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

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| Victor Rouco1,2, Anja Cengia3, & Matthias Ziegler3 |
| 1 Ghent University |
| 2 Institut de Neurociències de Barcelona |
| 3 Humboldt Universität zu Berlin |
|  |

# Author note

Add complete departmental affiliations for each author here. Each new line herein must be indented, like this line.

Enter author note here.

Correspondence concerning this article should be addressed to Matthias Ziegler, Postal address. E-mail:

Abstract

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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]](#footnote-1). In both cases, personality is conceived as a hierarchical model which describes human 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 Big Five inventories has focused on the covariation between the Big Five domains 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 (John et al., 2014; Lounsbury, Sundstrom, Loveland, & Gibson, 2002; Paunonen & Ashton, 2001; Ziegler et al., 2014; Ziegler, Danay, Schölmerich, & Bühner, 2010). 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 (Goldberg, 1999). One potential reason for this proliferation could be that many facet-level models were developed as an elaboration or extension to an existing measure. This ad-hoc inception has the disadvantage of potentially limiting the search space for possible facets, while at the same time provides a window of opportunity for elaborating an exhaustive collection of different facets related to the Big Five.

## 1.2. 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 proposal 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 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, & Wu (2017), or the Big Five Aspect Scales by DeYoung, Quilty, & Peterson (2007)

Table 1. Most common Big Five models

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Taxonomy | Domains | Facets | Reliability | Nom.net. /Number of items | No. of items |  |  |  |
|  |  |  |  |  |  |  |  |  |
| HEXACO-PI-R |  |  | (Lee & Ashton, 2016) | 100 | 100\*, 60 |  |  |  |
|  | 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 | 240 |  |  |  |
|  | 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 | 60 |  |  |  |
|  | 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 | 120 |  |  |  |
|  | 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 1* displays the abundance of proposed facets related to each of the Big Five domains, and stresses 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).

Although all core facets are included in the most influential models, the reverse is not true, and not every facet included in the four instruments above cited are covered by the so-called core constructs. As an example, we find *Self-Consciousness*, a Neuroticism facet defined by the NEO-PI-R and the IPIP-NEO-120, not being tapped by neither *Anxiety* nor *Depression*. Soto & John (2016) referred to this phenomenon by saying that the Big Five dimensions *“can be conceptualized and assessed more broadly or more narrowly”*, either focusing on central facets or on a set of peripheral facets, depending on the interest of research. In this project we pursued an exhaustive coverage of the dimensions’ content by developing an instrument which contains both “core” and peripheral facets.

A possible layer between dimensions and facets has been suggested by DeYoung, Quilty, and Peterson (2007). Their work focused on the biological consistency of the NEO-PI-R set of facets, thereby proposing that each domain can first be split into two aspects: Agreeableness would be composed by *Compassion* and *Politeness*; Neuroticism by *Volatility* and *Withdrawal*; Conscientiousness by *Industriousness* and *Orderliness*; Extraversion by *Enthusiasm* and *Assertiveness*; and Openness by *Intellect* and *Openness*. Both Soto and John’s (2009) and DeYoung et al.’s (2007) proposals have many points in common.

To inspect evidence of concurrent validity of the collection of facets that we propose, a nomological network linking personality characteristics to external constructs will be constructed. Nomological networks can also 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 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.

## 1.3 Facets predict consequential outcomes

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

The question of whether narrow measures have a superior predictive power over broad measures enjoys a lively debate nowadays. Research summarized below suggests an advantage for scores derived from more narrow measures. Nonetheless, other lines of research points 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 in this study will be useful to forthcoming contributions on this topic.

**1.3.1 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 satisfaction (Diener, Oishi, & Lucas, 2003; Schimmack, Diener, & Oishi, 2002). Lately, 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 would significantly correlate with SWL, with a moderate to big effect size.

**1.3.2 Academic Performance**

Another relevant outcome that has being typically predicted by personality is academic achievement. Conscientiousness has been recognized as the strongest Big Five dimension 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 dimensional 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*). Moreover, John et al. (2014) found that *Openness to ideas* was positively related to work performance, while *Openness to fantasy* was negatively related, potentially masking the overall effect of Openness over the working performance criterion. In line with these findings, we hypothesize that the facets which entail the Conscientiousness dimension 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).

**1.3.3 Academic Absenteeism**

Likewise, personality has been reported as a powerful predictor of work and educational absenteeism (Chamorro-Premuzic & Furnham, 2003; Judge, Martocchio, & Thoresen, 1997; Salgado, 2002). Research has highlighted the predictive power of personality test over the so-called integrity test scores when predicting absences (Ones, Viswesvaran, & Schmidt, 2003). Again, most research has focused on the domain level, although some researchers suggested that personality assessed at a narrower level would improve the predictive ability of the models (Lounsbury et al., 2004). Lounsbury et al. (2004) found a modest predictive gain of *Work drive* scores over Big Five domain scores.

## 1.4 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 developed a comprehensive measure of personality facets which covers the content of the Big Five domains to a major extent. This research thus exhibits the first effort in elaborating a multi-facetted personality inventory based in the Big Five model. An antecedent to this study can be found in MacCann, Duckworth, and Roberts (2009), where data from the International Personality Item Pool (IPIP) was used in order to design a measure of Conscientiousness containing the maximum number of relevant facets. This research extends MacCann et al. (2009) to the full 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 USA sample, we reported the procedure used to select the items and validate the internal consistency, higher order structure, and nomological network of our proposed set of facets. In study two, we replicated previous findings with a sampled based on Germany, 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

The sample of the first study 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 IPIP 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

##### Items from the International Personality Item Pool (IPIP)

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 selection procedure was introduced in by MacCann, Duckworth, and Roberts (2009), and it is explained in detail there. 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 α = 0.88.

##### Graded point average (GPA)

Participants reported their high school GPA and their current college GPA.

##### Absences:

Absenteeism was reported from high school teachers, as part of a larger set of items measuring student’s social behaviors (MacCann et al., 2009). Absences were log transformed prior to analyses, in line with Lounsbury et al. (2004).

#### Procedure

##### Exploratory Factor Analysis (EFA) with subsample 1

To identify the number of components underlying the domains, we used a top-down approach following the likes of Goldberg (2006). Velicer’s (1976) Minimum Average Partial (MAP) and Horn’s (1965) Parallel Analysis (PA) methods were applied to correlation matrices in order to guide the subsequent factor analysis. Based on these statistics, a series of EFAs were calculated for each domain via Mplus (Muthen & Muthen, 20XX) 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 by EFA. In case of omission of relevant content captured in other models, new items were added a-posteriori.

##### Confirmatory Factor Analysis (CFA) and Exploratory Structural Equation Modelling (ESEM) with subsample 2

To confirm the structure outlined by EFAs, one CFA per facet was calculated 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 evident floor and ceiling effects on the item’s responses. Model fit was determined based on Hu and Bentler’s (1999) guidelines, 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 (SRMSR) smaller than .08 and the Root Mean Square Error of Approximation (RMSEA) smaller than .06. In a second step, all five domain models were integrated using ESEM (Asparouhov & Muthén, 2009). ESEM was used to model the higher order structure as it can accommodate personality data more naturally by allowing cross-loadings (Marsh et al., 2010). As a control mechanism for content-validity, we eliminated any facet with non-significant loadings from its intended domain. The ESEM was fitted using geomin oblique rotation and ML estimation. For the ESEM models, we compared our model fit with the findings by Marsh et al. (2010), which uses more lenient cut-offs for ESEM models.

##### Reliability

Cronbach’s and McDonald’s were estimated for each facet score to provide evidence for the test scores’ internal consistency.

##### Nomological network

To examine criterion validity of the proposed set of facets and domains with external constructs, a set of linear models and correlations were fitted. Pearson correlations were calculated for each outcome with facets and dimensions’ scores. One linear model per domain and per criteria was fitted, using all facets included in the domains as predictors. Betas for each predictor and an overall R square coefficient were calculated from the linear models.

The following general hypothesis were investigated, relying on research summarized in the introduction:

* H1. SWL will be predicted by *Positive Attitude* (E4) and *Emotional Robustness* (N6) with a big to moderate effect size, in line with Schimmack et al. (2004). Neuroticism and Extraversion will be most important dimensions when predicting SWL.
* H2. Conscientiousness will predict 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. The facet level will provide a clearer picture to predict academic abseentism from personality than the dimension level.

## Results

##### EFA

Exploratory analysis revealed the domains could be structured into eight to eleven narrower constructs. Model fit information for the EFA procedure are presented in *table 1,* 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 less than .30 and with non-central content to the domain in question were eliminated (John et al., 2014).

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 |
| Neuroticism (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.

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*.

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 contruct in other important facet models. The final set of facets of the Openness dimension 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 were obtained using and (they can be found in table 3). 95% C.I. estimates of McDonald’s for the domains were: Agreeableness ranged from 0.83 to 0.86, Conscientiousness ranged from 0.86 to 0.88, Opennessranged from 0.91 to 0.92, Emotional Stability ranged from 0.89 to 0.91, Extraversion ranged from 0.88 to 0.90.

### 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 saturated (they were reflected by three indicators). Goodness of fit estimations for each facet are available in *table 3.* Models with two or zero degrees of freedom indicate that the facets had four or three items respectively, models with five degrees of freedom signal reflective factors with five indicators.

### ESEM

The final ESEM model was constructed after removing four facets that did not significantly load in their intended domain: *openness to feelings* (expected to load on openness), *crybabiness* and *need to be liked* (expected to load on agreebleness), and *sensation seeking* (expected to load on extraversion). The resulting ESEM comprised 37 facets, all of them with significant loadings in their intended domains, and some exhibiting cross-loadings to other domains. This model yielded an acceptable model fit, according to Marsh et al. (2010) (CFI = .87, RMSEA = .072, SRMR = .036). 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.

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

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | IC | | CFA | | | | ESEM |
|  |  | α | ω | chisq | pvalue | CFI | RMSEA | λ std\* |
| Agreebleness | |  |  |  |  |  |  |  |
|  | Appreciation of others | 0.71 | 0.73 | 15.02(5) | 0.01 | 0.99 | 0.08 | -0.38 |
|  | Meanness | 0.72 | 0.74 | 3.17(5) | 0.67 | 1 | 0 | 0.64 |
|  | Superiority\_grandiosity | 0.72 | 0.72 | 1.99(5) | 0.85 | 1 | 0 | 0.76 |
|  | Trust | 0.65 | 0.69 | 33.59(5) | 0 | 0.97 | 0.13 | -0.23 |
|  | Manipulation | 0.65 | 0.68 | 5.5(5) | 0.36 | 1 | 0.02 | 0.64 |
|  | Altruism\_nurturance | 0.52 | 0.56 | 0.37(2) | 0.83 | 1 | 0 | -0.35 |
| Conscientiousness | |  |  |  |  |  |  |  |
|  | Control of others | 0.71 | 0.73 | 38.45(5) | 0 | 0.93 | 0.14 | 0.27 |
|  | Perserverance | 0.57 | 0.62 | 19.72(5) | 0 | 0.98 | 0.09 | -0.32 |
|  | Lack of self-control | 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 | 0.77 | 0.77 | 13.6(5) | 0.02 | 0.99 | 0.07 | 0.68 |
|  | Deliberation | 0.68 | 0.68 | 12.94(5) | 0.02 | 0.98 | 0.07 | 0.58 |
|  | Lack of tidiness | 0.82 | 0.83 | 25.64(5) | 0 | 0.99 | 0.11 | -0.46 |
|  | Preferred load | 0.63 | 0.67 | 10.41(5) | 0.06 | 0.99 | 0.06 | 0.35 |
|  | Procrastination | 0.68 | 0.69 | 12.17(5) | 0.03 | 0.98 | 0.06 | 0.4 |
| Extraversion | |  |  |  |  |  |  |  |
|  | Shyness | 0.66 | 0.68 | 13.27(5) | 0.02 | 0.99 | 0.07 | -0.75 |
|  | Reclusiveness | 0.65 | 0.68 | 16.52(5) | 0.01 | 0.98 | 0.08 | -0.69 |
|  | Positive emotions | 0.82 | 0.83 | 1.75(5) | 0.88 | 1 | 0 | 0.55 |
|  | Assertiveness | 0.68 | 0.7 | 20.94(5) | 0 | 0.97 | 0.09 | 0.2 |
|  | Emotionality | 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 |
|  | Gregariousness | 0.69 | 0.71 | 14.89(5) | 0.01 | 0.98 | 0.07 | 0.74 |
|  | Activity | 0.71 | 0.74 | 0(0) | 0 | 1 | 0 | 0.49 |
| Neuroticism | |  |  |  |  |  |  |  |
|  | Irritability | 0.74 | 0.75 | 9.38(5) | 0.09 | 1 | 0.05 | 0.39 |
|  | Depression | 0.86 | 0.86 | 10.02(5) | 0.07 | 0.99 | 0.05 | 0.54 |
|  | Anxiety | 0.77 | 0.77 | 8.46(5) | 0.13 | 1 | 0.04 | 0.76 |
|  | Self-assuredness | 0.7 | 0.71 | 8.2(5) | 0.15 | 1 | 0.04 | -0.41 |
|  | Lethargia | 0.62 | 0.64 | 13.21(5) | 0.02 | 0.98 | 0.07 | 0.59 |
|  | Sentimentality | 0.75 | 0.76 | 13.6(5) | 0.02 | 0.99 | 0.07 | 0.73 |
|  | Self-serving attention | 0.6 | 0.63 | 0(0) | 0 | 1 | 0 | 0.63 |
| Openness | |  |  |  |  |  |  |  |
|  | Self-attributed ingenuity | 0.68 | 0.68 | 17.19(5) | 0 | 0.98 | 0.08 | 0.81 |
|  | Openmindedness judgement | 0.66 | 0.67 | 19.17(5) | 0 | 0.98 | 0.09 | 0.77 |
|  | Openness to reading | 0.85 | 0.86 | 5.79(5) | 0.33 | 1 | 0.02 | 0.54 |
|  | Openness to arts | 0.81 | 0.82 | 18.32(5) | 0 | 0.99 | 0.09 | 0.59 |
|  | Need for cognition | 0.78 | 0.79 | 11.04(5) | 0.05 | 0.99 | 0.06 | 0.78 |
|  | Love of learning | 0.81 | 0.82 | 8.03(5) | 0.15 | 1 | 0.04 | 0.71 |
|  | Intellect | 0.8 | 0.81 | 0(0) | 0 | 1 | 0 | 0.62 |

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

### Nomological network

Table 5 summarizes correlations and predictions of the facet scores with external criteria. High Emotional Stability and high Extraversion correlated with higher SWL scores, in line with the proposed hypothesis. The whole set of Extraversion’s facets significantly predicted SWL, yielding a R^2 of 0.25. *Positive emotions* (E4) was the most important predictor. The facets belonging to Emotional Stability also significantly predicted SWL, the model’s R^2 is 0.29. *Emotional Robustness* (N2) was the most important predictor for this domain. Most of the Big Five dimensions predicted school and university GPA. Conscientiousness and Openness were the most influencing dimensions. At the facet level, high *Interest in Reading* (O4), high *Intellect* (O9), high *Goal Orientation* (C5), high *Genuineness* (A7), high *Equanimity* (N1), low *Creativity* (O1) and low *Readiness to Take Risks* (E2) were the markers to predict high school GPA. College GPA scores were significantly predicted by high *Open Mindedness* (O3), high *Aesthetics* (O5), high *Carefreeness* (N3), and low *Readiness to Give Feedback* (A4). Abseentism in university was predicted, at the dimension level, by Conscientiousness, Extraversion and Neuroticism, but no dimension significantly predicted abseentism in high school. At the facet level, low *Task Planning* (C4), *Energy* (E9), *Equanimity* (N1) and *Drive* (N5), and high *Readiness to Take Risks* (E2) predicted abseentism in college; whereas low *Genuineness* (A6) and high *Humor* (E7) could predict abseentism in high school.

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| |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | Satisfaction with life | | | GPA | | | Absences | | | |  | correlation | beta |  | correlation | beta |  | correlation | beta |  | | Openness | | O1 | 0.063 | -0.1 | - | -0.013 | -0.138\* | - | 0.001 | 0.168 | - | | O2 | 0.176 | 0.076 | - | 0.092 | 0.047 | - | -0.067 | -0.034 | - | | O3 | 0.225 | 0.124 | - | 0.144 | 0.072 | - | -0.16 | -0.153 | - | | O4 | 0.072 | -0.023 | - | 0.152 | 0.126 | - | -0.06 | -0.029 | - | | O5 | 0.039 | -0.098 | - | 0.041 | -0.069 | - | -0.01 | 0.089 | - | | O6 | 0.134 | -0.057 | - | 0.1 | 0 | - | -0.068 | 0.073 | - | | O7 | 0.212 | 0.111 | - | 0.096 | -0.052 | - | -0.099 | -0.077 | - | | O8 | 0.176 | 0.122\* | - | 0.121 | 0.1 | - | -0.027 | 0.045 | - | | O9 | 0.238 | 0.166\* | - | 0.203 | 0.184\* | - | -0.193 | -0.174 | - | | Domain score | 0.2 | - | 0.095\* | 0.148 | - | 0.065\* | -0.097 | - | 0.026 | | Conscientiousness | | C1 | 0.033 | 0.019 | - | 0.061 | 0.06 | - | -0.065 | -0.07 | - | | C2 | 0.272 | 0.162\* | - | 0.115 | -0.014 | - | -0.105 | 0.035 | - | | C3 | 0.194 | 0.08 | - | 0.133 | 0.072 | - | -0.137 | -0.06 | - | | C4 | 0.202 | 0.013 | - | 0.164 | -0.009 | - | -0.227 | -0.104 | - | | C5 | 0.283 | 0.129 | - | 0.219 | 0.148\* | - | -0.188 | 0.017 | - | | C6 | 0.233 | 0.101 | - | 0.159 | 0.034 | - | -0.183 | -0.005 | - | | C7 | 0.112 | -0.074 | - | 0.14 | 0.061 | - | -0.202 | -0.151 | - | | C8 | 0.101 | -0.045 | - | 0.115 | 0.027 | - | -0.141 | -0.035 | - | | C9 | 0.231 | 0.073 | - | 0.133 | 0.005 | - | -0.226 | -0.136 | - | | Domain score | 0.303 | - | 0.116\* | 0.233 | - | 0.048\* | -0.274 | - | 0.052 | | Extraversion | | E1 | 0.255 | 0.091 | - | 0.109 | 0.099 | - | -0.041 | -0.022 | - | | E2 | -0.003 | -0.035 | - | -0.14 | -0.174\* | - | 0.116 | 0.11 | - | | E3 | 0.2 | 0.06 | - | 0.056 | 0 | - | -0.001 | 0.032 | - | | E4 | 0.493 | 0.513\* | - | 0.065 | 0.011 | - | -0.084 | -0.102 | - | | E5 | 0.09 | -0.019 | - | 0.005 | 0.001 | - | 0.01 | -0.006 | - | | E6 | 0.111 | -0.05 | - | 0.057 | 0.037 | - | -0.011 | -0.021 | - | | E7 | 0.164 | -0.059 | - | 0.023 | 0.014 | - | 0.13 | 0.233\* | - | | E8 | 0.222 | -0.06 | - | 0.053 | -0.007 | - | -0.075 | -0.094 | - | | E9 | 0.249 | 0.019 | - | 0.059 | 0.04 | - | -0.08 | -0.104 | - | | Domain score | 0.326 | - | 0.254\* | 0.05 | - | 0.028\* | 0.002 | - | 0.026 | | Agreeableness | | A1 | 0.159 | 0.004 | - | 0.12 | -0.034 | - | -0.081 | 0.054 | - | | A2 | 0.194 | 0.058 | - | 0.168 | 0.115 | - | -0.061 | -0.034 | - | | A3 | 0.026 | -0.129\* | - | 0.015 | -0.108 | - | 0.063 | 0.141 | - | | A4 | -0.05 | -0.079 | - | 0.093 | 0.084 | - | -0.138 | -0.069 | - | | A5 | -0.179 | -0.163\* | - | -0.026 | -0.017 | - | -0.006 | 0.017 | - | | A6 | 0.253 | 0.234\* | - | 0.168 | 0.091 | - | -0.164 | -0.123 | - | | A7 | 0.123 | 0.059 | - | 0.165 | 0.135\* | - | -0.135 | -0.178 | - | | A8 | 0.14 | 0.043 | - | 0.145 | 0.058 | - | -0.112 | -0.039 | - | | Domain score | 0.157 | - | 0.104\* | 0.201 | - | 0.057\* | -0.154 | - | 0.029 | | Emotional Stability | | N1 | 0.225 | 0.023 | - | 0.111 | 0.134\* | - | -0.047 | -0.08 | - | | N2 | 0.531 | 0.591\* | - | 0.091 | 0.135 | - | -0.062 | -0.035 | - | | N3 | 0.309 | -0.04 | - | -0.012 | -0.112 | - | 0.008 | 0.051 | - | | N4 | 0.25 | 0.093\* | - | 0.031 | 0.016 | - | -0.138 | -0.158 | - | | N5 | 0.269 | -0.047 | - | 0.079 | 0.057 | - | -0.095 | -0.142 | - | | N6 | 0.176 | -0.074 | - | -0.055 | -0.109 | - | 0.035 | 0.097 | - | | N7 | 0.206 | -0.038 | - | -0.001 | -0.034 | - | 0.068 | 0.163 | - | | Domain score | 0.401 | - | 0.289\* | 0.048 | - | 0.03\* | -0.048 | - | 0.024 | |  | GPA | Absences |

Note: \* means significant at alpha = 0.01. For the column, \* means p < 0.01 in the linear regression’s F statistic.

## Study 2

### Participants

Study two used 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 derived from Study 1 were translated and back-translated by bilingual experts. The translated items can be found in the supplemental materials.

### Procedure

#### CFA and ESEM with German sample

As conducted in the previous study, a CFA per facet was fitted with the German sample in order to test the robustness of its measurement models, and an ESEM with the full model was tested in order to integrate the facets in the Big Five framework.

#### Measurement invariance

In a last step, measurement invariance between German and US samples was examined. We followed the procedure suggested by Sass (2011) and tested configural, factorial, and strong factorial invariance. The cutoffs suggested by Chen (2007) were applied to compare model fits. According to this, configural measurement invariance can be assumed when the same item is associated with the same factor in each domain, while the factor loadings can differ. If the factor loadings of each item would not differ between the samples, factorial measurement invariance can be assumed. Strong factorial measurement invariance can be assumed when on top of that the intercepts of each item are equal. The limit to factorial measurement invariance was set to CFI < .01, RMSEA < .015 and SRMR < .03, at which the limit to strong factorial measurement invariance was set to CFI < .01, RMSEA < .015, SRMR < .01 as suggested by Chen (2007).

#### Measurement invariance with the German sample

: To check the facet structure that Study 1 delivered, multiple confirmatory factor analyses were calculated via Mplus following an analogue procedure to Study 1. First, measurement models were estimated for all facets, using WLSMV as the estimator. Model fit was determined based on the guide-lines mentioned above. In a final model, all five domain structural models were again integrated using ESEM.

### Results

### Measurement Invariance

The models presented used in the CFA procedure were tested For analyzing measurement invariance the latest facet model structure (with additional facets) was taken. The results are shown in Table 6. Configural measurement invariance could be shown for the facets *Appreciation*, *Low Competitiveness*, *Readiness to give feedback*, *Search for support*, *Genuiness*, *Altruism* (facets of Agreeableness), *Persistence*, *Task Planning*, *Goal-orientation*, *Wish to work*, *Productivity* (facets of Conscientiousness), *Forcefulness*, *Energy, Conviviality* (facets of Extraversion), *Equanimity*, *Self-Attention* (facets of Emotional Stability), *Creativity*, *Wish for variety*, *Open-mindednes*, *Willingness to learn*, *Sensitivity* and *Intellect* (facets of Openness).

Weak factorial measurement invariance could be shown for the facets *Integrity*, *Compliance* (facets of Agreeableness), *Dominance*, *Self-Discipline,* *Carefulness*, *Orderliness* (facets of Conscientiousness), *Readiness to take risks,* Wish for affiliation, *Positive attitude*, *Humor, Communicativeness* (facets of Extraversion), *Confidence,* *Carefreeness*, *Mental balance*, *Drive*, *Emotional robustness* (facets of Emotional Stability), *Interest in reading*, *Aesthetics* and *Wish to analyze* (facets of Openness).

The only facet with strong factorial measurement invariance was *Sociability*, a facet of Extraversion.

Table 6. Metric invariance

|  |  |  |  |
| --- | --- | --- | --- |
| Dimension | Configural MI | Factorial MI | Strong Factorial MI |
|  |  |  |  |
| Agreeableness | Appreciation | Integrity |  |
|  | Low Competitiveness  Readiness to give feedback | Compliance |  |
|  | Search for support |  |  |
|  | Genuineness |  |  |
|  | Altruism |  |  |
|  |  |  |  |
| Conscientiousness | Persistence | Dominance |  |
|  | Task planning | Self-discipline |  |
|  | Goal-orientation | Carefulness |  |
|  | Wish to work | Orderliness |  |
|  | Productivity |  |  |
|  |  |  |  |
| Extraversion | Forcefulness | Readiness to take risks | Sociability |
|  | Energy | Wish for affiliation |  |
|  | Conviviality | Positive attitude |  |
|  |  | Humor  Communicativeness |  |
|  |  |  |  |
| Emotional Stability | Equanimity | Confidence |  |
|  | Self attention | Carefreeness |  |
|  |  | Mental balance |  |
|  |  | Drive |  |
|  |  | Emotional robustness |  |
|  |  |  |  |
| Openness to Experience | Creativity | Interest in reading |  |
|  | Wish for variety | Aesthetics |  |
|  | Open-mindedness | Wish to analyze |  |
|  | Willingness to learn |  |  |
|  | Sensitivity |  |  |
|  | Intellect |  |  |



# Discussion

Aim of the current study was to provide an open-access Big Five facet tool and also demonstrate first evidence regarding the scores reliability and validity. The result is a 42 facet measure based on 202 items. The resulting scores are internally consistent and there is evidence regarding their structural as well as test-criterion related validity. Finally, most facets achieved the level of weak factorial invariance rendering them useful for cross-cultural correlational research.

### Facet Structure

The Big Five solution has been recognized as the most replicable model for personality inventories, reaching a hallmark of consensus in personality science for the last decades. However, some researchers have pointed out that while the Big Five has repeatedely been found when fitting EFA to personality data, its replicability under CFA procedures has been more elusive (McCrae, Zonderman, Costa, Bond, & Paunonen, 1996). The constriction of the common independent cluster solution, where cross-loadings are restricted to zero, may suppose a rather strong assumption for personality trait inventories (Marsh et al., 2010). ESEM helps overcoming this assumption and provides a measure about how well the Big Five solution adjusts to the data. Using this procedure, the degree of integration of our proposed set of facets to the Big Five factor solution has been solid enough according to the cut-off values proposed by Marsh et al. (2010). The number of significant cross-loadings in the ESEM models has not been large either, advocating a good discriminant validity.

The instrument presented in this work covers all the “core” facets proposed by Soto and John (2009), either directly or indirectly. The *Energy* construct in Extraversion is literally covered by a three-item facet in our instrument, whereas the *Assertiveness* construct has been tapped by items belonging to *Wish for affiliation*, *Communicativeness,* and *Conviviality*. *Altruism* and *Compliance* are directly reflected in five-item facets. *Order* and *Self-discipline,* constructs of the dimension Conscientiousness proposed by Soto and John (2009), are mirrored by facets in our instrument. *Anxiety* and *Depression,* constructs of Neuroticism in Soto and John (2009) are mirrored by facets representing Emotional Stability: *Mental balance* and *Emotional robustness*, respectively. For the Openness dimension, the *Aesthetic* construct is mirrored in our instrument, 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.

In addition, the instrument includes facets that are usually not within the scope of other big five inventories. For instance, *Search for support* (A5) is absent in the big five inventories revised here and may take an important role in predicting many different life outcomes, like mental disorder prognosis or academic development. Likewise, *Forcefulness* (E5) can be a good predictor of a leadership style in a human resource setting, a facet which is not clearly tapped in other inventories, although close to the construct assertiveness. Not only new facets can be found in our inventory, but also more complex nuances of classic facets. *Appreciation* (A1) and *Compliance* (A6) are two separate facets in our instrument which suggest different approaches to the shared NEO-PI-R, IPIP-NEO-120 and NEO-PI-R’s facet *Trust*. In the same vein, NEO-PI-R’s *Deliberation*, BFI-2’s *Organization* and IPIP-NEO’s *Cautiousness* may be included within two of our Conscientiousness facets: *Task planning* and *Carefulness*. This expansion of the facet structure opens possibilities when predicting behavior with personality.

### Reliability evidence

Internal consistency has been found good for the big five dimensions (ω ranging from .83 to .92) and for most of the facets (67% of facets’ ω > .70; 95% of facets’ ω > .60).

### Validity Evidence

We have tested different hypothesis which aim to replicate previous findings on the interplay between personality and SWL, academic performance and school absenteeism. Overall, the instrument presented here has shown at least a similar predictive ability as other personality instruments. Our first hypothesis of the nomological network stated that SWL would be predicted with a moderate to big effect size by facets which could mimic NEO-Pi-R’s *Cheerfulness* and *Depression*, we selected *Positive Attitude* (E4) and *Emotional robustness* (N6). *Positive Attitude* was significantly related to SWL, with a standardized β = .51; however, *Emotional Robustness* was not significantly associated with SWL. We have found that other Emotional Stability facets like *Confidence* (N2; stdβ = .59) or *Mental Balance* (N4; stdβ = .09) do predict SWL. This different effect can be understood because (1) facets which are heavily linked with the criterion at the maladaptative end of the continuum can be innocuous on the adaptative end, and because (2) effects that were condensed into one facet are now spread into different facets (i.e. *Emotional Robustness* and *Confidence* can both point at low *Depression*). Neuroticism and Extraversion were the dimensions which showed the strongest links to SWL as expected. Our second hypothesis stated that Conscientiousness would predict 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. Indeed, Conscientiousness’ sum score yielded a correlation of r = .233 with high school GPA. Openness was also related to GPA, and as hypothesized some facets were positively related to academic achievement *(Interest in Reading*, O4, β = .13; *Intellect*, O9, β = .18), while some others were related negatively (*Creativity*, O1; β = -.14). The third hypothesis concerning abseentism was more explorative due to the reduced evidence available on the interplay between this construct and Big Five personality. Mostly all the dimensions predicted college abseentism, while none predicted high school abseentism. The only statement made a priori was that the facet level would show a clearer picture on the personality constructs associated with abseentism. According to our data, an individual high on *Readiness to take Risks* (E2, β = .23), and low on *Energy* (E9, β = -.23), low on *Equanimity* (N1, β = -.15), low on *Drive* (N5, β = -.17), low on *Willingness to Learn* (O7, β = -.21), and low on *Task Planning* (C4, β = -.17) would have more chances of exhibit higher abseentism. For high school abseentism it seems that the social aspect is more important, as *Humor* (E7, β = .23) and *Genuineness* (A7, β = -.18) are the only significant facets.

### Measurement Invariance

The instrument has been tested in two different languages, collecting promising evidence of measurement invariance. All facets but two were invariant between two cultures at the configural level, and about half of the facets were metric invariant. Strong factorial invariance was attained in only one facet, showing non-equivalence at the intercept level. 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’ mean level change within the lifespan of individuals, the non-equivalence of the two samples in terms of intercept measurement invariance is not surprising. Even though age differences were important between the countries samples, the inventory has evidenced to be quite robust in its measurement structure, already allowing research on culture comparisons at the correlation level.

### Theoretical and Practical Implications

Using a broader set of facets to assess personality can have important implications in different research and applied settings. As we have introduced during this manuscript, there is a growing line of research that uses facets as means to predict external outcomes with a higher degree of specificity. However, the debate of whether facets increase the predictive validity of personality attributes to consequential outcomes is lively and a consensus has not been stablished. A broad facet inventory like the Berlin Multi-Facet could represent a milestone in this issue from which clearer empirical evidence may be collected.

Furthermore, a broad multi-facet inventory can also impact applied settings like clinical psychology. The clinical field is moving towards a dimensional representation of personality disorders, steadily shifting away from the categorical representation as personality itself once did (from types to traits). Moreover, one of the difficulties of this endeavor is to find adequate narrow constructs which could map the important characteristics of already documented disorders. For instance, 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). Instruments like the PID (Krueger, Derringer, Markon, Watson, & Skodol, 2012) reproduce the Big Five and focuses on the maladaptative end of the dimensions. However, the PID is, like NEO-PI-R, restricted to five facets per dimension. The Berlin Multi-Facet could have implications in this field by allowing clinicians to explore facets which are out of the scope of the PID.

### Limitations

### Conclusion

The usefulness of this inventory in the clinical realm has not being explicitly proven but can be inferred with the external evidence provided. The multiple facets in the Emotional stability / Neuroticism continuum would allow to detect adaptative and maladaptative styles of behavior.

Future directions are to provide a tool with the subset of items for public use. Gather community sample, from more cultures and test the extent of the universality of the instrument. And use the instrument to predict important life outcomes so the links between specific behaviors and facets become richer.

## 1.4. The Big Five and Personality Disorders

Definitions of personality disorders are steadily shifting from a categorical to a continua conceptualization. This process is not new for personality science history, as personality definitions also underwent a shift from the view of qualitatively distinct categories, called types, to a subset of continuous dimensions, named traits. In fact, the new version of the Diagnostic and Statistical Manual of mental disorders, DSM-V, now proposes two different ways of assessing personality disorders: 1) A descriptive model of personality disorders in section II which mimics the former model of assessing personality disorders and; 2) A novel trait model that follows research on the personality scientific domain (Section III), which conceptualizes personality disorders as extreme tendencies located in the continuum of the Big Five dimensions and facets (American Psychiatric Association, 2013; Widiger & Mullins-Sweatt, 2009)

This paradigm shift in clinical assessment of personality has led to the construction of the Personality Disorder Inventory (PID-5; R. F. Krueger, Derringer, Markon, Watson, & Skodol, 2012), a 25-facet and five-dimension self-report inventory, with an informant-report version (K. E. Markon, Quilty, Bagby, & Krueger, 2013). These five dimensions mirror the Big Five dimensions, although with a focus on the maladaptative end of the continuum,: I) Detachment (Big Five’s Introversion), II) Antagonism (absence of Big Five’s Agreeableness), III) Disinhibition (absence of Big Five’s Conscientiousness), IV) Negative affect (Big Five’s 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 dimensons predicting PD in a study by Reynolds and Clark (2001). Furthermore, the use of facets may be of extreme utility for those PDs 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 PDs which are not well covered by Big Five dimensions. 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 in current facet models. 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.

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**Appendix**

|  |  |  |
| --- | --- | --- |
| Domain | Facet | Item |
| Agreeableness | A1: Appreciation | I acknowledge others’ accomplishments. I respect others’ feelings. I respect others. I am a good listener. I am polite to strangers. |
|  | A2: Integrity | I speak ill of others. (-) I insult people. (-) I do things out of revenge. (-) I misuse power. (-) I try to avoid doing favors for others. (-) |
|  | A3: Low competitiveness | I would like to have more power than other people. (-) I want to control the conversation. (-) I tend to brag about my accomplishments. (-) I want to be told I am right. (-) I see other people as my competitors. (-) |
|  | A4: Readiness to give feedback | I want to be liked. I do what others want me to do. I change myself to suit others. I am afraid of providing criticism. I find it necessary to please the people who have power. |
|  | A5: Search for support | I show my sadness. I show my fear. I show my anger. I tend to complain. I seek support. |
|  | A6: Compliance | I trust what people say. I trust others. I believe that others have good intentions. I am good at working with a group. I feel like a loser if I compromise. (-) |
|  | A7: Genuineness | I lie to get myself out of trouble. (-) I respect authority. I try to fool others. (-) I find it easy to manipulate others. (-) I use flattery to get ahead. (-) |
|  | A8: Altruism | I think of others first. I let other people take the credit for my work. I try to respond with understanding when someone treats me badly. I return extra change when a cashier makes a mistake. |
| Conscientiousness | C1: Dominance | I want to be in charge. I try to lead others. I demand perfection in others. I resist authority. I try to outdo others. |
|  | C2: Persistence | I give up easily. (-) I never give up. I am easily discouraged. (-) I like to take my time. (-) My interests change quickly. (-) |
|  | C3: Self-discipline | I am easily talked into doing silly things. (-) I rush into things. (-) I act impulsively when something is bothering me. (-) I am easily distracted. (-) I say inappropriate things. (-) |
|  | C4: Task planning | I do things according to a plan. I follow a schedule. I make plans and stick to them. I want things to proceed according to plan. I am always prepared. |
|  | C5: Goal orientation | I accomplish a lot of work. I work hard. I put little time and effort into my work. (-) I am a goal-oriented person. I carry out my plans. |
|  | C6: Carefulness | I choose my words with care. I look at the facts. I make careful choices. I avoid mistakes. I take precautions. |
|  | C7: Orderliness | I leave a mess in my room. (-) I often forget to put things back in their proper place. (-) I am continually losing things. (-) I can never find anything. (-) I make a mess of things. (-) |
|  | C8: Wish to work to capacity | I work too much. I have extra time on my hands. (-) I am always busy. I have too many things to do. I am exacting in my work. |
|  | C9: Productivity | I can manage many things at the same time. I start tasks right away. I can`t wait to get started on a project. I finish tasks quickly. I stop when work becomes too difficult. |
| Extraversion | E1: Sociability | I am quiet around strangers. (-) I start conversations. I feel comfortable only with friends. (-) I feel comfortable around people. I have difficulty showing affection. (-) |
|  | E2: Readiness to take risks | I seek danger. I enjoy being reckless. I avoid dangerous situations. (-) I act wild and crazy. I like loud music. |
|  | E3: Wish for affiliation | I prefer to be alone. (-) I enjoy spending time by myself. (-) I enjoy silence. (-) I feel isolated from other people. (-) I hold back my opinions. (-) |
|  | E4: Positive attitude | I look forward to each new day. I look at the bright side of life. I love life. I laugh a lot. I feel lucky most of the time. |
|  | E5: Forcefulness | I automatically take charge. I do most of the talking. I know how to convince others. I like having authority over others. I challenge others’ points of view. |
|  | E6: Communicativeness | I talk a lot. I like talking about myself. I easily share my feelings with others. I love to chat. I disclose my intimate thoughts. |
|  | E7: Humor | I am known for my sense of humor. I try to add some humor to whatever I do. I like to amuse others. I try to tease my friends out of their gloomy moods. I amuse myself easily. |
|  | E8: Conviviality | I enjoy being part of a group. I enjoy teamwork. I am good at planning group activities. I would enjoy a lot of social interaction. I am good at getting people to like me. |
|  | E9: Energy | I maintain high energy throughout the day. I tire out quickly. (-) I am usually active and full of energy. |
| Emotional Stability | N1: Equanimity | I get angry easily. (-) I snap at people. (-) I get annoyed at the slightest provocation. (-) I shout or scream when I'm angry. (-) I get upset if others change the way that I have arranged things. (-) |
|  | N2: Confidence | I feel sad. (-) I think my life is a failure. (-) I have a dark outlook on the future. (-) I feel lonely. (-) I feel desperate. (-) |
|  | N3: Carefreeness | I worry a lot. (-) I often feel tense. (-) I am filled with doubts about things. (-) I worry about what people think of me. (-) I feel fearful. (-) |
|  | N4: Mental balance | I remain calm under pressure. (-) I can handle stress well. (-) I face danger confidently. (-) I readily overcome setbacks. (-) I adapt easily to new situations. (-) |
|  | N5: Drive | I feel it hard to get going. (-) I hardly know where my life is going. (-) I give up easily. (-) I let others discourage me. (-) I never spend more than I can afford. (-) |
|  | N6: Emotional robustness | I cry easily. (-) I get overwhelmed by emotions. (-) I need protection. (-) I am easily hurt. (-) I immediately feel sad when hearing of an unhappy event. (-) |
|  | N7: Self-attention | I need the approval of others. (-) I am preoccupied with myself. (-) I feel threatened easily. (-) |
| Openness to experience | O1: Creativity | I do unexpected things. I know that my ideas sometimes surprise people. I pride myself on being original. I ask questions that nobody else does. I love to think up new ways of doing things. |
|  | O2: Wish for variety | I like to visit new places. I like to travel. I am excited by many different activities. I have been creative during the last year. I like concerts. |
|  | O3: Open-mindedness | I am valued by my friends for my good judgment. I am valued by others for my objectivity. I know how to apply my knowledge. I can see different points of view. I come up with alternatives. |
|  | O4: Interest in reading | I read a lot. I like to read. I enjoy discussing books with others. I have read the great literary classics. I enjoy reading nonfiction. |
|  | O5: Aesthetics | I appreciate all forms of art. I like art. I like poetry. I seldom notice the emotional aspects of paintings and pictures. (-) I like to visit museums. |
|  | O6: Wish to analyze | I tend to analyze things. I like to speculate about things. I seek explanations of things. I love to reflect on things. I try to understand myself. |
|  | O7: Willingness to learn | I want to increase my knowledge. I look forward to the opportunity to learn and grow. I find the world a very interesting place. I dislike learning. (-) I am thrilled when I learn something new. |
|  | O8: Sensitivity | I am open about my feelings. I rarely notice my emotional reactions. (-) I find it hard to understand why people get emotional. (-) I am open about myself to others. |
|  | O9: Intellect | I learn quickly. I am quick to understand things. I can handle a lot of information. |

1. Often the terms are even used synonymously, which is why we will refer to the Big Five from here on. [↑](#footnote-ref-1)