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Initial Development of Pathological Personality Trait Domain Measures Using the Personality Assessment Inventory (PAI)

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This study set out to create measures of the five personality disorder trait domains outlined in Section III of the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (American Psychiatric Association, 2013) from the Personality Assessment Inventory items (Morey, 2007). Rasch rating scale model analyses and classical test theory analyses were applied to existing data sets ($N = 3,877$; community, clinical, offender, college) to identify relevant items. Five scales were created that had acceptable unidimensionality and generally conformed to Rasch model expectations. The ability of the items to cover the underlying construct and their differential item function by sex were acceptable, though a few of the proposed scales had weaknesses in these areas. Internal consistency was acceptable for all scales and the factor structure was generally consistent with expectations, but some scales had concerning cross-loadings. Preliminary analyses demonstrated validity of the scales in relation to history of mental health treatment/current symptoms, substance abuse, and, for one scale, violent rearrests. There were small-to-moderate associations with noncorresponding traits, suggesting a degree of saturation with general personality impairment. The relevance of the proposed scales for the assessment of *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* personality disorder is discussed.

Keywords: personality disorder, Personality Assessment Inventory, *DSM-5*, assessment, Rasch model

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A large and growing body of empirical research has linked personality traits with clinical disorders (Krueger & Eaton, 2010). It is only recently, however, that a trait model has been articulated in the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)* diagnostic system (American Psychiatric Association, 2013). Section III of the *DSM-5* offers a model of pathological personality that contains the five higher order trait domains of Negative Affectivity, Psychoticism, Disinhibition, Detachment, and Antagonism.

Negative affectivity refers to an individual's frequent and intense experience of negative emotional experiences such as sadness, anxiety, guilt, and anger. This domain may be conceptualized as a basic emotional disposition that correlates highly with dispositional anxiety and behavioral inhibition (Harkness, Finn, McNulty, & Shields, 2012). The *DSM-5* description also includes behavioral and interpersonal components such as self-harm, hostility, and submissiveness. Psychoticism represents odd, eccentric, or unusual patterns of thinking and behavior, patterns that are reflected in poor reality testing and peculiarity (Tackett, Silberschmidt, Krueger, & Sponheim, 2008). Disinhibition is the trait domain closely aligned with the constructs of disinconstraint and externalization (Wright et al., 2012) and refers to an orientation toward immediate gratification, often in the form of behavior that is not constrained by future consequences or prior learning. This domain contains facets such as irresponsibility, impulsivity, and risk-taking behavior. *DSM-5* Antagonism is described as the tendency to be hostile, manipulative, deceitful, and grandiose. Individuals high on this trait often find themselves at odds with other people. The trait is related to the construct of aggression but differs in that aggression involves more anger and rage (Harkness et al., 2012). Last, Detachment reflects a withdrawal from close relationships, restricted affectivity, depressiveness, and suspiciousness.

This *DSM-5* pathological trait model is important, as it builds upon conceptual models of both normal and abnormal personality. The five-factor model (FFM) of personality (McCrae &

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Leslie C. Morey is the author of the Personality Assessment Inventory and receives royalties from the sale of this test and related products. John F. Edens is an author of the Personality Assessment Inventory Interpretive Report for Correctional Settings (PAI-CS). He receives royalties from the sale of this software.

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Costa, 2010) contains trait dimensions closely aligned, though not identical, to the domains of the *DSM-5* model. For example, FFM Neuroticism bears resemblance to *DSM-5* Negative Affectivity, whereas more significant distinctions are evident between FFM Openness to Experience and *DSM-5* Psychoticism. The Psychopathology-Five (PSY-5) model of personality functioning has closer similarity to the *DSM-5* model than the FFM and helps to establish an empirical framework for understanding some clinical conditions (Harkness et al., 2012).

The PSY-5 model was identified from similarity matrices of normal and abnormal personality descriptors and contained the dimensions of Aggressiveness, Psychoticism, Disconstraint, Negative Emotionality, and Introversion/Low Positive Emotionality (Harkness et al., 2012). More recently, Harkness and colleagues (Harkness et al., 2014) applied rational and quantitative methods to various samples (veterans, correctional offenders, inpatient) to derive PSY-5 scales from the Minnesota Multiphasic Personality Inventory-2-Restructured Form (MMPI-2-RF; Ben-Porath & Tellegen, 2008). PSY-5 scores have moderate levels of convergent validity for predicting behavioral criteria (Petroskey, Ben-Porath, & Stafford, 2003).

The *DSM-5* personality traits were offered as part of an alternative hybrid model for diagnosing personality disorder that might eventually replace the current categorical system. In this model, personality disorder would be diagnosed based on impairments in personality functioning and pathological personality traits (American Psychiatric Association, 2013, p. 716). Despite the possibility that this alternative model could address limitations of categorical personality disorder diagnosis (Skodol et al., 2011), a categorical system remains in place given concerns that any replacement would not be widely accepted in clinical practice at this time (American Psychiatric Association, 2013).

Widespread acceptance of the *DSM-5* pathological trait model would be facilitated by well-validated measures. The Personality Inventory for *DSM-5* (PID-5; Krueger, Derringer, Markon, Watson, & Skodol, 2012) is a recently developed self-report instrument that was created to operationalize the *DSM-5* trait model. The PID-5 was constructed using rational and empirical methods, with the latter including item response theory and confirmatory factor analyses. Independent studies have demonstrated that PID-5 scores have adequate reliability and good convergent validity in psychiatric patient samples (Quilty, Ayearst, Chmielewski, Pollock, & Bagby, 2013) and in college students (Hopwood et al., 2013). Although these findings are encouraging, the PID-5 requires continued validation and the instrument's lack of validity scales may limit its application in some settings (Hopwood & Sellbom, 2013).

Another line of research has examined the validity of the MMPI-2-RF for assessing domains of the *DSM-5* trait model. Finn and colleagues found convergence between MMPI-2-RF PSY-5 scale scores and *DSM-5* traits in military and college student samples (Finn, Arbisi, Erbes, Polusny, & Thuras, 2014). MMPI-2-RF scales have also shown moderate levels of convergent validity with the PID-5 in a large North American college sample (Sellbom, Anderson, & Bagby, 2013). These findings demonstrate that a well-established measure like the MMPI-2-RF can be used to measure *DSM-5* personality disorder traits.

The Personality Assessment Inventory (PAI, Morey, 2007) is a broad-band self-report assessment instrument that is commonly

used in clinical evaluations. PAI scores are valid indicators of mental health, substance use, and select personality disorders (Douglas, Guy, Edens, Boer, & Hamilton, 2007; Patry, Magaletta, Diamond, & Weinman, 2011). The instrument is also related to important aspects of treatment outcome (Hopwood, Baker, & Morey, 2008). Furthermore, research has demonstrated that PAI scale scores are predictive of institutional misconduct and criminal and violent recidivism (Gardner, Boccaccini, Bitting, & Edens, 2015). A limitation of the instrument, however, is that it does not provide a comprehensive assessment of pathological personality trait domains as instantiated in the *DSM-5* Section III system. Measurement of such trait domains would have relevance for the assessment of both personality disorders (Widiger, 2015) and other disorders (Krueger & Eaton, 2010). Indeed, the *DSM-5* pathological personality trait domains are likely to represent a basic framework for personality assessment, given their specification in the major North American diagnostic system. These trait domains may offer fruitful integration of the bodies of research pertaining to normal and disordered personality.

Development of PAI pathological personality trait measures has begun. Busch and colleagues developed measures for the 25 lower order pathological personality traits (e.g., Emotional Lability, Withdrawal) using regression models based on PAI scales and subscales (Busch, Morey, & Hopwood, 2017). The objective of the current study was to advance that work in three primary ways. First, we developed scales for the five broad trait domains, as opposed to the lower order facets. Although domains do not provide the specificity of lower order facets, evaluation at the domain level is typically a starting point in personality assessment. Second, we sought to extend prior findings by examining additional types of samples relative to Busch et al. (2017). Prior work has demonstrated that important variations in personality pathology emerge in samples other than community-dwelling adults (Tackett et al., 2008). For example, criminal offenders tend to differ from noncriminal samples in critical ways, particularly with respect to impulsive and aggressive tendencies (Edens & Ruiz, 2005). Using different samples should provide a strong test for any measurement model. Third, we used a combination of Rasch model analyses (Bond & Fox, 2015) and classical test theory analyses to create trait domain scales for the PAI. The use of different analytical techniques also provides for a strong test for the proposed scales (Harkness et al., 2014). Rasch is one parametric item response model that is well-suited for this task, as the analyses provide a range of psychometric information about the functioning of any scale. Although more complex item response models than Rasch are available (e.g., two-parameter models that include item discrimination), the simplicity of the Rasch model's focus on item difficulty makes it useful for personality assessment responses that are typically summed to obtain a total score (Pilatti, Lozano, & Cyders, 2015).

We predicted that psychometrically sound PAI scales measuring domains of the *DSM-5* pathological trait model (i.e., Negative Affectivity, Detachment, Antagonism, Disinhibition, and Psychoticism) could be back-engineered from the PAI item pool. We made this prediction based on work that has found convergence between the PAI and the *DSM-5* pathological personality traits (Busch et al., 2017; Hopwood et al., 2013). We also expected that these scales would have acceptable convergent/discriminant validity with other indicators of personality and behavioral disorder

similar to what has been found with other measures of pathological personality (Finn et al., 2014; Quilty et al., 2013).

Method

Participants

Existing data sets were used in this study. A sample of college students ($n = 1,175$) who were recruited as part of an earlier study (Hopwood et al., 2013) was included. The sample was predominantly female (72%), with a mean age of 19.63 years ($SD = 2.31$). This sample was mostly White (84%), African American (4%), Asian (3%), or of some other ethnic background (e.g., Hispanic, multiracial). The offender sample included 632 participants who were initially reported in the study by Edens and Ruiz (2005). This sample contained mostly men (56%) and had a mean age of 33.61 years ($SD = 8.90$). The racial/ethnic background of these participants was African American (45%), White (38%), Hispanic (8%), and other (9%). The PAI community ($N = 1,000$) and clinical ($N = 1,246$) normative samples were also used (Morey, 2007). The PAI standardization sample was predominantly White (85%) with a balance of men and women (48% male). The age distribution of the sample was as follows: 18 to 29 (22.2%), 30 to 49 (42.7%), 50 to 64 (18.2%), and 65 to 89 (16.9%). The clinical sample was predominantly male (61.4%) and White (78.8%), though 12.6% of this sample was African American. The age distribution of the sample was as follows: 18 to 29 (28.3%), 30 to 49 (58.6%), 50 to 64 (11.2%), and ≥ 65 (1.9%). Last, we included an offender treatment sample ($N = 129$) that comprised individuals who were incarcerated in a county jail and participating in substance abuse treatment (Ruiz, Cox, Magyar, & Edens, 2014). This sample was included to augment the validity analyses; the sample was not used in the item selection process. The sample was predominantly male (73%), with an average age of 36.90 years ($SD = 11.50$). Participants identified themselves as White (43%), African American (42%), or Hispanic (10.5%), with the remaining participants providing either no response or "other." The most frequently abused substances were cocaine/crack cocaine (47%), marijuana (17%), alcohol (16%), or opiates (8%).

Materials and Procedure

The PID-5 (Krueger et al., 2012) is a 220-item self-report questionnaire designed to measure traits of the *DSM-5* model of pathological personality. The PID-5 contains 25 nonoverlapping scales that measure 25 personality facets (e.g., Anhedonia, Depressivity, and Separation Insecurity). These scales can be combined to generate measures of the higher order domains (e.g., Negative Affectivity, Detachment). The PID-5 facet scales had acceptable internal consistency reliability ($\alpha > .70$) in the college student sample reported here. The PAI (Morey, 2007) is a 344-item self-report questionnaire designed to measure response style, personality, symptoms of mental disorder, and other issues of clinical concern. The PAI scales of interest had acceptable reliability ($\alpha > .70$) in all of the samples used here (Edens & Ruiz, 2005; Hopwood et al., 2013; Morey, 2007). The Mental Health Screening Form-III (MHSF-III; Carroll & McGinley, 2001), an evidence-based interview used to screen for mental illness, was administered to participants in the offender treatment sample as part of the

intake procedures for the in-jail substance abuse treatment program.

Design and Procedure

The college students were offered course credit to participate in research and completed both the PAI and the PID-5. Some ($n = 186$) of these participants were removed due to missing items or high scores on the PAI validity scales measuring inconsistent or atypical patterns of responding. Data from the offender normative sample were gathered from existing data sets in correctional institutions that administered the PAI as part of the clinical services. Only the PAI and demographic data, gathered from institutional files from correctional facilities in Washington and New Jersey (Edens & Ruiz, 2005), were available for this study. The PAI community and clinical samples completed the PAI, in addition to various other inventories, during the development of the PAI (Morey, 2007). Only PAI data were available for the current study. Last, participants in the offender treatment sample were administered the MHSF-III during the clinical intake procedures for the treatment program and completed the PAI for research purposes at a later time while still in the program (Ruiz et al., 2014). Information on the number of substance use disorder symptoms and rearrests, both general and violent, following the release from incarceration (24–64-month follow-up period) was also available after being gathered from chart reviews. All data were collected under an approved institutional review board process or with institutional approval as an archival research project.

Results

Initial Item Selection

Exploratory factor analyses (principal axis factoring) of the PAI items and the PID-5 domain¹ scores were conducted with the college sample. PID-5 domain scores were used as personality pathology trait markers. A five-factor solution was specified and extracted based on the a priori hypothesis of a solution matching the *DSM-5* trait model. Oblique (Promax) rotation with Kaiser normalization was used to identify simple structure. The analyses were repeated using an orthogonal rotation. PAI items with high (≥ 1.30) factor loadings on one domain and lower (≤ 1.25) factor loadings on the other domains were selected as the initial candidate items. The number of initial items for each domain was as follows: 27 (Negative Affectivity), 29 (Detachment), 12 (Antagonism), 14 (Disinhibition), and 23 (Psychoticism).

One-parameter Rasch model rating scale analyses (Linacre, 2016) were completed on the initial candidate items. These analyses are based on the concept that the probability of endorsing any

¹ PID-5 Domain scale scores were calculated using the following algorithms based on the PID-5 facet scores: Negative Affectivity = Mean (Reverse Restricted Affect, Separation Insecurity, Anxiousness, Hostility, Emotional Lability, Perseveration, Submissiveness); Detachment = Mean (Suspiciousness, Depressivity, Withdrawal, Intimacy Avoidance, Anhedonia); Antagonism = Mean (Manipulativeness, Deceitfulness, Callousness, Attention-Seeking, Grandiosity); Disinhibition = Mean (Irresponsibility, Impulsivity, Distractibility, Reverse Rigid Perfectionism, Risk-Taking). Psychoticism = Mean (Eccentricity, Perceptual Dysregulation, Unusual Beliefs).

item is a function of the respondent's level of a given characteristic (e.g., trait) and the severity (or difficulty) of the item; the analyses identify good (or poor) items based on a balance of properties (Bond & Fox, 2015). Detailed information on the Rasch analyses is presented in online supplemental tables.

Negative affectivity. The initial candidate items for the Negative Affectivity scale were analyzed in the offender normative sample. Residual contrasts were used to evaluate the dimensionality of the items, with residual eigenvalues >2 reflecting multidimensionality. The items exhibited multidimensionality (residual eigenvalue = 7.7). However, the spread of the items along the underlying continuum, measured globally through the Item Separation Index (ISI; >1.5 = *minimally acceptable*; $2-3$ = *desirable*; >3 = *strong*), was good (ISI = 11.94). The redundancy of individual items along the continuum was also examined by evaluating the item severity estimates, with items having severity estimates in proximity being candidates for removal. No overlaps were identified. Next, infit/outfit values were examined for each item. Infit/Outfit values quantify the degree of fit to Rasch model expectations based on the analysis of item residuals generated from contrasts between the model-predicted data and the observed data (infit/outfit acceptable values range from 0.6 to 1.4). Four items (Items 2, 24, 122, and 184) exhibited poor model fit, based on infit and/or outfit values ≥ 1.40 , and had high loadings (.79–.87) on the residual contrast. Three additional items (Items 104, 136, and 344) also exhibited poor item fit (infit range = 1.40; outfit range ≥ 1.49). Some of the seven items (Items 104, 184, and 344) were validity scale items. Given the indications of poor performance, these seven items were removed and another Rasch analysis was calculated. The second analysis had some indication of multidimensionality (residual eigenvalue = 2.1), with Items 114 and 154 having the highest loadings (.57 and .59, respectively). Two additional items (185, 225) exhibited poor fit to the Rasch model (Item 185: infit = 1.24, outfit = 1.62; Item 225: infit = 1.59, outfit = 2.08). These four items were removed and a third Rasch analysis was conducted.

The remaining 16-item Negative Affectivity scale appeared unidimensional (residual eigenvalue = 1.8) and had good coverage along the underlying continuum (ISI = 9.95). Most of the items exhibited good fit to the Rasch model (infit range = 0.89–1.28; outfit range = 0.70–1.52). However, an item assessing anxiety (Item 164) had an undesirable fit to the model (infit = 1.20; outfit = 1.52) and may not be endorsed at greater rates by individuals with high-trait negative affectivity. Despite this finding, the representation of anxiety was considered important for measuring negative affectivity, so it was retained pending additional testing. Next, the issue of potential item bias by sex was examined with differential item functioning (DIF). DIF contrasts less than 1.49 are acceptable. There was no evidence of clinically significant DIF (DIF contrast range = 1.00–1.46).

Another Rasch analysis was conducted on the 16-item Negative Affectivity scale using the PAI community sample. The scale exhibited unidimensionality (residual eigenvalue = 1.8) and had good coverage along the underlying continuum (ISI = 12.95). The majority of items exhibited good fit to the Rasch model and did not have concerning DIF across men and women. Three exceptions to this general trend were items addressing trauma-related symptomatology (Item 114), negative relationships (Item 99), and emotionality instability (Item 54), with Items 99 and 114 exhibiting ques-

tionable fit to the Rasch model and Item 54 being endorsed at a higher level by women than men (DIF contrast = 1.59). Although arguments could be made for the removal of these items, we elected to retain them pending analysis in the clinical sample.

A final Rasch analysis of the 16-item Negative Affectivity scale was calculated with the PAI clinical sample. The items appeared unidimensional (residual eigenvalue = 2.0) and had good spread along the continuum (ISI = 11.81). Most items exhibited good fit to the Rasch model (infit range = 0.82–1.43; outfit range = 0.77–1.59), with Item 99 (negative relationships) exhibiting some signs of misfit (infit = 1.43; outfit = 1.59). None of the items showed signs of clinically significant DIF by sex (DIF contrasts = 1.00–1.37). Although Item 99 showed signs of misfit in both the clinical and community samples, the degree of misfit was marginal and generally confined to the outfit indicator. The item covered an important area on the underlying continuum and its interpersonal content was considered important to negative affectivity. Therefore, the item was retained.

Detachment. The 29 initial candidate items of the Detachment scale were subjected to a Rasch analysis in the offender normative sample. The first results identified seven misfitting items and evidence of multidimensionality (residual eigenvalue = 5.1). Many of the items from the Warmth scale appeared to be forming a second dimension, but these items were also reverse-scored in the PAI scoring process. Four items (53, 93, 202, and 261) with poor fit or high residual loadings were removed and the analysis was repeated. The results continued to be poor, with evidence of misfitting items and an unacceptable level of multidimensionality (residual eigenvalue = 2.9). Three additional items (13, 133, 293), all from the Warmth scale, were removed, but the results continued to show evidence of multidimensionality.

Although it would have been possible to continue removing items, there was concern that this would leave the resulting scale without any contribution of Warmth. The Warmth construct was considered relevant for the expression of trait detachment. It was also possible that the reverse scoring created a methodological artifact that could be removed by rereversing the scoring. Seven items had their scoring rereversed, and another Rasch analyses was calculated using the initial 29 items. The resulting scale exhibited evidence of clear multidimensionality (residual eigenvalue = 7.4). Seven items (20, 30, 70, 121, 126, 150, and 187) with the highest loadings ($>.50$) on the residual contrast were dropped, but the scale continued to exhibit multidimensionality (residual eigenvalue = 4.6). Nine items (1, 110, 180, 206, 261, 270, 274, 289, and 329) had positive loadings (.31–.62) on the residual contrast and appeared distinct from the remaining grouping of items when examining the standardized residuals. These items were dropped and the resulting 13-item scale was analyzed. The 13-items appeared to represent a single dimension (residual eigenvalue = 1.9) and exhibited good spread with an ISI of 11.32. All items exhibited good fit to the Rasch model (infit range = 0.70–1.29; outfit range = 0.72–1.37). Most of the items did not reveal significant DIF (DIF contrast range = 1.00–1.62). A Warmth item (Item 133) was significantly different across men and women, with women having higher endorsement rates than men (DIF contrast = 1.62).

The 13-item scale was then tested in the PAI community sample and found to be unidimensional (residual eigenvalue = 1.9) and with good spread among the items (ISI = 10.50). Most items exhibited good fit to the Rasch model (infit range = 0.73–1.44;

outfit range = 0.73–1.46), though items tapping suicidal ideation and nonsupport had marginal fit. The severity estimates indicated that the items fell at the end of the continuum and were therefore considered conceptually important, given their content. In light of the marginal degree of misfit, they were retained pending further analyses. None of the items exhibited clinically significant DIF by sex (DIF contrast range = 1.051–1.311).

The Rasch analysis was repeated with the PAI clinical sample. There was some evidence of multidimensionality (residual eigenvalue = 2.2), with three warmth items (Items 13, 53, and 93) having significant loadings on the residual contrast (.53–.70). The scale had good item separation (ISI = 12.38). Most of the items exhibited good fit to the Rasch model (infit range = 0.70–1.38; outfit range = 0.70–1.49). However, one treatment rejection item showed signs of marginal misfit confined to the outfit value (outfit = 1.49). There was no evidence of significant DIF (DIF contrast range = 1.001–1.351). Although some items had questionable performance in the clinical sample, there was no indication that these items were problematic in other samples, so they were retained.

Antagonism. Twelve initial candidate items for the Antagonism scale were analyzed using the offender normative sample. These items appeared unidimensional (residual eigenvalue = 1.9) but had marginal spread along the trait continuum (ISI = 1.77). However, all of the items had good fit to the Rasch model (infit range = 0.81–1.27; outfit range = 0.83–1.19). None of the items exhibited significant differential functioning by sex (DIF contrast range = 1.001–1.381).

A second Rasch analysis was conducted on the 12-item scale using the PAI community sample. There was possible evidence of multidimensionality (residual eigenvalue = 2.0). A review of the residual loadings did not reveal clear evidence of a second dimension, but an item related to dominance (Item 96) had the highest residual loading. This item fell at the extreme end on the antagonism continuum, so it is likely to be conceptually important for capturing a broad range of the trait. The spread of the items was just at the cut-off for acceptability (ISI = 1.53). There was no evidence of significant model misfit (infit range = .83–1.29; outfit range = .81–1.16) or DIF.

A final Rasch analysis was calculated with the clinical sample. The items appeared unidimensional (residual eigenvalue = 1.9) but had minimal spread along the underlying continuum (ISI = 1.56). All but one of the items demonstrated good fit to the Rasch model (infit = .83–1.33; outfit = .83–1.45). An item tapping egocentricity (Item 131) exhibited misfit (i.e., infit = 1.33, outfit = 1.45) but not to an extreme level and confined only to the outfit indicator. There was no evidence of significant DIF (DIF contrast = 1.001–1.401) among the items. Despite evidence of misfit in the clinical sample, Item 131 was retrained, given its acceptable performance in other samples and its conceptual importance to antagonism.

Disinhibition. A Rasch analysis was performed on the 14 initial candidate items for Disinhibition using the offender normative sample. These items exhibited evidence of multidimensionality from the residual analysis (residual eigenvalue = 2.2). A review of the residual loadings showed that Item 264, a validity scale item, had a high loading (loading = .75) on the contrast. This item also exhibited significant misfit (infit = 1.90; outfit = 2.53) and was removed. On reanalysis, the resulting 13-item scale was

unidimensional (residual eigenvalue = 1.9) but had a limited item spread along the continuum (ISI = 1.74). All but one of the items exhibited good fit to the Rasch model (infit range = 0.74–1.4; outfit range = 0.68–1.45). An item assessing concentration difficulties from the Schizophrenia scale (Item 318) had poor fit (infit = 1.31; outfit = 1.45) but was retained pending further analysis. No items exhibited significant differential functioning across men and women (DIF contrast range = 1.001–1.471).

Another Rasch analysis was calculated on the 13 items using the community sample with mixed results. The items appeared unidimensional (residual eigenvalue = 1.7) but had poor spread along the underlying continuum (ISI = 1.11). Most items exhibited good fit to the Rasch model. Two exceptions to this general trend were items related to substance abuse (Items 22 and 215), which exhibited mild degrees of misfit. Two items measuring aspects of antisocial personality also had clinically significant DIF (Items 39 and 91). Men scored higher than women on both of these items. Although considerations were made for dropping these items, there were concerns that the reduction of an already limited item pool would reduce reliability and subsequent validity of the scale.

In light of the mixed findings with the community sample, the proposed 13-item Disinhibition scale was tested with the clinical sample. The scale had some indication of multidimensionality (residual eigenvalue = 2.1). Examination of the item loadings revealed that two substance abuse items had high loadings on the residual component (Item 55 = .85, Item 215 = .83). The spread of the items was at a borderline acceptable level (ISI = 1.56). All but two of the items exhibited good fit to the Rasch model, with items tapping sensation-seeking (Item 279: infit = 1.30; outfit = 1.50) and concentration difficulties (Item 318: infit = 1.26; outfit = 1.44) showing signs of misfit. Four items (55, 91, 215, and 318) exhibited clinically significant DIF (DIF contrasts ranging from 1.551 to 1.101). Men obtained higher scores than women on items tapping alcohol use and antisocial tendencies, whereas women endorsed higher levels of concentration difficulties. The impact of dropping the two substance abuse items (Items 55 and 215) with the worst performance was considered but decided to retain them because substance abuse is an important marker of disinhibition.

Psychoticism. The 23 initial candidate items selected to identify Psychoticism were subject to Rasch analysis, and the results were mixed when tested in the offender normative sample. The scale showed evidence of multidimensionality (residual eigenvalue = 2.1), with Item 163 having the highest loading (.57) on the residual contrast. Another item exhibited poor fit (Item 170: infit = 1.50; outfit = 1.00). Two additional items (Items 49 and 129) were from the Negative Impression Management validity scale. All four items were dropped. The remaining 19 items were reanalyzed with the offender sample. The scale appeared unidimensional (residual eigenvalue = 1.9) with a good degree of item spread (ISI = 5.81). One item exhibited signs of marginal misfit (Item 283: infit = 1.41; outfit = 1.11) and one item tapping a conversion symptom (Item 243) exhibited DIF (DIF = 1.511). Given that Items 243 and 283 had reasonable performance across other indicators, they were retained.

Another Rasch analysis was calculated on the 19 items using the PAI community sample. Item 283 again exhibited significant misfit to the Rasch model (infit = 1.66) and DIF (DIF = 1.811). The item was dropped. The analysis was repeated but another item

exhibited misfit (Item 309: $\text{infit} = 1.52$) and was dropped. The remaining 17 items were analyzed and appeared unidimensional (residual eigenvalue = 1.8) and with a good degree of coverage along the trait continuum ($\text{ISI} = 7.44$). All but one of the items had infit/outfit values within an acceptable range. Item 250, the only problematic item, had only marginal misfit on the outfit value ($\text{outfit} = 1.46$) but acceptable infit . No items exhibited significant DIF across sex. Given that the degree of misfit for Item 250 was marginal and confined to the outfit, it was retained pending further analyses.

The Rasch analysis of the 17-item psychoticism scale was repeated using the clinical sample. Although the scale had some evidence of multidimensionality (residual eigenvalue = 2.1), a review of the item loadings from the contrast did not provide strong evidence of a conceptually coherent set of items distinct from psychoticism. The items exhibited good spread along the continuum ($\text{ISI} = 8.67$) and none showed evidence of misfit ($\text{infit range} = 0.83\text{--}1.30$; $\text{outfit range} = 0.68\text{--}1.30$) or clinically significant DIF.

The analyses were repeated with the offender normative sample and were supportive of good Rasch structure. Residual variance of the first contrast was acceptable (residual eigenvalue = 1.8) and the items had good coverage along the continuum ($\text{ISI} = 4.82$). The items exhibited good fit ($\text{infit range} = 0.71\text{--}1.32$; $\text{outfit} = 0.63\text{--}1.30$), though Item 243 again exhibited clinically significant differential functioning across men and women (DIF contrast = 1.51). However, its good performance on other Rasch indicators argued for its retention.

Classical Test Theory Analyses

Table 1 presents the internal consistency reliability, mean interitem correlation, and descriptive values for the proposed personality disorder trait scales from all four samples. These findings indicate that the proposed scales have adequate psychometric properties. A principal axis factor analysis was conducted on the community sample using the final item pool for the proposed trait domain scales (Table 2). Most of the scale items had a primary loading on the corresponding dimension and minimal cross-loadings ($\geq .30$). There were exceptions to this trend, particularly for Disinhibition and Psychoticism that had notable cross-loadings with Negative Affectivity. A Procrustes targeted rotation factor analysis was conducted to compare factor solution similarity between the community and clinical normative samples. Congruence coefficients for the factors across the census-matched and clinical samples ranged from .88 (Antagonism) to .96 (Detachment).

Preliminary Validity Analyses

Preliminary validity analyses were calculated on two samples, one of which was independent of the item selection process. We relied on Cohen's (1988) categorization of effect size magnitude (small $r = .10$; medium $r = .30$; large $r = .50$) rather than statistical significance in interpreting the results, given the sample sizes involved. Correlations between the domains and facet scores of the PID-5 were calculated in the undergraduate sample (Table 3). We expected the relationships to be inflated, as this sample was also used to identify the initial candidate items. The findings

Table 1
Psychometric and Descriptive Values of Personality Assessment Inventory Pathological Personality Trait Domain Scales

Trait domains	α	MIC	M	SD	Skew (SE)	Kurtosis (SE)
Community						
Negative affectivity	.88	.33	10.93	7.78	1.18 (.08)	1.56 (.16)
Detachment	.82	.27	11.22	6.02	−0.85 (.08)	1.3 (.16)
Antagonism	.77	.22	9.36	5.38	0.63 (.08)	0.25 (.16)
Disinhibition	.72	.18	7.00	4.78	1.4 (.08)	3.3 (.16)
Psychoticism	.79	.20	6.39	5.48	1.6 (.08)	2.8 (.16)
Clinical						
Negative affectivity	.92	.41	20.90	11.48	0.25 (.07)	−0.88 (.14)
Detachment	.86	.32	15.69	7.67	−0.47 (.07)	−0.33 (.14)
Antagonism	.77	.23	10.60	5.92	0.57 (.07)	0.18 (.14)
Disinhibition	.81	.25	12.81	7.43	0.65 (.07)	0.10 (.14)
Psychoticism	.87	.29	10.46	8.72	1.2 (.07)	1.3 (.14)
Offender normative						
Negative affectivity	.92	.41	15.46	10.55	0.75 (.10)	−0.06 (.19)
Detachment	.82	.26	26.77	6.82	−0.66 (.10)	0.57 (.19)
Antagonism	.81	.27	11.73	6.62	0.61 (.10)	0.23 (.19)
Disinhibition	.79	.22	13.64	6.88	0.42 (.10)	−0.09 (.19)
Psychoticism	.87	.28	8.37	7.91	1.6 (.10)	3.1 (.19)
College						
Negative affectivity	.91	.40	15.88	9.63	0.73 (.08)	0.14 (.16)
Detachment	.89	.38	27.57	7.29	−0.52 (.08)	−0.25 (.16)
Antagonism	.81	.27	10.11	5.69	0.63 (.08)	0.37 (.16)
Disinhibition	.82	.29	9.34	6.08	0.95 (.08)	0.85 (.16)
Psychoticism	.91	.38	6.02	6.99	1.7 (.08)	2.8 (.16)

Note. Number of items per scale ranged from 12 (Antagonism) to 17 (Psychoticism). MIC = mean interitem correlation. Community sample: $n = 883\text{--}944$; clinical sample: $n = 1,246$; offender normative sample: $n = 629\text{--}632$; college sample: $n = 989$. Cases with missing variables were excluded when calculating means and standard deviations.

Table 2

Factor Structure of the Proposed Scale Items in the Personality Assessment Inventory (PAI) Community Sample

PAI Items	NA	DE	PS	AN	DI
14. Affective instability	.52	-.05	.10	.25	.13
17. Identity problems	.57	-.08	.19	.15	.12
25. Cognitive anxiety	.53	-.08	.30	-.09	.20
26. Phobias	.52				.13
44. Affective anxiety	.52		.22	-.11	.10
54. Affective instability	.42	-.11	.17	.35	.22
66. Phobias	.65	-.08	.12		.10
74. Traumatic stress	.49		.19	.13	.14
97. Identity problems	.59	-.06	.22	.12	.14
99. Negative relationships	.42		.08	.29	.06
105. Cognitive anxiety	.53	-.14	.40		.13
114. Traumatic stress	.50		.23	.09	.16
145. Cognitive anxiety	.58	-.07	.17		
164. Affective anxiety	.42	-.39			
265. Cognitive anxiety	.63				
276. Irritability	.55	-.10		.21	.11
8. Hypervigilance	-.19	.36	-.07	-.20	
13. Warmth	-.07	.58	.14	.16	-.08
41. Nonsupport	-.13	.34		-.07	-.22
53. Warmth	-.15	.57	.21	.20	-.08
81. Nonsupport	-.12	.47	-.10		
93. Warmth	-.07	.59	.21	.20	-.10
133. Warmth		.60			-.09
190. Social detachment		.64	-.10	.11	-.07
201. Nonsupport	-.09	.56	-.18	-.08	
202. Treatment rejection	-.13	.26	-.22		
293. Warmth	.16	.49	-.18		-.05
301. Suicidal ideation	-.09	.51	-.41	.14	-.18
310. Social detachment	.08	.47	-.12		-.09
36. Irritability	.16		.09	.46	.14
71. Egocentricity	.13	-.11	.07	.18	.31
96. Dominance	-.11	.13	-.10	.58	
98. Verbal aggression	.24			.33	.24
111. Egocentricity	.13		.22	.24	.34
131. Antisocial features	.26	-.10	.23	.14	.52
138. Verbal aggression	.09	.10		.42	
151. Egocentricity	.07	.09		.47	.25
156. Irritability	.21	-.05	.42	.34	.15
171. Antisocial behaviors	.14	-.12	.28	.25	.44
176. Dominance		.10		.61	.15
339. Aggressive attitude			.20	.50	.14
19. Negative relationships	.24	-.15	.23	.30	.24
22. Drug problems	.11			.48	
39. Stimulus-seeking	.12			.26	.57
55. Alcohol problems	.16	-.06		.05	.52
91. Antisocial behaviors	.11		-.16	.25	.42
143. Self-harm	.29		.15	.24	.31
215. Alcohol problems	-.05	-.11	.24		.48
223. Self-harm	.17	-.09	.30	.17	.27
279. Stimulus-seeking			.24	.15	.33
299. Aggressive attitude	.20	-.20	.10	.24	.09
303. Self-harm	.09	-.14	.14	.11	.47
318. Thought disorder	.29	-.19	.23		
322. Stress	.32	-.06	.10	.16	.20
10. Psychotic experiences	.13	-.06	.25	.25	.30
50. Psychotic experiences	.39		.11	.07	.13
83. Conversion	.09		.51	.06	
90. Psychotic experiences	.30	.05	.24	.21	.07
113. Anxiety—physiological	.32		.52		
116. Irritability	.39		.07	.33	.09
123. Conversion	.25		.27		
149. Persecution	.26	-.09	.25	.27	.07
158. Thought disorder	.32	-.07	.33		.14
189. Persecution	.19	-.23	.40	.18	.11

PAI Items	NA	DE	PS	AN	DI
203. Conversion	.16		.30		.10
208. Hypervigilance	.28	-.17	.22	.23	
210. Psychotic experiences	.18	-.16	.43	.14	.06
238. Thought disorder	.15	-.13	.57	.05	.17
243. Conversion	.15		.52		.07
250. Psychotic experiences	.10	.07	.13	.26	.11
278. Thought disorder	.19		.38		.11

Note. $N = 1,000$. Loadings $< .05$ were not reported. Loadings $\geq .40$ appear in boldfaced type. Significant cross-loadings ($\geq .30$) are also italicized. NA = Negative Affectivity; DE = Detachment; AN = Antagonism; DI = Disinhibition; PS = Psychoticism.

generally, though not always, showed evidence of convergence between the proposed PAI scales and the corresponding PID-5 variables but also some small-to-moderate degree of shared variance. We also calculated validity analyses using the offender treatment sample, a sample that was independent of the item selection process (Table 4). Correlations were calculated between select *DSM-5* personality disorder facets generated with the re-

Table 3

Correlations Between Personality Assessment Inventory (PAI) Pathological Personality Trait Domain Scores and Personality Inventory for DSM-5 (PID-5) Scores in the College Sample

PID-5 scores	PAI trait domain scores				
	NA	DE	AN	DI	PS
PID-5 domains					
Negative affectivity	.77	.31	.30	.31	.30
Detachment	.57	.69	.29	.49	.57
Antagonism	.28	.23	.70	.54	.51
Disinhibition	.24	.26	.33	.68	.39
Psychoticism	.51	.42	.46	.59	.69
PID-5 facets					
Submissiveness	.30	.08	.03	.04	.22
Depressivity	.60	.61	.25	.47	.52
Separation anxiety	.54	.25	.25	.28	.26
Anxiousness	.74	.30	.15	.20	.20
Emotional instability	.67	.31	.26	.32	.31
Suspiciousness	.56	.45	.37	.46	.48
Restricted affectivity	.08	.31	.24	.34	.32
Withdrawal	.43	.65	.20	.31	.42
Anhedonia	.51	.70	.18	.36	.42
Intimacy avoidance	.15	.32	.14	.33	.41
Manipulation	.21	.13	.63	.42	.33
Deceitfulness	.35	.37	.60	.52	.46
Hostility	.54	.38	.57	.46	.40
Callousness	.24	.44	.54	.55	.61
Attention-seeking	.18	-.09	.48	.34	.25
Grandiosity	.11	.11	.47	.31	.38
Irresponsibility	.35	.46	.40	.61	.60
Impulsivity	.29	.23	.42	.66	.41
Distractibility	.49	.33	.22	.47	.34
Perseveration	.57	.37	.34	.43	.44
Rigid perfectionism	.32	.13	.26	.09	.23
Risk-taking	-.10	-.08	.32	.51	.13
Eccentricity	.47	.34	.37	.50	.47
Perceptual dysregulation	.51	.44	.41	.58	.68
Unusual beliefs	.36	.34	.43	.47	.68

Note. $N = 999-1,001$. NA = Negative Affectivity; DE = Detachment; AN = Antagonism; DI = Disinhibition; PS = Psychoticism.

Table 4
Correlations Between Personality Assessment Inventory (PAI) Pathological Personality Trait Domain Scores, Select PAI Pathological Personality Facets, and Validity Indicators in the Offender Treatment Sample

Facets and indicators	PAI trait domain scores				
	NA	DE	AN	DI	PS
Negative affectivity					
Emotional lability	.89	.28	.53	.60	.63
Anxiousness	.79	.36	.20	.51	.37
Separation anxiety	.80	.05	.41	.60	.48
Detachment					
Withdrawal	.22	.83	.03	.11	.19
Anhedonia	.56	.57	.24	.52	.30
Intimacy avoidance	.66	.43	.51	.52	.70
Antagonism					
Manipulation	.45	.10	.87	.51	.60
Deceitfulness	.14	.43	.56	.27	.27
Grandiosity	.30	.05	.70	.19	.62
Disinhibition					
Irresponsibility	.68	.36	.67	.76	.72
Impulsivity	.60	.16	.58	.85	.46
Distractibility	.51	.36	.18	.58	.29
Psychoticism					
Unusual beliefs	.59	.20	.61	.45	.91
Eccentricity	.31	.30	.41	.18	.56
Perceptual dysregulation	.77	.30	.61	.68	.90
MHSF-III					
Treatment history	.50	.19	.22	.42	.30
Depression	.51	.20	.23	.47	.38
Suicide attempt	.37	.22	.13	.31	.24
Traumatic stress	.38	.18	.14	.29	.23
Aggression	.33	.15	.22	.27	.19
Paranoia	.39	.31	.23	.24	.40
Substance abuse	.42	.04	.19	.52	.16
Criminal Arrests					
Arrest-total	-.05	.10	.04	-.06	.04
Arrest-violent	.02	.13	.21	.04	.16

Note. $N = 116-129$. NA = Negative Affectivity; DE = Detachment; AN = Antagonism; DI = Disinhibition; PS = Psychoticism; MHSF-III = Mental Health Screening Form-III.

gression equations developed by Busch et al. (2017). Similar to the results with the PID-5, there was evidence of convergence between corresponding domains and facets in addition to a degree of shared variance. Last, correlations were calculated between the PAI pathological personality trait domain scores and treatment history, symptoms of mental illness (MHSF-III interview), substance use disorder symptom (via chart review), and general and violent rearrests (arrest record). The results indicated that most of the PAI domains correlated with some aspects of mental health history, though more specific relationships were evident with substance abuse and violent offending.

Discussion

These results provide preliminary support for PAI *DSM-5* pathological personality trait domain scales. The findings extend earlier PAI work of Busch and colleagues (2017) and are in line with studies demonstrating the ability of broadband assessment measures (e.g., MMPI-2-RF) to measure pathological personality traits (Finn et al., 2014; Sellbom et al., 2013). This work suggests that

the PAI may add to existing options (e.g., PID-5; MMPI-2-RF) for self-report assessment of *DSM-5* personality disorder domains and facets. Although encouraging, the proposed scales have both strengths and limitations.

The Negative Affectivity, Detachment, and Psychoticism scales exhibited the strongest psychometric properties among the scales. Each scale was unidimensional. Scale items also tapped a wide range of the underlying trait continuum. The items had varying severity levels and the probability of responding conformed to the Rasch expectations. The items within these scales exhibited minimal DIF, suggesting that the selected trait indicators were not likely to be biased across men and women. The Negative Affectivity scale draws largely from items tapping anxiety, emotional instability, fearfulness, and trauma-related reexperiencing. The *DSM-5* definition of Negative Affectivity (American Psychiatric Association, 2013) contains interpersonal facets (hostility, separation anxiety) and depression that are not well represented in the proposed PAI scale. In addition, the proposed PAI Detachment scale primarily contains items reflecting low interpersonal warmth, lack of social interest, and perceived lack of support. One item also taps mistrust. These are fairly good indicators of the withdrawal, suspiciousness, and intimacy avoidance of *DSM-5* Detachment. These items did not have a strong representation of depressive symptoms or restricted emotional expressions that are *DSM-5* facets. This might limit the scale's ability to identify schizoid disorders that present with distinctive emotional features. Last, the Psychoticism items reflect some facets contained in *DSM-5* psychoticism (e.g., unusual beliefs/experiences, cognitive/perceptual dysregulation) but not others (e.g., behavioral peculiarity). This might limit the validity in assessing schizotypal conditions that present with prominent behavioral impairments. The factor loadings for this scale also reflected a moderate level of shared variance with Negative Affectivity, something that might further limit the discriminating ability of the scale in applied settings.

The Negative Affectivity scale exhibited the strongest level of convergent validity with the corresponding personality disorder domains and facets, in addition to a history of mental health treatment and symptoms. This scale was also associated with symptoms of substance use disorder but was unrelated to rearrests. The strength of these relationships is similar to results found with other instruments (Finn et al., 2014; Petroskey et al., 2003). The Detachment scale had fairly limited convergence with the mental illness treatment/symptoms, substance abuse symptoms, and rearrests, though the available variables were not ideal for tapping detachment-related pathology (e.g., social isolation). The Psychoticism scale did have a moderate relation with paranoia and smaller magnitude relationships with mental health treatment history and depression. The scale was unrelated to externalizing indicators such as substance abuse or criminal behavior, a finding showing some degree of divergent validity. All three scales exhibited small-to-moderate relationships with noncorresponding personality disorder domains and facets, suggesting saturation with generalized personality impairment and emotional distress (Quilty et al., 2013).

The proposed Antagonism and Disinhibition scales had acceptable psychometric properties. However, both scales had relatively limited coverage of the underlying construct continuum in light of the item separation findings. These scales also had multiple items that did not have a primary loading on the intended scale dimen-

sion in the factor analysis. The Antagonism items predominantly reflect egocentricity, dominance, and verbal aggression. A review of the item content further suggests that they capture aspects of manipulation (e.g., lying to get out of things) and callousness (e.g., taking advantage of others) mentioned in the *DSM-5* Antagonism definition. They do not, however, capture the attention-seeking facet in *DSM-5*. The Disinhibition items reflect substance abuse, impulsivity, high-risk/aggressive behavior, and concentration (one item) difficulties. These items represent most of the *DSM-5* Disinhibition facets. The spread of the items along the underlying continuum was restricted, and this suggests that this scale might not capture a full range of disinhibited behavior. The items selected for the scale primarily tap psychopathology, and this may limit the coverage of less pathological indicators of disinhibited behavior (e.g., spontaneity). The Disinhibition scale had the most extensive DIF across the community and clinical samples. Women tended to obtain higher scores on items measuring self-harm and concentration difficulties, whereas men obtained high scores on antisocial tendencies and substance abuse. Although these findings may reflect real differences in the rates of antisocial and substance use disorder, it is preferred to have trait indicators that are invariant across men and women (Krueger et al., 2002). The Disinhibition scale also had a concerning pattern of cross-loadings in the factor analysis, suggesting the items might have influences from competing personality domains.

Preliminary validity analyses indicated that the Antagonism and Disinhibition scales had both nonspecific and specific relationships with other variables. Antagonism had small effect size relationships with aggressive tendencies and violent rearrests. The scale also had small magnitude associations with mental health treatment history and symptoms. The Disinhibition scale exhibited its strongest relationship with symptoms of substance use disorder. The scale also had moderate magnitude associations with treatment history, depression, and prior suicide attempts. Findings of similar nature and magnitude have been reported for other measures of personality impairment (Finn et al., 2014; Petroskey et al., 2003). Both Antagonism and Disinhibition generally had the strongest associations with their corresponding PID-5 domain and facet scores as well as facet scores generated from the PAI. However, each scale shared a small-to-moderate degree of variance with noncorresponding domains and facets. Again, similar findings have been reported elsewhere and likely reflect the measures' saturation with general personality impairment and emotional distress (Quilty et al., 2013).

A major benefit of the proposed personality disorder trait domain scales is that they are independent of the PAI validity scales. Some existing measures of *DSM-5* pathological traits, while comprehensive, do not contain validity scales. Although personality assessment does not necessarily require the consideration of response styles, personality disorder evaluations often take place in settings where this is an issue (Hopwood & Sellbom, 2013). Moreover, personality disorders often present with an unrealistic perceptual style that impacts self-report assessment. The ability of the PAI to evaluate both pathological personality and response style is an important feature for applied assessment.

The introduction of a pathological personality trait model in *DSM-5* (American Psychiatric Association, 2013) is likely to increase attention toward the role of personality in clinical disorders (Krueger & Eaton, 2010). Indeed, the five broad domains of

the pathological personality trait model represent a framework for organizing personality assessment in clinical and research settings (Widiger, 2015). The development of PAI scales to assess this framework extends the instrument's capability for evaluating personality pathology. This development may facilitate the implementation of the proposed *DSM-5* pathological personality trait model.

The most significant limitation of the study was that the validity analyses were preliminary. Some of the analyses (i.e., PID-5) were calculated on a sample used in item selection, which inflated the identified relationships. Although other analyses were completed using an independent sample, the validity indicators were limited and were not specifically designed to capture aspects of personality pathology. It may be the case that the novel methods for detecting nuanced aspects of personality pathology, such as separation insecurity or eccentricity, are necessary for future validation studies. These caveats notwithstanding, the current results are encouraging regarding the ability of the PAI to tap *DSM-5* personality constructs and may foster additional research.

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