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SYMPTOMS OF EXECUTIVE DYSFUNCTION ARE ENDEMIC TO SECONDARY PSYCHOPATHY: AN EXAMINATION IN CRIMINAL OFFENDERS AND NONINSTITUTIONALIZED YOUNG ADULTS

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Psychopathy is a heterogeneous personality disorder exhibiting deficits in passive avoidance, emotional processing, and arousal. In a mixed-gender group ($N = 293$) of undergraduates and prisoners, we examined the relationship of multiple indices of primary and secondary psychopathy to components of executive dysfunction as measured by the Frontal Systems and Behavior Scale (FrSBe; Grace & Malloy, 2001). After controlling for demographic variables, we found strong associations between psychopathy and components of executive dysfunction ($Rs = .55$ to .70). Primary psychopathy was negatively, whereas secondary psychopathy was positively, predictive of symptoms indicative of executive dysfunction. When indices of primary and secondary psychopathy and indices of executive functioning were jointly included in a factor analysis, a two-factor solution was obtained. Secondary psychopathy and all subscales of the FrSBe loaded on a single factor, whereas indices of primary psychopathy loaded solely on a second factor. These findings underscore the role of prefrontal circuitry in psychopathy, and specifically implicate executive dysfunction in secondary psychopathy.

Since Cleckley's (1941/1976) seminal monograph, psychopathy has been a personality disorder that has drawn increasing attention from researchers attempting to parse the construct. Karpman (1941) advocated two types. Primary psychopaths were characterized as callous, calculating, manipulative, and deceitful. In contrast, secondary psychopaths were hypothesized to suffer from a neurotic disorder that stimulates impulsive be-

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havior. Despite recently advanced three- (Cooke & Michie, 2001) and four- (Hare, 2003) factor models of psychopathy, factor analytic studies of the Psychopathy Checklist Revised (PCL-R; Hare, 1991) have generally supported a two-factor model. Similarly, factor analyses of psychopathy measures *not* directly based on the PCL-R have also yielded two basic dimensions (Benning, Patrick, Hicks, Blonigen, & Krueger, 2003; Blackburn, 1987). Although 3- and 4-factor models may have special import in the prediction of psychopathic behavior, we focus on the higher-order 2-factor model, which is most commonly represented in the literature. Overall, these findings for two components of psychopathy are consistent with the historical distinction between primary and secondary subtypes (Brinkley, Schmitt, Smith, & Newman, 2001; Newman, MacCoon, Vaughn, & Sadeh, 2005).

In efforts to understand the etiologies of the construct, investigators have focused on potential deficits in psychopathy (e.g., response modulation, Newman & Schmitt, 1998; semantic processing, Intrator, Hare, Stritzke, & Brichtswein, 1997; Kiehl et al., 2004; affective disturbance, Levenston, Patrick, Bradley, & Lang, 2000) and associations of these deficits with particular components of psychopathy (Patrick, Bradley, & Lang, 1993). Within a two-factor framework, the current study investigated components of psychopathy and executive functioning associated with the frontal lobes in a mixed sample of undergraduate and incarcerated men and women. Using multiple measures of primary and secondary psychopathy, we examined the relationship of psychopathy to the recently developed Frontal Systems and Behavior Scale (FrSBe; Grace & Malloy, 2001), a comprehensive measure of executive functioning which includes indices corresponding to the three major frontostriatothalamic circuits innervating the prefrontal lobes (Cummings, 1993).

RECENT ADVANCES IN THE SELF-REPORT ASSESSMENT OF PSYCHOPATHY

As the focus has turned toward the assessment of psychopathy in noninstitutionalized samples, self-report measures of the construct have improved. Two recently developed measures of psychopathy are the Levenson Self-Report Psychopathy Scale (LSRP; Levenson, Kiehl, & Fitzpatrick, 1995) and the Psychopathic Personality Inventory (PPI; Lilienfeld & Andrews, 1996). Inspired by criteria from the PCL-R, the LSRP primary psychopathy scale purports to assess a "selfish, uncaring, and manipulative posture towards others" (p. 152) whereas the LSRP secondary psychopathy scale was created to assess "impulsivity and a self-defeating life style" (p. 152; Levenson et al., 1995). A number of studies have demonstrated adequate reliability and validity for the LSRP (Brinkley et al., 2001; Lynam, Whiteside, & Jones, 1999; Ross, Lutz, & Bailley, 2004). The two-factor model of the LSRP appears fairly robust (Lynam et al., 1999) and total scores discriminate between psychopathic and nonpsychopathic offenders on passive avoidance tasks (Brinkley et al., 2001; Lynam et al., 1999).

Further, Brinkley et al. found that scores on LSRP primary and secondary psychopathy are related to Factors 1 and 2 of the PCL-R and are associated with violent but not nonviolent criminal activity in offenders. Finally, low Agreeableness was related to both LSRP subscales, whereas Conscientiousness demonstrated substantial associations only with LSRP secondary psychopathy (Ross et al., 2004), as hypothesized by Lynam and Widiger (1998) for psychopathy (specifically, the PCL-R) in the Five Factor Model (FFM) of personality.

In contrast, the authors of the PPI made a broader, more inclusive attempt to represent theoretically-relevant constructs from the psychopathy literature. Although the PPI total score has been shown to index psychopathy (Sandoval, Hancock, Poythress, Edens, & Lilienfeld, 2000), Benning et al. (2003) found that the eight subscales of the PPI may be parsed into at least two factors: PPI-I (fearless dominance) and PPI-II (impulsive antisociality). These factors show good discriminant validity. Fearless dominance is associated with adult symptoms of antisocial personality disorder, higher socioeconomic status, low anxiety, and enjoyment of physically dangerous activities (Benning et al., 2003). In contrast, impulsive antisociality is associated with both child and adult symptoms of antisocial behavior, substance abuse and dependence symptoms, lower socioeconomic status and verbal IQ, and high levels of aggression (Benning et al., 2003). Similar to the LSRP, both PPI factors also demonstrate good convergent validity in the FFM by their relationships with low Agreeableness (Ross, Benning, Patrick, Thompson, & Thurston, under review), the latter of which appears to represent the FFM *core* of psychopathy (Lynam & Widiger, 1998).

Further, efforts to represent personality disorders in terms of the FFM have recently resulted in prototype models based on facet scales of the Revised NEO Personality Inventory (NEO-PI-R; Costa & McCrae, 1992; Miller, Lynam, Widiger, & Leukefeld, 2001). Miller et al. (2001) asked experts in psychopathy to complete ratings of the psychopathic prototypicality of each of the 30 facets of the NEO-PI-R. In this prototype, psychopathy was related to each facet of low Agreeableness, and it showed selective relations with specific facets of other FFM domains. FFM prototype scores demonstrated expected relationships to symptoms of internalizing disorders (–), externalizing disorders (+), and antisocial personality disorder (+; Miller et al., 2001). In addition, scores reflecting the degree of correspondence between each person's NEO-PI-R profile and the expert-generated psychopathy prototype correlated .46 with LSRP total scores. Correspondence with the expert psychopathy prototype was also related to higher levels of aggression and impulsivity on experimental tasks (Miller & Lynam, 2003).

FRONTAL DEFICITS IN PSYCHOPATHY

From a descriptive to an explanatory approach, numerous theories have been advanced to determine the deficits responsible for increased antiso-

cial and violent behavior in psychopaths. To this end, one group of theorists has attempted to locate psychopathy within a compromised nervous system. Gorenstein (1982) hypothesized that frontal lobe damage may give rise to many of the classic behavioral symptoms of psychopathy, including the inability to plan ahead and learn from mistakes. Indeed, lesions to the ventromedial prefrontal cortex produce behavioral and physiological deficits consistent with those observed in psychopathy (Damasio, Tranel, & Damasio, 1990). However, support for this hypothesis has been less forthcoming for global psychopathy scores (Hart, Forth, & Hare, 1990). One reason for this surprising null finding may be that the two factors of psychopathy have different, or even opposing, relationships with frontal lobe functioning. Similar to differing relations between PPI factors of fearless dominance and impulsive antisociality with verbal IQ (Benning et al., 2003), secondary psychopathy represented by impulsive antisociality may be negatively related to frontal lobe functioning (cf. Morgan & Lilienfeld, 2000), whereas primary psychopathy reflected in fearless dominance may be unrelated to frontal lobe functioning. Some evidence for a similar dissociation in psychopathy comes from Yang et al. (2005). Separating psychopathic individuals into "unsuccessful" (incarcerated high PCL-R offenders) and "successful" (not incarcerated high approximate PCL-R scorers) groups, Yang et al. found a 22% reduction in prefrontal gray matter volume for unsuccessful psychopaths. Other recent neuro-imaging studies also provide support for the involvement of the prefrontal cortex in psychopathy (Birbaumer et al., 2005; Kiehl et al., 2001; Soderstrom et al., 2002). However, these results have been mixed. For example, Kiehl et al. (2001) points to under-arousal in limbic structures and over-excitation of the prefrontal cortex. Other studies have found *hypo*activity in the prefrontal cortex; however, these studies have either used only violent offenders as participants (Soderstrom et al., 2002) or included confounds by comparing criminal psychopaths with nonincarcerated controls (see Birbaumer et al., 2005; Blair, Mitchell, & Blair, 2005). Including a broader base of participants representing the full continuum of psychopathy may help to remedy threats to external validity in examining the association between executive functioning and psychopathy.

THE FRONTAL SYSTEMS & BEHAVIOR SCALE (FrSBe)

Although neuroimaging provides the most epistemologically sound method for measuring frontal lobe dysfunction, the costs of obtaining this data in large-scale studies is currently prohibitive. Instead, the bulk of investigations using neuroimaging have been low-powered, based on small samples. Though not optimal, measures of executive functioning that rely on self-report could allow for high-powered investigations of the frontal lobe hypothesis in psychopathy. Similar to the rendering of Gray's psychophysiological constructs into self-report form (see Carver & White, 1994), Grace and Malloy (1999) developed the Frontal Systems and Behavior Scale (FrSBe) in an effort to parse the functions of the frontal lobes, based on

previously established correlates for three primary circuits innervating the prefrontal cortex (Cummings, 1993). Barring direct neuroimaging data, the psychometrics of the FrSBe are strong and exceed those of other self-report scales designed to measure functional aspects of the frontal lobes (see Malloy & Grace, 2005, for a review). Supporting the internal validity of the FrBSe, Stout, Ready, Grace, Malloy, and Paulsen (2003) report strong evidence for the three-factor model of the FrSBe in a large neurologic sample. Additionally, the FrSBe accurately discriminates among patients with frontal lobe damage, patients with anterior lesions, and healthy controls (Grace, Stout, & Malloy, 1999). Furthermore, recent studies support the validity of the FrSBe in the prediction of neuropsychological functioning in patients with multiple sclerosis (Chiaravolloti & DeLuca, 2003) and schizophrenia (Velligan, Ritch, Sui, DiCocco, & Huntzinger, 2002), in dysregulation involved in eating disorders (Spinella & Lyke, 2004), and in determining dementia severity in Alzheimer's patients (Ready, Ott, Grace, & Cahn-Weiner, 2003). Earlier, Paulsen et al. (1996) found that the three FrSBe subscales effectively discriminated between subcortical and cortical dementia; classification accuracy paralleled neuropsychological tests and correctly identified 79% of patients with Huntington's Disease and 92% of patients with Alzheimer's Disease (AD). In addition, discriminant validity for the subscales of the FrSBe appears promising. For example, the Apathy subscale correlates with depression items reflecting loss of interest and motivation, but not negative mood (Ready et al., 2003) or total scores on the Geriatric Depression Scale (Cahn-Weiner, Grace, & Ott, 2002). Additionally, the Disinhibition subscale is selectively elevated in AD patients with psychotic symptoms and predicts caregiver burden in AD (Paulsen et al., 1996). Spinella (2003) also found that polysubstance users demonstrate higher elevations on the Disinhibition subscale compared with non-polysubstance users.

CURRENT STUDY

In a mixed sample of male and female prisoners and young adults, we examined the association of psychopathy subtypes with components of prefrontal circuity as theorized by Cummings (1993). We used multiple measures of primary and secondary psychopathy to represent these respective constructs; similarly, we represented the multi-factorial structure of executive functioning using the FrSBe. Given the varied literature speaking to the role of executive dysregulation in psychopathy, we expected to find differential relationships between primary and secondary psychopathy, with global executive functioning. Studies have linked impulsive, reactive offenders to reduced frontal lobe activity (Broomhall, 2005; Raine et al., 1998). Consequently, we expected generally strong associations with secondary psychopathy. Specifically, we hypothesized positive relationships between indices of secondary psychopathy (e.g., PPI impulsive antisociality, LSRP secondary psychopathy) and the FrSBe. For

FrSBe subscales, positive associations of Apathy with LSRP secondary psychopathy and PPI impulsive antisociality were also expected. In contrast, consistent with connections of primary psychopathy to perhaps a more successful dimension (see Hall & Benning, 2006), we expected to find null or negative relationships for PPI-I (fearless dominance) and the LSRP primary psychopathy scale with subscales of the FrSBe. Additionally, we believed that FrSBe Executive Dysfunction and Disinhibition would be more specific to indices of secondary psychopathy (e.g., LSRP secondary psychopathy scale and PPI impulsive antisociality), especially when controlling for other psychopathy dimensions.

METHOD

PARTICIPANTS

One hundred thirty-four students attending a small Midwestern liberal arts university and 169 offenders from medium security state correctional facilities comprised the total sample. Participants were excluded if they had a Variable Response Inconsistency ($n = 14$) or Deviant Response ($n = 4$) score more than 3 *Sds* above the mean for the pooled sample, leaving a total of 293 participants (38 male students, 96 female students; 88 male prisoners, 71 female prisoners). For students, the average age was 20.8 ($Sd = 6.2$) years; racial composition was Caucasian (74.4%), African-American (11.2%), Latino (3.8%), Native American (6.8%), or Other (3.8%). Median reported family income was in the $60,000 to $80,000 range; across participants, the median educational level for both father and mother was a bachelor's degree. In offenders, the average age was 35.4 ($Sd = 9.6$) years; racial composition was Caucasian (68.6%), African-American (21.4%), Latino (1.9%), Native American (3.1%), or Other (5.0%). Median reported family income was in the $20,000 to $40,000 range; across participants, the median educational level for both father and mother was a GED. All participants received all of the measures listed below.

MEASURES

Psychopathic Personality Inventory (PPI). The PPI was developed by Lilienfeld and Andrews (1996) as a self-report measure to assess the core personality traits of psychopathy. It consists of 187 items answered using a four-point Likert scale ranging from 1 (false) to 4 (true). The PPI yields a total psychopathy index, as well as scores on eight subscales (e.g., Blame Externalization, Machiavellian Egocentricity). The PPI also includes three validity scales: the Deviant Responding Scale, the Unlikely Virtues Scale, and the Variable Response Inconsistency Scale. Lilienfeld and Andrews (1996) have reported high internal consistency for the PPI total score, ranging from .89 to .93. Internal consistency for the eight PPI subscales ranged from .70 to .90 (Lilienfeld & Andrews, 1996). In the current study, coefficient alpha for the PPI total score was .94, and coefficients for PPI

subscales ranged from .80 for Coldheartedness to .90 for Machiavellian Egocentricity. Because we were interested in the higher-order factors of the PPI as representations of primary and secondary psychopathy, we focused on the first two factors of the PPI (e.g., PPI-I or fearless dominance and PPI-II or impulsive antisociality), but included Coldheartedness for comparison.

Levenson Self-Report Psychopathy (LSRP) Scales (Levenson et al., 1995). The LSRP was developed to assess psychopathic attitudes and beliefs via self-report. Twenty-six items comprise two subscales designed to measure both factors of the PCL-R in noninstitutionalized young adults. The primary psychopathy subscale consists of 16 items measuring an inclination to lie, lack of remorse, callousness, and manipulativeness (sample item = "I enjoy manipulating other people's feelings"). Coefficient alpha for the current sample was .85. The secondary psychopathy subscale consists of 9 items measuring impulsivity, frustration tolerance, quick-temperedness, and lack of long-term goals (sample item = "I find myself in the same kinds of trouble, time after time"). Coefficient alpha in the current sample was .71.

FFM Psychopathy Prototype (Miller et al., 2001). Because each participant also completed the Revised NEO Personality Inventory (Costa & McCrae, 1992), we were able to determine the Psychopathy Resemblance Index (PRI) based on expert prototype ratings of NEO-PI-R facets for the psychopathy construct. In this study, the resemblance of each participant's NEO-PI-R profile to Miller et al.'s (2001) facet-level FFM prototype for psychopathy was calculated as a Q-correlation. To center FFM facet scores around the midpoint of each scale, scores on each facet for the FFM psychopathy prototype were rescaled to range from −2 to 2 by subtracting 2 from the values reported in Miller et al. (2001), then multiplied by 8 to account for the number of items on each NEO-PI-R facet, yielding a final score ranging from −16 to +16. Accordingly, 24 was subtracted from participants' scores on each facet of the NEO-PI-R to rescale them to range between −16 to +16. The sum of the squared differences between each participant's rescaled scores on each NEO-PI-R facet and the rescaled score on that facet for the FFM psychopathy prototype were then computed to be the numerator of a disparity fraction. The squared differences of each participant's score from the midpoint on each NEO-PI-R facet were summed, as were the squared differences of each facet-level score of the FFM psychopathy prototype from the midpoint on each NEO-PI-R facet. The sum of these two quantities was then used as the denominator of the disparity fraction. The value of the disparity fraction was then subtracted from 1 to obtain the Q correlation, which ranges from −1 to +1 (Brown, 1993). Scores on this index of psychopathy ranged from −.36 to .63 in this sample (median for prisoners = −.26; median for students = −.18).

Frontal Systems And Behavior Scale (FrSBe; Grace & Malloy, 2001). The FrSBe is a 46-item inventory that assesses personality and behavioral characteristics associated with frontal lobe damage. Item responses are on

a 5-point Likert scale ranging from *almost never* to *almost always*. The total score is a composite of three subscales: Apathy (14 items; e.g., "Sits around doing nothing"), Disinhibition (15 items; e.g., "Talks out of turn"), and Executive Dysfunction (17 items; e.g., "Is disorganized")—which putatively correspond to functioning associated with the anterior cingulate, lateral orbital, and dorsolateral prefrontal circuits, respectively (Cummings, 1993). Coefficient alphas in the current sample were .77 for Apathy, .75 for Disinhibition, and .81 for Executive Dysfunction.

PROCEDURE

Participants from two state penitentiaries were randomly selected from a pool generated by prison administrators. Offenders had been screened for reading ability above the 8th grade, a self-reported history for absence of significant head trauma (loss of consciousness >1 hour) and neurologic disease (e.g., multiple sclerosis, lupus, and stroke), and were contacted by prison officials and asked to participate. For those who agreed, small group testing sessions were conducted, ranging from 15 to 30 offenders. Participants completed a battery of measures, including a demographics sheet, the NEO-PI-R, LSRP, FrSBe, and PPI, in that order. As remuneration, offender participants were given a pizza lunch for their time. Student participants were recruited from undergraduate psychology courses. All were similarly administered the same battery of tests in small groups of 15 to 35. Student participants received co-curricular credit, extra credit in psychology or biology classes, and/or a pizza lunch. The study was approved by IRBs at both the university and state correctional levels.

DATA ANALYSIS

Zero-order correlations for demographic variables and psychopathy indices with FrSBe total and three subscales were computed. Primary psychopathy was represented by the LSRP primary psychopathy scale and PPI-I (fearless dominance). Secondary psychopathy was represented by the LSRP secondary psychopathy scale and PPI-II (impulsive antisociality). In addition, we included the FFM-Psychopathy Resembance Index (FFM-PRI) as a measure of global psychopathy. For the PPI, we computed scores on the two factors (inter-factor $r = .15$, $p > .005$) according to the approach described in Benning et al. (2003) and used these factor scores in our primary analyses for fearless dominance (PPI-I) and impulsive antisociality (PPI-II). Specifically, the subscales that loaded most strongly on one PPI factor or the other were standardized using a *z*-transformation and summed to yield a composite score for each participant on each factor. For the purposes of demonstrating discriminant validity in this sample, the Coldheartedness scale from the PPI was also included in correlational analyses with the FrSBe subscales. Because Coldheartedness indexes an unsentimental and detached interpersonal attitude, we hypothesized it

would have a selective positive relationship with FrSBe—Apathy. To determine the unique associations of individual psychopathy indices with FrSBe subscales, multiple regression analyses were conducted. Using hierarchical regression, demographic variables were included in the first block, followed by psychopathy indices in the second block, to predict each FrSBe subscale and total score. Finally, a factor analysis of all psychopathy and FrSBe variables was conducted to further determine the relationship of components of psychopathy with symptoms of frontal lobe dysfunction.

RESULTS

Zero-order correlations for all demographic variables and psychopathy indices are reported in Table 1. With respect to demographic variables, only gender demonstrated relationships with the FrSBe disinhibition subscale. However, psychopathy indices were robustly related to components of executive functioning. In particular, positive correlations were found for PPI impulsive antisociality, LSRP primary and secondary psychopathy, and the FFM-PRI, with all FrSBe subscales and total score. Similarly, total scores for the PPI and LSRP were positively related to all FrSBe subscales. PPI Coldheartedness was unrelated to any FrSBe subscale. Additionally, PPI fearless dominance was negatively related to most indices from the FrSBe.

TABLE 1. Correlations of FrSBe Subscale and Total Scores with Demographic and Psychopathy-Related Variables

Variable	FrSBe Apathy	FrSBe Disinhibition	FrSBe Executive Control	FrSBe Total
Demographics				
Group	−.11	.12	.06	.03
Age	−.11	−.16	.12	−.16
Gender	.07	.23*	.07	.15
Father's education	.11	−.02	−.01	.03
Mother's education	.05	−.03	.03	.02
Income	−.03	−.04	−.09	−.06
Psychopathy Indices				
Psychopathic Personality Inventory (PPI)				
PPI-I: Fearless Dominance	−.29**	.17	−.18	−.11
PPI-II: Impulsive Antisociality	.37**	.69**	.64**	.67**
PPI: Coldheartedness	.09	.11	.05	.09
PPI—Total	.12	.61**	.38**	.45**
Levenson Self-Report Psychopathy (LSRP)				
LSRP—Primary psychopathy	.18	.47**	.32**	.39**
LSRP—Secondary psychopathy	.42**	.57**	.63**	.66**
LSRP—Total	.32**	.60**	.52**	.58**
Five-Factor Model				
Psychopathy Resemblance Index	−.07	.42**	.19	.22*

Note. Group was coded as 0 = university students, 1 = prisoners; gender was coded as 0 = female, 1 = male. *FrSBe* = Frontal Systems & Behavior Scale. *$p < .001$, **$p < .0001$. Bonferroni correction $p < .0008$.

In order to evaluate the unique and collective contributions of demographic variables and psychopathy indices in the prediction of FrSBe scores, hierarchical multiple regression (MR) was used where demographics were included in the first step, followed by psychopathy indices in the second step. Because parental education and Coldheartedness were uncorrelated with any FrSBe index, they were excluded from further analyses. In MR, demographic variables proved to be more potent predictors of FrSBe subscales than when considered separately as zero-order correlations (see Table 2). Although gender was important only in the prediction of FrSBe total and FrSBe Disinhibition scores, age, group, and income achieved significance in 3 out of 4 equations. Demographic variables collectively accounted for 4% to 14% of the variance across FrSBe indices. Nonetheless, psychopathy indices carried the lion's share of variance in predicting executive functioning. Whereas PPI impulsive antisociality and LSRP secondary psychopathy were positively predictive of all FrSBe subscales and total score, LSRP primary psychopathy was not predictive of any FrSBe scores, and PPI fearless dominance retained significant, negative power in the prediction of apathy and executive functioning. However, in contrast to zero-order correlations, the FFM-PRI made only a modest

TABLE 2. Hierarchical Multiple Regression Results of Demographic Variables Entered in Step One and Psychopathy Factor and Subscales in Step Two Predicting FrSBe Indices

Variable	FrSBe Apathy	FrSBe Disinhibition	FrSBe Executive Control	FrSBe Total
Step One: *Demographics*				
Group	−.18+ (−.26**)	.29** (.03)	.15+ (−.02)	.12 (−.11)
Age	−.09 (.02)	−.40**	−.34**	−.34**
	−.09 (.02)	−.40** (−.17**)	−.34** (−.16+)	−.34** (−.13+)
Gender	.11 (.09)	.18* (−.02)	.04 (−.04)	.14+ (.03)
Income	−.17+ (−.04)	−.08 (.02)	−.18+ (−.03)	−.16+ (−.01)
R =	.20+	.38**	.27**	.30**
R^2 =	.04+	.14**	.07**	.09**
Step Two: *Psychopathy Indices*				
Psychopathic Personality Inventory (PPI)				
PPI-I: Fearless Dominance	−.20*	.03	−.25**	−.13+
PPI-II: Impulsive Antisociality	.34**	.47**	.51**	.48**
Levenson Self-Report Psychopathy (LSRP)				
LSRP—Primary psychopathy	.01	.03	−.10	−.03
LSRP—Secondary psychopathy	.25**	.21**	.30**	.36**
Five-Factor Model Psychopathy Resemblance Index	−.16+	.09	.07	−.01
$R\Delta$ =	.55**	.62**	.69**	.70**
$R^2\Delta$ =	.30**	.38**	.48**	.49**

Note. Group was coded as 0 = university students, 1 = prisoners; gender was coded as 0 = female, 1 = male. Beta weights are reported for all variables by step number; beta weights in parentheses for variables in step 1 are reported when included with step 2 in the full model. +$p < .05$. *$p < .005$, **$p < .001$.

contribution to the prediction of FrSBe subscales when included with other psychopathy indices in MR equations.

Finally, in order to determine the discriminability of frontal lobe symptoms from psychopathic characteristics, subscales of the FrSBe and components of psychopathy were included in a factor analysis. Using principal axis factoring, a two-factor solution was obtained with eigenvalues of 3.82 and 1.96 for the first and second factors; .60 and .53 for 3rd and 4th factors. Two factors were retained and rotated using promax; the first factor accounted for 43.7% and the second factor 19.8% of the covariance. The correlation between the two factors was .31, $p < .001$. Factor loadings are reported in Table 3. All FrSBe subscales in addition to PPI impulsive antisociality and LSRP secondary psychopathy loaded on the first factor. The FFM-PRI, followed by PPI fearless dominance, LSRP primary psychopathy, and PPI Coldheartedness loaded on the second factor.

DISCUSSION

The current study highlights the role of executive functioning in psychopathy, selectively implicating secondary psychopathy in the manifestation of executive dysfunction. Although global psychopathy was robustly associated with indices of the FrSBe, measures of secondary psychopathy were clearly most potently related to symptoms of frontal dysregulation. Conversely, indices of primary psychopathy—specifically, fearless dominance, may index a protective factor against executive dysfunction. Indeed, the opposing relations that primary psychopathy as indexed by fearless domi-

TABLE 3. Results of PAF Analyses for FrSBe Subscales and Psychopathy Factor Scales ($N = 291$)

	Two-Factor Solution	
Scale	**A**	**B**
Executive Functioning		
FrSBe—Apathy	**.71**	−.33
FrSBe—Disinhibition	**.65**	.23
FrSBe—Executive Dysfunction	**.93**	−.19
Primary Psychopathy		
PPI-I: Fearless Dominance	−.31	**.73**
LSRP Primary Psychopathy	.35	**.51**
FFM—Psychopathy Resemblance Index	.01	**.95**
Secondary Psychopathy		
PPI-II: Impulsive Antisociality	**.73**	.32
LSRP Secondary Psychopathy	**.77**	.00
PPI Coldheartedness	.00	**.47**

Note. Factor loadings > = .4 are presented in boldface. *PAF* = Principal axis factoring. *FrSBe* = Frontal Systems & Behavior Scale. FFM = Five-Factor Model. *LSRP* = Levenson Self-Report Psychopathy. *PPI* = Psychopathic Personality Inventory.

nance, and secondary psychopathy exhibit with respect to executive functioning, may explain the inconsistency in findings of executive dysfunction in global psychopathy (Gorenstein, 1982; Hare, 1984).

Findings implicating secondary psychopathy and disruption of the frontal lobes are most consistent with observations of frontal hypoactivity in psychopathy (Birbaumer et al., 2005; Blair, Mitchell, & Blair, 2005; Soderstrom et al., 2002). As pointed out earlier, these studies included criminal or violent psychopathic offenders, which would more closely correspond to secondary psychopathy in the current study. Consequently, failure to inhibit inappropriate impulses and impaired planning may represent decreased frontal lobe functioning in secondary psychopaths (or antisocial offenders, in incarceration). In contrast, findings by Kiehl et al. (2001) implicate a primary emotional disturbance (amygdaloid dysregulation) in which frontal lobes compensate, in part, to inhibit these impulses (frontal *hyper*activity). Although restricted to violent offenders, Broomhall (2005) found that primarily reactive (impulsive) offenders were impaired on measures of executive functioning compared to primarily instrumental (selectively impulsive) offenders. Similarly, Raine et al. (1998) found that frontal dysfunction was specific to reactive rather than instrumental murderers. Raine and Yang (2006) comment on these findings saying, "While predatory, controlled murderers may have sufficient prefrontal regulation to control the excess aggressive feelings generated subcortically, this inhibitory control may be lacking in . . . impulsive murderers" (p. 282). Similarly, psychopathic behavior in primary psychopaths may arise from a basic emotional deficit, consistent with the affective features of factor 1 on the PCL-R. In contrast to secondary psychopathy, primary psychopaths may be better able to inhibit maladaptive impulses. Though speculative, to the extent that both lowed IQ and overall impulsivity are associated with antisociality (Lynam, Moffitt, & Stouthamer-Loeber, 1993), executive dysfunction may be a third variable associated with both IQ (Duncan, 2005) and impulsivity (Goyer, Andreason, Semple, & Clayton, 1994; Lynam et al., 1993) that contributes to social maladjustment (Andersen, Damasio, Tranel, & Damasio, 2001), and failures at self-control arising in antisocial behavior (Lynam & Henry, 2001). Consistent with Karpman's view of secondary psychopathy as representing associated (neither necessary *nor* sufficient) features of psychopathy and arising from an impulsive disorder, it may be that secondary features (disinhibition reflected in reduced frontal activity) interact with core emotional deficits (low fear reflecting, in part, amygdaloidal dysfunction) in otherwise primary psychopathy. Consequently, secondary psychopathic features may reflect increased disinhibition (reduced frontal activity) putting psychopaths at greater risk (in a moderational relationship) for developing overt antisocial behavior. These findings are consistent with Patrick's (in press) dual-deficit model of low fear-potentiated startle in PCL-R factor 1 (primary) and impaired self-regulation deficits resulting in impulsivity in PCL-R factor 2 (secondary) psychopathy.

Of psychopathic indices, Coldheartedness was unrelated to the Apathy subscale of the FrSBe. These findings suggest that Coldheartedness may be fairly specific in measuring emotional disattachment, rather than lack of motivation, in psychopathy. Although Coldheartedness is unrelated to fearless dominance and does not share its external correlates (Benning et al., 2003), this scale loaded solely on the primary psychopathy factor. Consistent with the affective criteria composing factor 1 of the PCL-R, the emotional deficits ascribed to psychopathy appear to be specific to primary psychopathy. Further, our findings suggest that emotional deficits may be only weakly linked to executive dysfunction, consistent with Spinella (2005) showing a modest effect for reduced empathy associated with executive functioning as measured by the FrSBe in community-dwelling adults (Spinella, 2005). In contrast, decreased executive functioning in secondary psychopaths may represent more of a cognitive than an affective deficit. Jutai and Hare (1983) proposed the hypothesis that psychopaths are overly distracted by peripheral events when attending to stimuli of immediate interest. More specifically, divided attention tasks show that psychopaths have difficulty attending to the peripheral or contextual features of a compound stimulus (Kosson, 1996, 1998). These types of complex attentional disturbances seem to reflect disruption of executive processes, further corroborating the link between (secondary) psychopathy and executive dysfunction.

Factor analysis was particularly useful in demonstrating the proximity of executive functioning and secondary psychopathy. Although the factor representing secondary psychopathy and frontal lobe symptoms was moderately associated with primary psychopathy on a second factor, executive functioning was clearly separable from primary psychopathy. Furthermore, the problem of *method variance* that plagues factor analyses involving different measurement techniques was not an issue in this study. Because we used similar methods to measure both sets of constructs (e.g., frontal lobe symptoms and psychopathic features), the factors that we obtained likely represent different sets of psychological constructs, rather than distinct methods of measuring the same constructs. Unexpectedly, LSRP primary psychopathy demonstrated moderate positive relationships with the FrSBe subscales and total score, and came close (.35) to loading notably on the secondary psychopathy factor. Despite previous studies showing adequate discriminant validity for the LSRP, the primary psychopathy scale may be contaminated by a substantial portion of variance shared with the construct of secondary psychopathy. Future studies should include a wider variety and number of psychopathy measures in order to determine the generalizability of the current findings.

Although testing hypotheses for components of psychopathy and frontal lobe dysfunction would have been highly preferable using neuroimaging, these large-scale studies are not practically possible. Instead, the current study is unique in that it (1) examined subcomponents of psychopathy in relation to components of executive dysfunction, (2) treated psychopathy

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REFERENCES

Andersen, S. W., Damasio, A quelae of pr quired in mental Neur

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Benning, S. D., P Blonigen, I (2003). Fact pathic Pers and implica ment. *Psyc* 340–350.

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as a continuous variable as well as included extremes on the dimension, and, (3) used a multi-factorial approach to the assessment of frontal lobe functioning. These findings underscore the close relationship between frontal lobe symptoms and secondary psychopathy, pointing to the selective role of secondary psychopathy in predicting disruption of multiple aspects of prefrontal functioning.

REFERENCES

Andersen, S. W., Damasio, H., Tranel, D., & Damasio, A. (2001). Long-term sequelae of prefrontal cortex damage acquired in early childhood. *Developmental Neuropsychology, 18,* 281–296.

Benning, S. D., Patrick, C. J., Blonigen, D. M., Hicks, B. M., & Iacono, W. G. (2005). Estimating facets of psychopathy from normal personality traits: A step toward community-epidemiological investigations. *Assessment, 12,* 3–18.

Benning, S. D., Patrick, C. J., Hicks, B. M., Blonigen, D. M., & Krueger, R. F. (2003). Factor structure of the Psychopathic Personality Inventory: Validity and implications for clinical assessment. *Psychological Assessment, 15,* 340–350.

Birbaumer, N., Veit, R., Lotze, M., Erb, M., Hermann, C., Grodd, W., & Flor, H. (2005). Deficient fear conditioning in psychopathy: A functional magnetic resonance imaging study. *Archives of General Psychiatry, 62,* 799–805.

Blackburn, R. (1987). Two scales for the assessment of personality disorder in antisocial populations. *Personality and Individual Differences, 8,* 81–93.

Blair, J., Mitchell, D., & Blair, K. (2005). *The psychopath: Emotion and the brain.* Victoria, Austria: Blackwell Publishing.

Brinkley, C. A., Schmitt, W. A., Smith, S. S., & Newman, J. P. (2001). Construct validation of a self-report psychopathy scale: Does Levenson's self-report psychopathy scale measure the same constructs as Hare's psychopathy checklist-revised? *Personality and Individual Differences, 31,* 1021–1038.

Broomhall, L. (2005). Acquired sociopathy: A neuropsychological study of executive dysfunction in violent offenders. *Psychiatry, Psychology, and Law, 12,* 367–378.

Brown, S. R. (1993). A primer on Q methodology. *Operant Subjectivity, 16,* 91–138.

Cahn-Weiner, A. A., Grace, J., & Ott, B. R. (2002). Cognitive and behavioral features discriminate between Alzheimer's and Parkinson's disease. *Neuropsychiatry, Neuropsychology, and Behavioral Neurology, 15,* 79–87.

Carver, C. S., & White, T. L. (1994). Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS scales. *Journal of Personality and Social Psychology, 67,* 319–334.

Cleckley, H. (1941/1976). *The mask of sanity* (5th ed.). St. Louis, MO: Mosby.

Cooke, D. J., & Michie, C. (2001). Refining the construct of psychopathy: Towards a hierarchical model. *Psychological Assessment, 13,* 171–188.

Costa, P. T., & McCrae, R. R. (1992). *NEO PI-R professional manual.* Lutz, FL: PAR.

Chiaravolloti, N. D., & DeLuca, J. (2003). Assessing the behavioral consequences of multiple sclerosis: An application of the Frontal Systems Behavior Scale (FrSBe). *Cognitive & Behavioral Neurology, 16,* 54–67.

Cummings, J. L. (1993). Frontal-subcortical circuits and human behavior. *Archives of Neurology, 50,* 873–880.

Damasio, A. R., Travel, D., & Damasio, H. C. (1990). Individuals with sociopathic behavior caused by frontal damage fail to respond autonomically to social stimuli. *Behavioural Brain Research, 41,* 81–94.

Deckel, A. W., Hesselbrock, V., & Bauer, L. (1996). Antisocial Personality Disorder, childhood delinquency, and frontal brain functioning: EEG and neuropsychological findings. *Journal of Clinical Psychology, 52,* 639–650.

Duncan, J. (2005). Frontal lobe function and general intelligence: Why it matters. *Cortex, 41,* 215–217.

Gorenstein, E. E. (1982). Frontal Lobe Functions in Psychopaths. *Journal of Abnormal Psychology, 91,* 368–379.

Goyer, P. F., Andreason, P. J., Semple, W. E., & Clayton, A. H. (1994). Positron-emission tomography and personality disorders. *Neuropsychopharmacology, 10,* 21–28.

Grace, J., & Malloy, P. F. (2001). *Frontal Systems Behavior Scale: Professional manual.* Lutz, FL: PAR.

Hall, J., & Benning, S. D. (2006). The "Successful Psychopath". In C. J. Patrick (Ed.) *Handbook of psychopathy* (pp. 459–494). New York: Guilford Press.

Hare, R. D. (1984). Performance of psychopaths on cognitive tasks related to frontal lobe function. *Journal of Abnormal Psychology, 93,* 133–140.

Hare, R. D. (1991). *Manual for the Hare Psychopathy Checklist-Revised.* Toronto, Ontario, Canada: Multi-Health Systems.

Hare, R. D. (2003). *The Hare Psychopathy Checklist—Revised* (2nd Edition). Toronto, Ontario: Multi-Health Systems.

Hart, S. D., Forth, A. F., & Hare, R. D. (1990). Performance of criminal psychopaths on selected neuropsychological tests. *Journal of Abnormal Psychology, 99,* 374–379.

Intrator, J., Hare, R., Stritzke, P., & Brichtswein, K. (1997). A brain imaging (SPECT) study of semantic and affective processing in psychopaths. *Biological Psychiatry, 42,* 96–103.

Jutai, J. W., & Hare, R. D. (1983). Psychopathy and selective attention during performance of a complex perceptual-motor task. *Psychophysiology, 20,* 146–151.

Karpman, B. (1941). On the need of separating psychopathy into two distinct clinical types: The symptomatic and the idiopathic. *Journal of Criminal Psychopathology, 3,* 112–137.

Kiehl, K. A., Smith, A. M., Hare, R. D., Mednrek, A., Forster, B., Brink, J., & Liddle, P. (2001). Limbic abnormalities in affective processing by criminal psychopaths as revealed by functional magnetic resonance imaging. *Biological Psychiatry, 50,* 677–684.

Kiehl, K. A., Smith, A. M., Mendrek, A., Forster, B. B., Hare, R. D., & Liddle, P. F. (2004). Temporal lobe abnormalities in semantic processing by criminal psychopaths as revealed by functional magnetic resonance imaging. *Psychiatry Research: Neuroimaging, 130,* 297–312.

Kosson, D. S. (1996). Psychopathy and dual-task performance under focusing conditions. *Journal of Abnormal Psychology, 105,* 391–400.

Kosson, D. S. (1998). Divided visual attention in psychopathic and nonpsychopathic offenders. *Personality and Individual Differences, 24,* 373–391.

Levenson, M. R., Kiehl, K. A., & Fitzpatrick, C. M. (1995). Assessing psychopathic attributes in a noninstitutional population. *Journal of Personality and Social Psychology, 68,* 151–158.

Levenston, G. K., Patrick, C. J., Bradley, M. M., & Lang, P. J. (2000). The psychopath as observer: Emotion and attention in picture processing. *Journal of Abnormal Psychology, 109,* 373–385.

Lilienfeld, S. O., & Andrews, B. P. (1996). Development and preliminary validation of a self report measure of psychopathic personality traits in noncriminal populations. *Journal of Personality Assessment, 66,* 488–524.

Lynam, D. R., & Henry, B. (2001). The role of neuropsychological deficits in conduct disorders. In J. Hill and B. Maughan (Eds.), *Conduct disorders in childhood and adolescence.* New York: Cambridge University Press.

Lynam, D. R., Moffitt, T. E., & Stouthamer-Loeber, M. (1993). Explaining the relation between IQ and delinquency: Class, race, test motivation, school failure, or self-control? *Journal of Abnormal Psychology, 102,* 187–196.

Lynam, D. R., Whiteside, S., & Jones, S. (1999). Self-reported psychopathy: A validation study. *Journal of Personality Assessment, 73,* 110–132.

Malloy, P., & Grace, J. (2005). A review of ratings scales for measuring behavior change due to frontal systems damage. *Cognitive & Behavioral Neurology, 18,* 18–27.

Miller, J. D., & Lynam, D. R. (2003). Psychopathy and the five-factor model of personality: A replication and extension. *Journal of Personality Assessment,* 168–178.

Miller, J. D., Lynam, D. R., Widiger, T. A., & Leukefeld, C. (2001). Personality disorders as extreme variants of common personality dimensions: Can the five-

factor model adequately represent psychopathy? *Journal of Personality, 69,* 253–276.

Morgan, A. B., & Lilienfeld, S. O. (2000). A meta-analytic review of the relation between antisocial behavior and neuropsychological measures of executive function. *Clinical Psychology Review, 20,* 113–136.

Newman, J. P., MacCoon, D. G., Vaughn, L. J., & Sadeh, N. (2005). Validating a distinction between primary and secondary psychopathy with measures of Gray's BIS and BAS constructs. *Journal of Abnormal Psychology, 114,* 319–323.

Newman, J. P., & Schmitt, W. A. (1998). Passive avoidance in psychopathic offenders: A replication and extension. *Journal of Abnormal Psychology, 107,* 527–532.

Patrick, C. J. (in press). Getting to the Heart of Psychopathy. In H. Herve & J. C. Yuille (Eds.), *Psychopathy in the third millennium: Research and practice.* New York: Academic Press.

Patrick, C. J., Bradley, M. M., & Lang, P. J. (1993). Emotion in the criminal psychopath: Startle reflex modulation. *Journal of Abnormal Psychology, 102,* 82–92.

Paulsen, J., Stout, J. C., DeLaPena, J., Romero, R., Tawfik-Reedy, Z., Swenson, M. R., et al. (1996). Frontal behavioral syndromes in cortical and subcortical dementia. *Assessment, 3,* 327–337.

Raine, A., & Yang, Y. (2006). The neuroanatomical bases of psychopathy. In C. J. Patrick (Ed.), *Handbook of Psychopathy* (pp. 278–295). New York: Guilford Press.

Raine, A., Meloy, J. R., Bihrle, S., Stoddard, J., LaCasse, L., & Buchsbaum, M. S. (1998). Reduced prefrontal and increased subcortical brain functioning assessed using positron emission tomography in predatory and affective murderers. *Behavioral Sciences and the Law, 16,* 319–332.

Ready, R. E., Ott, B. R., Grace, J., & Cahn-Weiner, D. A. (2003). Apathy and executive dysfunction in mild cognitive impairment and Alzheimer disease. *American Journal of Geriatric Psychiatry, 11,* 222–228.

Ross, S. R., Benning, S. D., Patrick, C. J., Thompson, A., N., & Thurston, A. B. (2005). Factors of the Psychopathic Personality Inventory: Criterion-Related Validity and the Five-Factor Model of Personality. *Assessment,* under review.

Ross, S. R., Lutz., C. J., & Bailley, S. E. (2004). Psychopathy and the Five-Factor Model in a noninstitutionalized sample: A domain and facet level analysis. *Journal of Psychopathology and Behavioral Assessment, 26,* 213–222.

Sandoval, A.M.R., Hancock, D., Poythress, N. G., Edens, J. F., & Lilienfeld, S. O. (2000). Construct validity of the Psychopathic Personality Inventory in a correctional sample. *Journal of Personality Assessment, 74,* 262–281.

Soderstrom, H., Hultin, L., Tullberg, M., Wikkelso, C., Ekholm, S., & Forsman, A. (2002). Reduced frontotemporal perfusion in psychopathic personality. *Psychiatry Research: Neuroimaging, 114,* 81–94.

Spinella, M. (2005). Prefrontal substrates of empathy: Psychometric evidence in a community sample. *Biological Psychology, 70,* 175–181.

Spinella, M., & Lyke, J. (2004). Executive personality traits and eating behavior. *International Journal of Neuroscience, 114,* 83–93.

Stout, J. C., Ready, R. E., Grace, J., Malloy, P. F., & Paulsen, J. S. (2003). Factor analysis of the Frontal Systems Behavior Scale (FrSBe). *Assessment, 10,* 79–85.

Velligan, D. I., Ritch, J. L., Sui, D., DiCocco, M., & Huntzinger, C. D. (2002). Frontal Systems Behavior Scale in schizophrenia: Relationships with psychiatric symptomatology, cognition and adaptive function. *Psychiatry Research, 113,* 227–236.

Widiger, T. A., & Lynam, D. R. (1998). Psychopathy as a variant of common personality traits: Implications for diagnosis, treatment, and etiology. In T. Millon (Ed.), *Psychopathy: Antisocial, violent, and criminal behavior* (pp. 171–187). New York: Guilford.

Yang, Y. Raine, A., Lencz, T., Bihrle, S., LaCasse, L., & Colletti, P. (2005). Volume reduction in prefrontal gray matter in unsuccessful criminal psychopaths. *Biological Psychiatry, 57,* 1103–1108.