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10 Aspects of the Big Five in the Personality Inventory for DSM-5

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Abstract

DSM-5 includes a dimensional model of personality pathology, operationalized in the Personality Inventory for DSM-5 (PID-5), with 25 facets grouped into five higher-order factors resembling the Big Five personality dimensions. The present study tested how well these 25 facets could be integrated with the 10-factor structure of traits within the Big Five that is operationalized by the Big Five Aspect Scales (BFAS). In two healthy adult samples, 10-factor solutions largely confirmed our hypothesis that each of the 10 BFAS scales would be the highest loading BFAS scale on one and only one factor. Varying numbers of PID-5 scales were additional markers of each factor, and the overall factor structure in the first sample was well replicated in the second. Our results allow Cybernetic Big Five Theory (CB5T) to be brought to bear on manifestations of personality disorder, because CB5T offers mechanistic explanations of the 10 factors measured by the BFAS. Future research, therefore, may begin to test hypotheses derived from CB5T regarding the mechanisms that are dysfunctional in specific personality disorders.

Keywords

Personality Disorders; Big Five; Five Factor Model; Personality Inventory for DSM-5; Big Five Aspect Scales

One of the most important developments in research on psychopathology has been the discovery that symptoms of mental disorders lie on dimensional continua with normal personality traits, rather than constituting markers of distinct categorical disease entities (Markon, Krueger, & Watson, 2005; Widiger & Trull, 2007; Wright & Simms, 2015). Many forms of psychopathology, therefore, may result from dysfunctional extremity of psychological traits that exist in all people, just as many pathological physical conditions, such as hypertension, are caused by dysfunction of universal human mechanisms (those

governing circulation and blood pressure, in the case of hypertension). This realization is likely to facilitate the discovery of the causes of psychopathology because it means that what is known about the structure and sources of normal personality is likely to be applicable to understanding abnormal symptoms. The goal of the present research is to integrate the system for measuring pathological personality symptoms that was developed for DSM-5 with the measurement system associated with Cybernetic Big Five Theory (CB5T; DeYoung, 2015).

CB5T is an explanatory theory based on the best established model of personality structure, the Five-Factor Model or Big Five. Cybernetics is the study of principles governing goal-directed, adaptive mechanisms, whether those be thermostats or missile-guidance systems or animals. CB5T applies these principles to understand personality traits as reflections of variation in the parameters of evolved cybernetic mechanisms within the mind and brain (viewing psychological processes as instantiated by neurobiological ones). To the extent that the DSM-5 personality system can be integrated with CB5T, this will facilitate application of theory regarding the sources of the Big Five and their subtraits to research on the sources of psychopathology.

The Big Five model is based on the observation that five broad factors typically appear in analyses of any sufficiently broad pool of personality descriptors, including both adjectives culled from dictionaries and scales from existing personality questionnaires (even when the latter were not designed to measure the Big Five) (John, Naumann, & Soto, 2008; Markon et al., 2005). The Big Five dimensions are commonly labeled Extraversion, Neuroticism, Agreeableness, Conscientiousness, and Openness/Intellect.¹ The Personality Inventory for the DSM-5 (PID-5; Krueger, Derringer, Markon, Watson, & Skodol, 2012) was not intentionally developed to be congruent with the Big Five. Rather, its 25 scales were developed in order to operationalize experts' understandings of the important symptoms or manifestations of personality disorders as represented in DSM-IV—without attempting to constrain them to any particular higher-order structure. Nonetheless, when the PID-5 scales have been factor-analyzed, they show a five factor structure that has clear resemblance to the Big Five, though emphasizing the opposite poles of the Extraversion, Agreeableness, and Conscientiousness dimensions (Krueger et al., 2012; Krueger & Markon, 2014). The five factors have been labeled Detachment, Negative Affectivity, Antagonism, Disinhibition, and Psychoticism.

Research prior to the creation of the PID-5 had already shown that, when measures of normal and abnormal personality are analyzed together, they jointly show the Big Five factor structure (Markon et al., 2005; Widiger & Trull, 2007), and this has now also been demonstrated repeatedly for the PID-5 in combination with normal personality scales (Ashton, Lee, de Vries, Hensrickse, & Born, 2012, footnote 6; De Fruyt et al., 2012; Gore & Widiger, 2013; Thomas et al., 2012). Clearly, therefore, the PID-5 is aligned conceptually with the standard Big Five, and integration with personality theory can proceed from the

¹Although a six-factor solution for ratings of adjectives may be more replicable across languages, it does not seem to be as robust in personality questionnaires, nor is it very different from the Big Five model, primarily just redistributing traits subsumed by Agreeableness across multiple factors (DeYoung, Quilty, & Peterson, 2007; Markon et al., 2005; Saucier, 2009).

premise that the same patterns of covariation that underlie normal personality also underlie personality pathology. This conclusion is consistent with previous work showing the ability of the Big Five and their facets to organize features of personality disorders (Samuel & Widiger, 2008; Widiger & Costa, 2013).

The Big Five are an important discovery, but they do not inherently represent a theory of personality. Rather, they constitute an empirical observation that subsequently requires explanation. Why are the Big Five the major dimensions of covariation among traits, and what are the mechanisms that produce variation in those dimensions? CB5T represents the most extensive attempt to date to answer these questions, linking each of the Big Five to variation in evolved mechanisms for the pursuit of goals, such as systems designed to respond to reward or to detect errors (DeYoung, 2015). CB5T is not the first attempt to identify mechanisms associated with each of the Big Five (e.g., Denissen & Penke, 2008; MacDonald, 2006; Nettle, 2006, 2007), but it is the first to identify mechanisms for a level of traits below the Big Five as well. Personality traits are structured hierarchically, such that below the Big Five there are many more specific traits, often called “facets.” The 25 scales of the PID-5 can be considered to measure facet-level traits, for example. There is no consensus in personality psychology regarding the identity and number of facets within each of the Big Five, nor even clear empirical approaches to identifying them. The number of valid facets might be limited only by the number of traits that can be shown to have discriminant validity. What is special about CB5T is that its theory of traits below the Big Five is based on the empirical discovery of a level of trait structure between the many facets and the Big Five. At this intermediate level of the hierarchy, it appears that each of the Big Five has exactly two subfactors (DeYoung et al., 2007; Jang et al., 2002).

The facet level of the personality hierarchy has typically been considered to reside immediately below the Big Five, but this assumption was challenged by twin research that showed two genetic factors were necessary to explain the covariance among the six facets in each of the Big Five as measured by the NEO Personality Inventory-Revised (NEO PI-R; Costa and McCrae, 1992; Jang et al., 2002). If the facets were the next level of the personality hierarchy below Big Five, only one genetic factor would have been necessary for each of the Big Five. The existence of exactly two factors within the facets of each of the Big Five was replicated in non-genetic factor analyses of 15 facets per dimension, combining the 6 NEO PI-R facets with the 9 facets of the Abridged Big Five Circumplex for the International Personality Item Pool (IPIP; DeYoung et al., 2007; Goldberg, 1999). To distinguish these factors conceptually from the facets, they were described as “aspects” of the Big Five. The 10 aspects were characterized by correlating factor scores with over 2000 items from the IPIP. The most highly correlated items were then used to construct a questionnaire, the Big Five Aspect Scales (BFAS; DeYoung et al., 2007). In addition to providing scores for the 10 aspects, the BFAS provides scores for the Big Five as the mean of aspect pairs. Its measurement of the Big Five converges well with other Big Five measures, and it has been used in over 75 studies since its publication. Psychometrically, the aspects are important because they form an empirically derived substructure for the Big Five that is lacking at the facet level. The two aspects in each of the Big Five are likely to reflect the most important distinction for discriminant validity within each of the five broader

dimensions (e.g., DeYoung, Grazioplene, & Peterson, 2012; DeYoung, Weisberg, Quilty, & Peterson, 2013; Hirsh, DeYoung, Xu, & Peterson, 2010).

CB5T embraces the importance of the aspects by developing a mechanistic (i.e., causal) account of their sources. Because valid unique variance exists at each level of the personality hierarchy (Jang et al., 1998, 2002), each of the two aspects must have unique causal sources, in addition to whatever shared causes make them vary together within their Big Five dimension. For example, whereas Extraversion is posited to reflect variation in sensitivity to reward generally, its Assertiveness aspect is posited to reflect sensitivity to the incentive properties of reward, driving “wanting,” and its Enthusiasm aspect is posited to reflect sensitivity to the hedonic properties of reward, driving “liking” (Berridge, 2007; DeYoung, 2013, 2015). Integrating the PID-5 with the BFAS has the capacity to extend the clinical relevance of CB5T, allowing identification of mechanisms for symptoms associated with each BFAS aspect. For example, disorders of incentive reward are likely to be reflected in amotivation, whereas disorders of hedonic reward are likely to be reflected in anhedonia, and these may be associated with different groups of personality disorder symptoms in the Detachment dimension. Thus, if the PID-5 aligns well with the structure measured by the BFAS, this finding will facilitate the development of theories regarding the mechanisms of psychopathology.

The breakdown of each of the Big Five into two aspects is likely to be particularly useful for resolving one of the more contentious issues in attempts to integrate models of personality disorder with the Big Five, namely the correspondence of schizotypy or psychosis-proneness (Psychoticism in the PID-5) with the Openness/Intellect dimension. Many studies have now shown that Psychoticism and Openness/Intellect scales load together in five-factor solutions, and scales designed to measure maladaptive variants of Openness/Intellect facets have shown validity in predicting schizotypal traits (Edmundson, Lynam, Miller, Gore, & Widiger, 2011). However, Openness/Intellect and Psychoticism tend to split apart in six-factor solutions (Ashton et al., 2012; De Fruyt et al., 2012; cf. Watson, Clark, & Chmielewski, 2008), and some new evidence supports longstanding concerns that Psychoticism does not correspond well to a maladaptive variant of Openness/Intellect. Specifically, an item response theory (IRT) analysis of the PID-5 in conjunction with the IPIP analog of the NEO PI-R showed that Psychoticism items were not measuring the same latent variable as Openness/Intellect items, whereas items from the other four dimensions were clearly measuring the same latent variables across the two inventories (Suzuki, Samuel, Pahlen, & Krueger, 2015). (Note, however, that a similar IRT study using different instruments found that items from the SNAP-2 Eccentric Perceptions scale, a measure of psychosis-proneness, did measure the same latent variable as Openness/Intellect items; Stepp et al., 2012.)

CB5T asserts that the resolution of this issue can be accomplished by recognizing that Openness to Experience and Intellect are separable subdimensions (aspects) of the broader Big Five dimension (DeYoung et al., 2007; DeYoung, Grazioplene, & Peterson, 2012). Our hypothesis is that psychoticism does not correspond to Openness/Intellect as a global dimension but, rather, is a maladaptive variant of its Openness aspect specifically. Studies in both normal and clinical populations have demonstrated that, although Openness shows a

positive association with psychosis-proneness (or *apophenia*, the tendency to detect patterns where none exist), the association of Intellect with apophenia is very weak or even negative (DeYoung et al., 2012; Chmielewski, Bagby, Markon, Ring, & Ryder, 2014). Because Psychoticism appears to be differentially associated with Openness and Intellect, its association with the general Openness/Intellect factor is suppressed, and its linkage with normal personality dimensions may be best modeled at the aspect level. Our hypothesis for the present study was that the Psychoticism facets of the PID-5 would load on a factor with Openness specifically, whereas Intellect should mark a separate factor.

To integrate the BFAS and PID-5 structurally, we carried out joint factor analyses of the two instruments in two samples. This method is preferable to merely examining bivariate correlations between the two instruments because it shows the association of all scales with underlying latent dimensions and allows for cross-loadings of individual scales on multiple factors. We extracted and rotated a 10-factor solution, for which we hypothesized that each factor would be associated with one of the 10 BFAS dimensions, in that each BFAS scale would show a stronger factor loading than any other BFAS scale on one and only one factor, and factor content would be interpretable in a manner congruent with the BFAS and CB5T. We did not expect, however, that each BFAS scale would load on just one factor; substantial cross-loadings are likely, especially on the factor marked by the other BFAS dimension within the same Big Five trait (e.g., one would expect Assertiveness to show a cross-loading on the factor marked by Enthusiasm, and vice versa, given that both of these scales assess subfactors of Extraversion). Other likely cross-loadings, across Big Five dimensions, were between aspects of Extraversion and Agreeableness, given that their four aspects correspond to the four major axes of the interpersonal circumplex (DeYoung et al., 2013), and between several correlated aspects that have been hypothesized to be linked to dopamine, including Assertiveness, Intellect, Industriousness, and Withdrawal (DeYoung, 2013; DeYoung et al., 2007).

We used exploratory rather than confirmatory factor analysis because of the likely prevalence of cross-loadings and because we did not have well-established hypotheses about exactly which PID-5 facets would be associated with each of the 10 aspects. Note that the goal of the study was confirmatory, however, such that we did not focus on the empirically optimal number of factors to extract (which might not detect factors represented in this study by a small number of variables) but rather on testing our hypothesis about the loadings of the BFAS in a 10-factor solution. We initially tested our 10-factor hypothesis in Sample 1 and subsequently collected Sample 2 in order to determine whether the pattern would replicate. For cogency of presentation, however, we will report on both samples in parallel. A follow-up analysis in Sample 1 made use of additional measures that were not collected in Sample 2.

Method

Participants

Sample 1 consisted of 321 people (160 female) between the ages of 20 and 40 years ($M = 26.3$, $SD = 5.1$) who were recruited from the community via the website Craigslist to participate in a study that included an extensive battery of questionnaires and cognitive tests

as well as neuroimaging and genetic assessments not relevant to the present study. Questionnaire assessments were carried out in the laboratory at the University of Minnesota.

Sample 2 consisted of 549 people who completed the questionnaires online (326 female, M age = 31.9 years, $SD = 12.7$, range = 18–74), with 424 of these recruited via Amazon's Mechanical Turk and 125 recruited from the undergraduate student body of the University of Minnesota to participate for course credit. MTurk participants were paid \$5.00.

The reported sample sizes do not include participants who were excluded. In both samples, participants were excluded if they reported having become fluent in English after 6 years old or if there was evidence of improper scale use (e.g., using only one response option or never using either of the extreme response options). Participants in Sample 2 were also excluded if they failed to respond correctly to several items included among the real questionnaire items as attention checks, such as, "I have a pet kangaroo living in my bathroom," and, "There are no words on this page."

Measures

Both samples completed the BFAS and the PID-5. The BFAS includes 100 items rated on a 5-point scale from *Strongly Disagree* to *Strongly Agree*, with 10 items to assess each of the 10 subfactors of the Big Five reported by DeYoung et al. (2007). The 25 PID-5 scales include from 4 to 14 items, for a total of 220 items, rated on a 4-point scale ranging from *Very False or Often False* to *Very True or Often True*. For descriptive statistics, see Table 1. Consistent with their maladaptive content, many of the PID-5 scales have skewed distributions, which can attenuate correlations. Scale scores for both instruments were log-transformed if they showed skewness greater than .75 in both samples combined (Table 1). This relatively conservative cutoff for skewness was selected so that the same variables could be transformed in both samples, while making sure to transform scales that were considerably more skewed in one sample than the other. Scales that were negatively skewed were reverse-keyed, transformed, and then flipped in sign, to retain their original keying. (Follow-up factor analyses carried out using only untransformed variables yielded extremely similar loading patterns.)

One potential terminological confusion arises when attempting to integrate the BFAS and PID-5. Each includes a scale labeled "Withdrawal," but the two scales have quite different content, thereby risking the jingle fallacy (the assumption that scales with the same name must be measuring the same construct). In the BFAS, Withdrawal is an aspect of Neuroticism reflecting anxious and depressive traits (items include, "I worry about things," "I am easily discouraged"). In the PID-5, Withdrawal is a facet of Detachment reflecting social disengagement (items include, "I avoid social events," "I'm not interested in making friends"). To avoid confusion, in the rest of the current article we will label the BFAS scale "Withdrawn Distress" and the PID-5 scale "Social Withdrawal."

For a follow-up analysis in Sample 1, we used several additional measures. IQ was estimated using four subtests of the Wechsler Adult Intelligence Scale (WAIS-IV; Wechsler, 2008), including Block Design, Matrix Reasoning, Vocabulary, and Similarities ($M = 113.79$, $SD = 15.46$, Skewness = -0.02). IQ was not available for two participants. Absorption was

assessed using the Multidimensional Personality Questionnaire (MPQ; Tellegen & Waller, 2008). The Absorption scale includes 34 items rated on the same 5-point scale as the BFAS ($M = 3.12$, $SD = 0.74$, Skewness = 0.21, $\alpha = .94$). Absorption was not available for three participants. Empathy was assessed with the abbreviated version of the Externalizing Spectrum Inventory (ESI; Patrick, Kramer, Krueger, & Markon, 2013). The Empathy scale includes 11 items, rated on the same scale as the PID-5, and was log-transformed to reduce skewness ($M = 3.58$, $SD = 0.44$, Skewness = -1.55 , $\alpha = .88$).

Analysis

Factors were extracted using maximum likelihood with oblimin rotation ($\delta = 0$). To examine replication of the 10-factor solution in Sample 2, we used targeted rotation toward the Sample 1 matrix. We used exploratory factor analysis because of a lack of specific hypotheses regarding the loadings of some PID-5 scales and because neither the PID-5 nor the BFAS was designed to have simple structure. Personality in general does not have simple structure, especially at levels of the personality hierarchy below the Big Five, and EFA allows the many cross-loadings that are necessary for realistic factor models (Hofstee, Goldberg, & de Raad, 1992; McCrae, Zonderman, Costa, Bond, & Paunonen, 1996). Further, the use of targeted rotation introduces a confirmatory component to the process of replication. To examine the precision of replication, for each factor we calculated Tucker's congruence coefficient, which is analogous to a correlation, ranging from -1 to 1 , with higher absolute values indicative of greater similarity (it is equivalent to the cosine of the angle between the two vectors). Congruence coefficients greater than $.85$ are typically considered evidence of similarity, and those greater than $.95$ are considered evidence of replication (Lorenzo-Seva & Ten Berge, 2006).

Results

The 10-factor solutions for each sample are presented in Tables 2 and 3, with each factor labeled according to an interpretation of content across both samples (full correlation matrices, as well as 5-factor solutions, are available in an online supplement). In both samples, the hypothesis was largely supported that a single BFAS scale would show a higher loading than any other BFAS scale on one and only one factor. The one failure of this prediction was in the *Openness/Psychoticism* factor in Sample 2, for which the loading of Openness was quite low ($.22$) and both Industriousness and Politeness had higher loadings than Openness. Among all of the other factors, the smallest gaps between the highest and next highest BFAS loadings were seen in Sample 2 for the *Intellect* factor, where the loading for Intellect was only $.07$ greater than the loading for Assertiveness, and for the *Assertiveness vs. Submissiveness* factor, where the loading for Assertiveness was only $.08$ greater than the loading for Withdrawn Distress. Another relatively small gap was seen in the *Compassion vs. Callousness* factor in both samples, where the loading for Compassion was only $.11$ or $.12$ greater than the loading for Politeness. All other gaps were at least $.17$.

Congruence coefficients provided strong evidence of replication for 7 of the 10 factors (Table 3). Three factors fell below the conventional cutoff for replication, although they were well above the cutoff for similarity. These were the smallest factors. Two of them,

Orderliness and *Assertiveness vs Submissiveness*, were marked by only one PID-5 scale in addition to their BFAS scale, and one, *Intellect*, was not marked by any PID-5 scale. The lower congruence coefficients result directly from the fact that, for such small factors, the congruence coefficients depend heavily on many weak loadings, which are less likely to have stable rank-order across samples than strong loadings. Despite falling below the conventional congruence criterion for replication, these three factors were clearly marked by the same scales in both samples, such that we believe they can reasonably be considered replications, although future studies employing additional markers for these factors would be useful to solidify this conclusion.

Although unrelated to our hypothesis, it is worth noting that there were some instances in which the highest loading for a BFAS scale across the 10 factors (i.e., in a row) was not on the factor for which it was the highest loading BFAS scale (i.e., in a column). These loadings did not violate our hypothesis because other BFAS scales had even higher loadings on the factors where those scales had their highest loading, but they may be of interest because they indicate where some BFAS loadings are lacking in specificity. In Sample 1, there were three such cases: Withdrawn Distress, which had its highest loading on the *Volatility* factor, Politeness, which had its highest loading on the *Compassion vs. Callousness* factor, and Assertiveness, which had its highest loading on the *Intellect* factor. In Sample 2, there were also three: Openness and Politeness, both of which had their highest loading on the *Compassion vs. Callousness* factor, and Assertiveness, which had its strongest loading on the Intellect factor.

After observing these results, we performed two sets of follow-up analyses, the first to investigate a possible cause of the one deviation from our hypothesis (for Openness in Sample 2), and the second to investigate whether adding additional markers for three factors would improve the clarity of factor structure in Sample 1 (these additional measures were not available for Sample 2). As noted in our introduction, one possible cause of suppressed loadings of Openness on the *Openness/Psychoticism* factor is the variance that Openness shares with Intellect, because Intellect shows no association or even a negative association with psychosis-proneness (DeYoung et al., 2012; Chmielewski et al., 2014). The degree to which Openness and Intellect are each associated with Psychoticism could, therefore, influence the discrepancy in the *Openness/Psychoticism* factor between the two samples. Regression was used to predict Psychoticism (the mean of the three PID-5 Psychoticism facets) from Openness and Intellect (Sample 1: Openness $\beta = .42$, $p < .001$; Intellect $\beta = .03$, $p = .60$; Sample 2: Openness $\beta = .25$, $p < .001$; Intellect $\beta = -.19$, $p < .001$). These results suggest that partialling out the variance that Openness shares with Intellect could be especially important in Sample 2. To test this possibility, we created residual scores for Openness by regressing it on Intellect and ran the factor analysis again, including the new Openness scores, removing Intellect and the original Openness scale from the model, and extracting 9 factors instead of 10, using oblimin rotation ($\delta = 0$). As expected, this substantially increased the loading of Openness on the *Openness/Psychoticism* factor in Sample 2. The new loading was .47, which was .14 higher than the next highest loading BFAS scale (Withdrawn Distress). Loadings for the three Psychoticism facets were between .65 and .71. Thus, partialling out the variance that Openness shares with Intellect effectively eliminated the only deviation from our hypothesis.

Our second follow-up analysis added three additional variables to the factor analysis in Sample 1. Because there are no PID-5 scales associated with the *Intellect* factor, it could be distorted by having only one primary indicator. We therefore included a measure of intelligence (IQ), given that IQ has been located as a facet of the Intellect aspect in factor analysis (DeYoung, 2011; DeYoung et al., 2012). To further clarify the *Openness/Psychoticism* factor, we included the MPQ Absorption scale. The full name of the construct measured by this scale is “Openness to Absorbing and Self-Altering Experiences” (Tellegen & Atkinson, 1974), and it is an excellent marker of the Openness aspect, capturing content that is more similar to apophenia or psychosis-proneness than is the content of typical Openness scales, despite the fact that it assesses normal personality variation (DeYoung et al., 2012). Finally, to clarify the *Compassion vs. Callousness* factor, which had a cross-loading for the BFAS Politeness scale almost as strong as the loading for Compassion, we added the ESI Empathy scale, with the hypothesis that part of the reason this factor might not strongly differentiate Compassion from Politeness is that its only other primary indicator, PID-5 Callousness, combines items reflecting a callous lack of empathy with items reflecting aggression (Krueger et al., 2012). In the BFAS, items most clearly related to aggression (e.g., “I love a good fight”; “I seek conflict”) are included in Politeness.

Results of this factor analysis are presented in Table 4. As expected, the addition of three new indicators clarified several factors. Intellect and IQ clearly mark the *Intellect* factor, which has no other major loadings. Absorption is the best marker of the *Openness/Psychoticism* factor, and the loading of Openness on this factor has risen to .58. Compassion is now a far stronger marker of the *Compassion vs. Callousness* factor than is Politeness. And finally, Assertiveness now has its highest loading on its own factor, *Assertiveness vs. Submissiveness*.

Discussion

In two samples, a 10-factor solution largely confirmed the hypothesis that each of the BFAS scales would load on one and only one factor more strongly than any other BFAS scale. In addition, the 25 PID-5 facet scales loaded within this 10-factor space in ways that group the 10 BFAS scales and the 25 PID-5 facets into 10 conceptually coherent factors, thereby joining the two instruments in a common framework. The one deviation from our hypothesis (for the *Openness/Psychoticism* factor in Sample 2) could be eliminated by partialling variance shared with Intellect out of the Openness scores. Previous research has provided evidence that the difficulty of aligning Psychoticism with the Big Five is caused by the differential association of Openness and Intellect with psychosis-proneness (Chmielewski et al., 2014; DeYoung et al., 2012), and the present results are consistent with this pattern. Psychoticism can usefully be interpreted as a maladaptive variant of Openness that is unrelated or even negatively related to the unique variance of Intellect.

Our results speak to the comprehensiveness of the BFAS in spanning the universe of personality traits, both normal and abnormal. They also suggest that the theoretical framework of CB5T can be used to understand the symptoms of personality disorder, as delineated by the DSM-5’s alternative model of personality disorder and as assessed by the PID-5. Each of the 10 factors of normal and abnormal personality can be ascribed to the

mechanisms hypothesized by CB5T to underlie one of the 10 factors operationalized by the BFAS. To be clear, the present study provides no evidence regarding mechanisms of personality traits or symptoms. It was a purely psychometric endeavor. However, the resulting psychometric mapping affords a wealth of potentially useful hypotheses for future investigations regarding the sources of psychopathology because the BFAS operationalizes a theory that identifies psychological mechanisms (and in some cases biological mechanisms) for each of its 10 factors (Allen & DeYoung, in press; DeYoung, 2015). To facilitate future research, we will close by briefly discussing each of the 10 factors in turn.

We labeled the first factor *Distress* because the content of the PID-5 Anxiousness and Depressivity scales that most strongly mark this factor lines up well both with the content of the BFAS Withdrawn Distress scale and with the factor labeled “Distress” in research on comorbidity among mental disorders (Krueger & Markon, 2006; Wright et al., 2013). The latter represents shared risk for anxiety and mood disorders. CB5T follows Gray and McNaughton (2000) in identifying passive avoidance as the underlying psychological mechanism that anxiety and depression have in common, governed by the brain’s behavioral inhibition system, which includes the hippocampus and amygdala as its central nodes. The function of this system, from a cybernetic perspective, is involuntary inhibition of relevant goals, behavioral strategies, and interpretations of events in response to threat or punishment, uncertainty or error. The Withdrawn Distress scale loaded almost equally on the *Distress* and *Volatility* factors, which may reflect that its content describes tendencies toward anxiety and depression in the normal rather than clinically symptomatic range, causing it to cohere more closely with the other aspect of Neuroticism than the PID-5 Anxiousness and Depressivity scales do. Nonetheless, it loads on *Distress* considerably more strongly than does any other BFAS scale. This factor shows the most cross-loading for scales with primary loadings on other factors, highlighting emotional distress as the core of psychopathology.

We labeled the next factor *Volatility* because it combines the tendency to be easily irritated, angered, and upset with the tendency to be emotionally labile. CB5T suggests that Volatility reflects variation in active defensive reactions in response to immediate threat, punishment, and frustration, including reactive anger and, potentially, panic. These reactions are linked to what Gray and McNaughton (2000) called the Fight-Flight-Freeze system and are governed primarily by phylogenetically ancient brain systems in the hypothalamus and brain stem. Whereas *Distress* represents the major risk for unipolar depression, *Volatility* is associated specifically with risk for bipolar disorder (Quilty, Pelletier, DeYoung, & Bagby, 2013).

The next two factors comprise traits associated with Agreeableness in the Big Five. CB5T posits that all traits in this broad dimension reflect variation in mechanisms that evolved to allow cooperation and altruism within social species. From a cybernetic perspective, cooperation and altruism require coordinating one’s goals with those of others. However, the optimal degree of coordination with others is not fixed from the perspective of adaptation over either evolutionary or individual timescales. Selfishness is sometimes advantageous. In the extreme, however, selfishness is likely to cause suffering for others and may be considered dysfunctional even if it is not associated with subjective distress. Personality disorders are often characterized by interpersonal dysfunction, to which traits in the Agreeableness dimension are central.

The first Agreeableness factor we labeled *Exploitativeness*, and it is marked most strongly by Manipulativeness and Deceitfulness. (Note that high scores on this factor indicate lower Agreeableness.) Politeness is the BFAS scale that most strongly marks this factor, but it is not very specific, given that it has a similar or even stronger loading on the *Compassion vs. Callousness* factor. This lack of specificity may be due to the fact that the BFAS was created by analyzing facets of Big Five instruments developed from lexical models that deemphasize content related to honesty and humility. In the six-factor personality model proposed as an alternative to the Big Five, *Exploitativeness* is described in terms of its opposite pole as “Honesty-Humility” or “Propriety/Non-Violativeness” (Ashton et al., 2012; Saucier, 2009). However, previous analyses indicate that the PID-5 scales marking this factor can be readily subsumed within Agreeableness (Krueger & Markon, 2014; Suzuki et al., 2015), and CB5T distinguishes these traits from others within Agreeableness at the aspect level, rather than at the Big Five (or Six) level. CB5T proposes that *Exploitativeness* reflects variation in mechanisms that carry out suppression of rude, exploitative, or belligerent impulses, in order to avoid taking advantage of others or violating social norms. Whereas *Exploitativeness* is hypothesized to involve top-down control over antisocial behavior, the second Agreeableness factor, *Compassion vs. Callousness*, is hypothesized to reflect variation in more automatic, emotional mechanisms that promote care and concern for others, including the ability to empathize.

The next factor, *Industriousness vs. Distractibility*, contains most of the PID-5 scales associated with Conscientiousness vs. Disinhibition. CB5T proposes that this factor represents variation in the mechanisms that govern the pursuit of non-immediate goals, keeping behavior on track by orienting attention away from distractions and toward goal-relevant stimuli. The other Conscientiousness factor, *Orderliness*, contains Rigid Perfectionism, the only PID-5 scale that exhibits bipolarity, meaning that it is negatively related to the other Disinhibition scales. Orderliness is similarly marked by perfectionism in normal-range personality inventories (DeYoung et al., 2007). CB5T hypothesizes that Orderliness reflects the ability and tendency to follow rules, set either by others or by oneself. If one is governed by rules inflexibly or compulsively, this may be dysfunctional.

The next two factors reflect variation in Extraversion vs. Detachment. Many of the PID-5 scales associated with Detachment load strongly on the *Enthusiasm* factor, which combines sociability and positive emotionality. Anhedonia loads about equally on this factor and the *Distress* factor, highlighting the link between depression and anhedonia. As noted in the introduction, CB5T considers this factor to stem from variation in the mechanisms of hedonic reward, which involve the endogenous opioid system that produces the hedonic component of positive affect and is important for social affiliation.

The *Assertiveness vs. Submissiveness* factor is rather weak, containing just two scales with loadings around .4 or .5 as its indicators. Nonetheless, this aspect of Extraversion is important because it is hypothesized to represent the primary manifestation of sensitivity to incentive reward in personality, governed by the neurotransmitter dopamine (DeYoung, 2013). Greater sensitivity of this system leads to drive and heightened approach behavior. Assertiveness does not show much specificity as a marker for this factor, but that may be due in part to the lack of additional markers for the *Intellect* factor, on which Assertiveness

cross-loads. When IQ was included in the factor analysis for Sample 1, BFAS Assertiveness showed a stronger and more specific loading on *Assertiveness vs. Submissiveness*.

The last two factors are related to the Openness/Intellect dimension of the Big Five, which CB5T considers to reflect variation in the mechanisms of cognitive exploration that allow people to create interpretations of the correlational and causal structure of their experience. Engagement with correlational patterns in sensory and perceptual information is posited to be reflected in Openness, whereas engagement in causal and logical analysis of abstract or semantic information is posited to be reflected in Intellect (DeYoung, 2015). The *Openness/Psychoticism* factor combines the tendency to detect and appreciate patterns (Openness) with the tendency to perceive non-existent patterns (Psychoticism), suggesting that Psychoticism can be understood as a dysfunctional sensitivity of the same mechanisms that produce Openness. This is particularly coherent as an explanation if one describes the core of Psychoticism as apophenia, which constitutes the tendency to make Type I errors, falsely identifying a pattern as real when it is not (DeYoung et al., 2012). In this context, it is also sensible that Intellect might be negatively associated with Psychoticism because skill in logical analysis should aid in determining which patterns are likely to be objectively real, thereby reducing Type I errors. Our follow-up analysis in Sample 2 confirmed that partialling out variance in Openness shared with Intellect strengthened the loading of Openness on this factor. Our follow-up analysis in Sample 1 confirmed that MPQ Absorption is a particularly good marker of the *Openness/Psychoticism* factor, which may make it useful in future research on the links between normal and dysfunctional manifestations of this dimension.

No PID-5 scale showed a loading above .3 on the *Intellect* factor, suggesting that this dimension is not particularly strongly related to any manifestations of personality disorder. Nonetheless, it is clearly a crucial dimension of individual differences, given that our follow-up analysis in Sample 1 indicated that this is the only dimension with a major loading for IQ. Intelligence is a protective factor against most forms of psychopathology (Gale, Batty, Tynelius, Deary, & Rasmussen, 2010; Zammit et al., 2004), so *Intellect* may be broadly relevant to psychopathology, even if it is not specifically linked to any PID-5 traits.

Limitations of this study include the fact that the extra measures used to clarify the factor structure of Sample 1 were not available in our replication sample. Additionally, neither sample included a clinical population. The PID-5 has been shown to have a similar factor structure in clinical populations as in healthy populations (Krueger & Markon, 2014), but, nonetheless, future work on integrating the PID-5 and BFAS could usefully attempt to replicate our findings in a clinical population. Finally, peer or expert ratings could be used to supplement self-ratings.

Conclusion

This study delivers the possibility of integrating the PID-5 with the personality theory operationalized by the BFAS. It was by no means a foregone conclusion that a 10-factor solution for the BFAS and PID-5 jointly would produce only factors that correspond to the empirically derived BFAS dimensions for which CB5T offers theoretical explanations. The

fact that it did suggests that the BFAS model provides parsimonious and comprehensive coverage of the universe of personality traits, both normal and abnormal. (Which is not to say that the specific measurement properties of the BFAS could not be improved—the present analyses, for example, suggest that the Withdrawn Distress and Politeness scales could potentially be better aligned with content related to *Distress* and *Exploitativeness*, respectively, and that the Openness scale might benefit from including content reflected in MPQ Absorption.) This psychometric integration provides a fruitful opportunity for theoretical integration, as it allows the mechanistic hypotheses of CB5T to be brought to bear on the PID-5. Future research on personality disorder symptoms, using the PID-5, may now directly test CB5T's hypotheses about how dysfunction in specific psychological and biological mechanisms causes specific groups of symptoms related to different personality traits.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

- Allen, TA.; DeYoung, CG. Personality neuroscience and the Five Factor Model. In: Widiger, TA., editor. Oxford handbook of the Five Factor Model. New York: Oxford University Press; in press
- Ashton MC, Lee K, de Vries RE, Hendrickse J, Born MP. The maladaptive personality traits of the personality inventory for DSM-5 (PID-5) in relation to the HEXACO personality factors and schizotypy/dissociation. *Journal of Personality Disorders*. 2012; 26:641–659. [PubMed: 23013335]
- Berridge KC. The debate over dopamine's role in reward: The case for incentive salience. *Psychopharmacology*. 2007; 191(3):391–431. [PubMed: 17072591]
- Chmielewski M, Bagby RM, Markon K, Ring AJ, Ryder AG. Openness to experience, intellect, schizotypal personality disorder, and psychoticism: Resolving the controversy. *Journal of Personality Disorders*. 2014; 28:483–489. [PubMed: 24511900]
- Costa, PT., Jr; McCrae, RR. NEO PI-R Professional Manual. Odessa, FL: Psychological Assessment Resources; 1992b.
- De Fruyt F, De Clercq B, De Bolle M, Wille B, Markon KE, Krueger RF. General and maladaptive traits in a five-factor framework for DSM-5 in a university student sample. *Assessment*. 2013; 20:295–307. [PubMed: 23405016]
- Denissen JJ, Penke L. Motivational individual reaction norms underlying the Five-Factor model of personality: First steps towards a theory-based conceptual framework. *Journal of Research in Personality*. 2008; 42:1285–1302.
- DeYoung, CG. Intelligence and personality. In: Sternberg, RJ.; Kaufman, SB., editors. The Cambridge handbook of intelligence. New York: Cambridge University Press; 2011. p. 711-737.
- DeYoung CG. The neuromodulator of exploration: A unifying theory of the role of dopamine in personality. *Frontiers in Human Neuroscience*. 2013; 7:article 762.10.3389/fnhum.2013.00762 [PubMed: 24294198]
- DeYoung CG. Cybernetic Big Five Theory. *Journal of Research in Personality*. 2015; 56:33–58.
- DeYoung CG, Grazioplene RG, Peterson JB. From madness to genius: The Openness/Intellect trait domain as a paradoxical simplex. *Journal of Research in Personality*. 2012; 46:63–78.
- DeYoung CG, Quilty LC, Peterson JB. Between facets and domains: 10 aspects of the Big Five. *Journal of Personality and Social Psychology*. 2007; 93:880–896. [PubMed: 17983306]

- DeYoung CG, Weisberg YJ, Quilty LC, Peterson JB. Unifying the aspects of the Big Five, the interpersonal circumplex, and trait affiliation. *Journal of personality*. 2013; 81:465–475. [PubMed: 23126539]
- Edmundson M, Lynam DR, Miller JD, Gore WL, Widiger TA. A Five-Factor Measure of Schizotypal Personality Traits. *Assessment*. 2011; 18:321–334. [PubMed: 21571737]
- Gale CR, Batty GD, Tynelius P, Deary IJ, Rasmussen F. Intelligence in early adulthood and subsequent hospitalisation for mental disorders. *Epidemiology*. 2010; 21:70–77. [PubMed: 19907333]
- Goldberg, LR. A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. In: Mervielde, I.; Deary, I.; De Fruyt, F.; Ostendorf, F., editors. *Personality psychology in Europe*. Vol. 7. Tilburg, The Netherlands: Tilburg University Press; 1999. p. 7-28.
- Gore WL, Widiger TA. The DSM-5 dimensional trait model and five-factor models of general personality. *Journal of Abnormal Psychology*. 2013; 122:816–821. [PubMed: 23815395]
- Gray, JA.; McNaughton, N. *The neuropsychology of anxiety: An enquiry into the functions of the septo-hippocampal system*. 2. New York: Oxford University Press; 2000.
- Hirsh JB, DeYoung CG, Xu X, Peterson JB. Compassionate liberals and polite conservatives: Associations of Agreeableness with political ideology and values. *Personality and Social Psychology Bulletin*. 2010; 36:655–664. [PubMed: 20371797]
- Hofstee WK, de Raad B, Goldberg LR. Integration of the Big Five and circumplex approaches to trait structure. *Journal of Personality and Social Psychology*. 1992; 63:146–163. [PubMed: 1494982]
- Jang KL, Hu S, Livesley WJ, Angleitner A, Riemann &, Vernon PA. Genetic and environmental influences on the covariance of facets defining the domains of the five-factor model of personality. *Personality and Individual Differences*. 2002; 33:83–101.
- Jang KL, McCrae RR, Angleitner A, Riemann R, Livesley WJ. Heritability of facet-level traits in a cross-cultural twin sample: Support for a hierarchical model of personality. *Journal of Personality and Social Psychology*. 1998; 74:1556–1565. [PubMed: 9654759]
- John, OP.; Naumann, LP.; Soto, CJ. Paradigm shift to the integrative Big Five trait taxonomy: History: measurement, and conceptual issue. In: John, OP.; Robins, RW.; Pervin, LA., editors. *Handbook of personality: Theory and research*. New York: Guilford Press; 2008. p. 114-158.
- Krueger RF, Derringer J, Markon KE, Watson D, Skodol AE. Initial construction of a maladaptive personality trait model and inventory for DSM-5. *Psychological Medicine*. 2012; 42:1879–1890. [PubMed: 22153017]
- Krueger RF, Markon KE. The role of the DSM-5 personality trait model in moving toward a quantitative and empirically based approach to classifying personality and psychopathology. *Annual Review of Clinical Psychology*. 2014 Online publication before print.
- Lorenzo-Seva U, ten Berge JMF. Tucker's congruence coefficient as a meaningful index of factor similarity. *Methodology: European Journal of Research Methods for the Behavioral and Social Sciences*. 2006; 2:57–64.
- MacDonald K. Evolution, the five-factor model, and levels of personality. *Journal of Personality*. 2006; 63:525–567.
- Markon KE, Krueger RF, Watson D. Delineating the structure of normal and abnormal personality: An integrative hierarchical approach. *Journal of Personality and Social Psychology*. 2005; 88:139–157. [PubMed: 15631580]
- McCrae RR, Zonderman AB, Costa PT Jr, Bond MH, Paunonen SV. Evaluating replicability of factors in the Revised NEO Personality Inventory: Confirmatory factor analysis versus Procrustes rotation. *Journal of Personality and Social Psychology*. 1996; 70:552.
- Nettle D. The evolution of personality variation in humans and other animals. *American Psychologist*. 2006; 61:622–631. [PubMed: 16953749]
- Nettle, D. *Personality: What makes you the way you are*. New York: Oxford University Press; 2007.
- Patrick CJ, Kramer MD, Krueger RF, Markon KE. Optimizing efficiency of psychopathology assessment through quantitative modeling: Development of a brief form of the Externalizing Spectrum Inventory. *Psychological assessment*. 2013; 25:1332–1348. [PubMed: 24320765]

- Quilty LC, Pelletier M, DeYoung CG, Bagby RM. Hierarchical personality traits and the distinction between unipolar and bipolar disorders. *Journal of Affective Disorders*. 2013; 147:247–254. [PubMed: 23261133]
- Samuel DB, Widiger TA. A meta-analytic review of the relationships between the five-factor model and DSM-IV-TR personality disorders: A facet level analysis. *Clinical Psychology Review*. 2008; 28:1326–1342. [PubMed: 18708274]
- Saucier G. Recurrent personality dimensions in inclusive lexical studies: Indications for a Big Six structure. *Journal of Personality*. 2009; 77:1577–1614. [PubMed: 19678873]
- Stapp SD, Yu L, Miller JD, Hallquist MN, Trull TJ, Pilkonis PA. Integrating competing dimensional models of personality: Linking the SNAP, TCI, and NEO using item response theory. *Personality Disorders: Theory, Research, and Treatment*. 2012; 3:107–126.
- Suzuki T, Samuel DB, Pahlen S, Krueger RF. DSM-5 alternative personality disorder model traits as maladaptive extreme variants of the five-factor model: An item-response theory analysis. *Journal of Abnormal Psychology*. 2015; 124:343–354. [PubMed: 25665165]
- Tellegen A, Atkinson G. Openness to absorbing and self-altering experiences (“Absorption”), a trait related to hypnotic susceptibility. *Journal of Abnormal Psychology*. 1974; 83:268–277. [PubMed: 4844914]
- Thomas KM, Yalch MM, Krueger RF, Wright AGC, Markon KE, Hopwood CJ. The convergent structure of DSM-5 personality trait facets and five-factor model trait domains. *Assessment*. 2013; 20(3):308–11. [PubMed: 22946103]
- Watson D, Clark LA, Chmielewski M. Structures of personality and their relevance to psychopathology: II. Further articulation of a comprehensive unified trait structure. *Journal of Personality*. 2008; 76(6):1545–1586. [PubMed: 19012658]
- Wechsler, D. Wechsler adult intelligence scale—Fourth Edition (WAIS—IV). San Antonio, TX: NCS Pearson; 2008.
- Widiger, TA.; Costa, PT. *Personality disorders and the Five-Factor Model of personality*. 3. Washington, DC: American Psychological Association; 2013.
- Widiger TA, Trull TJ. Plate tectonics in the classification of personality disorder: Shifting to a dimensional model. *American Psychologist*. 2007; 62:71–83. [PubMed: 17324033]
- Wright AGC, Simms LJ. A metastructural model of mental disorders and pathological personality traits. *Psychological medicine*. 2015:1–11.
- Zammit S, Allebeck P, David AS, Dalman C, Hemmingsson T, Lundberg I, Lewis G. A longitudinal study of premorbid IQ score and risk of developing schizophrenia, bipolar disorder, severe depression, and other nonaffective psychoses. *Archives of General Psychiatry*. 2004; 61:354–360. [PubMed: 15066893]

Table 1

Descriptive Statistics for the BFAS and PID-5.

	Sample 1 (N = 321)			Sample 2 (N = 549)			Combined		
	Mean	SD	Skewness	α	Mean	SD	Skewness	α	Skewness
BFAS									
Withdrawn Distress	2.68	0.71	0.19	.83	2.84	0.83	0.04	.88	0.12
Volatility	2.53	0.81	0.43	.90	2.60	0.84	0.23	.92	0.30
Politeness	3.78	0.64	-0.61	.76	3.92	0.58	-0.58	.78	-0.61
Compassion	4.23	0.56	-0.77	.86	3.94	0.71	-0.83	.91	-0.90
Industriousness	3.43	0.70	-0.43	.83	3.58	0.71	-0.10	.87	-0.21
Orderliness	3.38	0.71	-0.23	.79	3.61	0.68	-0.15	.84	-0.19
Enthusiasm	3.74	0.73	-0.49	.85	3.41	0.77	-0.24	.88	-0.33
Assertiveness	3.67	0.67	-0.43	.85	3.26	0.79	-0.27	.90	-0.38
Openness	4.04	0.64	-0.61	.82	3.77	0.68	-0.37	.87	-0.45
Intellect	4.01	0.61	-0.56	.83	3.83	0.67	-0.41	.83	-0.48
PID-5									
Anhedonia	1.66	0.54	1.21	.84	1.93	0.66	0.64	.90	0.84
Anxiousness	2.11	0.74	0.53	.89	2.32	0.82	0.22	.94	0.34
Attention Seeking	2.10	0.70	0.18	.88	1.79	0.63	0.53	.89	0.42
Callousness	1.33	0.38	1.87	.86	1.42	0.47	1.47	.91	1.62
Deceitfulness	1.66	0.57	0.88	.86	1.67	0.57	0.74	.89	0.79
Distractibility	1.92	0.68	0.60	.91	1.87	0.62	0.50	.95	0.55
Depressivity	1.42	0.50	1.65	.90	1.65	0.68	1.08	.90	1.29
Eccentricity	2.25	0.84	0.23	.95	2.03	0.75	0.34	.96	0.33
Emotional Lability	1.84	0.62	0.57	.83	1.97	0.70	0.64	.90	0.65
Grandiosity	1.73	0.55	0.86	.73	1.69	0.57	0.96	.82	0.92
Hostility	1.76	0.50	0.76	.79	1.87	0.59	0.79	.87	0.82
Impulsivity	1.78	0.64	0.69	.85	1.73	0.62	0.57	.88	0.62
Intimacy Avoidance	1.42	0.48	1.44	.73	1.65	0.72	1.18	.90	1.38
Irresponsibility	1.44	0.48	1.24	.74	1.50	0.48	1.04	.79	1.10
Manipulativeness	1.93	0.70	0.60	.81	1.83	0.68	0.62	.85	0.61

	Sample 1 (N = 321)			Sample 2 (N = 549)			Combined		
	Mean	SD	Skewness	α	Mean	SD	Skewness	α	
Perceptual Dysregulation	1.62	0.55	1.16	.84	1.54	0.45	1.00	.84	1.13
Perseveration	1.81	0.56	0.61	.80	2.00	0.58	0.17	.86	0.32
Restricted Affectivity	1.94	0.64	0.60	.79	1.94	0.60	0.41	.82	0.48
Rigid Perfectionism	2.01	0.65	0.35	.87	2.19	0.69	0.27	.91	0.31
Risk Taking	2.45	0.53	0.01	.87	2.09	0.59	0.16	.91	0.03
Separation Insecurity	1.75	0.64	0.85	.83	1.86	0.65	0.58	.84	0.67
Social Withdrawal	1.73	0.59	0.65	.88	2.11	0.75	0.40	.93	0.56
Submissiveness	2.28	0.67	-0.19	.78	2.30	0.68	-0.24	.82	-0.22
Suspiciousness	1.80	0.56	0.75	.71	2.01	0.61	0.53	.81	0.62
Unusual Beliefs and Experiences	1.79	0.69	1.00	.83	1.68	0.61	1.01	.85	1.03

Table 2

Factor Structure Matrix for Sample 1.

	Neuroticism		Agreeableness		Conscientiousness		Extraversion		Openness/Intellect	
	Distress	Volatility	Exploit- ativeness	Compassion vs. Callousness	Industriousness vs. Distractibility	Orderliness	Enthusiasm	Assertiveness vs. Submissiveness	Psychoticism/ Openness	Intellect
Withdrawn Distress (BFAS)	.64	.66	-.06	.05	-.34	-.15	-.43	-.28	.24	-.24
Depressivity	.86	.48	.14	-.12	-.50	-.10	-.48	-.07	.41	-.05
Anxiousness	.81	.56	.12	.03	-.35	.15	-.33	-.15	.32	-.15
Separation Insecurity	.54	.21	.23	-.07	-.24	.12	.05	-.26	.20	-.07
Suspiciousness	.53	.33	.21	-.32	-.28	.15	-.39	.27	.38	-.12
Volatility	.36	.91	.16	-.16	-.24	.08	-.16	.02	.13	-.12
Hostility	.44	.73	.40	-.37	-.40	.23	-.24	.16	.29	.01
Emotional Lability	.55	.66	.22	.19	-.37	.19	-.09	-.05	.38	-.03
Politeness (BFAS)	-.19	-.47	-.51	.59	.31	.11	.12	-.15	-.24	-.24
Manipulativeness	.14	.21	.82	-.26	-.36	.19	.09	.06	.27	.28
Deceitfulness	.37	.29	.79	-.37	-.39	-.06	-.17	-.07	.38	.09
Grandiosity	.11	.13	.54	-.40	-.21	.22	.06	.02	.32	.33
Attention Seeking	.17	.17	.54	-.09	-.43	.21	.32	.02	.33	.23
Compassion (BFAS)	-.14	-.15	-.15	.70	.05	-.06	.36	-.11	.00	.10
Callousness	.29	.34	.45	-.73	-.26	-.04	-.31	.27	.32	.07
Industriousness (BFAS)	-.46	-.44	-.10	.00	.71	.41	.27	.29	-.30	.14
Distractibility	.45	.36	.24	-.08	-.87	-.10	-.28	-.15	.44	-.06
Impulsivity	.34	.26	.40	-.08	-.73	-.07	-.11	.24	.43	-.01
Perseveration	.56	.42	.30	-.10	-.65	.17	-.29	-.11	.50	-.11
Irresponsibility	.53	.32	.49	-.16	-.57	-.21	-.27	.15	.45	.03
Orderliness (BFAS)	-.10	-.08	-.12	.03	.36	.67	.13	-.06	-.31	-.14
Rigid Perfectionism	.26	.24	.20	-.08	-.18	.68	-.08	-.02	.26	-.05
Enthusiasm (BFAS)	-.34	-.30	.10	.33	.13	.23	.82	.10	-.16	.16
Social Withdrawal	.42	.34	.07	-.38	-.27	-.02	-.82	.04	.37	-.09
Anhedonia	.67	.43	.06	-.30	-.33	-.17	-.67	-.07	.28	-.10
Restricted Affectivity	.18	-.03	.12	-.51	-.25	.07	-.61	.07	.29	.02

	<u>Neuroticism</u>		<u>Agreeableness</u>		<u>Conscientiousness</u>		<u>Extraversion</u>		<u>Openness/Intellect</u>	
	Distress	Volatility	Exploit- ativeness	Compassion vs. Callousness	Industriousness vs. Distractibility	Orderliness	Enthusiasm	Assertiveness vs. Submissiveness	Psychoticism/ Openness	Intellect
Intimacy Avoidance	.37	.23	.23	-.11	-.43	.09	-.54	.09	.35	-.08
Assertiveness (BFAS)	-.23	.02	.43	-.11	.01	.30	.33	.50	.10	.57
Submissiveness	.21	.03	.18	.08	-.13	.09	.06	-.56	-.06	-.17
Risk Taking	-.10	.00	.30	-.12	-.35	-.03	.14	.42	.40	.23
Openness (BFAS)	.08	.14	-.14	.39	-.26	-.18	-.02	.14	.47	.40
Perceptual Dysregulation	.50	.33	.23	.02	-.52	.03	-.27	.05	.82	.12
Unusual Beliefs and Experiences	.23	.13	.30	-.06	-.34	.02	-.15	.24	.82	.24
Eccentricity	.37	.24	.13	-.21	-.55	-.01	-.34	.00	.78	.28
Intellect (BFAS)	-.14	-.13	.11	.00	.08	-.09	.10	.12	.17	.84

Note. $N = 321$. Numbers in bold indicate the highest loading in each row. Italics indicate the BFAS scale that was hypothesized to have the highest loading in each column.

Table 3

Factor Structure Matrix for Sample 2.

	Neuroticism		Agreeableness		Conscientiousness		Extraversion		Openness/Intellect	
	Distress	Volatility	Exploit- ativeness	Compassion vs. Callousness	Industriousness vs. Distractibility	Orderliness	Enthusiasm	Assertiveness vs. Submissiveness	Psychoticism/ Openness	Intellect
Withdrawn Distress (BFAS)	.76	.75	-.16	.04	-.39	-.10	-.33	-.38	.22	-.29
Depressivity	.88	.51	.14	-.10	-.47	-.07	-.61	-.08	.43	-.15
Anxiousness	.81	.65	-.01	.00	-.38	.11	-.37	-.28	.31	-.17
Separation Insecurity	.53	.36	.30	.16	-.41	.11	.08	-.21	.32	-.14
Suspiciousness	.58	.51	.26	-.38	-.25	.15	-.47	.09	.35	-.01
Volatility	.54	.95	.13	-.09	-.36	.01	-.18	-.05	.22	-.18
Hostility	.54	.74	.47	-.35	-.42	.20	-.46	.09	.42	-.02
Emotional Lability	.62	.67	.23	.22	-.46	.11	-.09	-.07	.45	-.12
Politeness (BFAS)	-.12	-.42	-.56	.67	.33	.06	.08	-.32	-.23	-.18
Manipulativeness	.13	.14	.73	-.36	-.23	.17	.08	.03	.29	.38
Deceitfulness	.40	.33	.76	-.50	-.40	.01	-.13	-.06	.39	.14
Grandiosity	.05	.11	.56	-.42	-.18	.26	-.03	.29	.30	.29
Attention Seeking	.08	.12	.58	-.15	-.44	.09	.39	.11	.30	.24
Compassion (BFAS)	-.17	-.28	-.28	.79	.28	.08	.48	-.18	-.17	.14
Callousness	.38	.36	.62	-.69	-.35	.07	-.39	.26	.42	-.02
Industriousness (BFAS)	-.49	-.48	-.08	.09	.78	.45	.29	.22	-.26	.28
Distractibility	.60	.44	.26	.01	-.84	-.18	-.37	-.18	.43	-.22
Impulsivity	.27	.28	.46	-.14	-.72	-.12	.07	.18	.47	.03
Perseveration	.63	.44	.22	-.13	-.69	.21	-.39	-.16	.55	-.14
Irresponsibility	.52	.31	.52	-.23	-.69	-.25	-.29	.07	.47	-.09
Orderliness (BFAS)	-.03	-.04	-.11	.02	.44	.66	.09	-.02	-.19	-.04
Rigid Perfectionism	.28	.23	.12	-.22	-.14	.78	-.27	.00	.33	.06
Enthusiasm (BFAS)	-.42	-.34	.10	.52	.15	.10	.90	.09	-.17	.21
Social Withdrawal	.50	.34	.03	-.41	-.23	.06	-.97	-.06	.35	-.12
Anhedonia	.79	.45	.09	-.26	-.34	-.08	-.78	-.08	.28	-.23
Restricted Affectivity	.22	.00	.19	-.66	-.33	.06	-.69	.06	.35	.05

	<u>Neuroticism</u>		<u>Agreeableness</u>		<u>Conscientiousness</u>		<u>Extraversion</u>		<u>Openness/Intellect</u>	
	Distress	Volatility	Exploit- ativeness	Compassion vs. Callousness	Industriousness vs. Distractibility	Orderliness	Enthusiasm	Assertiveness vs. Submissiveness	Psychoticism/ Openness	Intellect
Intimacy Avoidance	.35	.16	.14	-.35	-.26	-.01	-.65	.14	.27	-.05
Assertiveness (BFAS)	-.41	-.21	.29	-.04	.11	.22	.54	.46	-.04	.57
Submissiveness	.41	.20	.15	.18	-.28	.00	-.09	-.42	.13	-.26
Risk Taking	-.15	.02	.40	-.25	-.41	-.05	.39	.34	.31	.29
Openness (BFAS)	-.11	.00	-.22	.44	.06	.01	.18	.01	.22	.43
Perceptual Dysregulation	.58	.36	.38	-.10	-.55	.06	-.20	.05	.79	.03
Unusual Beliefs and Experiences	.35	.20	.30	-.02	-.35	.10	-.17	.15	.72	.20
Eccentricity	.39	.35	.15	-.12	-.56	.02	-.38	.04	.72	.19
Intellect (BFAS)	-.42	-.36	-.10	.18	.42	.16	.16	.21	-.01	.64
Congruence with Sample 1	.98	.98	.97	.96	.96	.93	.97	.90	.97	.94

Note. $N = 549$. Numbers in bold indicate the highest loading in each row. Italics indicate the BFAS scale that was hypothesized to have the highest loading in each column. Bottom row is Tucker's congruence coefficient.

Table 4

Factor Structure Matrix for Sample 1 from Follow-Up Analysis with Three Extra Variables.

	Neuroticism		Agreeableness		Conscientiousness		Extraversion		Openness/Intellect	
	Distress	Volatility	Exploitativeness	Compassion vs. Callousness	Industriousness vs. Distractibility	Orderliness	Enthusiasm	Assertiveness	Openness/ Psychoticism	Intellect
Withdrawn Distress (BFAS)	.65	.67	-.13	-.05	-.29	-.16	-.43	-.34	.20	-.10
Anxiousness	.83	.55	.05	-.11	-.33	.12	-.37	-.16	.28	-.11
Depressivity	.81	.48	.08	-.23	-.48	-.13	-.54	-.12	.36	.02
Separation Insecurity	.54	.21	.23	-.06	-.25	.12	-.04	-.22	.15	-.02
Volatility (BFAS)	.35	.92	.14	-.19	-.22	.06	-.19	-.00	.10	-.15
Hostility	.40	.73	.40	-.36	-.40	.19	-.34	.15	.23	-.09
Emotional Lability	.59	.64	.16	.08	-.37	.18	-.12	-.05	.37	-.05
Politeness (BFAS)	-.12	-.47	-.55	.55	.31	.14	.23	-.16	-.18	-.16
Manipulativeness	.15	.20	.82	-.22	-.38	.15	.00	.10	.23	.16
Deceitfulness	.35	.28	.75	-.39	-.40	-.10	-.26	-.11	.31	.08
Grandiosity	.07	.13	.61	-.31	-.23	.21	-.06	.09	.26	.25
Attention Seeking	.18	.14	.55	-.06	-.47	.20	.20	.08	.28	.12
Compassion (BFAS)	-.05	-.16	-.17	.81	.03	-.06	.42	-.07	.11	.12
Empathy	-.11	-.12	-.21	.92	.10	.01	.38	-.09	-.01	.10
Callousness	.19	.35	.47	-.76	-.26	-.08	-.43	.21	.23	-.02
Industriousness (BFAS)	-.46	-.46	-.03	.06	.66	.42	.30	.39	-.27	-.03
Distractibility	.43	.38	.20	-.13	-.84	-.12	-.34	-.22	.41	.01
Impulsivity	.33	.25	.34	-.16	-.75	-.12	-.18	.15	.40	-.11
Perseveration	.55	.42	.25	-.18	-.64	.15	-.36	-.18	.44	-.08
Irresponsibility	.50	.33	.43	-.23	-.58	-.27	-.35	.07	.44	-.01
Risk Taking	-.13	-.02	.30	-.17	-.39	-.05	.06	.37	.38	.05
Orderliness (BFAS)	-.08	-.08	-.08	.09	.34	.68	.15	.03	-.31	-.19
Rigid Perfectionism	.28	.23	.20	-.11	-.18	.67	-.12	-.01	.22	-.10
Enthusiasm (BFAS)	-.27	-.34	.11	.35	.06	.24	.84	.19	-.09	.03
Social Withdrawal	.35	.35	.05	-.43	-.22	-.05	-.86	-.06	.28	-.04
Anhedonia	.60	.46	.02	-.37	-.29	-.20	-.72	-.13	.21	-.02

	<u>Neuroticism</u>		<u>Agreeableness</u>		<u>Conscientiousness</u>		<u>Extraversion</u>		<u>Openness/Intellect</u>	
	Distress	Volatility	Exploit- ativeness	Compassion vs. Callousness	Industriousness vs. Distractibility	Orderliness	Enthusiasm	Assertiveness	Openness/ Psychoticism	Intellect
Restricted Affectivity	.09	.00	.16	-.47	-.23	.05	-.68	.03	.20	.02
Intimacy Avoidance	.36	.23	.16	-.24	-.41	.05	-.53	-.02	.30	-.07
Suspiciousness	.47	.33	.18	-.36	-.29	.09	-.48	.24	.33	-.26
Assertiveness (BFAS)	-.23	-.02	.49	-.06	-.04	.27	.29	.64	.16	.28
Submissiveness	.26	.04	.18	.14	-.12	.11	.03	-.53	-.13	.00
Openness (BFAS)	.11	.12	-.17	.29	-.25	-.17	.03	.18	.56	.37
Absorption	.15	.09	.10	.18	-.36	-.05	.00	.21	.84	.19
Unusual Beliefs and Experiences	.20	.12	.29	-.14	-.35	.01	-.23	.19	.82	.14
Perceptual Dysregulation	.48	.32	.18	-.10	-.52	.02	-.34	.00	.81	.09
Eccentricity	.32	.25	.15	-.26	-.53	-.01	-.43	-.02	.71	.30
Intellect (BFAS)	-.15	-.15	.17	.02	.06	-.07	.10	.29	.19	.80
IQ	.04	-.03	.05	.08	-.01	-.17	-.06	-.38	.07	.60

Note. $N = 318$. Numbers in bold indicate the highest loading in each row. Italics indicate the BFAS scale that was hypothesized to have the highest loading in each column.