Examining hypothesized curvilinear and interactive relations between psychopathic traits and externalizing problems in an offender sample using item response–based analysis

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Running Head: FEARLESS DOMINANCE AND CURVILINEARITY

Examining hypothesized curvilinear and interactive relations between psychopathic traits and externalizing problems in an offender sample using item response-based analysis

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Abstract

Fearless Dominance (FD) generally manifests null to small relations with externalizing problems, leading some researchers to propose alternative paths by which FD may relate to these problems. The current study provides a test of two possibilities, namely that FD (a) demonstrates curvilinear relations with externalizing problems such that it is associated with these problems only at high levels; and (b) interacts statistically with other features of psychopathy such that FD is associated with externalizing problems at high levels of other psychopathic traits. We used a large correctional sample and item-response theory-related statistics to precisely estimate individuals' scores at the extremes of each major psychopathic trait. FD traits were not significantly associated with externalizing problems at higher levels of FD traits or in interaction with other psychopathic traits. In those few cases in which FD traits displayed curvilinear relations, they were negatively associated with externalizing problems at higher levels.

Keywords: Nonlinear, Curvilinearity, Boldness, Antisocial PD

Examining hypothesized curvilinear and interactive relations between psychopathic traits and externalizing problems in an offender sample using item response-based analysis

Despite being one of the most empirically examined and well-validated personality disorders, the basic structure of psychopathy remains disputed. Among the main components (i.e., Antagonism/Meanness, Disinhibition, Fearless Dominance (FD)/Boldness) that have figured prominently in modern conceptualizations, FD/Boldness, which is characterized by emotional resilience, fearlessness, and social potency, is considered central and indispensable to psychopathy by some historical (e.g., Cleckley, 1941; Lykken, 1995), and contemporary (e.g., Lilienfeld et al., 2012, 2015; Patrick, 2009) scholars, but peripheral or largely irrelevant by others (e.g., Gatner et al., 2016; Lynam & Miller, 2012; Miller & Lynam, 2012).

FD has been examined empirically in two main domains of research. In the first, scholars have either disputed or supported FD's relevance by examining its convergence with (versus divergence from) consensually-regarded psychopathy scales and classic conceptualizations, with the result being that FD appears to diverge from measures based on the Psychopathic Checklist-Revised (PCL-R; Hare, 2003) (Miller & Lynam, 2012) while converging with other measures (Lilienfeld et al., 2015) and with certain classic clinical descriptions of psychopathy, such as those of psychiatrist Hervey Cleckley (1941; Crego & Widiger, 2016; Miller, Lynam, Widiger, & Leukefeld, 2001).

In the second domain of research, scholars have investigated the degree to which FD traits are related to behaviors of interest to researchers who study psychopathy and allied conditions like antisocial personality disorder, namely externalizing problems. Externalizing problems may be defined as a history of engagement in maladaptive use of substances, criminal and antisocial acts involving theft, destruction of property, and physical aggression towards

others, and violations of rules of conduct within prison facilities. Some scholars question FD's relevance to psychopathy, given that it is at best a modest or even weak correlate of externalizing problems like "antisociality" that have long been associated with psychopathy (e.g., DeLisi, 2009; Hare & Neumann, 2010; Karpman, 1948; Lykken, 1995). Other scholars suggest that empirical relations with future criminal behavior—a prototypic externalizing problem—have limited bearing on a trait's relevance to psychopathy and have instead argued that criminal behavior is better construed as a downstream consequence of psychopathic personality traits (e.g., Skeem & Cooke, 2010). They have proposed that FD may serve other purposes, including "masking" the more overtly maladaptive psychopathy traits, such as dishonesty, callousness, guiltlessness, and poor impulse control (Lilienfeld, Watts, & Smith, 2015).

In contrast, other scholars have argued that FD's relations with externalizing problems may be more complicated. In particular, they have posited that FD either relates more strongly to externalizing problems (a) at particularly high levels of FD (which we term the curvilinearity hypothesis; first hypothesized by Blonigen, 2013); or (b) in concert with other psychopathic traits, such as disinhibition (which we term the moderation hypothesis; Lilienfeld et al., 2012). The latter hypothesis is consistent with the view that psychopathy is a configural condition marked by statistical interactions among some or all of its constituent traits (Lilienfeld, 2013). The purpose of the present study is to test these two hypotheses in a large offender sample. Examining these hypotheses has considerable significance for our evaluation of how psychopathic traits may contribute to externalizing problems.

Fearless Dominance across Psychopathy measures

Among the measures that treat FD as a central component of psychopathy, the PPI and its revision, the Psychopathy Personality Inventory-Revised (PPI-R; Lilienfeld & Widows, 2005),

are the most widely used. The PPI/PPI-R comprises eight subscales, which can be combined into two higher-order factors (Benning et al., 2003, but see Neumann, Malterer, & Newman, 2008, for an alternative factor structure). The first factor (PPI FD) consists of Fearlessness, Stress Immunity, and Social Influence, which reflect social and physical boldness along with emotional stability. The second factor, Self-centered Impulsivity (PPI SCI), consists of Carefree Nonplanfulness, Rebellious Nonconformity, Machiavellian Egocentricity, and Blame Externalization, and reflects a narcissistic and impulsive willingness to take advantage of others. The subscale Coldheartedness (PPI C) does not load on either of the two higher order factors and is often used as a standalone dimension reflecting guiltlessness, lovelessness, and lack of sentimentality. More recently developed measures such as the Triarchic Psychopathy Measure (TriPM; Patrick, 2010) and Elemental Psychopathy Assessment (EPA; Lynam et al., 2011) also include FD-like constructs as components of psychopathy. Research indicates that FD is almost interchangeable with TriPM Boldness (e.g., r = .84) and correlates highly with EPA Emotional Stability (e.g., r = .74) and EPA Narcissism (e.g., r = .59; Crego & Widiger, 2014). In general, these constructs are mutually characterized by immunity to stress, fear, and anxiety, lower neuroticism, higher extraversion, and interpersonal dominance. Given their considerable overlap (rs ≈ .80-.90), we use the terms FD and boldness to describe the same construct.

Fearless Dominance's Association with Externalizing Problems and Adaptive Behaviors

Still, disagreement remains regarding the role of FD in psychopathy. Scholars who support FD's relevance to psychopathy emphasize FD's instantiation in non-PCL-R measures of psychopathy (Lilienfeld et al., 2015) and classic clinical descriptions of psychopathy (e.g., Cleckley, 1941; Crego & Widiger, 2016)—and some point to positive empirical relations between TriPM Boldness and at least some forms of violent crime (Drislane et al., 2014), verbal

aggression (Fanti, Kyranides, Drislane, Colins, & Andershed, 2016) and manipulative traits (Strickland et al., 2013; Wygant et al., 2016). In contrast, scholars who question FD's relevance to psychopathy point to meta-analyses and other studies showing small positive or null relations with externalizing problems (e.g., , antisocial and aggressive behavior, substance use, physical violence, aggression, and rule-breaking; Donnellan & Burt, 2015; Miller & Lynam, 2012), moderate negative relations with a number of maladaptive outcomes (e.g., reactive aggression, internalizing psychopathology; Donnellan & Burt, 2015), and moderate positive relations with ostensibly adaptive variables (e.g., emotional stability, positive emotionality, sociability, heroic altruism, leadership success, and emotion recognition; e.g., Crego & Widiger, 2014; Gatner et al., 2016; Miller & Lynam, 2012; Smith, Lilienfeld, Coffey, & Dabbs, 2013).

As noted earlier, in an effort to account for criticisms of FD's relevance to psychopathy, some proponents of FD have posited that FD may be more strongly related to externalizing in at least two specific ways. The first, the curvilinearity hypothesis, suggests that FD is related to externalizing problems only at high levels of the trait, such that only individuals with particularly high FD are substantively disposed towards externalizing problems (Blonigen, 2013). Three published studies have examined his hypothesis to date, none of which have found support for the curvilinearity hypothesis. The first prospectively investigated the effect of FD in early adolescence on externalizing problems in adulthood, finding no curvilinear effects (Vize et al., 2016). The second investigated TriPM Boldness' curvilinear relation to antisocial behavior in an adult sample (Gatner et al., 2016), finding one small quadratic effect in the statistical prediction of physical aggression that the authors interpreted as being too small in magnitude to support the curvilinearity hypothesis. These studies come with some limitations. First, they were not able to test lower-order components of FD as the first used a proxy measure of FD and the other used

the TriPM. It is possible that only lower-order facets of FD like Fearlessness bear curvilinear relations to externalizing problems. Second, Vize et al. (2016) examined the link between FD in early adolescence and externalizing in adulthood, rather than examining the link concurrently in adulthood. A third study (Crowe et al., 2018) used direct measures of psychopathy (i.e., PPI-R subscales), a large sample of approximately 787 undergraduate students and 603 MTurk community members, and an ideal point Item Response Theory-based statistical technique believed to accurately estimate extreme scores on psychopathic traits. The authors' findings did not support the curvilinearity hypothesis: rather than observing a convex curvilinear pattern, the authors observed the opposite pattern (i.e., a reduction in the relation between FD and externalizing/aggressive behavior at higher levels of the trait). However, the composition of the samples used in this study, especially with regard to levels of externalizing problems, may raise some concerns about generalizability, given the lower incidence of externalizing problems and level of psychopathic traits outside of offender samples.

The second hypothesis, the moderation hypothesis, posits that FD is either (a) only related or (b) more strongly related to externalizing problems in the presence of higher levels of other psychopathic traits (e.g., antagonism, disinhibition). Lilienfeld and colleagues (2015) proposed that FD may not predispose individuals to maladaptive behaviors on its own, but may produce these outcomes in interaction with other traits. For example, it is postulated that an individual with higher levels of both Blame externalization and Fearlessness may be more prone to externalizing problems than an individual with a higher level of Blame externalization alone. Investigations of this hypothesis have examined a myriad of potential outcomes (e.g., antisocial behavior, substance use), yielding mixed results that have mostly failed to support this hypothesis (e.g., Crowe et al., 2018; Gatner et al., 2016; Maples et al., 2014; Miller, Maples-

Keller, & Lynam, 2016; Vize, Miller, Lynam, Lamkin, Miller, & Pardini, 2016; see Lilienfeld, Patrick, et al., 2012 for other examples). Studies that have supported the hypothesis have found relations between FD and treatment failure (Rock, Sellbom, Ben-Porath, & Salekin, 2013), sexually predatory attitudes (Marcus & Norris, 2014), and predatory aggression (Smith, Edens, & McDermott, 2013) at higher levels of PPI SCI. Moreover, in contrast with predictions based on the moderation hypothesis, other findings indicated that FD may protect against social aggression and impulsiveness at higher levels of antagonism (Gatner et al., 2016).

The Present Study

The present study has two main aims, namely to systematically test both the curvilinearity and moderation hypotheses. First, we examine whether FD manifests curvilinear relations with a broad range of externalizing problems (see below). Specifically, we examine whether FD traits exhibit a convex pattern of curvilinear relations, characterized by a slope that increases towards the higher end of the distribution, indicating a pronounced likelihood of externalizing problems at extreme levels of FD. To be comprehensive, we also examine whether non-FD traits exhibit curvilinear relations with externalizing problems. Second, to test the moderation hypothesis, we examine whether FD scales manifest relations with externalizing problems at high levels of other psychopathic traits (e.g., SCI; Coldheartednesss). As noted earlier, by examining the subscales of the PPI FD, we conducted a more granular test of where curvilinear or interactive relations may emerge within the broader construct. The present study evaluates these hypotheses using a large sample of adult criminal offenders, which is ideal given that such samples are not limited by restriction of range at the higher end of the externalizing problems distribution.

Building upon previous studies, the present study employs numerous indices of

externalizing problems, including self-report and diagnostic assessments of substance abuse and a range of antisocial behavior and traits as well as records of post-assessment arrests (i.e., general and violent offenses). Furthermore, we use the ideal point Item Response Theory-based Generalized Graded Unfolding Model (GGUM; Roberts, Donoghue, & Laughlin, 2000), which is regarded as an accurate approach for reproducing response patterns for self-report measures of personality (e.g., Stark, Chernyshenko, Drasgow, & Williams, 2006) and attitudes (e.g., Carter & Dalal, 2010). The ideal point approach to scoring has been shown to more accurately recover curvilinear relationships in simulated (Carter, Guan, Dalal, & LoPilato, 2015) and observed (Carter et al., 2014) data than the dominance approach. Its use in this large data set provides a well-powered test of the hypothesis that FD bears stronger, positive relations with externalizing problems when at particularly high levels of FD and other psychopathic traits.

Method

Participants

Participants included (a) prisoners and (b) individuals sentenced to court-ordered substance use treatment programs in Florida, Nevada, Oregon, Texas, Washington, and Utah (see Poythress et al., 2010, for more details). Four of the five treatment programs were community-based and one (Texas) was located within a prison. Participants were excluded if they were currently receiving psychotropic medications for active symptoms of psychosis or resided in a mental health unit in prison. Incarcerated participants were deemed eligible if they spoke English fluently and had an estimated IQ > 70 on the Quick Test, a brief screen of intellectual functioning (Ammons & Ammons, 1962). Individuals from substance use treatment programs were required to have completed all detoxification procedures prior to recruitment. At each site, participants were randomly recruited from lists of individuals who met the inclusion criteria.

After obtaining informed consent, screening measures for IQ and reading ability were administered, followed by the research protocol for eligible participants.

A total of 1,741 participants were enrolled in the study: 1413 men (81.2%), 299 women (17.2%), and 29 individuals (1.7%) with missing gender data. The self-reported ethnic and racial composition of the sample was as follows: 1079 Caucasians (62.0%), 595 African Americans (34.2%), and 67 participants (3.8%) with missing race data. In terms of recruitment site, 911 participants were drawn from prisons (52.3%) and 830 from substance use treatment programs (47.7%). The present analyses were based on 1701 eligible participants with available data on either psychopathy or the relevant criterion measures. The mean age across these participants at time of assessment was 31.04 years (SD = 6.60, range = 17.96–59.37).

Measures

Independent Variables: Psychopathy Measures.

PPI. The Psychopathic Personality Inventory (PPI; Lilienfeld & Andrews, 1996) consists of 187 items answered on a 4-point Likert-type scale (1 = False, 4 = True). The inventory provides a total score and scores on eight subscales (alphas for the subscales ranged from .79 to .91). As noted earlier, seven of the eight PPI subscales cohere into the two largely orthogonal higher-order factors of FD and SCI (Benning et al., 2003; Lilienfeld & Widows, 2005; c.f., Neumann, Malterer, & Newman, 2008). Scores for PPI FD were computed by taking the average of the z-scores of IRT-generated thetas for Social Potency (standard deviation [SD] = .92), Fearlessness (SD = .90), and Stress Immunity (SD = .91). Scores for PPI SCI were computed by taking the average of the z-scores of IRT-generated thetas for Machiavellian Egocentricity (SD = .94), Impulsive Nonconformity (SD = .89), Blame Externalization (SD = .94), and Carefree Nonplanfulness (SD = .92). Coldheartedness was treated as a standalone dimension. PPI data

were available for 1605 participants. In the analyses reported here, we examined all 8 PPI subscales along with the two major higher-order dimensions of FD and SCI.

Dependent Variables: Measures of externalizing.

PAI. The Personality Assessment Inventory (PAI; Morey, 1991) is a 344-item self-report inventory of personality and psychopathology. The scales of primary interest in this study included clinical scales reflecting externalizing psychopathology including Aggression (AGG), Alcohol Problems (ALC), Drug Problems (DRG), and the Antisocial Behaviors subscale (ABS; αs ranged from .80 to .94). PAI data were available for approximately 1570 participants, depending on the scale.

PDQ-4 Antisocial Personality Disorder. The Personality Diagnostic Questionnaire-4 Antisocial Personality Disorder (ASPD) scale (Hyler, 1994) is a self-report measure consisting of 22 true-false items, one for each ASPD childhood and adult criterion in DSM-IV (and now DSM-5). The 15-item ASPD childhood scale ($\alpha = .83$) and the 7-item adult scale ($\alpha = .58$) were used as separate outcomes. PDQ-4 ASPD adult criteria data were available for 1557 participants, whereas childhood criteria data were available for 1472.

Interview measures of externalizing. Diagnostic symptom counts of conduct disorder (CD) and adult antisocial behavior (AAB) were obtained using the ASPD module of the Structured Clinical Interview for DSM–IV Axis-II Personality Disorders (SCID-II; First, Gibbon, Spitzer, Williams, & Benjamin, 1996), administered by trained advanced graduate students in psychology. This module, based on criteria from the Diagnostic and Statistical Manual of Mental Disorders (4th and 5th editions), yields dimensional scores for both CD and ASPD. In this study, the interrater reliability was high for total symptom count (ICC = .86; n = 46), along with similarly high internal consistency ($\alpha = .83$). AAB data were available for 1,494

participants, and retrospective CD data were available for 1,212 participants.

Criminal recidivism. We used arrest records of participants who were released into the community following protocol completion. Identifying information was used for all participants from drug treatment programs and for those near-release prison inmates recruited into the study within 6 months of their sentence completion in order to search arrest records, both state and federal, archived by the Federal Bureau of Investigation. Two count variables were computed to capture (a) the number of times arrested for *any kind of offense (general offense arrest count)*; and (b) the number of times arrested for a *violent offense (violent offense arrest count).* Counts were assessed within the full follow-up period (range = 4 – 1590 days) following enrollment (drug treatment program participants) or following release from prison into the community (near-release prisoners). General offenses included seven arrest types (i.e., violent, potentially violent, other person, sexual, property, drug, minor) across 12 potential time points (i.e., times at which arrest history was recorded). Violent offenses included any explicitly assaultive act against another person (e.g., murder, manslaughter, assault, robbery, and rape or other sexual assault). across the 12 time points. Recidivism data were available for 1,087 participants.

Data Analytic Plan

Scoring Methods. Research shows that implementing appropriate scoring rules for self-report agree/disagree measures is advantageous to uncovering curvilinear relationships when they exist and avoiding Type 1 errors when they do not (Carter et al., 2014, 2015, 2017). Accordingly, we compared the fit of a traditional *dominance* IRT model (i.e., the generalized partial credit model; GPCM) to the fit of an *ideal point* IRT model (i.e., the generalized graded unfolding model; GGUM, Roberts, Donoghue, & Laughlin, 2000) to produce latent trait estimates to be used in our primary analyses as indicators of the broader latent constructs

described earlier (e.g., IRT scores of PPI Fearlessness).

In contrast to models that hold dominance assumptions (e.g., GPCM), ideal point model assumptions recognize that items differ from one another in their level of extremity (e.g., "I sometimes like to go to parties" compared with "I always like to go to parties"), and that an individual fully endorses items (i.e., strongly agree) whose extremity coincides most closely with his/her own location on the latent trait scale. Furthermore, ideal point models such as GGUM rest on the understanding that an individual may be less likely to fully endorse an item (i.e., "strongly agree") because the item's extremity is above their latent trait level (i.e., as in the case of GPCM) *or* because the item is not extreme enough (e.g., a person who is extremely high on extraversion may disagree with the item, "I sometimes like to go to parties" because he/she *always* likes to). Dominance approaches do not take this tendency into consideration, meaning that they run the risk of underestimating some individuals' location on the latent trait scale. As a result, dominance models can cause disordering at the high ends of the trait distribution (Roberts, Laughlin, & Wedell, 1999), and thus distort tests for curvilinearity (Carter et al., 2017). Thus, we used the GGUM as our representation of the ideal point model. Item and person parameter were estimated using the GGUM2004 program (Roberts, Fang, Cui, & Wang, 2006), which uses MML estimation to determine item parameters and EAP estimation of to determine persons' scores.

Preliminary Psychometric Analyses of Scoring Methods. The two scoring approaches used here (GPCM, GGUM) have different indicators of score quality. In the following section, we present evidence of the quality of the measures used in this study using methods that are commonly applied to each respective scoring approach.[1]

[1] The quality of IRT-based scoring approaches is assessed by inspection of model-data fit statistics. One commonly used approach for assessing the absolute and relative fit of IRT models is the adjusted χ^2/df ratio

Model-data fit was generally acceptable, and most items met the $\chi^2/df < 3$ criteria. To assess relative model data fit, we calculated the Akaike Information Criterion (AIC; see Bozdogan, 1987), which represents the difference in the model likelihoods but penalizes less parsimonious models (the GGUM is more complex). As can be seen, the AIC indicated that GGUM was the superior model. In only 4 of 29 measurement models did GPCM show better fit than GGUM according to AIC, and in most of these cases differences between GGUM and GPCM were not large in terms of AIC, and χ^2/df ratios were almost identical.

GGUM scale construction. Constraints related to GGUM scale construction required two adjustments. First, we modified two latent constructs to negotiate various scoring issues. Two items from the PDQ-4 7-item ASPD adult scale were removed (i.e., PDQ-4 items 46 and 75) due to (a) a GGUM2004 singularity-related error and (b) an error in scale administration (item 75 was not administered). One item out of 19 from the PPI Fearlessness subscale was removed (i.e., item 34) due to extremely high χ^2/df ratios when it was included in the model.

Second, because GGUM can only be used for unidimensional models, we were unable to generate ideal point latent trait estimates of multidimensional factor-level scores (i.e., PPI SCI and PPI FD). To assess for curvilinearity at this level, GGUM-generated latent trait estimates were averaged across component scales to generate an estimate of latent trait factor-level scores.

Plan for analyzing criminal recidivism count data. Because count data often do not meet the normality assumption of OLS regression, we applied alternative models (i.e., Poisson regression, negative binomial regression) in the present analyses (see Coxe, West, & Aiken,

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(Chernyshenko et al., 2001; Drasgow et al., 1995). Here we evaluated model-data fit using the MODFIT v2.0 program (Stark, 2007). The χ^2/df ratio assesses the extent to which the IRT models' predictions about item endorsement rates are close to the actual observed endorsement rates. The statistic is "adjusted" to approximate the model data fit that would be found if $N = 3{,}000$ to avoid Type II errors. Adjusted χ^2/df ratios less than 3 are considered to have acceptable fit (Cherynyshenko et al., 2001).

2009). Poisson regression and negative binomial regression are designed to model count data. Although the Poisson assumes that the variance of data is congruent with the mean, negative binomial regression accounts for any overdispersion that may be present (i.e., when variance exceeds the mean) by estimating an additional dispersion parameter (α) and applying more conservative tests of significance in proportion to the degree of dispersion and standard error (Atkins, Baldwin, Zheng, Gallop, & Neighbors, 2013). We evaluated whether to use Poisson or negative binomial regression by comparing model fit using the AIC, which includes a correction for the increased complexity of the negative binomial model.

Plan for evaluating the presence of curvilinearity. We evaluated curvilinearity in two steps. In the first step of all analyses, standardized psychopathy scores (i.e., GGUM latent trait estimates) were entered as predictors of externalizing criterion variables. In the second step, the squared value of the standardized psychopathy score (i.e., quadratic term) was entered as an additional predictor. The change in model-data fit across these two steps was evaluated to assess for curvilinearity.

The incremental contribution of the curvilinear effect for each model was evaluated using AIC (Bozdogan, 1987), R^2, and Pseudo R^2 (McFadden, 1974). AIC was the primary fit index used when evaluating curvilinearity. McFadden's (1974) pseudo-R^2 calculation was planned for all Poisson or negative binomial models, which do not have a statistical equivalent to Ordinary Least Squares (OLS) R^2. However, although McFadden's pseudo-R^2's intended use is similar to the OLS R^2 metric, its values tend to be much smaller and cannot be interpreted as variance accounted for by the model. For reference, McFadden pseudo-R^2 values ranging from .2 - .4 indicate excellent model fit, which are comparable to OLS R^2 values of .7-.9 (Domenich & McFadden, 1975).

Results

In the following section, we report the results of hierarchical regression analyses. In all analyses, the linear effect was modeled in Step 1. In Step 2, the quadratic term was added to test for curvilinearity by examining its significance. For all models, AIC and either R^2 or McFadden's pseudo-R^2 (depending on outcome) were used to evaluate change in model-data fit between steps 1 and 2. Statistical significance was determined using alpha equal to $p < .01$; we adopted a somewhat more conservative alpha level to balance the risk for Type I and Type II errors given the large number of analyses (351 analyses in total). Correlations between manifest psychopathy variables are reported in the Appendix (Table 7). Results of regression analyses for externalizing problems are reported in Tables 1 through 5. To interpret the size of quadratic and interaction terms (i.e., small, medium, large), we used the f^2 statistic, which equals the unique variance explained by the interaction term divided by the sum of the error and interaction variances (Aiken & West, 1991; Kenny, 2015). Plots of all significant quadratic effects that improved model fit are available in the Appendix (Figure 2-25). Unless otherwise noted, a negative quadratic term coefficient indicates decreasing strength of relations at higher levels of the predictors, whereas a positive quadratic term coefficient indicates increasing strength of relations at higher levels of the predictors in a manner consistent with this hypothesized effect (Blonigen, 2013).

Evaluating whether there are curvilinear relationships between FD and externalizing problems

Aggression, Antisocial Behavior, and Substance Use.

PAI AGG. In Step 1, all PPI subscales and one factor score estimate, PPI SCI, showed

significant linear effects when separately predicting AGG.[2] In Step 2, four PPI subscales (i.e., Coldheartedness [medium effect size], Rebellious Nonconformity [small], Fearlessness [large], Stress Immunity [small]) and the PPI FD factor score estimate [small] yielded statistically significant quadratic effects (effect size indicated in brackets)[3]. AICs indicated that these quadratic effects represent meaningful improvements. Quadratic term coefficients ranged in magnitude from -.23 (Fearlessness) to .08 (Coldheartedness). The quadratic term coefficient for Coldheartedness was positive, whereas the quadratic term coefficients for Rebellious Nonconformity, Fearlessness, Stress Immunity, and PPI FD were negative and inconsistent with the curvilinearity hypothesis. Specifically, Rebellious Nonconformity, Fearlessness, and FD exhibited a decreasing slope at higher trait levels, while Stress Immunity exhibited a decreasing slope at lower trait levels.

***PAI ANT Antisocial behaviors subscale*.** In Step 1, all PPI subscales with the exception of Coldheartedness and PPI SCI showed significant linear effects when separately predicting ANT ANT antisocial behaviors. In Step 2, three PPI subscales (i.e., Coldheartedness [medium], Carefree Nonplanfulness [small], Fearlessness [large]) and PPI SCI [small] yielded statistically significant quadratic effects that improved model fit. Quadratic effects ranged in magnitude from -.22 (Fearlessness) to .10 (Coldheartedness). The quadratic term coefficient for Fearlessness was negative, whereas the quadratic terms for Coldheartedness, Carefree Nonplanfulness, and SCI were positive.

PAI DRG. In Step 1, all PPI subscales with the exception of Coldheartedness and both PPI factor score estimates (FD and SCI) showed significant linear effects when separately

[2] Of note, PPI FD did not show a significant linear effect though all of its facets (e.g., PPI fearlessness) did. This likely owes to negative and positive relations across its facets that offset each other.
[3] Interpretations of interactive effect sizes vary by subject area, but Kenny (2015) suggests ascribing a small, medium, and large to f^2 effect sizes of .005, .01, and .025, respectively, in view of evidence that the average effect size associated with including interaction terms is .009 (Aguinis, Beaty, Boik, & Pierce, 2005).

predicting DRG. In Step 2, only Fearlessness [large] yielded a statistically significant (negative) quadratic effect that improved model fit (b = -.16).

PAI ALC. In Step 1, all PPI subscales, with the exception of Coldheartedness and Fearlessness, and both PPI factor score estimates (FD and SCI) showed significant linear effects when separately predicting ALC. In Step 2, only Fearlessness [small] yielded a statistically significant (negative) quadratic effect that improved model fit (b = -.09).

Adult Antisocial Personality Disorder.

PDQ Adult. In Step 1, six PPI subscales (exceptions: Fearlessness, Social Potency) and both PPI factors showed significant linear effects when separately predicting PDQ Adult. In Step 2, four PPI subscales (i.e., Carefree Nonplanfulness [medium], Machiavellian Egocentricity [small], Coldheartedness [small], Fearlessness [large]) and PPI SCI [large] yielded statistically significant quadratic effects that improved model fit. Quadratic effects ranged in magnitude from -.19 (Fearlessness) to .09 (Carefree Nonplanfulness). All quadratic terms with the exception of Fearlessness were positive.

SCID Adult. In Step 1, all PPI subscales and PPI SCI showed significant linear effects when separately predicting SCID Adult. In Step 2, only Fearlessness [large] yielded a statistically significant (negative) quadratic effect that improved model fit (b = -.16).

Childhood Conduct Disorder / Antisocial behavior.

PDQ Child. In Step 1, all PPI subscales and PPI SCI showed significant linear effects when separately predicting PDQ Child. In Step 2, three PPI subscales (i.e., Carefree Nonplanfulness [small], Coldheartedness [medium], Fearlessness [large]) and PPI SCI [small] yielded statistically significant quadratic effects that improved model fit. Quadratic effects ranged in magnitude from -.19 (Fearlessness) to .09 (Coldheartedness). Quadratic term

coefficients for Carefree Nonplanfulness, Coldheartedness, and PPI SCI were positive, whereas the quadratic term coefficient for Fearlessness was negative.

SCID Child. In Step 1, all PPI subscales with the exception of Stress Immunity and both PPI factors showed a significant linear effect when separately predicting SCID Child. In Step 2, three PPI subscales (i.e., Coldheartedness [small], Machiavellian Egocentricity [small], Fearlessness [medium]) yielded statistically significant quadratic effects that improved model fit. Quadratic effects ranged in magnitude from -.13 (Fearlessness) to .05 (Coldheartedness). Quadratic term coefficients for Machiavellian Egocentricity and Coldheartedness were positive, whereas the quadratic term coefficient for Fearlessness was negative.

Criminal Recidivism. Over-dispersion was evaluated for all count models by comparing the AIC fit of the Poisson model to the negative binomial model. Results indicated that negative binomial regression was appropriate for all analyses; both Poisson and negative binomial regression predict the natural log of the expected count variable. Unless otherwise indicated, all reported coefficients are reported in log units. To convert coefficients to count units, they must be exponentiated (i.e., e^x). However, doing so changes their interpretations from additive to multiplicative (see Coxe, West, & Aiken, 2009 for review). In addition, the time period during which participants' rearrests were recorded (i.e., follow up period) varied widely across participants. To control for the effect of the length of this follow-up period on rearrests, the follow-up period was included as a covariate. Results are reported in Table 5.

General arrest count. No PPI subscales or higher-order factors showed significant linear or quadratic effects when separately predicting general recidivism.

Violent offense arrest count. No PPI subscales or higher-order factors showed significant linear or quadratic effects when separately predicting general recidivism.

Evaluating whether psychopathic traits moderate the relationship between Fearless Dominance and externalizing problems

To examine associations between psychopathic traits and externalizing problems at elevated levels of PPI FD subscales, 19 analyses were conducted for each of our 10 externalizing-related outcomes (190 analyses in total) in which each PPI FD subscale was included with every other PPI subscale (e.g., Stress Immunity x Coldheartedness; Stress immunity x Rebellious Nonconformity). Analyses were also conducted in which PPI FD and PPI SCI factor scores were included in the model. In addition, although not originally hypothesized by Lilienfeld et al. (2015), analyses were also conducted in which interactions between FD subscales were included (e.g., Fearlessness x Stress Immunity). Eight significant interactions (approximately 4.2% of analyses conducted) were found that improved model fit.

In two cases, coefficients for the interaction term were positive, indicating that the statistical effect of PPI FD was more strongly positive at higher levels of the other traits. Carefree Nonplanfulness interacted with Stress Immunity in the prediction of PAI AGG (i.e., aggressive behavior). As Carefree Nonplanfulness increased, the magnitude of the association between Stress Immunity and aggressive behavior grew less negative (low Carefree Nonplanfulness: $\beta_{\text{Stress Immunity}} = -.33$, $p < .01$; high Carefree Nonplanfulness: $\beta_{\text{Stress Immunity}} = -.18$, $p < .01$). f^2 indicated a small effect size. Carefree Nonplanfulness also interacted with Fearlessness in the prediction of the PAI ANT antisocial behaviors subscale. As Carefree Nonplanfulness increased, the association between Fearlessness and antisocial behavior grew more positive (low Carefree Nonplanfulness: $\beta_{\text{Fearlessness}} = .11$, $p < .01$; high Carefree Nonplanfulness: $\beta_{\text{Fearlessness}} = .23$, $p < .01$). f^2 indicated a small effect size.

In six cases, coefficients for the interaction term were negative, indicating a decrease in

the effect of PPI FD at elevated levels of the other traits. This pattern is inconsistent with the standard moderation hypothesis and indicates that PPI FD traits operate as protective as opposed to potentiating factors for externalizing behavior broadly construed. Machiavellian Egocentricity interacted with Social Potency in the prediction of PAI DRG (i.e., drug dependence). As Social Potency increased, the magnitude of the association between Machiavellian Egocentricity and externalizing decreased (low Social Potency: $\beta_{\text{Machiavellian Egocentricity}} = .36$, $p < .01$; high Social Potency: $\beta_{\text{Machiavellian Egocentricity}} = .24$, $p < .01$). f^2 indicated a small effect size. PPI SCI interacted with PPI FD in the prediction of PAI DRG (i.e., drug dependence). As FD increased, the magnitude of the association between SCI and drug dependence decreased (low FD: $\beta_{\text{SCI}} = .14$, $p < .01$; high FD: $\beta_{\text{SCI}} = .10$, $p < .01$). f^2 indicated a small effect size. Machiavellian Egocentricity interacted with PPI Stress Immunity in the prediction of PDQ Adult Antisocial Behavior. As Stress Immunity increased, the magnitude of the association between Machiavellian Egocentricity and antisocial behavior decreased (low Stress Immunity: $\beta_{\text{Machiavellian Egocentricity}} = .56$, $p < .01$; high Stress Immunity: $\beta_{\text{Machiavellian Egocentricity}} = .40$, $p < .01$). f^2 indicated a small effect size. Finally, Stress Immunity interacted with Fearlessness in the prediction of three outcomes (i.e., PAI ANT antisocial behaviors, PDQ Childhood Antisocial Behavior, and SCID Childhood ASPD symptoms). As Stress Immunity increased, the magnitude of the association between Fearlessness and externalizing decreased (for PAI ANT antisocial behaviors: low Stress Immunity: $\beta_{\text{Fearlessness}} = .29$, $p < .01$; high Stress Immunity: $\beta_{\text{Fearlessness}} = .16$, $p < .01$; for PDQ childhood antisocial behavior: low Stress Immunity: $\beta_{\text{Fearlessness}} = .25$, $p < .01$; high Stress Immunity: $\beta_{\text{Fearlessness}} = .09$, $p < .01$; for SCID childhood ASPD symptoms: low Stress Immunity: $\beta_{\text{Fearlessness}} = .20$, $p < .01$; high Stress Immunity: $\beta_{\text{Fearlessness}} = .05$, *ns*). f^2 across these analyses indicated small effect sizes.

Discussion

According to some conceptualizations, traits related to Fearless Dominance/Boldness are an important component of psychopathy (e.g., Cleckley, 1941; Lilienfeld et al., 2012; 2015; Lykken, 1995; Patrick et al., 2009). At the same time, empirical examinations of FD's relations with criminal and antisocial behavior, which some see as central to psychopathy (Hare & Neumann, 2010; Karpman, 1948; Lykken, 1995), are often null, weak, or even negative (e.g., Gatner et al., 2016; Miller & Lynam, 2012; Vize et al., 2015), raising questions about its relevance to the broad psychopathy construct (Lynam & Miller, 2012; Miller & Lynam, 2012). In fact, research thus far suggests that FD exhibits a largely adaptive network of associations (e.g., emotional stability, leadership, interpersonal warmth; Gatner et al., 2016; Lilienfeld et al., 2013; Miller & Lynam, 2012; Smith et al., 2013).

In view of the observed relations between FD and antisocial behavior broadly construed, researchers have offered two alternative scenarios under which relations between FD and externalizing problems might be found. The curvilinearity hypothesis suggests that FD relates to externalizing problems at high but not necessarily low or moderate levels (Blonigen, 2013). The three prior studies that examined this hypothesis yielded little support for such a possibility (Crowe et al., 2018; Gatner et al., 2016; Vize et al., 2016). The moderation hypothesis proposes that FD is relevant to externalizing problems through synergistic interactions with other psychopathic traits (i.e., antagonism/meanness, disinhibition; Lilienfeld et al., 2015). Extant findings offer mixed, at best, support for this possibility (Gatner et al., 2016; Maples et al., 2014; Miller, Maples-Keller, & Lynam, 2016; Vize et al., 2016; cf. Marcus & Norris, 2014; Rock et al., 2013).

The present study expands upon the previous ones in a number of ways. First, our sample

consists of approximately 1,500 offenders (i.e., prisoners and individuals recruited from court-ordered substance use treatment programs) who exhibit relatively high levels of psychopathic traits and externalizing problems, conditions that are critical for observing curvilinear and interactive effects. Second, we used the ideal point IRT-based generalized graded unfolding model (GGUM), which provides the most accurate and sensitive means of detecting curvilinear and moderation-based relations (e.g., Carter et al. 2014, 2015, 2017). Third, only one other study (i.e., Vize et al., 2016) has prospectively examined the effect of FD on future arrests.

Our analysis yielded six key findings. First, subscales of FD – Fearlessness and Stress Immunity, but not Social Potency – showed curvilinear relations with externalizing problems. Contrary to the curvilinearity hypothesis, however, Fearlessness exhibited concave curvilinear relations across measures of adult externalizing (i.e., aggression, antisocial behaviors, drug and alcohol dependence) indicating a *reduction* in the relation between Fearlessness and externalizing problems at higher ends of the trait spectrum (See Figures 6, 10-12, 17, 18, 22, 25 in Appendix). These results suggest that Fearlessness tends to bear a weak positive relation with externalizing problems among individuals with below average to average levels of Fearlessness, but negative associations with these problems among individuals with above average levels. In general, high levels of Fearlessness appeared protective against externalizing problems. In addition, Stress Immunity was negatively curvilinearly related to aggressive behavior, such that the relation between Stress Immunity and aggressive behavior was reduced at lower levels of Stress Immunity (see Figure 5), although this curvilinearity did not arise for other forms of externalizing problems.

Power analysis simulations were conducted in order to evaluate our capacity to detect a curvilinear effect that approximated Blonigen's (2013) hypothesized curvature (see Appendix for

details). This effect was specified in efforts to be small enough that any lower positive coefficient would be fairly linear, and thus not meaningfully supportive of Blonigen's (2013) hypothesis. Using Monte Carlo simulations, we observed power exceeding .90 for detecting this curvature in models involving ordinary least squares regression, which accounted for 8 of 13 outcomes. Notably, however, significantly lower power was found for negative binomial (power = .65) models, which accounted for criminal recidivism-related outcomes.

Second, examinations of linear effects of FD scales suggest that Stress Immunity consistently evinced negative linear relations across all externalizing problems and showed no evidence of curvilinear relations that would be consistent with Blonigen's (2013) hypothesis. These findings suggest that among FD scales, Stress Immunity may be least relevant to externalizing problems typically viewed as most relevant to psychopathy. In addition, both Social Potency and Stress Immunity bore weak to moderate negative relations with drug and alcohol dependence, perhaps reflecting their ties to emotional resilience and stability.

Third, our examination of moderation provided little support for the hypothesis that FD is related to externalizing problems at higher levels of other psychopathic traits (Lilienfeld et al., 2012; 2015). Of the 190 analyses conducted, only two indicated increased and positive associations between FD and externalizing at higher levels of other psychopathic traits. Changes in R^2 associated with adding the interaction term were small (i.e., less than .01) in each of these analyses. Power analysis simulations were conducted in order to evaluate our capacity to detect true interactive effects (see Appendix for details). Results indicated generally sufficient power (i.e., .80) to detect fairly small interactive effects approaching .10.

Fourth, the majority of meaningful curvilinear relations between PPI SCI and PPI Coldheartedness and externalizing problems were positive, indicating an increased relation

between traits and externalizing problems at higher trait levels. Findings involving Coldheartedness suggest that individuals who are particularly lacking in concern for others and emotional empathy may be at exponentially greater risk of engaging in antisocial behavior. Coldheartedness consistently showed substantially smaller linear relations with externalizing problems than did PPI SCI scales, a result that is consistent with previous findings (e.g., Crego & Widiger, 2014; Miller, Maples-Keller, & Lynam, 2016). Our curvilinear results suggest that Coldheartedness' ostensibly weak linear relations with externalizing problems may belie its stronger association with maladaptive behavior at higher levels of the trait. Findings involving Carefree Nonplanfulness suggest that impulsivity and lack of deliberation may similarly be more strongly associated with antisocial behavior at higher levels of the trait.

There were at least two curvature patterns that emerged among these instances of positive curvilinear relations. The first pattern, characterizing PPI Coldheartedness, was a fairly symmetrical parabolic shape, which indicated null to weak linear relations between certain psychopathic traits and externalizing problems at below average to average levels of the trait and stronger relations at higher levels of the trait (e.g., Figure 8). The second pattern, characterizing Carefree Nonplanfulness, was a 90 degree parabolic shape (e.g., Figure 9) indicating positive relations at all levels of the trait, but exponentially stronger (amplified) relations to externalizing at the higher levels.

Fifth, inconsistent with the moderation hypothesis, there was more evidence that two FD subscales - Social Potency and Stress Immunity - may actually weaken the association between other psychopathic traits – in this case Machiavellian Egocentricity - and externalizing problems. However, these results must be interpreted cautiously as interactive effects were present in only 6 of 190 analyses, and all of these results were associated with a small change in R^2 (i.e., less

than .01). In general, there is little evidence of meaningful moderation in either an amplifying or mitigating direction.

In sum, using a large sample of offenders and a well-powered examination of psychopathic traits' relations with a broad swath of externalizing problems, we found little support for both the curvilinearity and moderation hypotheses for FD and its subscales. Although inconsistent with previous postulation (Blonigen, 2013; Lilienfeld et al., 2012; Lilienfeld et al., 2015), these findings are consistent with several previous empirical examinations (Crowe et al., 2018; Gatner et al., 2016; Vize et al., 2016). Relative to previous studies, however, the present study involves the most rigorous test of extant explanations for FD's null, weak, or negative relations with externalizing problems (Miller & Lynam, 2012). Moreover, our study is one of two that leverages GGUM, the most precise statistical technique for estimating extreme ends of a latent trait, which particularly strengthens investigations involving tests of curvilinearity and statistical interaction among latent traits. Taken together, the methodological strengths of the present study – namely, our sample size, coverage of an array of externalizing problems, and the use of a sample with sufficiently high mean levels of psychopathic traits – render the likelihood of alternative explanations for our findings (e.g., restriction of range, small sample size, measurement error) less compelling, and increase our confidence that we are on stronger ground to interpret our null findings.

Limitations and Conclusions

Despite its strengths, some limitations must be acknowledged. First, although records of criminal recidivism are particularly valuable indices of externalizing problems, they are imperfect (e.g., capture only antisocial behavior that is detected by law enforcement officers).

Second, we operationalized recidivism in a manner that failed to fully account for

participants' varying time at risk for such behavior, given different lengths of observation in the community. Some participants had much longer follow-up periods than others—and therefore were at risk to reoffend for longer. We mitigated the effect of length of follow-up by including it as a covariate in our analyses, but this statistical operation fails to completely address its confounding influence. For these reasons, results related to these indices of future criminal behavior should be interpreted cautiously.

Third, given that our sample is predominantly male (i.e., 82%) and entirely adult, our results cannot be readily generalized to women or to children and adolescents, where FD traits such as fearlessness may be more strongly related to externalizing problems even if they do not persist into adulthood (e.g., Vize et al., 2016).

Fourth, approximately 17% of our sample was female. Given the lower prevalence of criminal behavior among women, sex differences in relations between psychopathy traits and externalizing problems may limit generalizability of our results to the male offender population.

Fifth, our findings are limited to global externalizing problems—emphasizing criminal behavior, substance abuse, and antisocial traits. We did not examine specific antisocial behavior that might be tied to short-term interpersonal success, such as deception, manipulation, fraud, romantic seduction, and mate-poaching. Such behaviors might be especially relevant to boldness given that they are ostensibly tied to superficially adaptive social functioning (Lilienfeld, Watts, Smith, & Latzman, in press). In future research, proponents of the moderation hypothesis can furnish risky tests (Meehl, 1978) of this conjecture using antisocial outcomes that theoretically relate to boldness.

In response to concerns regarding FD's relevance to psychopathy, a number of explanations have been offered. In our analyses, we found no evidence for Blonigen's (2013)

hypothesis that FD traits are more strongly related to externalizing problems at higher levels of the traits. We also found only limited evidence for Lilienfeld et al.'s (2012; 2015) hypothesis that FD traits relate more strongly to externalizing problems at higher levels of other traits. The present study tests these hypotheses in a large sample of offenders exhibiting a broad range of relevant traits, using the most sensitive analytic approach for detecting curvilinearity and moderation developed to date, and with direct measures of FD and various externalizing problems. When considered in tandem with the limited previous evidence of curvilinear and interactive effects of FD in predicting externalizing problems, our results add to the ongoing debate regarding the relevance of FD-related traits to psychopathy, at least with regard to their relations with criminal behavior that many, but not all (e.g., Skeem & Cooke, 2010) scholars regard as critical to psychopathy.

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Tables

Table 1

Results of Regression Analysis for Psychopathy traits and Externalizing - PAI AGG and PAI ANT antisocial behaviors

		PAI AGG							PAI ANT antisocial behaviors						
		Step 1			Step 2				Step 1			Step 2			
PPI scale	Parameter	*b*	AIC	R^2	*b*	AIC	R^2	ΔR^2	*b*	AIC	R^2	*b*	AIC	R^2	ΔR^2
Coldheartedness	Intercept	.004	4327	.008	-.078	4306	.023	.015	.007	4325	.001	-.089*	4294	.022	.021
	Linear	.090*			.104*				.036			.053			
	Quadratic				.082*							.098*			
Self-centered Impulsivity	Intercept	.007	3855	.272	.010	3857	.272	.000	.011	3846	.270	-.035	3839	.275	.005
	Linear	.174*			.174*				.173*			.178*			
	Quadratic				.000							.005*			
Blame Externalization	Intercept	.006	4046	.175	.019	4047	.176	.001	.008	4227	.063	-.004	4228	.063	.000
	Linear	.421*			.419*				.251*			.253*			
	Quadratic				-.013							.012			
Carefree Nonplanfulness	Intercept	.006	4245	.060	.003	4247	.060	.000	.011	4087	.145	-.048	4078	.151	.006
	Linear	.246*			.247*				.382*			.394*			
	Quadratic				.003							.059*			
Rebellious Nonconformity	Intercept	.003	4077	.158	.055	4068	.164	.006	.007	3976	.205	.010	3978	.205	.000
	Linear	.398*			.401*				.452*			.453*			
	Quadratic				-.052*							-.003			
Machiavellian Egocentricity	Intercept	.007	3887	.257	.021	3887	.258	.001	.010	3933	.227	.003	3935	.227	.000
	Linear	.508*			.508*				.476*			.476*			
	Quadratic				-.015							.007			
Fearless Dominance	Intercept	.004	4335	.003	.062	4326	.011	.008	.007	4326	.000	.035	4326	.002	.002
	Linear	-.028			-.019				.000			.004			
	Quadratic				-.014*							-.006			
Fearlessness	Intercept	.003	4326	.009	.234*	4199	.089	.080	.007	4285	.027	.231*	4162	.103	.076
	Linear	.094*			.14*				.162*			.207*			
	Quadratic				-.229*							-.223*			
Stress Immunity	Intercept	.007	4167	.107	.073	4154	.116	.009	.009	4240	.055	.008	4242	.055	.000

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	Linear	-.328*			-.318*				-.235*			-.235*			
	Quadratic				-.067*							.001			
Social Potency	Intercept	.003	4321	.013	-0.01	4322	.013	.000	.007	4319	.005	-.023	4318	.007	.002
	Linear	.113*			.111*				.070*			.066			
	Quadratic				.014							.030			

Note. PAI = Personality Assessment Inventory; AGG = Aggression; ANT antisocial behavior = Antisocial behaviors subscale; *$p < .01$

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Table 2

Results of Regression Analysis for Psychopathy traits and Externalizing - PAI DRG and PAI ALC

		PAI DRG							PAI ALC						
		Step 1			Step 2				Step 1			Step 2			
PPI scale	Parameter	*b*	AIC	R^2	*b*	AIC	R^2	ΔR^2	*b*	AIC	R^2	*b*	AIC	R^2	ΔR^2
Coldheartedness	Intercept	-.001	4315	.002	.019	4315	.003	.001	.001	4312	.001	.026	4311	.002	.001
	Linear	-.048			-.051				.027			.022			
	Quadratic				-.020							-.026			
Self-centered Impulsivity	Intercept	.001	4093	.138	-.022	4093	.139	.001	.002	4232	.051	.000	4234	.051	.000
	Linear	.124*			.126*				.075*			.075*			
	Quadratic				.003							.000			
Blame Externalization	Intercept	.000	4293	.016	.008	4295	.017	.001	.001	4304	.006	.013	4305	.006	.000
	Linear	.128*			.127*				.076*			.074*			
	Quadratic				-.008							-.012			
Carefree Nonplanfulness	Intercept	.002	4023	.177	-.013	4024	.177	.000	.003	4227	.055	.009	4229	.055	.000
	Linear	.422*			.425*				.235*			.233*			
	Quadratic				.015							-.006			
Rebellious Nonconformity	Intercept	-.002	4165	.096	.014	4167	.096	.000	.001	4257	.036	.031	4256	.038	.002
	Linear	.309*			.31*				.188*			.190*			
	Quadratic				-.015							-.031			
Mach Egocentricity	Intercept	.000	4213	.067	.033	4209	.071	.004	.002	4262	.033	.017	4263	.034	.001
	Linear	.260*			.261*				.180*			.181*			
	Quadratic				-.033							-.015			
Fearless Dominance	Intercept	.000	4281	.024	.009	4283	.024	.000	.001	4272	.026	-.010	4274	.027	.001
	Linear	-.074*			-.073*				-.078*			-.08*			
	Quadratic				-.002							.003			
Fearlessness	Intercept	-.002	4296	.014	.161*	4236	.054	.040	.001	4312	.000	.094*	4294	.014	.014
	Linear	.120*			.154*				.015			.033			
	Quadratic				-.163*							-.093*			
Stress Immunity	Intercept	.002	4184	.084	.010	4186	.085	.001	.003	4235	.050	.021	4236	.050	.000
	Linear	-.291*			-.290*				-.222*			-.219*			
	Quadratic				-.009							-.019			

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Social Potency	Intercept	-.001	4283	.023	-.021	4283	.024	.001	.000	4287	.017	-.024	4286	.018	.001
	Linear	-.152*			-.155*				-.130*			-.133*			
	Quadratic				.020							.024			

Note. PAI = Personality Assessment Inventory; DRG = Drug problems; ALC = Alcohol Problems; Mach Egocentricity = Machiavellian Egocentricity; *$p < .01$

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Table 3

Results of Regression Analysis for Psychopathy traits and Externalizing - PDQ ADULT and SCID ADULT

		PDQ ADULT							SCID ADULT						
		Step 1			Step 2				Step 1			Step 2			
PPI scale	Parameter	*b*	AIC	R^2	*b*	AIC	R^2	ΔR^2	*b*	AIC	R^2	*b*	AIC	R^2	ΔR^2
Coldheartedness	Intercept	-.005	4281	.016	-.074	4267	.026	.010	-.003	4192	.020	-.045	4188	.023	.003
	Linear	.125*			.136*				.139*			.147*			
	Quadratic				.069*							.041			
Self-centered Impulsivity	Intercept	-.030	3830	.269	-.125*	3792	.288	.019	-.015	3999	.139	-.017	4001	.139	.000
	Linear	.175*			.182*				.125*			.125*			
	Quadratic				.011*							.000			
Blame Externalization	Intercept	-.011	4195	.070	.006	4196	.070	.000	-.007	4163	.039	.018	4162	.040	.001
	Linear	.265*			.264*				.198*			.196*			
	Quadratic				-.018							-.025			
Carefree Nonplanfulness	Intercept	-.018	3970	.198	-.110*	3942	.214	.016	-.006	4059	.104	-.008	4061	.104	.000
	Linear	.447*			.458*				.321*			.321*			
	Quadratic				.093*							.002			
Rebellious Nonconformity	Intercept	-.018	4117	.116	-.009	4119	.117	.001	-.011	4117	.068	.015	4117	.069	.001
	Linear	.345*			.346*				.265*			.268*			
	Quadratic				-.009							-.026			
Machiavellian Egocentricity	Intercept	-.027	3878	.245	-.060	3873	.249	.004	-.015	4039	.116	.012	4037	.118	.002
	Linear	.502*			.498*				.346*			.348*			
	Quadratic				.034*							-.028			
Fearless Dominance	Intercept	-.005	4282	.015	.012	4283	.015	.000	-.002	4221	.000	.021	4221	.002	.002
	Linear	-.058*			-.056*				-.010			-.006			
	Quadratic				-.004							-.005			
Fearlessness	Intercept	-.004	4303	.001	.177*	4228	.051	.050	-.002	4212	.006	.155*	4157	.043	.037
	Linear	.038			.076*				.079*			.112*			
	Quadratic				-.188*							-.161*			
Stress Immunity	Intercept	-.012	4181	.078	-.009	4183	.078	.000	-.005	4173	.032	.021	4173	.033	.001
	Linear	-.281*			-.280*				-.180*			-.177*			
	Quadratic				-.003							-.027			

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Social Potency	Intercept	-.003	4305	.000	-.023	4305	.001	.001	-.002	4216	.004	-.029	4215	.005	.001
	Linear	-.009			-.012				.060*			.057			
	Quadratic				.020							.027			

Note. PDQ ADULT = Personality Diagnostic Questionnaire Antisocial Personality Disorder (ASPD); SCID ADULT = Structured Clinical Interview for DSM–IV Axis-II Personality Disorders Adult Antisocial Behavior ; *$p < .01$

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Table 4

Results of Regression Analysis for Psychopathy traits and Externalizing - PDQ CHILD and SCID CHILD

		PDQ CHILD							SCID CHILD						
		Step 1			Step 2				Step 1			Step 2			
PPI scale	Parameter	*b*	AIC	R^2	*b*	AIC	R^2	ΔR^2	*b*	AIC	R^2	*b*	AIC	R^2	ΔR^2
Coldheartedness	Intercept	-.004	4028	.031	-.095*	4004	.049	.018	-.010	3374	.040	-.064	3368	.046	.006
	Linear	.174*			.188*				.194*			.200*			
	Quadratic				.088*							.051*			
Self-centered Impulsivity	Intercept	-.041	3810	.167	-.087*	3805	.172	.005	-.044	3335	.070	-.086	3332	.074	.004
	Linear	.142*			.143*				.092*			.091*			
	Quadratic				.005*							.005			
Blame Externalization	Intercept	-.017	3987	.059	-.025	3988	.059	.000	-.019	3399	.019	-.022	3401	.019	.000
	Linear	.246*			.246*				.141*			.141*			
	Quadratic				.009							.003			
Carefree Nonplanfulness	Intercept	-.015	4000	.05	-.067	3994	.055	.005	-.010	3410	.010	-.034	3411	.011	.001
	Linear	.225*			.230*				.101*			.103*			
	Quadratic				.052*							.024			
Rebellious Nonconformity	Intercept	-.031	3890	.120	-.003	3889	.122	.002	-.040	3339	.066	-.015	3339	.068	.002
	Linear	.354*			.361*				.268*			.277*			
	Quadratic				-.030							-.027			
Mach Egocentricity	Intercept	-.036	3832	.155	-.061	3830	.157	.002	-.042	3319	.082	-.086*	3313	.088	.006
	Linear	.404*			.397*				.297*			.280*			
	Quadratic				.028							.048*			
Fearless Dominance	Intercept	-.003	4073	.000	.040	4069	.004	.004	-.005	3401	.017	.030	3400	.020	.003
	Linear	.010			.017				.064*			.069*			
	Quadratic				-.010							-.008			
Fearlessness	Intercept	-.008	4054	.014	.163*	3988	.059	.045	-.010	3410	.010	.101*	3387	.030	.020
	Linear	.122*			.173*				.106*			.135*			
	Quadratic				-.188*							-.125*			
Stress Immunity	Intercept	-.009	4049	.017	.015	4050	.018	.001	-.002	3422	.000	.016	3423	.001	.001
	Linear	-.131*			-.130*				.022			.022			
	Quadratic				-.025							-.019			

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Social Potency	Intercept	-.004	4069	.003	-.020	4070	.004	.001	-.006	3395	.023	-.026	3395	.024	.001
	Linear	.056*			.054				.148*			.146*			
	Quadratic				.016							.020			

Note. Mach Egocentricity = Machiavellian Egocentricity; PDQ CHILD = Personality Diagnostic Questionnaire Childhood ASPD; SCID CHILD = Structured Clinical Interview for DSM–IV Axis-II Personality Disorders Conduct Disorder; *$p < .01$

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Table 5

Results of Negative Binomial Regression Analysis for Psychopathy traits and Criminal Recidivism

		General Offense Arrest Count							Violent Offense Arrest Count						
		Step 1			Step 2				Step 1			Step 2			
PPI scale	Parameter	*b*	AIC	Pseudo-R^2	*b*	AIC	Pseudo-R^2	ΔPseudo-R^2	*b*	AIC	Pseudo-R^2	*b*	AIC	Pseudo-R^2	ΔPseudo-R^2
Coldheartedness	Intercept	-.010	3687	.027	-.038	3688	.028	.001	-3.059*	620	.022	-3.093*	602	.023	.001
	Follow up	.001*			.001*				.001			.001			
	Linear	-.002			.008				.225			.225			
	Quadratic				.026							.037			
PPI SCI	Intercept	-.005	3687	.028	-.013	3688	.028	.000	-3.067*	622	.012	-3.083*	605	.012	.000
	Follow up	.001*			.001*				.001			.001			
	Linear	.012			.013				-.013			-.011			
	Quadratic				.001							.002			
Blame Extern	Intercept	-.016	3683	.031	-.037	3685	.032	.001	-3.083*	621	.016	-2.915*	599	.031	.015
	Follow up	.001*			.001*				.001			.001			
	Linear	.078			.078				.156			.194			
	Quadratic				.022							-.218			
Caref Nonplan	Intercept	-.020	3686	.028	-.035	3688	.029	.000	-3.128*	620	.020	-3.167*	602	.021	.001
	Follow up	.001*			.001*				.001			.001			
	Linear	-.039			-.038				-.194			-.178			
	Quadratic				.018							.043			
Rebel Nonconf	Intercept	-.003	3687	.028	-.020	3688	.029	.001	-3.108*	621	.018	-3.194*	600	.027	.009
	Follow up	.001*			.001*				.001			.001			
	Linear	.033			.032				-.163			-.140			
	Quadratic				.024							.106			
Mach Ego	Intercept	-.009	3687	.028	.002	3689	.028	.000	-3.067*	622	.015	-3.098*	604	.015	.001
	Follow up	.001*			.001*				.001			.001			
	Linear	.032			.032				.128			.122			
	Quadratic				-.011							.031			
PPI FD	Intercept	-.012	3687	.028	.013	3688	.029	.001	-3.06*	622	.015	-3.009*	603	.016	.001
	Follow up	.001*			.001*				.001			.001			
	Linear	.015			.018				.060			.072			
	Quadratic				-.007							-.015			
Fearlessness	Intercept	-.010	3687	.028	.015	3688	.028	.000	-3.063*	623	.012	-3.153*	604	.014	.002
	Follow up	.001*			.001*				.001			.001			
	Linear	-.028			-.024				-.028			-.039			
	Quadratic				-.023							.078			
Stress Immunity	Intercept	-.010	3687	.027	.020	3688	.029	.001	-3.061*	622	.012	-3.01*	604	.014	.002

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	Follow up	.001*			.001*				.001			.001			
	Linear	.011			.015				.054			.065			
	Quadratic				-.039							-.077			
Social Potency	Intercept	-.018	3684	.030	-.028	3686	.031	.000	-3.069*	620	.022	-3.086*	602	.022	.000
	Follow up	.001*			.001*				.001			.001			
	Linear	.073			.069				.216			.208			
	Quadratic				.011							.021			

Note. Coldhearted = Coldheartedness; Blame Extern = Blame Externalization; Caref Nonplan = Carefree Nonplanfulness; Rebel Nonconf = Rebellious Nonconformity; Mach Ego = Machiavellian Egocentricity; Pseudo-R^2 value was calculated using McFadden's (1974) formula; rPseudo-R^2 indicates change in Pseudo-R^2 between linear and quadratic models; *$p < .01$.

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