The Berlin Multi-Facet Personality Inventory: A Comprehensive Measure of Big Five Personality Facets

Abstract

A novel personality inventory is presented in this article, named the Berlin multi-facet personality inventory. This tool has been developed to comprise the maximum possible number of non-redundant narrow constructs below each of the Big Five domains. Two versions of the same inventory have been elaborated in two different languages (English and German) in order to facilitate international usability. In addition to the construction of the inventory, this work presents promising evidence of its psychometric properties in two different populations across two different studies. This inventory is freely available online.

Public significance statement. Personality traits are commonly understood under the prism of the Big Five domains. However, narrower constructs are sometimes a more useful unit of assessment. Here we present an instrument that maximizes the number of facets below the Big Five domain model.

Keywords: Personality, Big Five, facet models.

The Berlin Multi-Facet Personality Inventory: A Comprehensive Measure of Big Five Personality Facets

Over the last decades, the Five Factor Model (Costa & McCrae, 1992) as well as the Big Five (Goldberg, 1990; Digman, 1990) have become widely accepted models for describing general attributes of personality[1]. In both cases, personality is conceived as a hierarchical model which describes individual differences in personality at the dispositional level: One of the most basic, universal, biologically-influenced, and stable layer of inter-individual differences in behavior, cognition, and feeling (McAdams & Pals, 2006). This hierarchical conception is relevant to acknowledge behavior from the most specific (nuances) to the more general (domains) differences in personality, through a varying number of mid-level characteristics (facets). Most of the research concerning criterion validity of scores from Big Five inventories has focused on the covariation between Big Five scores and relevant external outcomes. However, specific dispositional characteristics captured on the facet level might be of utility to provide more complex descriptions of individuality and to predict life outcomes to a major extent (John et al., 2014; Lounsbury, Sundstrom, Loveland, & Gibson, 2002; Paunonen & Ashton, 2001; Ziegler et al., 2014; Ziegler, Danay, Schölmerich, & Bühner, 2010; Kretschmar et al., 2018). Unfortunately, the number and nature of facets below the Big Five domains is far from being consensual. In fact, many different sets of facets have been proposed (see Table 1). One potential reason for this proliferation could be that many facet-level models were developed as an elaboration or

[1] Often the terms are even used synonymously, which is why we will refer to the Big Five from here on.

extension to an existing domain level measure. This ad-hoc inception has the disadvantage of potentially limiting the search space for possible facets. The current research project was conducted in order to overcome such limitations and develop a facet set spanning an extensive behavior space.

Different Facet Models

As outlined above, there are a number of models that include a facet structure below the five broad domains. Among them, probably the most widely known is the one proposed by Costa and McCrae (1995), the NEO-PI-R model, which defines six facets per domain. Other popular models include the Big Five Inventory 2 (BFI-2; Soto & John, 2016), the IPIP (Goldberg et al., 2006), and the HEXACO model (Lee & Ashton, 2016; which assumes six broad domains). *Table 1* provides an overview of these different elaborations, listing psychometric information such as internal consistency estimates and correlations with external constructs. Other models have also been developed, although not listed in *Table 1* due to limited space, such as the Faceted Inventory of the Five-Factor Model by Watson, Nus, and Wu (2017), or the Big Five Aspect Scales by DeYoung, Quilty, and Peterson (2007).

----Insert table 1 around here---

Table 1 displays the abundance of proposed facets related to each of the Big Five domains, evidencing the reality of a topic that is not consensual and that gives rise to many different elaborations. Despite these differences, however, there is still some degree of overlap.

Soto and John (2009) inspected the convergence between the NEO-PI-R and the first version of the BFI, suggesting that two constructs per domain were measured at the facet level by both inventories. The constructs defined by Soto and John (2009) were: *Altruism* and *Compliance*

for agreeableness; *Anxiety* and *Depression* for neuroticism; *Order* and *Self-Discipline* for conscientiousness; *Assertiveness* and *Activity* for extraversion; and *Aesthetics* and *Ideas* for openness. Likewise, the existence of such "core" constructs was also suggested by DeYoung, Quilty, and Peterson (2007), in what they termed aspects. Even though both contributions' labels vary, they have a substantial degree of similarity in terms of content. Furthermore, these core constructs are present not only in the models which Soto and John (2009) analyzed, but also in all models listed in *Table 1*. Some of these constructs are explicitly covered (e.g. *Anxiety*), while others are implicitly encompassed, especially when given attention to the items' content (e.g. *Liveliness* in HEXACO resembles the "core" construct *Activity*, present in all other instruments).

While the majority of models based on the Big Five include these "core" constructs, there is still an abundance of other constructs which could be termed "peripheral", whose inclusion is more variable. Soto and John (2017, page 118) referred to this diversity of constructs by saying that the Big Five dimensions *"can be conceptualized and assessed more broadly or more narrowly"*, either by focusing on central or on peripheral facets, depending on the interest of research. In this paper those authors also proposed three core facets per domain (see Table 1). It is due to this multiplicity of peripheral constructs that an effort to convey different models would be beneficial, in order to obtain a comprehensive inventory which subsumes a maximum possible of these peripheral facets, as well as including the essential core facets.

An important step towards building such an extensive nomological net is to ensure that the proposed set of facets predict consequential outcomes. One of the most classical approaches to relate the constructs present in an inventory with external constructs is to define a nomological network between the personality traits and external outcomes (Cronbach & Meehl, 1955).

Nomological networks can be drawn from a hierarchical perspective, by either adopting narrow constructs, such as nuances, as personality units in the network or by utilizing broader domains. Relying on dimensions to describe behavior and to predict external outcomes can benefit from ease of interpretability. However, the domain level is sometimes too distal to depict behavioral mechanisms underlying personality-to-outcome associations thoroughly. Conversely, using nuances to predict behavior might yield a stronger predictive power (Seeboth & Mõttus, 2018), as specificity to situations and contexts is enhanced (Ziegler & Brunner, 2016). Nonetheless, using nuances in the prediction of external outcomes can have the disadvantage of dealing with extreme complexity when interpreting empirical findings. Facets are by definition in a middle ground between nuances and dimensions, in a compromise between specificity and sensitivity in the bandwidth-fidelity dilemma. This aggregation could satisfy the specificity of predictions while at the same time enhance the ease of interpretability of personality-to-outcome associations.

Facets associated with consequential outcomes

The question of whether narrow measures have a superior predictive power over broad measures has enjoyed a lively debate. Research summarized below suggests an advantage for scores derived from more narrow measures. Nonetheless, other lines of research point at the opposite direction (Salgado, 2017; Chen, 2012). It falls out of the scope of this study to provide evidence which could fuel this debate further. Still, we believe that the inventory presented here will be useful to forthcoming contributions on this topic.

The following section provides an overview of evidence for relations between domains, facets, and three consequential outcomes that are of interest to researchers. This outline has been included here in order to build a rationale of hypotheses which will guide the development of our facet model.

Satisfaction with Life

One of the outcomes that has been largely evidenced to be predicted by personality is satisfaction with life (SWL). Neuroticism and extraversion have been consistently recognized as the most important broad domains predicting subjective life satisfaction (Diener, Oishi, & Lucas, 2003; Schimmack, Diener, & Oishi, 2002). Schimmack, Oishi, Furr, and Funder (2004) observed that facets outperformed domains in terms of predictive validity. They observed that scores for *Depression* and *Positive Emotions* / *Cheerfulness* explained SWL above and beyond neuroticism and extraversion. Correlations in the Schimmack et al. (2004) study ranged from r = -.57 to r = -.49 for *Depression,* and from r = .51 to r = .38 for *Positive Emotions / Cheerfulness*. In line with these findings, we hypothesize that the set of facets which measure emotional stability and extraversion in our inventory should significantly correlate with SWL, with a moderate to big effect size.

Academic Performance

Another relevant outcome that has being typically predicted by personality is academic achievement. Conscientiousness has been recognized as the strongest Big Five domain to predict this outcome. At the facet level, De Fruyt and Mervielde (1996) hypothesized that facets of conscientiousness related to volition would be more strongly related with academic achievement. There is a collection of research that is consistent with this idea, linking academic performance with facets such as *Achievement-striving* (Chamorro-Premuzic & Furnham, 2003; O'Connor & Paunonen, 2007, r ranging from .15 to .39; Watson & Watson, 2002, r = .39) or *Work drive* (Lounsbury et al., 2002, r = .12). Nonetheless, other conscientiousness facets more related to duty or moral behavior have been found to predict GPA: for instance *Self-discipline* (O'Connor & Paunonen, 2007, r ranging from .18 to .25; Watson & Watson, 2002, r = .36), or *Dutifulness*

(Chamorro-Premuzic & Furnham, 2003; O'Connor & Paunonen, 2007, *r* ranging from .25 to .38). The relation of academic achievement with openness at the domain level has been more variant, in part because the facets of openness can be related in opposite directions with this outcome. Paunonen and Ashton (2001) found that the openness facet *Understanding* correlates with academic achievement in $r = .23$. Noftle and Robins (2007) identified a set of NEO-PI-R and HEXACO openness facets which predicted academic achievement (the HEXACO facets of *Aesthetic*, *Inquisitiveness*, *Creativity* and *Unconventionality*, plus the NEO-PI-R facets of *Fantasy*, *Aesthetics*, *Feelings* and *Ideas*, also see Ziegler et al., 2010). In line with these findings, we hypothesize that the facets which entail the conscientiousness domain in our inventory would consistently predict academic performance, with a small to moderate effect size, and that openness to experience will yield a mixed pattern at the facet level (Schwaba, Robins, Grijalva, & Bleidorm, 2019).

Academic Absenteeism

Personality has also been reported as a robust predictor absenteeism, with especial attention to inverse correlations between this outcome and the domain conscientiousness (Chamorro-Premuzic & Furnham, 2003; Judge, Martocchio, & Thoresen, 1997; Salgado, 2002; Ones, Viswesvaran, & Schmidt, 2003). Some specific facets of conscientiousness have been highlighted, like *work drive* (Lounsbury et al., 2004) or *need for achievement* (Wegge & Kleinbeck, 1993). The relation of abseentism with the other four domains has been vaguer. Chamorro-Premuzic et al. (2003) as well as Furnham and Medhurst (1995) found significant direct correlations with openness, while direct correlations with extraversion were reported by Judge, Martocchio, and Thoresen (1997). Perhaps this ambiguity could be resolved by

switching the focus to the facet level. In sum, we expect specific correlations between absenteeism and conscientiousness facets.

This research

Attending to the multiplicity of facet models available in the personality literature and the resurgence of narrow constructs as relevant units of analysis to describe personality and to predict important life outcomes, we strove to develop a comprehensive measure of personality facets which covers the content of the Big Five domains to a major extent. An antecedent to this study can be found in MacCann, Duckworth, and Roberts (2009), where part of the data was used in order to design a measure of conscientiousness containing a maximum number of relevant facets. This research extends MacCann et al. (2009) to all Big Five domains. Furthermore, the inventory presented here has been developed with the scope of being open source, by making it available to researchers and practitioners at no cost; and with the intention of facilitating internationally usage by testing its applicability in two different cultures.

In order to evidence its applicability among cultures, this research has been conducted in two studies using two independent samples from two different countries: the USA and Germany. In the first study, using the US sample, we empirically defined a facet model, selected items, and tested the facets' psychometric properties with regard to factorial validity evidence, internal consistency, and test-criterion correlations. In Study 2, we replicated the findings with a German sample, and further tested the measurement equivalence of the suggested models. Methods and results sections are presented separately for each study. General discussion and conclusion sections are provided at the end of this manuscript.

Study 1

Methods

Participants. This sample consisted on 722 American undergraduate students (59.30% male) who gave voluntary acceptance to their inclusion in this research. Their mean age was 21.60 years (SD = 5.90), and 59% of them were female. Students were e-mailed a link to a computerized assessment battery that included the items as well as several other tests not reported in this paper. The data set was randomly split into two equally sized subsamples. Both subsamples were matched in relation to missing values, outliers, and extreme values. Subsample 1's mean age was 21.80 years (SD= 6.30), subsample 2's mean age was 21.50 years (SD=5.60).

Measures. Altogether, 525 items from the IPIP were used in this study, as indicators of the Big Five domains. The IPIP is an open source database of personality items, launched in 1996 and containing over 2000 items (Goldberg et al., 2006). Participants were asked to provide self-ratings of personality items on a 5-point rating scale, ranging from 1 ("Not all like me") to 5 ("Very much like me").

The item set used originates from a complex item reduction conducted before. Here, all IPIP items were rated regarding their prototypicality for a Big Five domain. Based on these ratings, items for the current study were selected. More details can be found in MacCann, Duckworth, and Roberts (2009). That study also contains part of the sample used here. However, the current data set includes more participants.

Satisfaction with life (SWL). Measured with a 5-item composite defined in Diener, Emmons, Larsen, and Griffin (1985), in a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). Items included are: a) "In most ways my life is close to ideal", b) "The conditions of my life are excellent", c) "I am satisfied with my life", d) "So far I have gotten the important things in my life", and e) "If I could live my life over, I would change almost nothing". Psychometric properties have been reported excellent. In our sample, the reliability estimate was

$\alpha = 0.88$.

Graded point average (GPA). To measure academic performance, participants reported their GPA scores at the end of high school.

Absences: Participants reported an estimation of days that were absent from college without justification. This was an item extracted from a larger set of student social behaviors indicators (MacCann et al., 2009). Absences were log transformed prior to analyses, as proposed by Lounsbury et al. (2004).

Statistical Analyses

Exploratory Factor Analysis (EFA). The first subset of the collected sample was used to identify the number of components underlying the personality items in our dataset, with a top-down approach as proposed by Goldberg (2006). This means that a series of EFAs was run within each item group allocated to a specific Big Five domain. Velicer's (1976) Minimum Average Partial (MAP) and Horn's (1965) Parallel Analysis (PA) methods were applied in order to guide the subsequent factor analysis. EFAs were calculated via Mplus (Muthen & Muthen, 2012) using geomin rotation and Maximum Likelihood (ML) estimation. Decisions to retain facets were partly based on model fit information (CFI, RMSEA, SRMR) and partly on the interpretability of the facet solution. Additionally, alternative facet models inspired from other personality measures were considered and compared to the facet structure found. In case of omission of relevant content captured in other models, new items were added a-posteriori.

Reliability. Cronbach's α and McDonald's ω were estimated for each facet score to provide evidence for the test scores' internal consistency. For the domains, only McDonald's ω was estimated. The second subsample was used to compute these statistics.

Confirmatory Factor Analysis (CFA). To verify the structure outlined by EFAs, one CFA

per facet was fitted using the second subsample. We restricted the number of possible indicators to a maximum of five per facet in order to obtain facets as balanced as possible (Ziegler, 2014). This selection was done based on item content and pattern of the factor loading matrix. CFAs were fitted using WLSMV (Weighted Least Squares adjusted for Means and Variances) for ordered indicators due to floor and ceiling effects on some item's response distribution. Model fit was determined based on the usual goodness-of-fit indicators: the Cumulative Fit Index (CFI), for which a score > 0.9 indicates approximate fit; the Root Mean Square of Approximation (RMSEA), for which a value < 0.05 indicates good fit and a value < 0.6 indicates approximate fit; and the Standardized Root Mean Residual (SRMR), for which a value < 0.05 indicates adequate fit.

Exploratory Structural Equation Modelling (ESEM). In a third step with the second subsample, the higher order structure of the facets was tested with ESEM (Asparouhov & Muthén, 2009) using facet scores as indicators of the five domains. ESEM was the preferred procedure as it allows to relax the too strict independent clusters model in which CFA is usually performed (Marsh et al., 2010), accommodating personality data more realistically. As a control mechanism for content-validity, we eliminated any facet with non-significant loadings from its intended domain. The ESEM model was fitted using geomin oblique rotation and ML estimation.

Nomological network. In order to examine evidence of construct validity of our proposed facet model, a nomological network linking our constructs with external outcomes was build. This network was constructed by examining associations with a set of linear models and zero-order correlations, again with subsample 2. Pearson correlations were calculated for each outcome with both facets and domains' scores. One linear model per domain and per criteria was fitted, using all facets included in the domains as predictors, but excluding the domain sum-

scores. Standardized coefficients for each predictor (β) were reported, as well as the R^2 of the overall model -to represent associations at the domain level.

To guide the interpretation of the nomological network results, a set of hypotheses derived from research summarized in the introduction were investigated:

- H1. SWL will be predicted by facets of emotional stability mimicking NEO-PI-R *depression*, and facets of extraversion covering *positive emotions*, with a big to moderate effect size, in line with Schimmack et al. (2004). Emotional stability and extraversion will be most important domains in the personality-SWL association.
- H2. Conscientiousness will be associated with academic achievement with a small to moderate effect size. Openness will entail facets with positive effects and facets with negative effects on GPA scores.
- H3. Conscientiousness will yield the strongest associations with abseentism at the domain level, and facets tapping volitional components such as *goal orientation* or *wish to work* will outstand. Some specific facets of openness and of extraversion will also be significantly associated with abseentism. Overall, the facet level will provide a clearer picture to predict academic abseentism from personality than the domain level.

Results

EFA. Exploratory analysis revealed that the domains could be structured into between eight to eleven facets. Model fit information for the EFA procedure are presented in Table 2, as well as Eigenvalues, and results from the MAP and PA tests. To ensure the homogeneity of the facets and to reduce the risk of cross domain loadings, items with factor loadings of less than .30 and with non-central content to the domain in question were eliminated (John et al., 2014; Ziegler, 2014).

---Insert table 2 around here---

Eight facets were retained for the domain agreeableness, after two were eliminated due to weak loadings and clusters whose content was elusive. These facets were named *Appreciation, Integrity, Low competitiveness, Readiness to give feedback, Search for support, Compliance, Genuineness,* and *Altruism*. Items corresponding to these and the following facets can be found in the Appendix.

Conscientiousness consisted of nine facets after one facet with factor loadings below .30 was excluded, these were: *Dominance, Persistence, Self-discipline, Task planning, Goal orientation, Carefulness, Orderliness, Wish to work* (to capacity), and *Productivity*.

Extraversion was formed by nine facets. A new facet (*Energy*) was added in order to tap the physical component of extraversion, which was missing in the eight-facet solution the EFA suggested. These facets were labelled *Sociability, Readiness to take risks, Wish for affiliation, Positive attitude, Forcefulness, Communicativeness*, *Humor, Conviviality,* and *Energy*.

Neuroticism (interpreted here as emotional stability) consisted of seven facets. One facet was dropped due to poor interpretability and was therefore not included in the subsequent analyses. The final set of facets were named *Equanimity, Confidence, Carefreeness, Mental balance, Drive, Emotional robustness,* and *Self-attention*.

Openness to experience comprised nine facets. One facet was identified as a method factor and eliminated, as it solely contained negatively formulated items and no coherent underlying trait could be identified. Furthermore, an extra facet was added (*Intellect*), as it was not present in the EFA solution and represents a core construct in other important facet models. The final set of

facets of the openness domain were named *Creativity, Wish for variety, Open-mindedness, Interest in reading, Aesthetics, Wish to analyze, Willingness to learn, Sensitivity,* and *Intellect.*

Reliability. Reliability estimates for each of the facets and all domains were obtained using $\boldsymbol{\alpha}$ and $\boldsymbol{\omega}$ (they can be found in Table 3). 95% C.I. estimates of McDonald's $\boldsymbol{\omega}$ for the domains were: agreeableness ranged from 0.85 to 0.91, conscientiousness ranged from 0.83 to 0.88, openness ranged from 0.91 to 0.94, emotional stability ranged from 0.90 to 0.93, extraversion ranged from 0.89 to 0.92. All in all, reliability coefficients were at least good ($\boldsymbol{\omega} >$ 0.8) for all the domains, and at least acceptable ($\boldsymbol{\omega} >$ 0.7) for the majority of the facets (60%). Only one facet had poor internal consistency (*Altruism*, $\boldsymbol{\omega} = .\mathbf{52}$).

*CFA***.** Confirmatory factor analysis was applied to each of the facets identified in the previous step, using the second American-based sample. All measurement models fitted well, according to goodness-of-fit indices. The fit information of three facets was not available as these models were reflected by only three indicators and therefore saturated (*energy*, *self-attention*, and *intellect*). Goodness of fit estimations for each facet are available in *Table 3.*

*ESEM***.** The final ESEM model was constructed after removing four facets that did not significantly load in their intended domain: *sensitivity* (expected to load on openness), *search for support* and *readiness to give feedback* (expected to load on agreeableness), and *readiness to take risks* (expected to load on extraversion). Furthermore, two residuals were allowed to be correlated after inspection of modification indices: Emotional stability's facet *drive* was correlated with conscientiousness' facet *persistence,* as well as extraversion's facet *forcefulness* with conscientiousness' facet *dominance*. The addition of these correlated residuals was consistent with the facet's content and revealed that a significant amount of specific but shared variance was still present in the facets. The resulting model comprised 38 facets, all of them with significant

loadings in their intended domains. It yielded a model fit of χ^2(df) = 1614.8 (521), CFI = .83, RMSEA = .074, SRMR = .043. We consider this model fit as sufficient to approximate our data according to both RMSEA and SRMS, which indicate that the size of the residuals was not substantial. The CFI value was lower than the usual cut-offs, probably due to facet specific variance which was not accounted for in the model. The standardized loadings of the facets in their intended domain can be found in *Table 3*, the full factor-loading matrix of the ESEM model can be found in the supplemental materials. As it is usual in ESEM procedures, some facets presented significant cross-loadings in other domains. These significant cross loadings ranged from λ= 0.12 to λ= 0.68.

---Insert table 3 around here---

Nomological network. Assumptions from a nomological network with our proposed set of facets and three external criteria were tested in order to provide evidence of criterion validity. *Table 4* summarizes these findings and highlights that, overall, the hypotheses outlined in the methods section could be accepted. H1 stated that emotional stability and extraversion should be the domains which had bigger associations with SWL. Indeed, both domains showed the highest correlations and their models accounted for the most variance explained by the predictors. At the facet level, *mental balance* and *positive attitude* (both $\beta > 0.5$) were strongly associated with the criterion, also in line with what was hypothesized in H1. H2 stated that conscientiousness would be associated with GPA with a medium to small effect size and that openness would yield a mixed pattern of association at the facet level. Conscientiousness was, in line with previous research, the domain with higher associations on SWL, with a correlation of r = 0.26. Three openness facets were significantly associated with the outcome: *creativity* was inversely

associated (β = -0.14), while *interest in reading* and *intellect* correlated with it directly (β = 0.12 and 0.17). Thus, our nomological network showed the expected properties regarding H2. H3 stated that conscientiousness should be the domain yielding highest associations with abseentism, and that conscientiousness' facets related to volitional aspects would highlight this association. Indeed, conscientiousness had the strongest associations with abseentism (in an inverse relation, *r* = -0.28), and two facets related to volition, *task-planning* and *productivity*, were significantly associated with this outcome. Furthermore, H3 stated that the relation of abseentism with other domains will be clearer at the facet level. In this line, we have only found modest associations at the domain level, but some facets like *genuineness*, *energy*, *willingness to learn*, *humor* or *drive* were significantly associated with the outcome, thereby confirming H3.

---Insert table 4 around here---

Study 2

Procedure and Participants

Study two was conducted with an independent sample of 387 German speakers (49.10% male) with a mean age of 45.60 years (SD = 17.50), representative for the German working population with regard to age, gender, and education level. The data was collected in a test center.

Measures

For the German version of the presented tool, the IPIP items selected in Study 1 were translated and back-translated by bilingual experts. Non-matching back-translations were flagged as inadequate and were further adapted by the same experts. The translated items can be found in the supplemental materials.

Data analysis

Similarly as proceeded in Study 1, internal consistency and structural validity by means of one CFA model per facet and one ESEM model for the full inventory was conducted with the German sample. In addition, we present in this section a measurement invariance procedure used to test the equivalency of the measurement models in the two countries.

Measurement invariance (MI). Following tests for structural validity mirroring the procedures from Study 1, MI tests were conducted for each facet using the German and the US data. Three levels of MI were analyzed here: configural, metric, and scalar invariance. Model comparison was based on suggestions by Chen (2005). Metric invariance was accepted whenever Δ CFI < .01, Δ RMSEA < .015 or Δ SRMR < .03; and scalar invariance whenever Δ CFI < .01, Δ RMSEA < .015 or Δ SRMR < .01. MI for the full model was tested using ESEM.

In addition to full invariance tests, partial invariance was also tested at the facet level. Partial invariance was investigated by allowing a maximum of two factor loadings (for metric invariance) or intercepts (for scalar invariance) to differ between countries. The robust maximum likelihood estimator (MLR) was used in to fit the factor models in tests of invariance as it is simpler than categorical estimators when inspecting invariance, especially at the scalar level.

Results

MI at the facet level. Configural invariance was found in all facet models. This was the highest degree of invariance obtained for one facet, *Readiness to give feedback*, a facet of agreeableness. A relatively high number of facets reached partial scalar invariance (48.9%) after freeing a maximum of two intercepts in their respective models. One facet reached full scalar invariance: *Sociability*, a facet of extraversion. Furthermore, the vast majority of facets showed at least partial metric invariance between both countries (97.6%) (see Table A1 in the supplemental materials).

As stated above, the partial invariant solutions were tested after freeing a maximum of two parameters to differ between groups in each MI stage. Due to space constraints, it is not possible to list all freed parameters here. Researchers interested in a more detailed description are encouraged to examine these in supplemental materials (Table A2). As a general trend, non-invariant factor loadings of extraversion are larger in the USA sample than in the German sample, as well as positive factor loadings of openness. Conversely, negative factor loadings of openness are bigger in the German sample. Some freed factor loadings seem to deviate due to age differences between samples, as "I resist authority", an indicator of *Dominance*, and "I am easily discouraged", an indicator of *Persistence*, both yielding higher factor loadings in the younger sample (i.e. our German sample). At the scalar level, most non-invariant parameters of conscientiousness' facets show higher intercepts for Germans, excepting those of *Persistence*, which are higher in the American sample. Nonetheless, *Persistence* indicators may be higher in the American sample due to age differences ("I like to take my time" and "I never give up" are examples of items belonging to this facet). In fact, many of the non-scalar indicators may be best understood by the effect of age than that of culture, especially those that differ the most; for

instance: “I act impulsively when something is bothering me”, “I am easily talked into doing silly things”, “I get overwhelmed by emotions”, all of these yielding higher intercepts in the younger group.

MI of the full model. The ESEM model with the German sample showed similar fit as with the American sample (χ^2 (df) = 1386 (521), CFI = 885, RMSEA = 0.068, SRMR = 0.035). Importantly, all facets loaded significantly in their intended domains, replicating the results of Study 1. The MI approach revealed that configural invariance was tenable in the integrated model (χ^2 (df) = 3001(1042), CFI = 0.86, RMSEA = 0.071, SRMR = 0.04). Metric invariance was not obtained, as differences in CFI were higher than 0.01 (ΔCFI = 0.026). Partial invariance was not tested as it is not yet implemented in ESEM.

Discussion

The personality test presented herein, named Berlin multi-facetted personality inventory, was developed to cover the need for a tool which maximized the coverage of facets within the Big Five framework. Starting from a large online item pool, we have developed a questionnaire which assesses 38 facets with 202 items. The selected facets cover central constructs which are present in most Big Five models that include facet levels, as well as more peripheral constructs which could help to describe individual differences in a more nuanced manner. The first evidence of reliability, construct and test-criterion validity of the set of facets has been promising, according to the results presented in this manuscript. In addition, the Berlin Multi-facet has been developed to enable cross-cultural usage and to align with the principles of open accessibility, ensuring that researchers worldwide can benefit from this advance. These analyses also revealed interesting patterns of non-invariance, potentially informing cross-cultural research. For instance, higher factor loadings were found in the American sample for positively keyed items in the

openness domain, whereas inversely keyed items loaded highly in German's openness. This suggests that the indicators which reflect a low level of openness have a relatively higher influence in how this domain is defined by Germans. Also, non-invariant intercepts in conscientiousness were consistently higher in the German sample, indicating a higher baseline level in this domain for this group.

Facet Structure

The instrument presented in this work covers all the "core" facets proposed by Soto and John (2009 & 2016). In some cases, these core constructs have been labelled similarly to the proposal of the cited authors, that is the case of *energy*, *altruism*, *compliance*, *order* or *self-discipline*. In some other cases, our proposed labels were different as these were defined more narrowly than in Soto and John (2009). That is the case of *mental balance* (instead of *anxiety*), *emotional robustness* (*depression*), or *artistic interest* (aesthetics). In the remainder of cases, the core constructs were represented by more than a single facet, to account for nuances in facets that we believe are more heterogeneous. This is the case of *low competitiveness* and *integrity*, which both can be thought as related to *assertiveness*; or *open-mindedness* and *wish to analyze*, which are tapping the *ideas* component of the openness domain.

Psychometric properties

After defining the facet structure with an independent sample, we tested the psychometric properties in terms of internal consistency, construct validity, and structural validity. We found good internal consistencies, with 67% of the facets ω greater than 0.70 and 95% of the facets ω > 0.60. The domains were also reliably measured, with ω ranging from 0.83 to 0.92.

Construct validity was assessed by fitting a CFA to each of the facets. Goodness of fit measures signaled that the data is consistent with the facet models, with 88% of the chi-square

tests yielding non-significant results and all facets at least approximately fitting the data according to goodness-of-fit indices. These results suggest that the facets included in the Berlin multi-facet personality inventory can be used independently, in case that researchers and practitioners are more interested in a specific set of facets rather than in the full Big Five picture.

The higher order structure was tested using ESEM, a method which allows to overcome the constraint of independent clusters solution usually imposed in a CFA. Although some researchers could argue that such constraints are beneficial to ensure a high degree of discriminant validity, the independent cluster solution may be too strict to model constructs that are highly inter-related, as it occurs in personality traits. A control measure to deduce a reasonable degree of convergent and discriminant validity in the ESEM solution is to verify that the primary factor loadings are distinct from zero (i.e. that they are statistically significant), and that the proportion of significant cross-loadings is not excessive. All of this was the case for the current data in both languages.

Association with external constructs

We have tested different hypotheses which aimed to replicate previous findings on the interplay between personality and SWL, academic performance, and school absenteeism. Overall, the scores derived here have shown similar test-criterion-correlations as scores from other personality instruments. Confirming our first hypothesis we found that *positive attitude* (which is similar to *cheerfulness*) and *mental balance* (akin the inverse of *depression*) were associated with the outcome with a medium effect size ($\beta = .51$ and $\beta = .59$, respectively). Emotional stability and extraversion were, as expected, the domains which showed the strongest links to SWL. The other domains did not account for a big piece of variance of SWL (R^2 ranging from 0.08 and 0.13), although we did find some interesting associations at the facet level. For instance, *integrity*, *good*

faith, *persistence*, *confidence*, *open-mindedness* and *intellect* were significantly linked with SWL, highlighting the usefulness of a rich set of facets when inspecting associations with external outcomes.

Our second hypothesis stated that conscientiousness would be associated with academic achievement with a small to moderate effect size, and that openness would result in a heterogeneous structure of direct and inverse effects at the facet level. Our results were in line with the hypothesis. Conscientiousness' sum score yielded a correlation of r = .23 with high school GPA, while at the facet level *goal orientation* (β = .15) was the only construct predicting the outcome. Openness was also related to GPA, and as hypothesized some facets were positively related to academic achievement *(Interest in Reading*, β = .12; *Intellect*, β = .17), while some others were related negatively (*Creativity*, β = -.14). Furthermore, two facets of agreeableness were linked with high school GPA, they were *low competitiveness* (β = -.13) and *genuineness* (β = .14). The last facet that was significantly associated with the outcome was emotional stability's *equanimity* (β = .13).

The third hypothesis stated domains would not be directly linked with absenteeism in high school, but that some facets would picture this association more clearly. In line with this hypothesis, all R^2s were modest (R^2 ranging from 0.03 to 0.1), but some specific facets were significantly associated with the outcome. These were agreeableness' *genuineness* (β = -.15), conscientiousness' *task planning* (β = -.14) and *productivity* (β = -.13), extraversion's *energy* (β = -.18) and *humor* (β = .13), emotional stability's *drive* (β = -.14), and openness' *willingness to learn* (β = -.15). These results highlight that, in order to better predict educational absenteeism, researchers should focus on narrow constructs instead of on broader domains.

All in all, our nomological network sustains a reasonable degree of construct validity for the Berlin Multi-facetted personality inventory. Furthermore, our results suggest that switching the focus from a domain perspective towards a facet perspective may increase the strength of associations between personality scores and external criteria.

International usage

This instrument aims to be usable in different countries to promote internationalization of individual differences research. To this aim, it has been tested in two different languages, with samples gathered from two countries in two different continents. We have applied measurement invariance techniques to test the extent to which both versions of the inventory are equivalent. At the facet level, all of the facets yielded configural invariance, and the vast majority of the facets reached partial metric invariance. Scalar invariance was attained in one facet. Nonetheless, it is important to notice here that the two populations were very different in terms of age (effect size of the difference $d = 1.83$). Given that personality traits' structure and mean levels change within the lifespan of individuals, this age difference might have affected our invariance tests. For instance, Roberts, Walton and Viechtbauer (2006) reported in their meta-analysis that the mean levels of *Dominance* increase from late childhood into late adolescence, reaching a plateau at an approximate age of 35. Our results are in line with this finding. The facet *Dominance* is not scalar invariant, and only partial metric invariance could be established. Future studies should investigate normative change as a possible confounder in the results presented in this paper, as our two samples' mean age differ significantly. Despite this mean age difference, the degree of measurement invariance obtained by both versions of the inventory has been satisfying, indicating that cross-cultural research is feasible with the inventory presented here.

Limitations

Given that this study is the first outlet using the Berlin multi-facet personality inventory, its psychometric properties are still preliminary and subject to replication. More studies are needed with heterogeneous samples to test whether the found structure can be retrieved from other populations. We should bear in mind that some facets which were a priori defined had to be excluded from the final proposal due to deficits in their integration within the Big Five framework, this problem could arise in other populations.

One important limitation was sample size with regard to ESEM models which could not be fitted using a second order structure. Instead, we were forced to use the factor scores from previous facet models as indicators of the domains, as the model did not converge otherwise. By doing so, we had some specific facet variance left outside the ESEM model which resulted in lowered values for the CFI.

Currently, the Berlin multi-facetted personality inventory is only available in two languages. We hope to see a bigger dissemination through different cultures in order to extent its international usability. Although personality traits seem to be universal, a certain degree of cultural variation does exist. Further adaptations of this inventory will reveal the extent to which the chosen indicators relate to the proposed set of facets in countries distinct from the USA or Germany.

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Table 1. Most common Big Five models

Taxonomy	Domains	Facets	Reliability	Nom.net. /Number of items
HEXACO-PI-R		(Lee & Ashton, 2016)		100 items
	Humility			
		Sincerity	0.66	
		Fairness	0.76	- Psychopathy (-.66), - Antisocial behavior (-.44) (Gaughan, Miller, Lynam, 2012); + Ethics/Integrity (.22) (McAbee et al., 2014)
		Greed Avoidance	0.81	- Social Dominance Orientation (-.45) (Leone et al., 2012)
		Modesty	0.68	
	Emotionality			
		Fearfulness	0.70	
		Anxiety	0.64	
		Dependence	0.80	
		Sentimentality	0.70	- Callous affect (-.68) (Gaughan et al., 2012); + Diversity **(**.22**)** (McAbee, Oswald, Connelly, 2014)
	Extraversion			
		Social Self-Esteem	0.67	+ Adaptability / Life skills (.25) **(**McAbee et al., 2014**)**
		Social Boldness	0.76	+ Emision-reduction behavior (Brick & Lewis, 2014) + Leadership (.36) (McAbee et al., 2014)
		Sociability	0.71	
		Liveliness	0.76	+ Adaptability / Life skills (.25), + Social responsability (.22), + Health **(**.21**)** (McAbee et al., 2014)
	Agreeableness			
		Forgivingness	0.74	
		Gentleness	0.66	
		Flexibility	0.61	
		Patience	0.79	
	Conscientiousness			
		Organization	0.74	
		Diligence	0.70	+ GPA (.31), + Adaptability / Life skills (.37), + Perseverance **(**.50**)**

				(McAbee et al., 2014)
		Perfectionism	0.69	+ Emision-reduction behavior **(**.25**)** (Brick & Lewis, 2014)
		Prudence	0.69	- Erratic life-style **(**-.58**)** (Gaughan et al., 2012)
	Openness			
		Aesthetic	0.66	+ Emision-reduction behavior (.33) , + Connectedness to nature (.51) (Brick & Lewis, 2014); - Right Wing Authoritarism (-.37) (Leone et al., 2012); + Continuous learning (.30) (McAbee, 2014) + Artistic appreciation (.43) (McAbee et al, 2014)
		Unconventionality	0.52	- Political Conservatism **(**.29**)** (Brick & Lewis, 2014)
		Creativity	0.75	
		Inquisitiveness	0.66	+ Continuous learning (.30) **(**McAbee et al, 2014**)**
NEO-PI-r		(McCrae et al., 2011)		240 items
	Neuroticism			
		Anxiety	0.78	- Fearless dominance (-.49) (Gaughan et al, 2009)
		Angry Hostility	0.75	+ Callous / Manipulation (.29) + Dysregulation / Disinhibition (.48) + Anti-social behavior (.26) (Gaughan et al, 2009)
		Depression	0.81	+ Attachment Anxiety (.49), + Attachment avoidance (.26) (Noftle & Shaver, 2006); + Alexithymia (.36) (Bagby, Taylor, Parker; 1994); - Satisfaction with life (-.52) (Schimmack et al., 2004); + Avoidant attachment style (.32), + Anxious attachment style (.32) , - Secure attachment style (-.39) (Shaver & Brennan, 1992)
		Self-Consciousness	0.68	+ Autism-spectrum Quotient (.33) (Wakabayashi et al., 2006); + Avoidant attachment style (.32) (Shaver & Brennan, 1992)

	Impulsiveness	0.70	+ Alcohol related problems (.29) (Ruiz, Pincus & Dickinson, 2010)
	Vulnerability	0.77	
Extraversion			
	Warmth	0.73	+ Secure attachment style (Shaver & Brennan, 1992); - Attachment avoidance (-.26) (Noftle & Shaver, 2006)
	Gregariousness	0.72	- Autism-spectrum Quotient (-.43) **(**Wakabayashi et al., 2006**)**
	Assertiveness	0.77	
	Activity	0.63	
	Excitement Seeking	0.65	+ Fearless dominance **(**.53**)** (Gaughan et al, 2009)
	Positive Emotions	0.73	+ Satisfaction with life (.40) (Schimmack et al., 2004); - Avoidant attachment style (-.30) (Shaver & Brennan, 1992)
Openness			
	Fantasy	0.76	
	Aesthetics	0.76	
	Feelings	0.66	- Alexithymia (-.55) (Bagby et al., 1994)
	Actions	0.58	
	Ideas	0.80	
	Values	0.67	+ SAT verbal (.26) **(**Noftle & Robins, 2007**)**
Agreeableness			
	Trust	0.79	- Attachment avoidance (-.26) (Noftle & Shaver, 2006)
	Straightforwardness	0.71	- Interpersonal manipulation (-.75) (Gaughan et al., 2012); - Supervisor rating (Piedmont & Weinstein, 1994); - Fearless dominance (-.49), - Dysregulation / Disinhibition (-.49) (Gaughan et al, 2009)
	Altruism	0.75	- Callous affect (-.63), - Antisocial behavior (-.37) (Gaughan et al., 2009); - Antisocial behavior (-.26) (Gaughan, et al., 2012)
	Compliance	0.59	

		Modesty	0.67	
		Tender-Mindedness	0.56	- Callous affect **(**-.56**)** (Gaughan et al., 2012)
	Conscientiousness			
		Competence	0.67	
		Order	0.66	
		Dutifulness	0.62	- Dysregulation / Disinhibition (-.49) **(**Gaughan et al, 2009**)**
		Achievement Striving	0.67	+ Supervisor rating (.23) (Piedmont & Weinstein, 1994)
		Self-Discipline	0.75	- Attachment anxiety (-.35) (Noftle & Shaver, 2006); - Dysregulation / Disinhibition (-.51) (Gaughan et. al, 2009)
		Deliberation	0.71	- Erratic life-style (-.57) (Gaughan et al., 2012); - Alcohol related problems (-.38) (Ruiz et al., 2010)
BFI-2		(Soto & John, 2016)		60 items
	Extraversion			
		Sociability	0.83	- Conformity (-.36), - Tradition (-.24), + Stimulation (.21), + Positive affect **(**.32**)** (Soto & John, 2016)
		Assertiveness	0.80	+ Power **(**Soto & John, 2016**)**
		Energy level	0.74	+ Purpose in life (.53), + Self-acceptance (.53), + Social connectedness **(**.33**)** (Soto & John, 2016)
	Agreeableness			
		Compassion	0.68	+ Benevolence (.47), - Power (-.44), + Positive relations **(**.41**)** (Soto & John, 2016)
		Respectfulness	0.66	+ Conformity **(**.39**)** (Soto & John, 2016)
		Trust	0.75	+ Universalism (.21), + Likability **(**.25**)** (Soto & John, 2016)
	Conscientiousness			
		Organization	0.76	+ Security **(**.30**)** (Soto & John, 2016)

		Productiveness	0.74	- Hedonism (-.35), + Achievement (.26), + Environmental mastery (.56) (Soto & John, 2016)
		Responsability	0.68	- Stimulation, + Autonomy (Soto & John, 2016)
	Negative Emotionality			
		Anxiety	0.79	- Autonomy **(**-.32**)** (Soto & John, 2016)
		Depression	0.74	- Positive relations (-.56), - Purpose in life (-.55), - Environmental mastery (-.65), -Self-acceptance(-.68), - Positive affect **(**-.42**)** (Soto & John, 2016)
		Emotional Volatility	0.70	- Stress resistance **(**Soto & John, 2016**)**
	Open-mindedness			
		Intellectual curiosity	0.78	+ Self-direction (.44), + Personal growth **(**.50**)** (Soto & John, 2016)
		Aesthetic Sensitivity	0.67	
		Creative Imagination	0.67	
IPIP-NEO-120		(Johnson, 2014)		120 items
	Neuroticism			
		Anxiety	0.78	
		Anger	0.87	
		Depression	0.85	
		Self-Consciousness	0.74	
		Inmoderation	0.72	+ Hangover symptoms **(**.35**)** (McAdams & Donnellan, 2009)
		Vulnerability	0.76	
	Extraversion			
		Friendliness	0.81	
		Gregariousness	0.79	
		Assertiveness	0.85	
		Activity Level	0.71	

	Excitement Seeking	0.77	+ Alcohol Use (.45), + Drinking problems **(**.37**)** (McAdams & Donnellan, 2009)
	Cheerfulness	0.80	+ Addictive mobile phone usage style **(**.28**)** (Siddiqui, 2011)
Openness to Experience			
	Imagination	0.83	
	Aesthetics	0.76	
	Emotionality	0.69	
	Adventurousness	0.72	
	Intellect	0.75	
	Liberalism	0.64	+ Trendy mobile phone usage style **(**.31**)** (Siddiqui, 2011)
Agreeableness			
	Trust	0.86	
	Morality	0.76	+ Thrifty mobile phone usage style (.48) (Siddiqui, 2011)
	Altruism	0.76	
	Cooperation	0.73	
	Modesty	0.76	
	Sympathy	0.72	
Conscientiousness			
	Self-Efficacy	0.63	
	Orderliness	0.83	
	Dutifulness	0.69	
	Achievement-striving	0.80	+ Academic Performance **(**.23**)** (Rosander, Bäckström & Sternberg, 2011)
	Self-Discipline	0.73	+ General health behaviors (.27) (Hagger-Johnson & Whiteman, 2007)
	Cautiousness	0.87	

Note: Reliability stands for internal consistency estimates (Cronbach's α), retrieved from sources cited in the reliability column. Nom.net stands for nomological network. Coefficients in the nom.net column represent Pearson *r* coefficients. Numbers in the initial row of the predictive validity column represent number of items.

Table 2. EFA model fit

Domain (number of facets according to EFA)	Chi-squared (df)	CFI	RMSEA	SRMR	Eigenvalues	MAP	PA
Agreeableness (10)	6477.67*** (4363)	0.837	0.039	0.034	42.99	9	9
Conscientiousness (10)	8377.56*** (5243)	0.827	0.041	0.034	51.09	12	9
Extraversion (8)	4643.64*** (2620)	0.837	0.046	0.036	38.25	13	9
Emotional stability (8)	9346.97*** (5987)	0.836	0.039	0.034	53.50	9	7
Openness (9)	8178.52*** (5142)	0.824	0.040	0.036	47.41	10	11

Note: *** means p value < 0.01.

Table 3. Internal consistency, CFA model fit, and ESEM standardized loadings in the intended domain

	IC		CFA				ESEM
	α	ω	χ^2(df)	pvalue	CFI	RMSEA	λ std*
Agreebleness	-	0.86	-	-	-	-	-
Appreciation	0.71	0.73	15.02(5)	0.01	0.99	0.08	0.38
Integrity	0.72	0.74	3.17(5)	0.67	1	0	0.64
Low competitiveness	0.72	0.72	1.99(5)	0.85	1	0	0.76
Good Fatih	0.65	0.69	33.59(5)	0	0.97	0.13	0.23
Genuineness	0.65	0.68	5.5(5)	0.36	1	0.02	0.64
Altruism	0.52	0.56	0.37(2)	0.83	1	0	0.35
Conscientiousness	-	0.88	-	-	-	-	-
Dominance	0.71	0.73	38.45(5)	0	0.93	0.14	0.27
Persistence	0.57	0.62	19.72(5)	0	0.98	0.09	0.32
Self-discipline	0.68	0.68	13.62(5)	0.02	0.98	0.07	0.3
Task planning	0.81	0.81	5.66(5)	0.34	1	0.02	0.82
Goal orientation	0.78	0.82	13.6(5)	0.02	0.99	0.07	0.68
Carefulness	0.68	0.68	12.94(5)	0.02	0.98	0.07	0.58
Orderliness	0.82	0.83	25.64(5)	0	0.99	0.11	0.46
Wish to work to capacity	0.63	0.67	10.41(5)	0.06	0.99	0.06	0.35
Productivity	0.68	0.69	12.17(5)	0.03	0.98	0.06	0.4

Extraversion	-	0.9	-	-	-	-	-
Sociability	0.66	0.68	13.27(5)	0.02	0.99	0.07	0.75
Wish for affiliation	0.65	0.68	16.52(5)	0.01	0.98	0.08	0.69
Positive attitude	0.82	0.83	1.75(5)	0.88	1	0	0.55
Forcefulness	0.68	0.7	20.94(5)	0	0.97	0.09	0.2
Communicativeness	0.75	0.75	18.27(5)	0	0.98	0.09	0.7
Humor	0.79	0.79	18.77(5)	0	0.99	0.09	0.29
Conviviality	0.69	0.71	14.89(5)	0.01	0.98	0.07	0.74
Energy	0.71	0.74	0(0)	-	-	-	0.49
Emotional Stability	-	0.9	-	-	-	-	-
Equanimity	0.74	0.75	9.38(5)	0.09	1	0.05	0.39
Mental balance	0.86	0.86	10.02(5)	0.07	0.99	0.05	0.54
Carefreeness	0.77	0.77	8.46(5)	0.13	1	0.04	0.76
Confidence	0.7	0.71	8.2(5)	0.15	1	0.04	0.41
Drive	0.62	0.64	13.21(5)	0.02	0.98	0.07	0.59
Emotional robustness	0.75	0.76	13.6(5)	0.02	0.99	0.07	0.73
Self-attention	0.6	0.63	0(0)	-	-	-	0.63
Openness	-	0.92	-	-	-	-	-
Creativity	0.68	0.68	17.19(5)	0	0.98	0.08	0.81
Wish for variety	0.70	0.72	9.96(5)	0.08	1	0.05	0.42
Open-mindedness	0.66	0.67	19.17(5)	0	0.98	0.09	0.77
Interest in reading	0.85	0.86	5.79(5)	0.33	1	0.02	0.54
Artistic interests	0.81	0.82	18.32(5)	0	0.99	0.09	0.59
Wish to analyze	0.78	0.79	11.04(5)	0.05	0.99	0.06	0.78
Willingness to learn	0.81	0.82	8.03(5)	0.15	1	0.04	0.71
Intellect	0.8	0.81	0(0)	-	-	-	0.62

Note: IC = Internal Consistency. “*” = all factor loadings are significant with $p < 0.05$.

Table 4. Nomological network

	Satisfaction with life			GPA			Absences		
	r	stdβ	R^2	r	stdβ	R^2	r	stdβ	R^2
Appreciation	0.16	-0.01		0.12	-0.03		-0.07	0.02	
Integrity	0.19	0.14*		0.17	0.1		-0.11	-0.01	
Low competitiveness	0.03	-0.09		0.02	-0.13*		-0.05	0.04	
Good faith	0.25	0.2*		0.17	0.11*		-0.11	-0.08	
Genuineness	0.12	0.04		0.16	0.14*		-0.15	-0.15*	
Altruism	0.14	0.02		0.15	0.07		-0.09	-0.03	
Agreeableness	0.16		0.08	0.2		0.06	-0.14		0.03
Dominance	0.03	0.02		0.06	0.06		0.03	0.04	
Persistence	0.27	0.16*		0.12	-0.01		-0.16	0	
Self-discipline	0.19	0.08		0.13	0.07		-0.2	-0.09	
Task planning	0.2	0.01		0.16	-0.01		-0.25	-0.14*	
Goal-orientation	0.28	0.13		0.22	0.15*		-0.24	-0.08	
Carefulness	0.23	0.1		0.16	0.03		-0.17	0.03	
Orderliness	0.11	-0.07		0.14	0.06		-0.2	-0.05	
Wish to work	0.1	-0.05		0.11	0.03		-0.09	0.03	
Productivity	0.23	0.07		0.13	0		-0.24	-0.13*	
Conscientiousness	0.3		0.13	0.23		0.06	-0.28		0.1
Sociability	0.26	0.09		0.11	0.11		-0.03	-0.04	
Wish for affiliation	0.2	0.06		0.06	0		0.01	0.07	
Positive attitude	0.49	0.52*		0.07	0.03		-0.07	-0.07	
Forcefulness	0.09	-0.03		0	-0.05		0.06	0.07	
Communicativeness	0.11	-0.05		0.06	0.03		0.02	-0.01	
Humor	0.16	-0.07		0.02	-0.02		0.08	0.13*	
Conviviality	0.22	-0.06		0.05	-0.01		-0.01	0.01	
Energy	0.25	0.02		0.06	0.02		-0.15	-0.18*	
Extraversion	0.33		0.26	0.05		0.02	0.02		0.05
Equanimity	0.22	0.02		0.11	0.13*		-0.11	-0.09	
Mental balance	0.53	0.59*		0.09	0.13		-0.11	-0.08	
Carefreeness	0.31	-0.04		-0.01	-0.11		-0.04	0.09	
Confidence	0.25	0.09*		0.03	0.02		-0.02	0.04	
Drive	0.27	-0.05		0.08	0.06		-0.15	-0.14*	
Emotional robustness	0.18	-0.07		-0.05	-0.11		-0.01	0.04	
Self-attention	0.21	-0.04		0	-0.03		-0.06	-0.01	
Emotional stability	0.4		0.3	0.05		0.04	-0.1		0.04
Creativity	0.06	-0.1		-0.01	-0.14*		0	0.03	
Wish for variety	0.18	0.09		0.09	0.06		0.01	0.07	

Open-mindedness	0.22	0.14*		0.14	0.08		-0.07	-0.07
Interest in reading	0.07	-0.02		0.15	0.12*		-0.04	-0.04
Artistic Interests	0.04	-0.09		0.04	-0.06		0.04	0.09
Wish to analyze	0.13	-0.05		0.1	0.01		0.01	0.11
Willingness to learn	0.21	0.13		0.1	-0.04		-0.08	-0.15*
Intellect	0.24	0.16*		0.2	0.17*		-0.09	-0.08
Openness	0.2		0.09	0.15		0.07	-0.03	0.03

Note: * means significant at alpha = 0.01. For the R^2 column, * means p < 0.01 in the linear regression's F statistic.