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Self-assessed intelligence, objective intelligence and the higher-order structure of personality

Marcin Zajenkowski [a,*], Dimitri van der Linden [b], Radosław Rogoza [c,d]

[a] University of Warsaw, Poland
[b] Erasmus University Rotterdam, Netherlands
[c] Cardinal Stefan Wyszyński University in Warsaw, Poland
[d] Social Innovation Chair, University of Lleida, Spain

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ABSTRACT

The way people assess their own level of intelligence might have important consequences for many life domains. In two studies (*Ns* = 232 and 237) we examined the association between self-assessed and objective intelligence and the higher-order structure of personality: two metatraits, Plasticity and Stability, and the General Factor of Personality (GFP). The most consistent finding was the positive association between intelligence (self-assessed and objective) and Plasticity, which reflects Extraversion and Openness/Intellect. Plasticity is characterized by the tendency to explore and seek for novelty, which might theoretically link it with intelligence. People with high levels of the GFP perceived themselves as highly intelligent. We suggested that their beliefs might have various sources, such as actual cognitive ability as well as social desirability and agency associated with self-assessed intelligence. The metatrait of Stability was essentially unrelated to self-assessed and objective intelligence. Our research indicates that intelligence might be primary located close to Plasticity in the personality structure.

General intelligence is a well-established and substantial predictor of various outcomes such as work and school achievement, better health, and longevity (Gottfredson, 2002). However, research findings indicate that not only the actual level of cognitive ability, but also how people think about their own level of intelligence plays an important role in life. The latter concept is often studied under the label of subjectively assessed intelligence (SAI). SAI was found to be associated with higher well-being, self-confidence, and academic achievements (Horward & Cogswell, 2018; Neubauer & Hofer, 2020). Interestingly, SAI correlates with many of these real life outcomes, such as exam grades, beyond and above objective intelligence (Chamorro-Premuzic & Furnham, 2007). This might be due to the fact that people have limited insight into their ability as the typical correlation between objective and subjective intelligence oscillates around 0.30 (Freund & Kasten, 2012). General intelligence, is typically measured with maximum performance tests (e.g., IQ tests) that provide an objective estimate of intelligence. SAI, on the other hand, is based on person's own estimate of their intelligence. Whereas the maximum performance tests are assumed to provide a fairly accurate estimate of one's actual intelligence, SAI seems to be influenced by various other factors such as personality traits (Horward & Cogswell, 2018; Neubauer & Hofer, 2020). The present study aims to contribute to insight into the nature of SAI by testing its relation with higher-order factors of personality. Identifying the location of SAI in the structure of personality and comparing this to objective intelligence might shed some light into the lay understanding of intelligence.

1. Personality metatraits

One of the more recent debates on the structure of personality focuses on the fact that basic personality traits, such as the famous Big Five, are systematically inter-related and form higher-order factors in the personality structure (DeYoung, 2006; Digman, 1997). First analyses revealed the existence of two, so called, metatraits labeled as Alpha and Beta, later labeled as Stability and Plasticity (DeYoung, 2006; DeYoung et al., 2002; Digman, 1997). Stability comprises neuroticism (low), agreeableness and conscientiousness and reflects stable emotional, social and motivational functioning. The shared variance of extraversion and openness/intellect compose the second metatrait, Plasticity, which reflects the tendency towards exploration and seeking novel information. Theoretical accounts and empirical findings link the two metatraits with two neurotransmitter systems: serotonergic and dopaminergic system, respectively (DeYoung, 2013). The metatraits of Plasticity and

* Corresponding author at: Faculty of Psychology, University of Warsaw, Warsaw, Poland.
E-mail address: zajenkowski@psych.uw.edu.pl (M. Zajenkowski).

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Stability, while usually investigated from the perspective of the questionnaire approach, they also have been identified in psycholexical studies (e.g., Saucier et al., 2014). Furthermore, recent advances demonstrated that these two personality metatraits, while attributed to the Big Five personality traits, could be also extracted from the HEXACO model of personality (Strus & Cieciuch, 2021).

However, as it has been found that Stability and Plasticity show consistent correlations (e.g., Musek, 2007), it has been proposed that there might be even a higher-level factor labeled the General Factor of Personality (GFP; Figueredo et al., 2015; Musek, 2007; Rushton et al., 2008). This general factor implies that scoring in a socially desirable direction on one personality dimension, also makes it more likely to score in a similar direction on other personality dimensions. To illustrate, in terms of the Big Five, this implies that a high-GFP person would score relatively high on openness, conscientiousness, extraversion, and agreeableness, but relatively low on neuroticism.

The GFP has been now replicated in numerous datasets and in many personality models, including the Big Five (Van der Linden, Scholte, et al., 2010), Eysenck's Giant Three (Van der Linden et al., 2012), and the HEXACO, six-factor model (Anglim et al., 2020). Accordingly, the question no longer is whether the GFP exists, but rather what its nature is.

Although different views exists on the nature of the GFP, roughly, those can be classified in two large categories, namely the substantive view (e.g., Dunkel et al., 2021; Loehlin, 2011; Musek, 2007) and the artifact view (De Vries, 2011; Holden & Marjanovic, 2012). In the substantive view, the currently leading interpretation is that the GFP largely is social effectiveness (Van der Linden et al., 2017). This implies that the GFP reflects individual differences in how able and/or motivated people are to successfully navigate through various social situations. It needs to be acknowledged, however, that some authors question the social-effectiveness account of the GFP, suggesting it merely reflects methodological or statistical artifact, such as socially desirable response bias (De Vries, 2011; Holden & Marjanovic, 2012). Specifically, as personality is often measured by self-report, individual differences in having a conscious or unconscious motivation to present oneself in more favorable ways may lead to spurious correlations between socially desirable traits. For example, people who would think very highly of themselves would provide higher scores on many positive traits compared to more modest people. In that case, the trait intercorrelations and, thus, the GFP would not be a good reflection of their true personality, but would rather be a by-product of this motivational processes. Evidence in line with this view is, among others, that the GFP becomes smaller (but does not disappear) when the socially desirable components of personality items are reduced (Bäckström et al., 2009). Moreover, using multi-trait and multi-method approach, DeYoung (2006) corroborated the existence of Stability and Plasticity, however, the two factors were orthogonal.

Nonetheless, in line with the social-effectiveness account, the GFP has been found to overlap with trait and ability measures of emotional intelligence (Van der Linden et al., 2017). If this interpretation is correct then scoring high on social effectiveness or social/emotional intelligence can be expected to push the scores on a broad range of personality dimensions towards socially desirability, hence a GFP would emerge. Empirical findings that are in line with this interpretation are that high-GFP individuals are rated as more popular and likeable by others (Van der Linden, Te Nijenhuis, et al., 2010), receive higher ratings during job applications (Van der Linden et al., 2011), more often have leadership positions, and even are more desirable as a mate (Figueredo et al., 2015) and have more offspring (in males only: Van der Linden et al., 2018). In addition, as social effectiveness can be expected to have an influence on almost every area of life, the GFP has also been shown to relate to many indicators of actual job performance (Pelt et al., 2017).

2. Intelligence and personality metatraits

Only few studies have explored the association between objective intelligence and the metatraits of Stability and Plasticity. Across two studies Kretzschmar et al. (2018) found that Plasticity was positively associated with verbal and spatial ability, while Stability correlated with higher scores on numerical reasoning tests (only in Study 2). Although these associations were significant, the effect sizes were relatively small ($rs = 0.10–0.20$). Correspondingly, DeYoung et al. (2008) found positive correlations of similar size ($rs < 0.16$) between the two metatraits and the *g* extracted from three intelligence test, though the sample was smaller and the effects were nonsignificant.

Previous studies have also tested the relationship between the GFP and intelligence. The findings are mixed and indicate a weak positive (Dunkel et al., 2014; Schermer & Vernon, 2010) or null correlation between the GFP and intelligence scores (Schermer et al., 2012; Schermer & Goffin, 2018). Thus, the overall conclusion from these studies so far is that there seems to be no stable, nor a strong substantial association between objective intelligence and the GFP.

As the relation between the higher-order personality traits and objectively measured intelligence is weak or unclear, an interesting question is how these traits relate to SAI. As we noticed above, people can estimate their own intelligence with some level of accuracy (Freund & Kasten, 2012), however, SAI is also affected by various non-intellective factors (Horward & Cogswell, 2018). Specifically, SAI was found to be associated with high extraversion, openness and narcissism, and low neuroticism, agreeableness and honesty-humility (Chamorro-Premuzic et al., 2005; Chamorro-Premuzic & Furnham, 2007; Horward & Cogswell, 2018; Zajenkowski et al., 2020). In most cases, these associations held even after controlling for actual intelligence and therefore SAI might be treated as an indicator of perceptual bias. However, it has been also suggested that high SAI may be a manifestation of actual psychological adjustment. As a conclusion of their recent meta-analysis, Horward and Cogswell (2018) suggested that because intelligence is a highly valued characteristic in the society, SAI may play a central role in the self and can be key factor determining the way people feel. Indeed, beyond actual intelligence, SAI has been shown to positively associate with various aspects of well-being and psychological adjustment (Dufner et al., 2019; Zajenkowski & Czarna, 2015; Zajenkowski et al., 2020). A slight degree of self-enhancement seems to be more adaptive than accurate self-perception (Humberg et al., 2019). Moreover, SAI correlates with academic achievements beyond and above objective IQ scores (Chamorro-Premuzic & Furnham, 2007). Thus, it has been postulated that positive self-views on one's intelligence are adaptive and might be a manifestation of Bandura's (1997) famously conceptualized self-efficacy—the belief that one is capable of affecting a specific outcome (Chamorro-Premuzic & Furnham, 2007; Furnham, 2001; Horward & Cogswell, 2018). It has been suggested, however, that the association between SAI and academic achievements might be bidirectional that is, on one hand, intellectual self-confidence may influence educational outcomes, but on the other hand feedback regarding academic achievement may inform SAI (Horward & Cogswell, 2018).

3. The current research

In the current research we examined the relationship between objective and subjective intelligence, and higher-order personality traits. Prior findings revealed positive, albeit small, correlations between objective intelligence and both Plasticity and Stability (DeYoung et al., 2008; Kretzschmar et al., 2018). However, Plasticity have shown more a consistent pattern of associations with intelligence (Kretzschmar et al., 2018). Moreover, from a theoretical perspective, intelligence seems to have more in common with Plasticity. Intelligence is a highly agentic attribute which leads to success in various life domains (Gottfredson, 2002) and agency is considered to be at the core of manifestations of Plasticity (DeYoung, 2013). Additionally, DeYoung (2013)

suggested that both general intelligence and Plasticity might be parts of a broader dopaminergetic system which is the main driver of exploration. Thus, we expect that (H1) objective intelligence will be primarily associated with Plasticity rather than Stability. Because of the mixed findings on the GFP and intelligence, we expect (H2) null or small positive correlation between the two constructs (Dunkel et al., 2014; Schermer et al., 2012; Schermer & Goffin, 2018; Schermer & Vernon, 2010).

Because SAI is influenced by non-cognitive factors (Horward & Cogswell, 2018), we expect that the association between subjective intelligence and higher-order personality traits will be more salient than in case of objectively measured cognitive ability (H3). Specifically, we expect SAI to be positively correlated with Plasticity and the GFP. As mentioned above, agency is at the crux of Plasticity (DeYoung, 2013). On the other hand, there is evidence linking SAI with agency. First, SAI has been conceptually linked to self-efficacy (Chamorro-Premuzic & Furnham, 2007; Furnham, 2001; Horward & Cogswell, 2018). Second, intelligence is regarded as highly agentic attribute (Abele & Wojciszke, 2014). Finally, SAI overlaps with grandiose narcissism (Zajenkowski & Dufner, 2020) a personality trait defined in terms of high agency and positively related to Plasticity (Campbell & Foster, 2007; Rogoza et al., 2016, 2019). All these findings lead to presumption that (H4) SAI will be positively correlated with Plasticity.

Based on previous studies there are several reasons to expect (H5) a positive link between the GFP and SAI. First, GFP-traits loadings to some extent overlap with the profile of the SAI personality correlates. Specifically, SAI was found to be related to high levels of extraversion, conscientiousness, and openness, and low level of neuroticism (Horward & Cogswell, 2018). This is exactly the pattern one would expect if the GFP drives the SAI-personality relationship. Moreover, in the substantive account of the GFP, the construct is considered to be social effectiveness that facilitates performance, goal achievement and promotes well-being (Musek, 2007; Rushton & Irwing, 2011; Van der Linden et al., 2017). Likewise, thinking positively about one's intelligence has been found to correlate with genuine psychological adjustment (Dufner et al., 2019) and academic performance (Chamorro-Premuzic & Furnham, 2007). Finally, both SAI and the GFP might be influenced by socially desirable responding (Gignac, 2018; de Vries, 2011). Therefore, the last aim of the current research was to explore the unique contribution of objective and subjective intelligence to personality metatraits. Below, we present two studies where we tested the associations between subjective and objective intelligence and higher-order personality traits.

4. Method

4.1. Participants

4.1.1. Study 1

A total of 232 participants who were recruited via publicly accessible social networking websites took part in the study (122 women and 110 men). Their mean age was 23.62 ($SD = 3.79$) ranging from 18 to 39. The sample consisted of undergraduate students from various universities in [blinded], who were tested individually in a lab at the University of [blinded], and who received the equivalent of 10 EUR in Polish zloty for participating. All subjects gave their oral informed consent to participate in the study. The study was a part of larger project (e.g., published in [blinded]) and only the measures that were relevant for the current research question are described below. Power analysis (calculated in R package 'pwr') indicated that the current sample allowed for detecting a small correlation ($r = 0.16$) with a power > 0.80 (two-tailed α-level $= 0.05$). The data from both studies are available at https://osf.io/bzxjy.

4.1.2. Study 2

The sample consisted of 237 participants (117 men and 120 women), aged between 18 and 49 years ($M = 23.10$, $SD = 5.00$). Participants were recruited via publicly accessible social networking websites and were tested individually in a quiet laboratory at the University of [blinded]. All subjects gave their oral informed consent to participate in the study. The study was a part of larger project (e.g., published in [blind]) and only the measures that were relevant for the current research questions are described below. Power analysis indicated that the current sample allowed for detecting a small correlation ($r = 0.16$) with a power > 0.80 (two-tailed α-level $= 0.05$).

4.2. Measures

4.2.1. Personality

In Study 1, Big Five was measured with the Polish adaptation (Strus et al., 2014) of the 50-item set of International Personality Items Pool Big Five Factor Markers questionnaire (Goldberg, 1992). The questionnaire has a five-point Likert-type response format (1 = *very inaccurate*, 5 = *very accurate*). The reliability and validity of the Polish version was tested on a large sample, showing high internal consistency, an adequate factor structure and associations with other Big Five measures (Strus et al., 2014). In Study 2, Big Five was assessed with the Polish adaptation (Strus et al., 2014) of the *International Personality Item Pool - Big Five Aspect Scale* (DeYoung et al., 2007). This is a 100-item measure of trait domains (Agreeableness, Conscientiousness, Extraversion, Neuroticism, and Openness/Intellect) and the two lower-order aspects of each domain. Participants are asked to rate how much the statements are related to them on a Likert-type scale, from 1 (*strongly disagree*) to 5 (*strongly agree*).

4.2.2. Objective intelligence

In Study 1, intelligence was assessed with two tests. First we used *Cattell's Culture Fair Intelligence Test* (Cattell, 1973) which consists of four nonverbal subtests. In the first part (13 items), a series of three abstract figures with one piece missing is presented and respondents must complete the series by selecting a correct answer from six options. The next subtest consists of 14 items and respondents are required to identify the two patterns from a set of five that do not belong to the group. The third part contains 13 items and is similar to the Raven test. The last subtest (10 items) requires the respondents to select one out of five answers in order to replicate the relationships between figures and a dot in the model. The final score in the Cattell test is the total number of correct answers across all subtests. The second measure of intelligence was *Raven's* test in the advanced version (Raven et al., 1983). There are 36 original matrices, and the administration time in the current study was 30 min.

In Study 2, intelligence was assessed with three tests. In the *Number Series Test*, the task was to find the hidden rule, according to which a sequence or an array of numbers was constructed and to complete the sequence or the array with the missing number. For example, the sequence "1, 5, 12, 22, 35, ..." should be completed with "51". Participants were given 18 min to solve 18 number series problems with ascending difficulty. The second test was the *Paper Folding Test.* The test consisted of 16 tasks and the time limit was 10 min. In each task, participants were presented with a drawing showing a sheet of paper which has been folded. A black dot showed where a hole was punched. The task was to choose one correct answer out of five drawings presenting the holes when the sheet was unfolded. Finally, we used *Cattell's Culture Fair Intelligence Test* (Cattell, 1973) as in Study 1. In the analyses described below, we used factor scores of all three intelligence tests.

4.2.3. Subjectively assessed intelligence (SAI)

Participants assessed their own intelligence on a 1–25 point rating scale ranging from very low (1) to very high (25). Participants' SAI was indexed with the marked column counting from the first to the left; thus the score ranged from 1 to 25 (see Zajenkowski et al., 2016).

5. Results

Tables 1 and 2 present the descriptive statistics and intercorrelations of the basic personality traits, SAI and intelligence tests from Studies 1 and 2. To extract the higher-order factors of personality we conducted two independent factor analyses using principal axis factoring. and a forced one-factorial solution (see Table 3 for factor loadings). The first factor analysis comprised only the traits of extraversion and openness/intellect and corresponded to Plasticity, whilst the second factor analysis comprised emotional stability, agreeableness, and conscientiousness, corresponding to Stability. As we were interested in the effects of not only Stability and Plasticity, but also of the GFP, we entered Plasticity and Stability in an additional factor analysis in order to extract the General Factor of Personality. In this approach, the GFP is expected to be located at the top of the hierarchy of personality structure (e.g., Rushton & Irwing, 2011).

Table 4 shows the correlations between general intelligence (*g*), SAI and the higher-order personality factors. General intelligence was positively and significantly correlated with Plasticity in both studies and, only in Study 1, significantly related to the GFP. Across the two studies, SAI was positively and significantly associated with Plasticity and the GFP. Additionally, SAI correlated positively with Stability, however, only in Study 1. In order to test H3 stating that the association between subjective intelligence and higher-order personality traits will be more salient than the correlation with objectively intelligence we compared the correlation magnitudes (using Steiger's *z*) of *g* and SAI and personality metatraits. We found that both types of intelligence differed in their correlation with Plasticity and the GFP, while for Stability there were no difference (Study 1) or the associations were in opposite directions, though nonsignificant (Study 2).

SAI and *g* correlated positively in both studies ($r = 0.39$; $p < 0.001$ and $r = 14$; $p = 0.015$, respectively). Thus, as a final set of analyses, we examined the unique contribution of objective and subjective intelligence to the metatraits. In Table 5 we report regression coefficients as well as commonality[1] analysis examining the variance uniquely explained by each predictor as well as their shared variance. In each model, SAI and *g* were both entered as predictors and one of the metatraits (Stability, Plasticity, or GFP) was the dependent variable. The analyses revealed that in both studies, intelligence was most strongly associated with Plasticity. SAI and *g* shared the biggest portion of variance in explaining Plasticity. Also in both studies, it became clear that the lion share of the personality factors was explained by SAI rather than *g*., However, both intelligence variables had substantial shared variance regarding the GFP. Because for Stability the models were not significant and explained only marginal portion of variance, we did not analyze the commonality in this case.

6. Discussion

We examined the association between objective and subjective intelligence and higher-order personality traits. The most consistent finding was the positive association between intelligence and Plasticity. Specifically, intelligence assessed in both a subjective and objective way correlated with a higher level of this metatrait, which supported our hypotheses 1 and 4. Plasticity is composed of the shared variance of Extraversion and Openness/Intellect. Previous studies have shown that especially the latter trait is correlated with cognitive ability (Ackerman & Heggestad, 1997), with the facet of Intellect being most highly associated with both objective (DeYoung, 2014) and subjective (Zajenkowski & Matthews, 2019) intelligence. However, in the current research we were interested in more general factor of Plasticity which is characterized by the tendency to explore both behaviorally and cognitively (DeYoung, 2013). Moreover, Plasticity is associated with engagement with novel information and opportunities, low conformity (DeYoung et al., 2002) and creative expression of oneself (Hirsh et al., 2010). Thus, Plasticity may reflect flexible and creative approach towards novelty (DeYoung et al., 2002). Interestingly, many characteristics of Plasticity, such as the tendency for exploration, flexibility, and engagement with novelty seem to have much in common with aspects of intelligence. Intelligence is typically defined as an ability to adapt to the environment, especially to novel, untutored and unpredictable situations (e.g., Gottfredson, 2004) and so is Plasticity (DeYoung, 2015). Furthermore, the engagement with novelty is emphasized by evolutionary theories of intelligence. It has been suggested that general intelligence evolved to deal with evolutionarily novel problems, that is entities and situations that did not exist in the ancestral environment (Kanazawa, 2010). For instance, more intelligent individuals are better able to comprehend and deal with evolutionarily novel preferences and values, such as liberalism, atheism or monogamy (Kanazawa, 2010). Finally, intelligence highly overlaps with the effectiveness of executive functioning, and the latter is defined in terms of cognitive flexibility and the ability to deal with novel, unanticipated challenges (Diamond, 2013).

Although personality and intelligence are typically treated as independent entities (von Stumm et al., 2011), some researchers view intelligence as a part of personality (DeYoung, 2015; Eysenck & Eysenck, 1985). For instance, DeYoung (2015) considers intelligence as a facet of Openness/Intellect. The current research shows, however, that intelligence conceptually and empirically overlap with a broader trait of Plasticity. As we mentioned above, it is possible that both intelligence and Plasticity are parts of a broader dopaminergetic system (DeYoung, 2013). Dopamine is a neurotransmitter involved in a variety of psychological processes that increase motivation to explore and facilitate cognitive processes useful in exploration (DeYoung, 2013). More research is needed to establish whether dopamine is the factor underlying the shared variance between Plasticity and intelligence.

The GFP was positively and significantly associated with general intelligence in Study 1, but in Study 2 the correlation did not reach the assumed level of significance. This is in line with H2 and previous findings showing small positive or null association between these constructs (Dunkel et al., 2014; Schermer et al., 2012; Schermer & Goffin, 2018; Schermer & Vernon, 2010). Consistent with H5, self-assessed intelligence was positively correlated with the GFP across two studies.

More generally, it is relevant to note that in the GFP as well as Plasticity, SAI explained substantially more variance compared to objective intelligence. Thus, people with higher levels of the GFP or Plasticity perceive themselves as relatively smart, although their beliefs might have various sources. First, their intellectual self-confidence might be partly rooted in their actual cognitive ability as SAI and *g* shared some variance in explaining Plasticity and the GFP. Additionally, SAI may contain some aspects of social desirability (Gignac, 2018), self-confidence, and agency (Zajenkowski & Dufner, 2020). These aspects are not necessary rooted in objective intelligence, nevertheless, they might be highly adaptive. Intelligence self-enhancement has been found to be associated with higher well-being and educational achievements (Horward & Cogswell, 2018; Neubauer & Hofer, 2020). Looking at the GFP- intelligence link from an evolutionary perspective, it is relevant to note that the GFP as well as intelligence have both been linked to, what is called, a slow life history strategy (Rushton & Irwing, 2011; Van der Linden et al., 2018). This strategy is characterized by providing much parental care, pro-social behavior, as well as higher cognitive ability in order to deal with evolutionary novel problems and impulse control. Thus, one possibility that may need further research is that life history strategy may be the common denominator underlying higher-order

[1] In a typical regression analysis, one is usually interested of how each predictor uniquely predict dependent variable. There is, however, a source of additional information regarding how both predictors explain the same (i.e., common) variance of the dependent variable, which is referred as to commonality analysis (Nimon et al., 2008). In other words, in commonality analysis, one learns not only about unique effects of predictors, but also what is in common between them.

Table 1
Correlations and descriptive statistics of Big Five and intelligence tests (Study 1).

	M	SD	α	1	2	3	4	5	6	7	8.
1. Neuroticism	21.35	7.67	0.87	–							
2. Extraversion	32.49	8.14	0.87	−0.22**							
3. Agreeableness	39.34	5.65	0.80	−0.11	0.39**						
4. Conscientiousness	34.71	7.43	0.84	−0.05	0.11	0.13*					
5. Openness/Intellect	38.40	5.53	0.73	−0.01	0.25**	0.33**	0.04				
6. SAI	17.00	3.00	–	−0.15*	0.14*	0.12	0.04	0.40**			
7. Raven	22.01	7.13	0.90	0.03	−0.05	0.14*	−0.06	0.31**	0.41**		
8. Cattell	24.91	5.12	0.76	0.08	−0.02	0.10	−0.08	0.32**	0.32**	0.70**	
9. *g*	0.00	0.90	–	0.06	−0.04	0.13*	−0.08	0.34**	0.39**	0.92**	0.92**

SAI – subjectively assessed intelligence; g – general intelligence.
* $p < 0.05$.
** $p < 0.001$.

Table 2
Correlations and descriptive statistics of Big Five and intelligence tests (Study 2).

	M	SD	α	1	2	3	4	5	6	7	8	9
1. Neuroticism	61.61	14.25	0.91	–								
2. Extraversion	68.87	12.19	0.88	−0.17**								
3. Agreeableness	75.57	12.26	0.89	−0.08	−0.01							
4. Conscientiousness	63.53	10.55	0.81	−0.22**	0.10	0.09						
5. Openness/Intellect	74.00	9.37	0.76	0.07	0.29**	0.28**	−0.01					
6. SAI	17.03	2.46	–	−0.13*	0.35**	−0.10	0.07	0.30**				
7. Paper Folding	9.95	3.45	0.80	−0.06	0.06	0.01	−0.17**	0.18**	0.11			
8. Numbers	11.08	3.20	0.71	−0.07	0.00	0.03	−0.11	0.17*	0.14*	0.42**		
9. Cattell	25.60	4.51	0.67	0.06	0.04	0.08	−0.12	0.19**	0.10	0.48**	0.44**	
10. *g*	0.00	0.90	–	−0.02	0.05	0.06	−0.16*	0.23**	0.14*	0.79**	0.75**	0.86**

SAI – subjectively assessed intelligence; g – general intelligence.
* $p < 0.05$.
** $p < 0.001$.

Table 3
Factor loadings of the Big Five traits on personality metatraits.

	Plasticity		Stability		General Factor of Personality	
	Study 1	Study 2	Study 1	Study 2	Study 1	Study 2
Extraversion	0.50	0.51				
Openness/ Intellect	0.50	0.51				
Neuroticism			−0.21	−0.44		
Agreeableness			0.51	0.14		
Conscientiousness			0.25	0.52		
Plasticity					0.67	0.33
Stability					0.67	0.33

When two variables are entered into a forced one-dimensional factor analysis, the their factor loadings are always equal.

Table 4
Correlations between objective and subjective intelligence and personality metatraits.

	Study 1			Study 2		
	g	SAI	Steiger's *z*	*g*	SAI	Steiger's *z*
Plasticity	0.20**	0.35**	−2.15*	0.17**	0.41**	−3.01**
Stability	0.06	0.14*	−1.09	−0.10	0.10	−2.34*
GFP	0.15*	0.29**	−1.97*	0.05	0.35**	−3.64**

SAI – subjectively assessed intelligence; g – general intelligence; GFP – general factor of personality.
* $p < 0.05$.
** $p < 0.01$.

Table 5
Regression models and commonality analysis of g and SAI predicting personality metatraits.

	g	SAI	*g*	SAI		Model
	β	β	Unique (%)	Unique (%)	Common (%)	
Study 1						
Plasticity	0.07	0.31**	3.63	68.53	27.90	R^2 = 0.12**
Stability	0.01	0.14	–	–	–	R^2 = 0.02
GFP	0.05	0.27**	2.63	72.01	25.40	R^2 = 0.08**
Study 2						
Plasticity	0.11	0.39**	7.00	84.20	8.80	R^2 = 0.18**
Stability	−0.11	0.12	–	–	–	R^2 = 0.02
GFP	0.01	0.35**	0.01	97.70	2.30	R^2 = 0.12**

SAI – subjectively assessed intelligence; g – general intelligence; GFP – general factor of personality.
** $p < 0.01$.

factors of personality and intelligence.

Stability was unrelated to general intelligence in both studies, and only showed a relatively small association with self-assessed intelligence in Study1. Previous studies revealed that among the traits that constitute Stability, only neuroticism correlates, weakly, with intelligence, while agreeableness and conscientiousness do not show systematic association with objective intelligence (Ackerman & Heggestad, 1997). In fact, some studies revealed a negative correlation between conscientiousness and intelligence, suggesting that there might be a compensation mechanism in which high conscientiousness compensate the effects of low

intelligence (Moutafi et al., 2004; Zajenkowski & Stolarski, 2015). Moreover, Stability, opposite to Plasticity, has been linked to higher conformity (DeYoung et al., 2002), which might be in tension with the novelty seeking tendencies discussed above.

One aim of future research is to disentangle, beyond intelligence, the various sources by which personality factors relate to SAI. For example, part of the overlap may be due to biases in responding to the items such as individual differences in the tendency to seek higher or lower ends of any type of item or scale, or tendencies towards social desirable responses. On the other hand, part of the overlap likely also is substantive, reflecting true individual differences in self-esteem and social desirable behavior. Support for the notion that the SAI-personality overlap contains relevant substantive components comes from previous studies showing that the higher-order personality factors relate to various real-life and non-self-reported outcomes such as job performance, social status, and creativity (Feist, 2019;Van der Linden, Te Nijenhuis, et al., 2010).

7. Limitations and conclusions

Although the current research provided a set of consistent findings on the associations between intelligence and higher order personality traits, it also had several limitations. First, the study was correlational which does not allow for causal interpretation of the results. Second, some of the factor loadings differed across studies, especially in case of Stability. While in Study 1 agreeableness had the highest loading, in Study 2 this trait had the lowest factor loading. This might be due to differences in measures and/or sample fluctuations. Nevertheless, in both studies, the correlation of Stability with intelligence was relatively small.

Not only objective intelligence, but also one's own estimate of intelligence has shown to be relevant for various outcomes (Horward & Cogswell, 2018; Neubauer & Hofer, 2020). As such it is important to know what factors contribute to the perception of one's own intelligence. The present research may contribute to the literature as it showed how SAI substantially overlaps with Plasticity as well as the GFP. Higher-order personality factors, by definition, comprise a rather broad range of traits as behaviors, among which are higher general self-esteem and social efficacy, and better mental health (e.g. Van der Linden et al., 2017). It seems logical that, ceteris paribus, this also entails a relatively positive evaluation of one's cognitive ability. The belief that one is capable of doing something is associated with a more proactive attitude and a positive approach towards challenges, which may help to achieve success in various life areas.

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CRediT authorship contribution statement

MZ, DvdL, RR: conceptualization; MZ: methodology; RR: formal analysis; MZ, DvdL, RR: writing original draft.

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