1   The Berliner Multi-Facet Personality Inventory: An extensive measure of Big Five

2   personality

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Abstract

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1. Introduction

Over the last decades, the Five Factor Model as well as the Big Five model have
become widely accepted models for describing general attributes of personality. Often the
terms are even used synonymously, which is why we will refer to the Big Five from here on.
The Big Five is a hierarchical model which describes human individual differences in
personality at the dispositional level: one of the most basic, universal, biologically-influenced
and stable layers of human inter-individual differences in behavior, cognition and feeling (D.
P. McAdams & Pals, 2006). Its hierarchical conception is relevant to acknowledge behavior
from the most specific (nuances) to the most broad differences in temperament and character
(dimensions), through a varying number of mid-level personality characteristics (facets).
Most of the research concerning criterion validity of the Big Five inventories has focused on
the covariation between the Big Five dimensions and relevant external outcomes. However,
specific dispositional characteristics captured on the facet level might be of extreme utility to
provide more complex descriptions of individuality and to predict life outcomes to a major
extent (Lounsbury, Sundstrom, Loveland, & Gibson, 2002; S. V. Paunonen & Ashton, 2001;
Ziegler et al., 2014). Unfortunately, the number and nature of the facets below the Big Five
is far from being consensual. In fact, different facet level models have been proposed
(XXXX). One potential reason for this could be that many facet level models were developed
after a questionnaire version without such a level had been published. Thus, the facets were
developed as an elaboration or extension to an existing domain measure. While this has
many theoretical advantages it also has the disadvantage of potentially limiting the search
space of possible facets. In this work we aim at maximizing this search space and present a
personality questionnaire which is broad at the facet level, open-access, and measurement
invariant across two different cultures.

1.2. A short history of the Big Five

Francis Galton is credited as being the one who proposed the fundamental lexical hypothesis as a ground from where to describe interpersonal differences in personality. The hypothesis states that every apprehended characteristic in the realm of personality should have its place in the natural language, a corollary derived from this first statement is that the essential features must represent a unique word in the lexical universe of this language. Galton (1884) himself, and later Allport and Odbert (1936) and still later Norman (1967), used English dictionaries for a systematic collection of all adjectives which could be related to human personality characteristics. Using exploratory factor analyses on self and other ratings, five broad factors could repeatedly be extracted from the data.

Cattell was one of the first researchers who systematically applied exploratory factor analysis in order to explore personality structure. He inspected the correlation structure of the items in the word lists of his predecessors, finding 16 oblique personality factors, including one factor specifically for intelligence, these factors form the 16-PF. These 16 factors were the primary factors in a hierarchical structure for Cattell (coetany to L.L. Thurstone and undoubtedly influenced by him). Cattell himself viewed personality as a hierarchical structure, containing three layers (Cattell, 1956). The second order factors resemble the Big Five dimensions (Digman, 1990).

Different researchers followed Cattell in the study of dispositional traits of personality. One of the most influential models was Eysenck's Big Three. Grounded on a strong biological basis, Eysenck's theory supposed a link between temperament and personality. Its structural proposal concerned at first two big factors, named Neuroticism vs. Emotional stability and Extraversion vs. Introversion. These two dimensions were later joined by a third factor that Eysenck called Psychoticism. This label was criticized by others who suggested that a more appropriate term would be psychopathy (Digman, 1990). Eysenck's big two are

still "alive"" today in the Big Five, and his third factor, psychoticism, can be operationalized as other dimensions within the Big Five: Agreeableness, Conscientiousness and Openness.

A large number of studies have focused on the problem of personality structure resulting in a five factor solution (Borgatta, 1964; Fiske, 1949; Norman, 1967; Tupes & Christal, 1961). Possibly the two most widely cited works relating to the foundations of the Big Five are those by L. R. Goldberg et al. (2006) and P. T. Costa and McCrae (1995). Goldberg can be seen as one of the first who extended research concerning the Big Five, while McRae and Costa's importance rests on popularizing the terminology (OCEAN) and the development of one of the most used tools to assess personality based on the Big Five: the NEO-PI. The Big Five dimensions are labeled as follows: I) Extraversion vs. Introversion. II) Agreeableness or Friendliness. III) Conscientiousness or Achievement or Will. IV) Emotional Stability vs. Neuroticism, and V) Openness or Intellect or Culture.

One of the most important features of the Big Five is the fact that it could be replicated in different languages. Research is available in Japanese, Vietnamese, German, Spanish, Greek, and many more (**???, ???**). This finding suggests that the way human beings construe personality is at some point universal and that its basic features are retained within the Big Five. Another essential characteristic relies on its hierarchical nature. The five domains are useful to retain the big picture of personality, maximize the situation consistency and reliably assess difficult subjects such as children. Nonetheless, each dimension is conceptualized as a latent construct formed by more specific narrow factors called facets, which in turn are useful to depict the impact of personality characteristics into specific behaviors and concrete life outcomes.

The Big Five has proven to be a valid theoretical and empirical model to predict relevant life outcomes. Research such as Ozer and Benet-Martínez (2006) or B. W. Roberts, Kuncel, Shiner, Caspi, and Goldberg (2007) has shown that scores for the Big Five dimensions (and their related facets) are able to explain outcomes such as academic and

94 work performance, health, personality disorders, political attitudes and many more. The

95 empirical findings linking Big Five measures to life outcomes have reinforced the concurrent

96 validity of the test scores interpretations. At the same time, the broad nature of the domains

97 has spurned research into the more fine-grained lower order structure of facets.

98 **1.3. Facet Structures**

99   There are a number of models that include a facet structure below the five broad

100 domains. The most widely known model is the one suggested by P. T. Costa and McCrae

101 (1995), the NEO-PI-R model. Other popular models have been suggested for the Big Five

102 Inventory 2 (BFI-2; Christopher J Soto & John, 2016), the IPIP (L. R. Goldberg et al.,

103 2006), and the HEXACO model (Lee & Ashton, 2016), which assumes six broad domains.

104 *Table 1* gives an overview of these different models listing their facets per domain as well as

105 some information regarding their psychometric properties.

106   < Table 1 >

107   As shown in *Table 1*, there are different possibilities of facets forming the domains.

108 However, there is still a degree of overlap between the facets covered by the different

109 instruments. Christopher J. Soto and John (2009) inspected the convergences between the

110 NEO-PI-R and the first version of the BFI, suggesting that two constructs per domain were

111 measured at the facet level by both inventories. The constructs defined by Christopher J.

112 Soto and John (2009) were: *Altruism* and *Compliance* for Agreeableness; *Anxiety* and

113 *Depression* for Neuroticism; *Order* and *Self-Discipline* for Conscientiousness; *Assertiveness*

114 and *Activity* for Extraversion; and *Aesthetics* and *Ideas* for Openness. The convergence holds

115 for the four instruments listed in *Table 1*, as these ten constructs are covered within the

116 facets for every instrument. Some of the constructs are explicitly covered at the facet level

117 (e.g. Anxiety); meanwhile others are mainly covered by the four instruments, although

118 sometimes implicitly (e.g. Liveliness in HEXACO resembles the "core" construct Activity,

119 present in all other instruments). The reverse is not always true, not every facet within the

120 four instruments is covered by the constructs proposed by Christopher J. Soto and John

121 (2009). As an example we find Self-Consciousness, a Neuroticism facet defined by the

122 NEO-PI-R and the IPIP-NEO-120, which is not intrinsically tapping at either Anxiety or

123 Depression. The same authors asserted in a later work (Christopher J Soto & John, 2016)

124 that the Big Five domains *"can be conceptualized and assessed more broadly or more*

125 *narrowly"*, either focusing in a central facet or in a set of peripheral facets, depending the

126 research interest.

127   The mid-level layer between domains and facets has also been explored by DeYoung,

128 Quilty, and Peterson (2007). Their work has focused in the biological consistency of the

129 NEO-PI-R set of facets, thereby proposing a two factor source of variance for each facet of

130 the inventory. In line with their proposal, Agreeableness would be composed by *Compassion*

131 and *Politeness*; Neuroticism by *Volatility* and *Withdrawal*; Conscientiousness by

132 *Industriousness* and *Orderliness*; Extraversion by *Enthusiasm* and *Assertiveness*; and

133 Openness by *Intellect* and *Openness*. Both Christopher J. Soto and John (2009) and

134 DeYoung et al. (2007) proposals have many points in common. Maybe the labels *Volatility*

135 and *Withdrawal* for Neuroticism can be suspicious of a different content than *Anxiety* and

136 *Depression*, but when inspected at the item level it is revealed that they are tapping the

137 same components respectively (DeYoung et al. (2007); for item specification).

138   The nomological network commonly assumed in Big Five questionnaires is drawn from

139 nuances through facets to domains, from more specific to more general. Relying on domains

140 to explain and predict behavior can benefit from ease of interpretability. However,

141 predictions for specific contexts can be enhanced if a more specific set of traits is used. On

142 the other hand, using nuances to predict behavior might yield even stronger predictive

ability (Seeboth & Mõttus, 2018), but as the number of predictors grows the interpretations become more complex. Facets are on a middle ground between nuances and domains, in a compromise between specificity and sensitivity in the bandwidth-fidelity dilemma. This narrow aggregation both satisfies the specificity of predictions to concrete situations and environments and also enhances the ease of interpretability when summarizing individual personality characteristics.

Personality measured at the facet level has found to be a strong predictor of a large number of outcomes. Satisfaction with life (SWL) is one of them. Neuroticism and Extraversion were recognised as the most important personality dimensions in the prediction of subjective satisfaction (**???**; Diener, Oishi, & Lucas, 2003). Lately, (**???**) observed that the analysis at the facet level outperform the analysis at the domain level. They observed that *Depression* and *Positive Emotions / Cheerfulness* explained SWL above and beyond the dimensions they belong to, reaching to a 30% of explained variability of SWL. Correlations in the (**???**) study ranged in a longitudinal design from $r = -.57$ to $r = -.49$ for the first and from $r = .51$ to $r = .38$ for the second and third. We hypothesize that the facets *Confidence* (N2) and *Positive attitude* (E4) developed in our instrument will behave similarly

Another relevant outcome that has shown to be best predicted with personality at the facet level is academic achievement. Conscientiousness and Openness to experience have been regarded as the most important dimensions to predict academic success. The relation of Conscientiousness with school grades has gained a stable empirical evidence, widely inspected in the meta-analysis by O'Connor and Paunonen (2007), were the mean correlation was $r = .24$, our second hypothesis will be to replicate this finding. O'Connor and Paunonen (2007) found that *Achievement-striving, Self-discipline* and *Dutifulness* were the best predictors of academic performance under the Conscientiousness domain (ranging from $r = .15$ to $r = .39$, from $r = .18$ to $r = .46$, and from $r = .25$ to $r = .46$ respectively), to replicate this finding will be our third hypothesis. Openness is supposed to play an

important role in predicting academic achievement, however evidence has been elusive at the

dimension level (**???**). Openness to ideas has been found to be a facilitator towards better

GPA, wih correlations being found $r = .22$ in Dollinger and Orf (1991) and $r = .15$ in

Ziegler, Danay, Schölmerich, and Bühner (2010). We expect to find similar correlations with

Open mindedness (O3) in our fourth hypothesis. Often different facets within the same

domain can have effects in opposite directions, partially canceling out the predictive ability

of the dimensions. This could be the case of Openness to experience, were facet-level

analysis can be unveiling. Openness to fantasy has found to yield a negative relation to GPA

$r = -.22$ for men, whereas Aesthetics yielded a similar relationship with GPA for women $r = -.19$ (De Fruyt & Mervielde, 1996). In our case we expect that *Creativity* (O1) yield negative

correlations with GPA for both sexes, and the overall effect of Opennes on academic

achievement being nearly zero, this will be our fifth hypothesis.

Likewise, personality has proven to be a powerful predictor of laboral and educational

abseentism (**???, ???**). Research has highlighted the predictive power of personality over

integrity test when predicting absences (**???**). Again, most research has focused on the

dimensional level, although some researchers suggested that personality assessed at a

narrower level would improve the predictive ability of the models (**???, ???**). Nonetheless,

few studies have explored this relationship to our knowledge, being (**???**) and (**???**) the

most prominent. (**???**) reported no predictive gain when examining personality at the facet

level for the NEO-PI-R composites of Extraversion and Conscientiousness, whereas (**???**)

found a modest predictive gain of *Work drive* over the Big Five dimensions. Therefore, and

despite the conceptual expectation of facets maximizing the predictive ability of personality

on abseentism, evidence has manifested in favour of a dimension level analysis. Therefore our

sixth hypothesis of the criterion validity section will be that *Persistence* (C2) will add a

significative proportion of variance explained in the model which includes the five dimensions.

Furthermore, this study would help to envision the research question of which facets could

be involved in the relation between personality and school abseentism.

196   As described above, facet measures often yield scores that have stronger test-criterion

197   correlations than their respective domain scores. However, facet scores have also been shown

198   to be related to personality disorders. Thus, the combination of a higher fidelity along with

199   the potential clinical relevance of facet scores might open up unique advantages for clinical

200   research.

1.4. The Big Five and Personality Disorders

202   Personality disorders are steadily shifting from a categorical definition into a continua

203   conceptualization within the clinical realm. This process is not new for personality science

204   history, as the subject itself moved from a qualitatively distinct set of definitions, called

205   types, into a subset of continuous domains in which both normality and extreme tendencies

206   were moving along, named traits. In fact, the new version of the Diagnostic and Statistical

207   Manual of mental disorders, DSM-V, now proposes two different ways of assessing

208   personality disorders: 1) A descriptive model of personality disorders in section II which

209   mimics the former model of assessing personality disorders and; 2) A novel trait model that

210   follows research on the personality scientific domain (In section III), which conceptualizes

211   personality disorders as extreme tendencies located in the continuum of the Big Five domains

212   and facets (American Psychiatric Association, 2013; T. A. Widiger & Mullins-Sweatt, 2009)

213   This paradigm shift in clinical assessment of personality has led to the construction of

214   the Personality Disorder Inventory (PID-5; R. F. Krueger, Derringer, Markon, Watson, &

215   Skodol, 2012), a 25-facet and five-dimension self-report inventory, with an informant-report

216   version (K. E. Markon, Quilty, Bagby, & Krueger, 2013). These five dimensions mirror the

217   Big Five domains, although with a focus on the maladaptative end of the continuum,: I)

218   Detachment (Big Five's Introversion), II) Antagonism (absence of Big Five's Agreeableness),

219   III) Disinhibition (absence of Big Five's Conscientiousness), IV) Negative affect (Big Five's

220   Neuroticism) and V) Psychoticism (Absence of Big Five's Openness). The PID-5 has shown

satisfying evidences of criterion validity (...summary). However, the number of facets per domain on the PID-5 is limited.

In line with what has been stated previously for academic achievement, the examination of facets may result in an enhancement of the specificity of assessment when looking at the nature of PDs (L. A. Clark, 2005; Samuel & Widiger, 2008). This improvement of specificity resulted in a predictive gain ranging from 3% to 16% when comparing facets to domains predicting PD in a study by Reynolds and Clark (2001). Furthermore, the use of facets may be of extreme utility for those PD whose personality profile is less clear at the domain level. As Saulsman and Page (2004) pointed out, Schizotypal and Obsessive-Compulsive disorders are examples of PD which are not well covered by Big Five domains. A reason for it may be found in a pattern inconsistency of facets within the same dimension or in a lack of coverage for essential characteristics of the PD. For example, aberrant cognitions are essential characteristics of schizotypal disorder and are not covered by some instrument's facets like the NEO-PI-R (Samuel & Widiger, 2008; Saulsman & Page, 2004). Likewise, the expected high scores on warmth and low scores on assertiveness could mask the effects of extraversion when predicting Dependent Personality Disorder, following the theoretical correspondence between PD and Big Five facets proposed by Costa Jr. and Widiger (1994). Moreover, the PID-5 has prompted the elaboration of a number of Five Factor Model Personality Disorders (FFMPD) scales to maximize the facet coverage in relation to specific PDs (R. M. Bagby & Widiger, 2018).

Facet analysis and dedicated Big Five questionnaires have been used to solve issues like those mentioned in the last paragraph. We propose to base such research on a broader facet basis. To this end we suggest a general instrument to cover a broad number of facets which could aim for fine grained assessments.

This study

We present in this paper an instrument for personality assessment which aims to cover the need for an internationally usable, open source, and differentiated measure at the facet level. Two studies are presented, for each one inspects the factor structure of the instrument in a different sample drawn from a different culture (American vs. German). Measurement invariance across samples will be examined. Internal consistency and test-criterion correlations will be estimated for all scores. To sum up, the aim for this research project was to provide an instrument that can be used in non-clinical but also in clinical research which emphasizes the facet level of the Big Five.

Methods

Two different studies are presented in this work. The first study uses a sample drawn from the USA bachelor student population. The aim was to detect and confirm a model that maximizes the facet space below the Big Five domains. Exploratory factor analysis (EFA) was used to identify the number of facets per domain. A confirmatory factor analysis (CFA) per facet was specified in order to confirm the item - facet relationship. Finally, an exploratory strucutural equation model (ESEM) was applied to test a full model in which the facets serve as indicators of the Big Five domains. ESEM has gained reputation in the personality field, where the independent cluster model may not capture the complexity of the constructs measured (Marsh et al., 2010).

The second sample is a sample representative for the German speaking population of Germany, Austria and Switzerland. The aim for the second study was to replicate the structure found in study one, plus assess the degree of measurement invariance of the proposed model.

Study 1 - US-American Sample

268 **Participants.**   The sample consisted of 722 American undergraduate students

270 (59.30% male) who participated voluntarily. The mean age was 21.60 years (SD = 5.90).

271 Students were emailed a link to a computerized assessment battery that included the IPIP

272 items as well as several other tests not reported in this paper. The data set was randomly

273 split into two equally sized samples. Both samples were matched in relation to missing

274 values, outliers and extreme values. In Sample 1 the mean age was 21.80 years (SD= 6.30),

275 in Sample 2 the mean age was 21.50 years (SD=5.60).

Measures

277 **Items from the International Personality Item Pool (IPIP).**   Altogether, 525

278 items from the *International Personality Item Pool* (IPIP) were used to measure

279 Neuroticism, Extraversion, Openness (to experience), Agreeableness and Conscientiousness.

280 The IPIP is an open source database of personality items, which was launched in 1996, and

281 contains over 2000 items (L. R. Goldberg et al., 2006). Participants were asked to rate

282 themselves on typical behaviors or reactions on a 5-point Likert scale, ranging from 1 ("Not

283 all like me") to 5 ("Very much like me").

284 The item selection was part of a different project and the procedure has been explained

285 in detail in the appendix of a study by MacCann, Duckworth, and Roberts (2009). That

286 study also contains part of the sample used here. However, the current data set contains

287 more participants.

288 **Satisfaction With Life (SWL).**   Measured with a 5 item composite defined in

289 Diener, Emmons, Larsen, and Griffin (1985), answered in a 7 point Likert-type scale ranging

290 from 1 (*strongly disagree*) to 7 (*strongly agree*). The items are: a)"In most ways my life is

291 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
which moment have SWLS been measured? just at the same time point than personality?)

GPA. Grade Point Averages measured in high school, university, and in cc.

SAT.

ACT.

Absences from class. As a behavioral measure absence from class was asked to
report from subjects. ABS2 ABS4 what are the differences?

2.1.3. Procedure

EFA with subsample 1. To determine the number of possible facets per domain
Velicer (1976) Minimum Average Partial (MAP) method and Horn (1965) parallel analysis
(PA) were employed for every domain. Based on these results an Exploratory Factor
Analysis (EFA) was calculated for each domain via Mplus using a geomin rotation (Quelle)
and a Maximum Likelihood estimator (ML). The decision for the preferred number of facets
per domain was based partly on comparing model fits (CFI, RMSEA, SRMR). More
importantly though was the interpretability of the facet solution. To this end, facet solutions
from other personality measures were looked and compared to the found facet structure. If
there were important parts missing to present the domain with regards to content, new
facets were added a posteriori.

CFA and ESEM with subsample 1. To confirm the structure of facets the EFAs
delivered, multiple CFAs were calculated via Mplus. In a first step, measurement models
were estimated for each of the facets. To obtain balance between the facets, the items were
reduced to five per facet based on item content and loading pattern. In a second step, the

estimations for the measurement models on facet levels were repeated via CFA. For both

steps estimators were WLSMV (Weighted Least Squares adjusted for Means and Variances).

Aim was to ensure an optimal breadth and sufficient reliability. In a final model, all five

domain structural models were integrated using ESEM (Asparouhov & Muthén, 2009).

Marsh et al. (2010) could show that ESEM fits personality data better and results in

substantially more differentiated factors than CFA. All facets were allowed to load on all

domains. If there would show up facets that do not significantly load on the intended

domain, this facets would get eliminated subsequently. The estimators used were ML

!WLSMV?, factor scores from the facet CFAs were used as indicators and the rotation was

oblique (using Geomin). Model fit was determined based on the guide lines by Hu and

Bentler (1999) as well as Beauducel and Wittmann (2005). Consequently, to consider a good

fit of a proposed model, the Comparative Fit Index (CFI) should be at or over .95, the

Standardized Root Mean Squared Residual (SRMR) smaller than .08 and the Root Mean

Square Error of Approximation (RMSEA) smaller than .06. For the ESEM models we

compared our results with the findings by Marsh et al. (2010).

Reliability

Chronbach's α and McDonald's ω will be calculated for each facet to provide measures

of internal consistency.

Criterion validity evidence. To examine the nomological structure of the facets

and domains to external constructs, a set of linear models and correlations were fitted. We

describe here a set of hypothesis prompted by other's research in the interplay between

personality and the external criteria which we had access for this work.

To explore the first hypothesis which predicts SWL (N2 would correlate from a range r

= -.57 and r = -.49; and E4 would correlate r = .51 to r = .38) we fitted a linear model that

included N2 and E4 as predictors. Furthermore we fitted a stepwise regression with all the

facets to find covered relations. In a third model we compared the power of E4 and N2 with

their respective domains, Extraversion and Neuroticism.

The second to sixth hypothesis involves academic achievement as criterion variable.

The second and third hypothesis will be explored via inspection of the correlation matrix

with the Big Five dimensions. The fourth hypothesis will be explored by means of a stepwise

regression were all the Conscientiousness facets will form the initial set of predictors. The

fifth hypothesis will be explored with a simple regression of O3 on high school grades. The

sixth hypothesis will be explored by inspecting the correlation of the facets forming

Openness with academic achievement.

The seventh hypothesis involves the relations between educational abseentism and

personality. To explore whether C2 would add predictive power to the five dimensions on

predictive absences, we will fit a two step regression. Finally, a stepwise regression of all

facets on school absentism will be fitted to explore predictions at the facet level.

Results

Results of EFA.   In *Table 2* model fits for the chosen facet model for each domain

are shown, as well as Eigenvalues and results from MAP and PA test. To ensure the

homogeneity of the facets and to reduce the risk of cross domain loadings, items with factor

loadings less than .30 were eliminated. This was only done when item content was also

judged as being non-central to the domain in question (Ziegler et al., 2014).

< Table 2 here>

According to the exploratory model, Agreeableness consists of eight facets after two

facets were eliminated due to weakly loading and inconsistent items. The remaining facets were named Appreciation, Integrity, Low Competitiveness, Readiness to Give Feedback, Search for Support, Good Faith, Genuineness and Altruism.

Conscientiousness consists of nine facets after one facet with item factor loadings less than .30 was excluded, they are: Dominance, Persistence, Self-discipline, Task planning, Goal orientation, Carefulness, Orderliness, Wish to work to capacity and Productivity.

Extraversion is formed by nine facets. A new facet (Energy) was added in order to tap better the physical component of Extraversion, which was missing in the eight facet solution. The facets are Sociability, Readiness to take risks, Wish for affiliation, Positive attitude, Forcefulness, Communicativeness, Humor, Conviviality and Energy.

Neuroticism (interpreted here as emotional stability) consists 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 are named Equanimity, Confidence, Carefreeness, Mental balance, Drive, Emotional robustness and Self-attention.

Openness to experience comprises nine facets. One facet was identified as a method factor and eliminated, because it solely contained negatively formulated items and no coherent underlying trait could be identified. Furthermore another facet (Intellect) was added, because the remaining facets lacked an intellectual content. The facets of Openness are named Creativity, Wish for variety, Open-mindedness, Interest in reading, Artistic interests, Wish to analyze, Willingness to learn, Sensitivity and Intellect.

The items to each facet are listed in the appendix (A).

Results of CFA and ESEM.   All measurement models for the facets fitted well, results are summarized in *Table 3*. In this table both models with five items only and models with all items are presented with their respective model fit. The 5-item facets normally

385 outperform the models including all items regarding model fit.

386 < Table 3 here caption="Model fit for each facet")>

387 The ESEM of the final model with all five domains yielded an acceptable fit (Marsh et

388 al., 2010): CFI = .87, RMSEA = .072, SRMR = .036. As it can be seen in *Table 4* nearly all

389 facets loaded significantly on their intended domain. Some cross loadings emerged as is

390 typical for ESEM procedures.

391 < Table 4 here caption="ESEM factor scores")>

392 **Reliability.** Reliabilities for the 5 item facets were calculated with α and ω estimates.

393 Agreeableness showed a mean α of 0.68, and a mean ω of 0.69. Conscientiousness' mean α =

394 0.68, and mean ω = 0.70. Openness' mean α = 0.76, and mean ω = 0.77. Neuroticism mean

395 α = 0.68, and mean ω = 0.69. TExtraversion's mean α = 0.72, and mean ω = 0.74.

396 **Criterion validity evidence.** Our first hypothesis concerning external criteria

397 involved *Confidence* (N2) and *Positive attitude* (E4), as the most important predictors of

398 SWL. Our results, in line with Schimmack, Oishi, Furr, and Funder (2004), showed that

399 both facets were the most salient predictors of the factor in a stepwise regresssion, and that

400 they explained 0.34% of the factor. The final model reached with the stepwise procedure

401 explained 0.41% of the factor variance. N2 and E4 outperformed Neuroticism and

402 Extraversion, who failed to be significant predictors in a stepwise model which included these

403 four independent variables.

404 Bivariate correlations of the facets with the external criteria are shown in *Table 5*. The

405 facets N2 (Confidence, r = 0.53) and E4 (Positive attitude, r = 0.49) show the highest

406 correlations with life satisfaction respectively. The SWL scale was also correlated with facets

such as N4 (Mental balance, r = 0.25) and N5 (Drive, r = 0.27) in the Neuroticism /

Emotional stability realm. C5 (Goal orientation, r = 0.28) and C2 (Persistence, r = 0.27) in

Conscientiousness. E1 (Sociability, r = 0.26) and E9 (Energy, r = 0.25) in the Extraversion

domain. O9 (Intellect, r = 0.24) and O3 (Open-mindedness, r = 0.22) in Openness and A6

(Good faith, r = 0.25) in the Agreeableness domain.

Regarding the academic performance criteria (GPA, SAT and ACT), the Openness

facets O4 (Interest in reading), O6 (Wish to analyze) and O9 (Intellect) yield the most

consistent correlations. Interestingly, O4 correlates directly with the reading subtests of SAT

(r = 0.25) and ACT (r = 0.2) and shows a negligible relationship with the math (r = 0.06 /

0.08) subscales.

Furthermore, the global GPA scale (assuming cc is for global) correlated with several

Conscientiousness and Agreeableness facets. C9 (Productivity, r = 0.4), C5 (Goal

orientation, r = 0.38) and C4 (Task planning, r = 0.35) yield the higher correlations with

overall GPA respectively in the Conscientiousness domain, and A1 (Appreciation, r = 0.32)

in the Agreeableness domain.

Concerning the behavioral criteria controlled in this study, absence from class, the

meaningful correlations unsurprisingly loaded within the facets at the Conscientiousness

domain. Particularly the facets C4 (Task planning, r = -0.22 / -0.26), C7 (C6: Carefulness, r

= -0.21 / -0.21) and C9 (Productivity, r = -0.21 / -0.24) were the most robust indicators of

this criteria.

< Table 5 here caption="Criterion correlations" >

Study 2 – German Sample

429   **Participants.**   The representative sample consisted of 387 German speakers (49.10%

430   male) with a mean age of 45.60 years (SD = 17.50). The data was collected in a test center.

431   **Measures.**   The five items per facet derived from Study 1 were translated and

432   back-translated by bilingual experts, creating a German version of the measure used there.

433   The translated items can be found in appendix B.

Procedure

435   **Step 1 − Examining the structure.**   To check the facet structure Study 1

436   delivered, multiple confirmatory factor analyses were calculated via Mplus following an

437   analogue procedure to Study 1. First, measurement models were estimated for all facets,

438   using WLSMV as the estimator. Model fit was determined based on the guide lines

439   mentioned above. In a final model, all five domain structural models were integrated using

440   ESEM.

441   **Step 2 − Testing for measurement invariance.**   In a next step, measurement

442   invariance between German and US samples was examined. We followed the procedure

443   suggested by Sass (2011) and tested configural, factorial and strong factorial invariance. The

444   cutoffs suggested by Chen (2007) were applied to compare model fits. According to this

445   configural measurement invariance can be assumed when the same item is associated with

446   the same factor in each domain, while the factor loadings can differ. If the factor loadings of

447   each item would not differ between the samples, factorial measurement invariance can be

448   assumed. Strong factorial measurement invariance can be assumed when on top of that the

449   intercepts of each item are equal. The limit to factorial measurement invariance was set to Δ

450   CFI < .01, Δ RMSEA < .015 and Δ SRMR < .03, at which the limit to strong factorial

451   measurement invariance was set to Δ CFI < .01, Δ RMSEA < .015, Δ SRMR < .01 (Chen,

452   2007).

Results

Results of CFA.   The measurement models of the American sample were replicated for the reduced number of items per facet. Model fits can also be seen in *Table 3*. The ESEM with all five domains showed a relatively good fit to the data with CFI = .82, RMSEA = .078, SRMR = .044. *Table 6* shows the ESEM factor loadings for the German sample. All facets loaded significantly on their intended domain.

Results of MI.   For analyzing measurement invariance the latest facet model structure (with additional facets) was taken. The results are shown in Table 7. Configural measurement invariance could be shown for the facets Appreciation of others, Superiority/Grandiosity, Need to be liked, Crybabiness, Manipulation, Altruism (facets of Agreeableness), Perseverance, Task Planning, Goal-orientation/Achievement striving, Preferred Load, Procrastination (facets of Conscientiousness), Assertiveness, Sociability/Gregariousness, Activity (facets of Extraversion), Irritability, Self-serving Attention (facets of Neuroticism), Self-attributed Inginuity, Openness to actions and activities, Openmindedness/Judgement, Love of Learning, Openness to feelings and Intellect (facets of Openness).

Factorial measurement invariance could be shown for the facets Meanness, Trust (facets of Agreeableness), Control of others, Lack of (Self-) Control, Deliberation/Caution, Lack of Tidiness/Order (facets of Conscientiousness), Sensation Seeking, Reclusiveness, Emotionality, Humor (facets of Extraversion), Depression, Anxiety, Self-assuredness, Lethargia, Sentimentality (facets of Neuroticism), Openness to reading, Openness to arts and Need for cognition (facets of Openness).

The only facet with strong factorial measurement invariance was Shyness, a facet of Extraversion

⁴⁷⁷

⁴⁷⁸   We have presented in this work an open-access instrument for personality assessment

⁴⁷⁹ within the Big Five framework, which showed evidences of factorial validity in two different

⁴⁸⁰ cultures and maximized the space set of facets encompassed. With a modest number of

⁴⁸¹ items (202) by comparison with the most influential Big Five inventories presented in *Table*

⁴⁸² *1*, we have reached to a large set of facets which mostly show a robust factorial validity in

⁴⁸³ both studies, as shown in *Table 3*.

⁴⁸⁴   The Big Five solution has been recognized as the most replicable model for personality

⁴⁸⁵ inventories, reaching a hallmark of consensus in personality science for the last decades.

⁴⁸⁶ However, some researchers have pointed out that while the Big Five has repeatedly been

⁴⁸⁷ found when fitting EFA to personality data, its replicability under CFA procedures has been

⁴⁸⁸ more elusive (R. R. McCrae, Zonderman, Costa, Bond, & Paunonen, 1996). The constriction

⁴⁸⁹ of the common independent cluster solution, where cross-loadings are restricted to zero, may

⁴⁹⁰ suppose a rather strong assumption for personality trait inventories (Marsh et al., 2010).

⁴⁹¹ The idea of facets, or habits, being influenced by more than one domain can definitely make

⁴⁹² some sense. ESEM helps overcoming this assumption and provides a measure about how well

⁴⁹³ the Big Five solution adjusts to the data. Using this procedure, the degree of integration of

⁴⁹⁴ our proposed set of facets to the Big Five factor solution has been solid enough according to

⁴⁹⁵ the cut-off values proposed by Marsh et al. (2010). The number of significant cross-loadings

⁴⁹⁶ in the ESEM models has not been large either, advocating a good discriminant validity.

⁴⁹⁷   The instrument presented in this work covers all the "core" facets proposed by

⁴⁹⁸ Christopher J. Soto and John (2009), either directly or indirectly. The *Energy* construct in

⁴⁹⁹ Extraversion is literally covered by a three-item facet in our instrument, whereas the

⁵⁰⁰ *Assertiveness* construct has been tapped by items belonging to the *Wish for affiliation*,

⁵⁰¹ *Communicativeness* and *Conviviality* facets. *Altruism* is directly reflected in a five-item facet,

while the *Compliance* construct is reflected by our *Good faith* facet. The *Order* and *Self-discipline* constructs proposed by Christopher J. Soto and John (2009) are mirrored by dedicated facets in our instrument. The *Anxiety* and *Depression* constructs are mirrored by the facets *Mental balance* and *Emotional robustness*, respectively. For the *Openess* dimension, the *Aesthetic* contruct is covered by our facet *Artistic interest*, while the *Ideas* construct has been reflected by both the *Open-mindedness* and the *Wish to analyze* facets. The two-per-facet components proposed by DeYoung et al. (2007) were also being tapped by the set of facets in our inventory.

The instrument covers most of facets proposed by the most influential Big Five measures as seen in *Table 1*. The most salient differences are related to the HEXACO model, which entails a six factor solution with a slightly different theoretical conceptualization (Lee & Ashton, 2006). Most notably

Although these facets are not being covered directly in our inventory, components of facets from distinct domains in our model retain a glimpse of the missing facets. This underlies the importance of allowing cross-loadings for trait personality data. Let's use the example of *Patience*, a facet proposed in the HEXACO model for the Agreeableness domain which is not covered in our instrument, nor in the other three Big Five inventories which have been revised. Although patience, there is a notion of a patient trait within the Self-discipline facet in the Conscientiousness domain, specially with items such as "I rush into things" or "I act impulsively when something is bothering me" (See appendix A). In fact, Self-discipline has important cross-loadings with Agreeableness in both samples ($\lambda = .256$ in the USA sample and $\lambda = .341$ in the german sample).

In addition we included even more facets.

In addition, evidences for external criteria validity were attained.

We have collected some criterion validity evidences. Like bla bla bla. Nonetheless the

527 multi - facetted nature of the instrument makes forthcoming evidences for criterion and

528 predictive validity promising.

529   One limitation is the sample used. Students are not a representative population of

530 society and results may not be generalized.

531   Future directions are to provide a tool with the subset of items for public use. Gather

532 community sample, from more cultures and test the extent of the universality of the

533 instrument. And use the instrument to predict important life outcomes so the links between

534 specific behaviors and facets become richer.

535   Remove this page. This is used to include the tables' references into the bibliography.

536   Brick and Lewis (2014); Gaughan, Miller, and Lynam (2012); Leone, Chirumbolo, and

537 Desimoni (2012); Mcabee, Oswald, and Connelly (2014); Gaughan, Miller, Pryor, and Lynam

538 (2009); Noftle and Shaver (2006); R. M. Bagby, Taylor, and Parker (1994); Schimmack, Furr,

539 and Funder (1999); Wakabayashi, Baron-Cohen, and Wheelwright (2006); Shaver and

540 Brennan (1992); Ruiz, Pincus, and Dickinson (2003); Mccrae, Kurtz, Yamagata, and

541 Terracciano (2011); Rosander, Bäckström, and Stenberg (2011); K. K. McAdams and

542 Donnellan (2009); Siddiqui (2011); Hagger-Johnson and Whiteman (2007)

543   Ziegler et al. (2014)

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Table captions