avoidance showing a small positive association.

Item-Level Correlations

Item-level correlations, presented in a spreadsheet contained in the online Supplemental Material, generally reinforced the patterns observed at the facet-level but also highlighted a few subtle ways that items may infuse facet-level correlations. First, items that concerned abilities in other domains such as creativity, assertiveness, and competence in life often correlated positively with intelligence. Second, items related to cleaning and keeping things tidy were some of the stronger (and negative) correlations with intelligence. Third, neuroticism and related items concerned with an inability to maintain composure in stressful situations (e.g., easily stressed, overwhelmed, and fearful) showed stronger negative correlations with intelligence than those simply concerned with being tense, worried, or depressed.

In summary, in addressing Research Question 1, the results show that the relationship between personality and intelligence can be best understood at the facet level. Correlations at the facet-level varied in magnitude, suggesting that the strength of some of the personality–intelligence relationships could be masked by the more modest domain-level correlations. This result was replicated across each of the major personality frameworks—the NEO, BFAS, BFI-2, and HEXACO.

Age and Sex Differences in Personality and Intelligence

Research Question 2 sought to assess whether age and sex differences in both personality and intelligence might induce observed correlations between personality and intelligence. To examine this question, we first examined bivariate relationships of these demographic factors with personality and intelligence. We then examined whether partial correlations, controlling for age and sex, reduced or altered the correlations between personality and intelligence.

Graphs of the relationships between age, Big Five personality, intelligence, and crystallized and fluid intelligence are presented in the online Supplemental Material for samples with age standard deviations greater than 5 years using generalized additive models to capture nonlinear relations. They show the well-established pattern whereby fluid intelligence rises until the mid-20s and then declines, and crystallized intelligence rises over the course of adult life. As a result of these two countervailing trends, general intelligence was fairly stable until about age 50 after which it gradually declined as the decline in fluid intelligence became more rapid than the rise in crystallized intelligence. For Big Five personality, extraversion and neuroticism declined with age, agreeableness and conscientiousness increased with age, and openness rose until the mid-20s and then mostly declined.

A meta-analysis of sex differences in personality and intelligence is also presented in the online Supplemental Material. The analysis is based on the subset of sample that reported or enabled the extraction of sex differences. Sex differences in cognitive ability were small with males scoring slightly higher on general intelligence ($d = -0.19$; $k = 102$; $n = 82{,}437$, 95% CI [−0.23, −0.15]) and fluid intelligence ($d = -0.25$, $k = 32$, $n = 34{,}494$, 95% CI [−0.31, −0.19]). Differences for crystallized intelligence were nonsignificant ($d = -0.13$, $k = 32$, $n = 34{,}494$, 95% CI [−0.26, 0.01]). Standardized mean differences for the Big Five were all significantly higher for females ($p < .01$) $d = 0.28$ (neuroticism), $d = 0.13$ (extraversion), $d = 0.08$ (openness), $d = 0.32$ (agreeableness), and $d = 0.12$ (conscientiousness). A rich profile of facet-level differences is presented in the online Supplemental Material. Notably, given the current focus, males scored higher on intellect aspects of openness and females scored higher on aesthetic and emotional aspects of openness. Consistent with previous research (Lee & Ashton, 2020), the emotionality factor of the HEXACO model aligned more with sex differences than did Big Five neuroticism: $d = 0.31$ (honesty–humility), $d = 0.88$ (emotionality), $d = -0.05$ (extraversion), $d = 0.17$ (agreeableness), $d = 0.16$ (conscientiousness), and $d = -0.08$ (openness).

Consistent with general intelligence being fairly stable for much of adulthood, partial correlations between personality and general intelligence, covarying for age, did not materially change the observed correlations. A limitation to note with these analyses is that a majority of the studies in the meta-analysis (see Table 1) had age standard deviations insufficiently large to justify inclusion in this analysis. The partial correlation between Big Five personality and intelligence controlling for sex was changed by .012 for neuroticism (i.e., it was a less negative correlation with intelligence) and .022 larger for agreeableness (it was more positive). The difference between zero-order and partial correlations of other traits with intelligence was smaller than .01. Thus, sex differences appeared to explain, at most, only a small fraction of the obtained correlations.

Study-Level Moderators

Table 8 examines the effect of study-level moderators on the relationship between Big Five personality and intelligence (Research Question 3). First, consistent with the assumption that comprehensive measures of intelligence composed of a diverse array of subtests and typically administered in more controlled settings, the correlation between openness and intelligence was larger when measured using the WAIS. Second, the correlation between personality and intelligence was lower when assessment took place in high-stakes context (i.e., typically a job applicant setting). Third, given that BFAS openness was the only personality measure to include self-rated intelligence items, the correlation was, unsurprisingly, larger than for the other personality measures. Finally, in samples with a mean age over 60, the correlations for openness and neuroticism with intelligence were much stronger.

Study Bias Analysis

Overall, in approaching our research questions, we saw little reason to expect that publication bias would substantially influence the results of this meta-analysis. First, most studies in this meta-analysis were not focused on the relationship between personality and intelligence. Second, with the studies that were substantively focused on personality and intelligence, the studies' aims were diverse and were generally focused on interpreting the overall pattern of results; that is, it was not clear how the study's likelihood of publication would be contingent on a particular set of correlations being statistically significant. Given these baseline expectations, care is required when interpreting publication bias analyses. In particular, study sample size is related to methodologies which may moderate obtained correlations. Nonetheless, a publication bias analysis involving funnel plots and trim-and-fill analysis was performed. Contour-enhanced funnel plots of correlations between Big Five

Table 8
Meta-Analytic Correlations Between Big Five Personality and General Intelligence by Study Moderators

Moderator	Min k	Min n	Neuroticism		Extraversion		Openness		Agreeableness		Conscientiousness	
			$\bar{r}$	*SE*	$\bar{r}$	*SE*	$\bar{r}$	*SE*	$\bar{r}$	*SE*	$\bar{r}$	*SE*
Personality												
NEO	179	104,048	−.08***	(.008)	−.01	(.007)	.16***	(.009)	.00	(.008)	−.01	(.007)
BFAS	13	4,459	−.07***	(.015)	−.03	(.025)	.25***	(.024)	.06**	(.024)	−.06**	(.019)
BFI-2	4	1,477	−.09***	(.026)	−.05	(.026)	.17***	(.030)	.03	(.045)	−.03	(.035)
Intelligence												
Composite	55	29,110	−.09***	(.013)	−.01	(.010)	.19***	(.016)	.00	(.014)	−.02	(.012)
Wonderlic	26	4,450	−.06**	(.022)	.01	(.021)	.11***	(.023)	.00	(.019)	−.01	(.024)
WAIS	16	3,189	−.12***	(.032)	−.03	(.018)	.27***	(.020)	.12***	(.033)	.00	(.022)
Matrix	42	15,939	−.07***	(.015)	.02	(.013)	.13***	(.019)	.02	(.013)	.01	(.013)
Other	57	57,296	−.06***	(.012)	−.03**	(.012)	.16***	(.014)	−.02	(.013)	−.03*	(.013)
Stakes												
Low stakes	178	79,122	−.08***	(.008)	−.01	(.007)	.18***	(.009)	.01	(.008)	−.01	(.007)
High stakes	11	13,974	−.05	(.030)	−.01	(.025)	.06	(.034)	−.02	(.019)	.01	(.031)
Age mean												
Under 18	20	14,179	−.06**	(.022)	−.02	(.017)	.12***	(.026)	.02	(.023)	.03*	(.013)
18–59	146	81,621	−.07***	(.008)	−.02*	(.008)	.16***	(.010)	.00	(.008)	−.03***	(.008)
60 plus	5	2,556	−.24***	(.033)	.00	(.020)	.26***	(.018)	−.01	(.071)	.03	(.025)
Female %												
Under 25%	24	39,926	−.07***	(.019)	−.02	(.016)	.13***	(.025)	.02	(.020)	.00	(.022)
25%–75%	140	63,652	−.08***	(.009)	−.01	(.008)	.17***	(.010)	.01	(.009)	−.02*	(.008)
Over 75%	23	4,247	−.09***	(.020)	.00	(.019)	.16***	(.026)	−.02	(.019)	−.02	(.024)

Note. Number of studies and total sample size vary slightly across the Big Five. k and n reported in this table represent the minimum across the Big Five. More detailed reporting for each correlation is provided in the online Supplemental Material along with reporting of meta-regression models. BFAS = Big Five Aspect Scales; BFI-2 = Big Five Inventory–2.
* $p < .05$. ** $p < .01$. *** $p < .001$.

personality and intelligence are shown in Figure 2, and a complete trim-and-fill analysis (Duval & Tweedie, 2000) is presented in the online Supplemental Material. The funnel plots suggest that sample correlations are distributed close to symmetrically around the meta-analytic estimate. Consistent with the meta-analytic tau values and the moderator analyses, the funnel plots highlight how variance in sample correlations is caused by more than just sampling error. The trim-and-fill analysis suggests that observed estimates were not materially affected.

Domain, Facet, and Item-Level Overlap With Intelligence

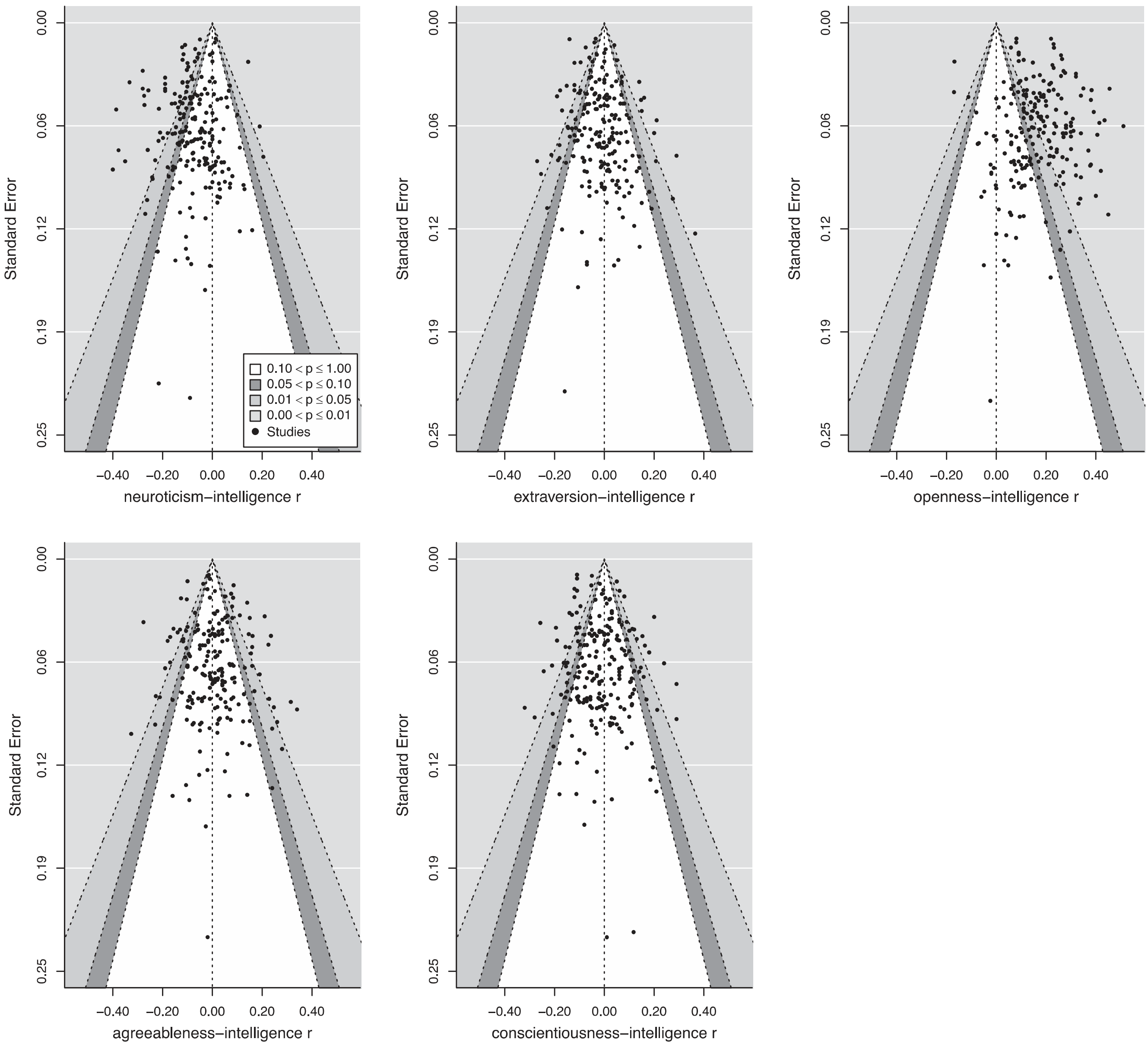
To assess the extent to which composite models of personality can predict intelligence and to assess the incremental prediction of personality facets over domains (Research Question 4), a meta-analysis of regression models was performed. Studies were included in this analysis if we had complete intercorrelation matrices for the relevant personality traits and intelligence (i.e., from the relevant article, provided by the author, or derived from data). Regression models were estimated separately for each study-level correlation matrix using *lavaan* (Rosseel, 2012). The sample size for each study is consistent with the values shown in Table 1. These were based on (a) the study reported sample size, (b) the smaller of the reported sample sizes where a study reported multiple sample sizes, or (c) the listwise-deleted sample size where the correlations were derived from data. Adjusted multiple R was obtained for each study-specific regression model, and it was used to capture the square root of variance explained in intelligence accounted for by domains, facets, and incrementally by facets over domains. For each study, the adjusted multiple R was calculated as the square root of adjusted R^2 or set to zero if adjusted R^2 was less than zero. Adjusted multiple R was used for meta-analytic synthesis as it allows for comparison with domain and facet-level correlations. The standard error of adjusted multiple R was estimated based on the study sample size. These study-level estimates of adjusted multiple R and their associated standard errors where then used to conduct a random-effects meta-analysis.

Table 9 presents meta-analytic estimates of adjusted multiple R for regression models predicting intelligence from domains and facets of personality. Overall, adjusted multiple R for the Big Five was .23, which is substantially more than the .17 obtained for Big Five openness alone. For all personality frameworks, facets provided substantially improved prediction of intelligence over domains. For instance, for the NEO framework, the adjusted multiple R was .40 (adjusted $R^2 = .16$) for facets and .22 (adjusted $R^2 = .05$) for domains, that is, approximately triple the variance explained. Incremental prediction of narrow traits over and above Big Five domains was slightly less for BFAS aspects and BFI-2 facets, but still large in absolute terms, especially considering the smaller number of narrow traits per domain (i.e., two aspects per domain for BFAS and three facets per domain for BFI-2), and that the BFAS has more intellect-related content in its openness domain scores.

To evaluate the capacity of item-level models to predict intelligence (Research Question 5), we turned to the four large-sample primary data sources that we had collected (i.e., industry, MOOC, student, and firefighter) as well as the Dutch sample from de Vries et al. (2021). In each data set, three regression models were estimated predicting intelligence from the following sets of predictors: (a) the

Figure 2

Contour-Enhanced Funnel Plots for Correlations Between Big Five and Intelligence



six HEXACO domains, (b) the 25 HEXACO facets, (c) the 100 items of the HEXACO-PI-R 100. For this analysis, domains and facets were scored using the 100 items from the HEXACO-PI-R 100, which were common to all five data sets. We note that the HEXACO was designed to exclude items measuring self-rated ability and thus avoids issues of criterion contamination. Models were compared on three indices. First, unbiased estimates of population-level prediction were obtained using adjusted multiple *R* to correct for the different number of predictors. Second, to assess within-sample model robustness, *k*-fold ($k = 10$) cross-validated multiple *R* was obtained. This approach involves dividing a sample into a training set (90% of cases) and a testing set (10%). A regression model is estimated with the training set. The regression weights from that "training set" model are used to predict intelligence scores in the testing set, and the correlation between predicted and actual intelligence scores (multiple *R*) is recorded. This process is completed 10 times, with different portions of the sample being allocated to the training and testing sets each time. Finally, the mean of the 10 observed multiple correlations, the "cross-validated *R*," was calculated. To assess the cross-sample generalizability, we assessed the ability of a regression model obtained from the largest sample (i.e., the Industry sample) to predict the other four samples. This was quantified as the correlation between the model-predicted and observed intelligence in these samples ("industry model *R*").

Table 9
Meta-Analytic Estimates of Adjusted Multiple R for Regression Models Predicting General Intelligence From Domains and Facets

Trait	*P*	*k*	*N*	$\bar{r}$	(*SE*)	95% CI *LL*	95% CI *UL*	$\tau_{\bar{r}}$	(*SE*)	*Q*	I^2
Big Five (NEO, BFI-2, BFAS)	5	162	86,786	.23**	(.009)	.21	.24	.10	(.04)	865.90**	84.49
NEO domains	5	149	82,375	.22**	(.010)	.20	.24	.10	(.04)	837.94**	85.68
NEO facets	30	23	18,131	.40**	(.023)	.35	.44	.10	(.06)	212.11**	87.77
BFAS domains	5	10	3,299	.26**	(.022)	.22	.30	.04	(.05)	17.33*	40.13
BFAS aspects	10	7	1,884	.36**	(.036)	.29	.44	.08	(.07)	16.15*	67.45
BFI-2 domains	5	3	1,112	.28**	(.032)	.22	.35	.03	(.06)	2.85	24.30
BFI-2 facets	15	3	1,112	.36**	(.036)	.29	.43	.04	(.06)	3.85	47.96
HEXACO domains	6	17	30,846	.14**	(.025)	.09	.19	.09	(.06)	104.62**	88.86
HEXACO facets	25	10	29,496	.28**	(.022)	.24	.32	.06	(.05)	76.85**	85.87

Note. P = number of predictors (e.g., 30 NEO facets) in the relevant model. Only studies with complete correlation matrices between personality traits and intelligence were included. Big Five combines all measures of Big Five domains. Analyses are a random-effects meta-analysis of adjusted multiple R of regression models predicting intelligence from relevant traits. "HEXACO facets" excludes the less commonly measured "proactive" facet. BFAS = Big Five Aspect Scales; BFI-2 = Big Five Inventory–2; CI = confidence interval; UL = upper limit; LL = lower limit.
* $p < .05$. ** $p < .001$.

Finally, we calculated sample-weighted averages for the estimates that were derived from each approach. The online Supplemental Material presents a corresponding set of analyses that also include the demographic variables of age and sex.

Results are shown in Table 10, and several observations can be made. First, items provided much greater prediction of intelligence than facets with sample-weighted average adjusted multiple R. Prediction increased from .17 (domains) to .32 (facets) to .44 (items). Second, consistent with what is expected given large sample sizes, same-sample cross-validated estimates of adjusted multiple R were only slightly lower than adjusted multiple R. Third, the pattern of improved prediction at facet and item levels persisted when the regression model from the industry sample was applied to the other four samples with *industry model R* of .06 (domains), .17 (facets), and .29 (items). Given the variation in measures of intelligence (ICAR vs. composite measure), sample type (age, gender balance, country), language (English and Dutch), and testing context (low-stakes vs. high-stakes), the ability of item-level models to predict well in different samples is particularly noteworthy. Finally, as shown in the online Supplemental Material, age and sex provided only modest prediction of intelligence and did not substantially alter the relative importance of domains, facets, and items.

Discussion

The present study provides the most extensive and nuanced meta-analytic investigation of the relationship between intelligence and personality to date. Several key findings emerged. First, at the domain-level, openness was the strongest positive correlate of intelligence, neuroticism was a modest negative correlate, and agreeableness, extraversion, conscientiousness, and honesty–humility were generally unrelated to intelligence. Second, facet-level correlations provided a richer picture of the links between personality and intelligence, clarifying the aspects of openness that were relatively strongly related (i.e., intellectual interests), moderately related (unconventionality, creativity), and less related to

Table 10
Predicting General Intelligence From Domains, Facets, and Items

Sample/predictors	*P*	Industry sample (n = 20,939)	MOOC sample (n = 4,286)	Firefighter sample (n = 941)	Student sample (n = 647)	Dutch sample (n = 1,330)	Weighted average All samples	Weighted average Validation samples
Adjusted multiple *R*								
Domains	6	.19	.11	.11	.24	.12	.17	.12
Facets	25	.33	.27	.20	.34	.26	.32	.27
Items	100	.45	.41	.34	.42	.38	.44	.40
Cross-validated *R*								
Domains	6	.19	.10	.08	.21	.09	.17	.10
Facets	25	.33	.26	.15	.30	.22	.31	.24
Items	100	.45	.38	.23	.31	.31	.42	.34
Industry model *R*								
Domains	6	—	.06	.10	.06	.01	—	.06
Facets	25	—	.21	.19	.19	.05	—	.17
Items	100	—	.34	.28	.22	.19	—	.29

Note. P = number of predictors. Adjusted multiple R is the square root of the adjusted R^2 of the model applied to the sample. Cross-validated R is the square root of the 10-fold cross-validated R^2 estimate. Industry model R is the correlation between observed intelligence in the sample and predicted intelligence obtained by applying the regression model developed from the industry sample to the corresponding sample. Domain, facet, and item predictors were the six domains, 25 facets, and 100 items from the HEXACO-PI-R. HEXACO-PI-R = HEXACO Personality Inventory–Revised; MOOC = massive open online course.

intelligence (openness to emotions and aesthetics). Third, although unrelated to intelligence at the domain-level, facet-level correlations with intelligence varied across extraversion (sociability negative; assertiveness positive) and conscientiousness (order negative; competence positive). Fourth, personality–intelligence correlations varied across measures of crystallized and fluid intelligence. Although openness correlated more with crystallized than fluid intelligence, neuroticism correlated similarly with both. At the facet level, sociability and excitement seeking had stronger negative correlations with crystallized than with fluid intelligence, and openness to aesthetics, feelings, and values had stronger positive correlations with crystallized than with fluid intelligence. Fifth, only a few sex differences partially aligned with the personality–intelligence associations, suggesting that overall age and sex are unlikely to be inducing the correlations between personality and intelligence. Sixth, across the personality frameworks we investigated, facets collectively explained more than double the variance in intelligence than did domains. Finally, item-level predictive models yielded considerably greater prediction of intelligence than facet-level models and much greater prediction than domain-level models.

Personality and Intelligence

The overall pattern of results suggests that, although correlations between self-report personality and objectively assessed intelligence are generally small, they are theoretically meaningful. This is particularly true given that observed correlations are likely to be substantially attenuated due to imperfections in self-rated assessments of personality and that typical intelligence assessment falls well short of gold standard assessments such as the WAIS. In particular, results highlight the fundamental importance of examining the relationship between personality and intelligence at the facet level. Indeed, important variation in facet-level correlations was obscured at the domain-level for extraversion, conscientiousness, and openness. Correlations also varied in theoretically meaningful ways across fluid and crystallized intelligence. Collectively, these results have a wide range of theoretical implications that highlight important avenues for future research.

Openness

Overall, the pattern of correlations of openness facets with intelligence supports a representation of openness as a spectrum where one pole is closely associated with intelligence and the other pole captures openness to experience (DeYoung et al., 2012) with mixed facets such as a preference for unconventional ideas and creativity in the middle. Interestingly, correlations between intelligence and intellectual interests (i.e., openness to ideas) were not that much smaller than those seen in a meta-analysis examining self-rated intelligence (Freund & Kasten, 2012). Thus, although the designers of the NEO and the HEXACO made an arguably sensible decision to exclude self-rated ability items from their measures, the empirical distinction between broad interests and aptitude may be more subtle (Silvia & Sanders, 2010). More generally, intelligence correlated progressively less with personality facets as the relevance of cognition to the facet declined. Consistent with research that finds that intelligence is negatively correlated with conservative values (Anglim et al., 2019; Onraet et al., 2015), intelligence was correlated fairly substantially with interest in unconventional people and ideas (unconventionality in HEXACO and openness to values in NEO). This suggests that relatively more intelligent people derive greater value from novel perspectives, whereas less intelligent people may prefer established ways of doing things. Finally, aesthetic and emotional openness had some of the weaker correlations with intelligence. Although intelligence might facilitate the intellectual appreciation of art, there may be a range of other social and cultural norms that influence such interests, and presumably many people enjoy art, nature, and music without necessarily intellectualizing the experience.

Of particular theoretical importance were the ways in which facets of openness differentially correlated with crystallized and fluid intelligence. It seems that the frequently discussed tendency for openness to correlate more with crystallized than fluid intelligence (DeYoung, 2020) is driven by openness to aesthetics, emotions, and values rather than the openness to ideas. The lack of an elevated correlation with openness to ideas partially conflicts with investment theories, given that openness to ideas represents intellectual engagement. An alternative interpretation is that openness facets represent a spectrum of interests from the more artistic and literary (i.e., openness to aesthetics, emotion, values) to the more logical, scientific, and quantitative (i.e., openness to ideas) and that these differences align with differences in the cognitive ability domain whereby crystallized intelligence reflects more verbal ability and fluid intelligence aligns more with mathematical and logical reasoning ability. Naturally, such an explanation could then be reconciled either with theories of domain-specific investment in learning or with theories that aptitude breeds interest.

Neuroticism

The other broad domain of personality that was clearly related to intelligence was (lower) neuroticism. Given the size of the correlation and that it is the only other meaningful Big Five correlate of intelligence (after openness), it is surprising that it has not received more theoretical attention. It may be that intelligence provides a cognitive resource that assists people in managing challenging external situations. Intelligence can also lead to greater access to opportunities to earn more money and other outcomes that reduce exposure to enduring threats (e.g., financial insecurity, homelessness, street crime; Cheung & Lucas, 2015). Equally, various health and cognitive disorders may simultaneously cause lower intelligence and increased neuroticism (Waggel et al., 2015). This is one possible explanation for the noticeably stronger negative relationship between neuroticism and intelligence among the samples of older adults, where there is likely to be more variance in health-related factors. By contrast, alternative causal explanations, based on testing anxiety (i.e., that neuroticism causes test anxiety, which causes underperformance on cognitive tests), seem unlikely given that the vast majority of research in this meta-analysis took place in low-stakes research contexts, and the correlations between neuroticism and intelligence were not larger in high-stakes settings.

Conscientiousness

Although intelligence and conscientiousness were unrelated at the domain level (cf. Rikoon et al., 2016), intelligence was associated with a lower preference for order, structure, and routine and a slightly greater sense of competence. Mostly, conscientiousness appears to be an independent factor that leads to greater performance in academic (Poropat, 2009) and work (Hurtz & Donovan, 2000) settings through the allocation of diligent effort. Importantly, given that conscientiousness is associated with applying effort in education, and education has a causal influence on intelligence (Ritchie & Tucker-Drob, 2018), the lack of a correlation between conscientiousness and intelligence is theoretically interesting. While investment theories of intelligence often emphasize the role of openness in promoting intellectual exploration and intellectual growth, conscientiousness should garner similar benefits if greater dedication to education and work lead to a subsequent increase in learning and intelligence. However, the absence of a correlation between conscientiousness and intelligence and lack of an elevated correlation with crystallized intelligence suggests that these effects may be too subtle to manifest in a correlation. Equally, the intellectual benefits of conscientiousness may be offset by compensatory processes (Ackerman & Rolfhus, 1999; DeYoung, 2020; Moutafi et al., 2006; Rammstedt et al., 2018). Specifically, conscientiousness is characterized by greater allocation of effort to tasks. On average, people who are less intelligent need to put in more time and effort to achieve comparable performance outcomes on novel and cognitively demanding tasks than those who are more intelligent.

Extraversion

Building on past work on extraversion (Wolf & Ackerman, 2005) and occupational interests (Pässler et al., 2015), the correlation between extraversion and intelligence was effectively zero, but the facet of sociability was a small negative correlate and assertiveness was a small positive correlate. Interestingly, the facet of sensation seeking and to a lesser extent sociability emerged as particularly strong negative correlates of crystallized intelligence. With regard to assertiveness, it may be that intelligence permits people to have more reasoned opinions and be more capable of presenting these arguments with confidence. The negative association with sociability may suggest that intelligent people have a slight tendency to adopt a more ideas-oriented rather than people-oriented lifestyle.

Agreeableness and Honesty–Humility

Both Big Five agreeableness and HEXACO's honesty–humility were unrelated to intelligence. Within the NEO, there were some small negative correlations for modesty, altruism, and tender-mindedness. Within the HEXACO model, greed avoidance and patience showed small positive correlations, but modesty and altruism were unrelated to intelligence. A close examination of the item-level correlations with intelligence from the two modesty scales suggests that although intelligent people are more likely to regard themselves as better than some others, this tendency does not extend to the more extreme forms of narcissism and arrogance. Thus, although the HEXACO and the NEO modesty scales both have many items indicative of socially undesirable narcissism that are mostly uncorrelated with intelligence, the NEO modesty scale has a few items that overlap with socially acceptable forms of self-belief that correlate positively with intelligence. This pattern of findings is consistent with meta-analytic correlations of intelligence with the dark triad, for which obtained correlations are close to zero (O'Boyle et al., 2013). Thus, overall, our results suggest that intelligence is relatively unrelated to whether someone is a kind and moral person.

Broader Theoretical Considerations

While acknowledging the limitations of cross-sectional data, it is intriguing to consider how many of the above findings can be interpreted through a lens of intelligence influencing personality traits. From this perspective, objective intelligence causes people to develop a self-concept as intelligent (i.e., BFAS Intellect). Intelligence involves a greater capacity to perform and benefit from cognitively demanding activities, which in turn enables people to enjoy relatively more intellectually demanding activities (i.e., openness to ideas, intellectual curiosity, inquisitiveness). Furthermore, differential aptitudes (e.g., crystallized vs. fluid) feed into different academic, life, and career interests. Intelligence also leads to a greater willingness to entertain novel and unconventional ideas and embrace change (i.e., openness to values, unconventionality) which again likely requires more cognitive resources than dealing with conventional ideas and people or people with similar values. On the conscientiousness facets front, the intelligence-as-cause perspective also implies that lower intelligence drives a relatively elevated desire for structure and routine as a means of managing the complexity of life, whereas higher intelligence leads people to seek out activities and occupations where their intellect can be applied to novel challenges (e.g., negative correlation with order). Explaining the near-zero correlation of intelligence with the conscientiousness domain, higher intelligence also allows people to achieve performance outcomes in some settings with relatively less effort, reducing a need for, or the benefit from, higher conscientiousness. Intelligence might also lead to cognitive confidence which in turn prompts relatively greater assertiveness and higher performance in work and academic settings, mapping on to general feelings of competence. Intelligence could also drive lower modesty among some people because its social and occupational consequences provide one small basis by which people might judge their relative self-worth. Intelligence also acts as a resource that helps people to manage daily life with less stress. And in more extreme cases, cognitive deficits associated with aging and brain injury can be a source of stress and anxiety (i.e., neuroticism).

Nonetheless, the associations observed in this meta-analysis could be explained by a range of mechanisms. Human agency is important in influencing life choice, and personality is an important factor in shaping human experience. Personality traits such as conscientiousness are meaningful correlates of academic performance (Poropat, 2009) and job performance (Hurtz & Donovan, 2000). Thus, although intelligence represents a general cognitive capacity that can be successfully applied toward academic and occupational success, these applications are nonetheless underpinned by sustained effort, which in turn is supported by interests and conscientiousness. Furthermore, generational changes in technology, nutrition, medicine, social structure, and education have led to changes in personality (Brandt et al., 2022) and the well-documented improvements in intelligence (Flynn, 2007; Trahan et al., 2014). Finally, a key contribution of PPIK theory (Ackerman & Kanfer, 2020) is that it focusses attention on how personality, intelligence, and interests contribute to the growth of knowledge, skills, and abilities throughout adulthood. Most of this intellectual growth reflects the development of domain-specific expertise that is not captured by typical measures of crystallized intelligence, which instead typically rely on assessing vocabulary and general knowledge.

Do Age and Sex Differences Explain Personality–Intelligence Associations?

It is interesting to consider how age-related developmental processes and the environmental and biological effects of sex influence the development of personality and intelligence—and potentially induce correlations between personality and intelligence. Regardless of whether their cause is biological or environmental, such processes also provide insights into topics including the diversity–validity trade-off in employee selection (Pyburn et al., 2008; Sackett et al., 2001), occupational segregation (McCabe et al., 2020), the gender pay gap (Joshi et al., 2015), and other gender differences such as the tendency for women to live longer (Marais et al., 2018) and men to commit more violent crimes (Heidensohn & Silvestri, 2012).

Because of its focus on the relations of personality and intelligence, a full systematic review of the literature on sex differences in general intelligence was out of scope for this research. Nonetheless, it remained possible to undertake a meta-analysis of sex differences as they were observed in the studies that were in scope for the systematic review we conducted. In that respect, based on studies of adult and older adolescent samples, we observed very small sex differences favoring males of $d = -.19$ in general intelligence. These sex differences showed the commonly observed pattern of males being relatively stronger in measures of fluid intelligence ($d = -.25$) than measures of crystallized intelligence ($d = -.13$, ns). However, there are several reasons to exercise caution in generalizing these results to the wider population. Component studies in the meta-analysis rarely sought to obtain nationally representative samples; in particular, research suggests that less intelligent males tend to be underrepresented in research samples (Dykiert et al., 2009). In addition, the composition of component tests used in the studies we examined will likely moderate the obtained estimates.

The examination of sex differences in personality broadly converged with other meta-analytic and large sample estimates (Ashton & Lee, 2016; Roberts & Yoon, 2022). Specifically, females were notably higher on neuroticism ($d = 0.28$) and agreeableness ($d = 0.32$), and HEXACO emotionality ($d = 0.88$). Sex differences also varied substantially across facets within the broad domains (e.g., females were relatively higher on anxiety and vulnerability facets of neuroticism; females were also higher on warmth, gregariousness, and positive emotions, but lower on excitement seeking facets of extraversion). Of particular relevance to the aims of the current article, males were higher on intellectual facets of openness and lower on aesthetic and emotional aspects of openness. These results may reflect a mixture of the general tendency for males to provide higher self-rated estimates of intelligence ($d = .37$ in a meta-analysis by Syzmanowicz & Furnham, 2011) and report greater interest in investigative vocational interests including science and mathematics (Su et al., 2009).

In general, data on age-related trends in this meta-analysis were not as comprehensive as that provided for sex differences because only a few studies provided a large age range from which to extract age-related trends in intelligence and personality. Nonetheless, the data—albeit cross-sectional—support the idea that adult development is characterized by rising crystallized intelligence, declining fluid intelligence, and maturation of personality (rising conscientiousness and agreeableness and falling neuroticism; Bleidorn, 2015; Roberts et al., 2008). Consistent with rising conservatism and consolidation of world views over time, openness also generally showed declines with age, albeit with some fluctuations. Overall, these analyses suggest that age and sex differences may explain, at best, only a small part of the observed correlations between personality traits and intelligence. Ultimately, sex differences explained only about one-fifth of the correlation between neuroticism and intelligence. Finally, the subset of studies that provided reasonable variation in age suggest that controlling for age in adulthood did not alter or explain the correlations between personality and intelligence. Overall, the results suggest that age and sex do not confound the observed associations between personality and intelligence; rather, the role of age and sex in adult development appears to be best described as driving individual differences in personality and cognitive abilities.

Study-Level Moderators

The research also revealed several study-level moderators. With regard to the measurement of general intelligence, the choice of measure mostly moderated the magnitude but not the pattern of the observed correlations of openness and neuroticism with intelligence. Studies that used the WAIS showed the strongest correlations, whereas the ICAR, Culture Fair, Wonderlic, and the Raven's showed weaker correlations. A common theme of measures showing stronger correlations was that they contained multiple discrete subtests that combined both verbal and nonverbal components. This is consistent with these measures being more *g*-loaded and having less test-specific variance and error variance.

Interestingly, the correlations between personality and intelligence were lower in high-stakes research contexts than in low-stakes contexts, although this pattern was not as clear for the HEXACO. Our analyses appear not to replicate the observation that high-stakes assessment contexts are associated with inflated correlations between intelligence and conscientiousness (Schilling et al., 2021). That pattern of inflated correlations is hypothesized to be caused by more intelligent people being better able to manage their impression on personality measures. We note, however, several possible reasons for why our results diverge from those of Schilling et al. (2021). First, Schilling et al. (2021) were focused specifically on personnel selection assessment settings. Second, their analysis included laboratory studies that often involve strong "fake-good" manipulations that tend to dramatically affect the structure of personality profiles (Schmit & Ryan, 1993). Third, Schilling et al. (2021) also included proxies of intelligence such as the SAT and ACT and had classified traits into the Big Five rather than selecting from a predefined set of measures. Interestingly, in our study, neuroticism did not correlate more with intelligence in high-stakes settings, as would be expected if test anxiety had a causal effect on test scores in high-stakes settings. This finding reinforces our expectation that the correlation between neuroticism and intelligence reflects a substantive relationship between latent constructs rather than simply an issue of measurement.

We also examined whether sample age and sex moderated personality–intelligence correlations. The correlations between personality and intelligence appeared to be amplified in samples of older adults (i.e., 60 or over), particularly for neuroticism. This may reflect age-related declines in cognitive ability co-occurring with elevated levels of neuroticism (Kliegel & Zimprich, 2005). In particular, a range of disorders associated with cognitive decline that are more prevalent in older ages such as Alzheimer's disease and stroke are associated with anxiety, depression, and cognitive decline (Wium-Andersen et al., 2020).

In contrast, there were no differences in correlations based on the gender composition of the sample. This lack of difference reinforces the general finding that the relationship between neuroticism and intelligence is only very slightly explained by gender differences in neuroticism. In particular, correlations did not appear to be attenuated in samples that were predominantly male or female. Instead, it suggests that the relationship between intelligence and neuroticism is substantive. It is consistent with the idea that intelligence may provide a resource for managing anxiety and fear for men and women alike.

Quantifying the Overlap Between Intelligence and Personality

Meta-analytic regression models predicting intelligence from personality highlighted how there is extensive overlap between personality and intelligence. In particular, facets afforded much greater prediction of intelligence than did domains. For instance, the meta-analytic multiple adjusted R for NEO domains increased from .22 to .40 or from 5% to 16% of variance explained. The scale of this incremental prediction by facets is also much larger than has been seen with other psychological criteria such as well-being (Anglim, Horwood, et al., 2020), workplace deviance (Pletzer et al., 2020), trait emotional intelligence (Anglim, Morse, et al., 2020), and personal values (Anglim et al., 2017). The present finding is more akin to sex differences in personality which are moderate at the domain level, but are quite substantial when taking composites of personality facets (e.g., Costa et al., 2001; Lee & Ashton, 2020).

There are several reasons why facets may provide such substantial prediction of intelligence. First, whereas many other outcomes mentioned are often measured via self-report and have close conceptual alignment with personality traits (i.e., well-being, personal values, trait emotional intelligence) or can be understood as domain-specific contextualized expressions of personality (e.g., workplace deviance), intelligence is objectively measured thereby reducing effects related to common-method bias. Second, many personality frameworks such as the HEXACO and the NEO exclude self-reported intelligence from their measures, and when items related to intellectual interests are included, they tend to align more with narrow traits of openness rather than the broader domain. Third, intelligence is a powerful determinant of many important life outcomes including academic achievement (Poropat, 2009), job performance (Schmidt & Hunter, 1998), health (Calvin et al., 2011), and income (Ceci & Williams, 1997). Such outcomes may have a diverse range of independent, often small effects on personality development, such as through the effect of income on well-being, education on openness, and occupational experiences on personality. Finally, several demographic factors are theorized to influence both intelligence and personality, and these effects on personality likely vary across facets within a domain. For instance, the current meta-analysis found that, for openness, females were more open to emotions and aesthetics, whereas males were more open to ideas. Similarly, for neuroticism, women were more likely than men to report anxiety but not more hostility. Thus, facet-level predictive models allow for the subtle incorporation of a diverse range of demographic predictors of intelligence.

We also discovered dramatic improvements in prediction when employing items to predict intelligence. The average adjusted multiple correlation of .44 was larger than the meta-analytic correlation of about .33 that has been obtained between self-ratings of intelligence and objectively measured intelligence (Freund & Kasten, 2012). Indeed, we observed improved prediction of intelligence with item-level models after applying both within-sample cross-validation and between-sample cross-validation. The extent of the between-sample cross-validation of our item-level prediction model was particularly striking given that (a) the nature of the cross-validation samples (i.e., a highly homogeneous group of mostly male firefighter applicants, a multinational cohort of MOOC students, a mostly female sample of psychology students, and a Dutch sample of students) was markedly different from the training sample (i.e., a large sample of job applicants from mixed industries), (b) the intelligence measures were different across the samples, (c) the assessment stakes varied across the samples, and (d) the language of the personality measure varied. Altogether, we take away from these cross-validation analyses a very high degree of confidence that the item-level models are not simply capitalizing on idiosyncrasies in the samples or the measures (i.e., overfitting), but instead reflect true associations between combinations of items and intelligence. These findings reinforce claims by Mõttus et al. (2017, 2019) that personality measures include meaningful and reliable variance at the item level, which can yield improved prediction of criteria. Indeed, many of the reasons why facets should outperform factors in predicting outcomes would also apply to item-level prediction. In particular, there are potentially various ways of expressing domains and facets in items that will correlate differently with major aspects of people's lives such as age, sex, cultural background, and intelligence. Such subtle variation should contribute to stronger item-level prediction.

Limitations and Future Research

Despite the unique strengths of this meta-analysis, several limitations highlight the substantial opportunity for future research. First, the meta-analysis focused on cross-sectional associations, which limits the potential to uncover causal processes underlying the relationship between personality and intelligence. It would be particularly valuable for future research to examine changes in means and correlations using large longitudinal samples with facet-level assessment of personality and comprehensive assessment of cognitive abilities.

Second, observed personality–intelligence correlations are likely to substantially underestimate latent correlations between personality and intelligence. Although the present meta-analysis reports standard reliability-corrected personality–intelligence correlations (see online Supplemental Material), future research could explore the implications of making more substantial corrections. Some of the factors expected to attenuate the correlations reported in this meta-analysis include (a) the use of self-report personality assessments, (b) many studies using shorter form measures of cognitive ability, (c) the need in a small number of studies to estimate personality correlates of general intelligence by averaging personality–ability correlations of component abilities, (d) some studies using unproctored data collection where not all participants allocate maximal effort to the ability assessments (Duckworth et al., 2011), and (e) range restriction from nonrepresentative samples. Notably, although all personality measures used in this meta-analysis had high levels of internal consistency reliability, interrater reliability of personality measures is substantially lower. When correlating personality with objectively assessed criteria such as intelligence, it is likely that it is the objective aspects of personality that infuse self-report ratings which drive correlations with objective criteria (for relevant theoretical perspectives, see Funder, 1995; McAbee & Connelly, 2016; Vazire, 2010). The capacity of self-report personality to assess objectively true personality is more modest as indicated by self–other agreement on personality measures, with meta-analytic estimates ranging from $r =$ .32–.43 (Connelly & Ones, 2010). Furthermore, typical measures of intelligence used in empirical research rarely achieve the rigor of a gold standard test battery such as the WAIS. As such, the correlation between empirically obtained measures of intelligence and latent g is less than the test–retest and split-half reliability estimates reported in test manuals. Future research could obtain aggregates of multiple other raters of personality and investigate the assumption that true personality–intelligence correlations are substantially attenuated by the limitations of self-report measurement. Future research could also combine such measurements with large and representative samples using comprehensive ability assessments in order to provide upper bounds of empirically obtainable correlations between personality and intelligence.

Third, although the current meta-analytic correlations have small standard errors, we must recognize that the generalizability of the observed estimates is limited to the representativeness of the studies in the literature. Indeed, the studies involved the use of certain measures, contexts, and samples more than others. For instance, relatively more common samples included university students (especially psychology students), high school students, workers (especially employee selection samples and white-collar workers completing assessments for professional development), older samples (researchers studying aging), convenience samples, and online panels (e.g., Mechanical Turk). In contrast, nationally representative samples of the adult population were rare, as were samples that combined teenagers and older adults. Notably, people with lower levels of intelligence were relatively underrepresented in many of these samples. Furthermore, while the literature on personality–intelligence associations is internationally diverse, most samples were obtained from developed countries, especially North America, Europe, Australasia, and East Asia. In the context of ability assessments, many studies measured intelligence with shorter measures, such as combining single measures of verbal and abstract reasoning ability. In addition, measures labeled crystallized intelligence typically focused on vocabulary and verbal reasoning and less commonly on broader measures of acquired knowledge. By contrast, fewer studies administered comprehensive batteries of ability measures. In addition to attenuating correlations through range restriction, measurement error, and test-specific variance, some sample and design characteristics may moderate obtained correlations. We, therefore, encourage future researchers to examine the relationship between personality and intelligence in samples underrepresented in the literature. In particular, more research is needed on how the relationship between personality and intelligence varies (a) across cultures and (b) in groups with particular medical conditions related to cognitive ability or personality.

Fourth, the results highlight the need for more research on how intelligence is expressed in personality. Item-level analysis highlighted how items within a given facet vary in their correlation with intelligence. This is consistent with the idea that intelligence influences both the levels of personality traits and also the stylistic expression of traits. However, more research is needed to articulate and measure such variation in stylistic expression.

Finally, our meta-analysis reflects but one—albeit important—paradigm for developing a complete model of the connections between personality and intelligence. Deeper understanding of these connections requires continued research on (a) developmental perspectives, (b) the effects of generational and societal changes, (c) evolutionary, cross-species, and paleontological perspectives, (d) genetic studies using a range of current (e.g., twin, genome-wide association studies) and emerging methodologies (for critical discussion, see Friedman et al., 2021; Tam et al., 2019), (e) biological and neurological models of personality and intelligence, (f) behavioral and cognitive representations of real-time expression of cognitive ability and personality, (g) cross-cultural comparisons, (h) experimental investigation of measurement issues and the effect of context, (i) invention and investigation of novel measurement tools, and (j) broader integration of the role of personality and intelligence into idiographic representations of people, including interests, values, characteristic adaptations, and life histories.

Conclusion

Overall, the current research provides the most precise picture to date of how personality and intelligence are related at different levels of the personality hierarchy. In particular, it provides the first meta-analytic assessment of how the domains and facets of four of the most scientifically popular hierarchical measures of personality relate to intelligence. Major strengths of the approach included the use of consistent measures and the large-scale use of complete correlation matrices, raw data, and item-level data. Overall, the results show that the relationship between personality and intelligence is more nuanced than implied by the Big Five domains and is best understood at the facet level. When these facet-level correlations are considered in aggregate, it becomes clear that personality and intelligence are more strongly related than may be commonly understood. Importantly, having a precise understanding of how facet-level correlations vary within domains of the Big Five and across crystallized and fluid intelligence provides important constraints for a unified conception of personality and intelligence.

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