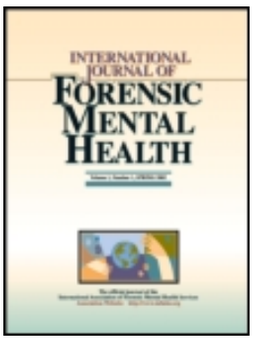

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Structure and Correlates of the Barratt Impulsiveness Scale (BIS-11) in Offenders: Implications for Psychopathy and Externalizing Pathology

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Structure and Correlates of the Barratt Impulsiveness Scale (BIS-11) in Offenders: Implications for Psychopathy and Externalizing Pathology

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Based on a large sample of offenders (male, $n = 1{,}316$; female, $n = 267$), we (a) tested the relative fit of alternative factor models for the Barratt Impulsiveness Scale (BIS-11), and (b) assessed the pattern of relationships among BIS-11 scales and theoretically relevant measures of psychopathy and externalizing pathology. Of four alternative factor models, none yielded satisfactory fit to these data in confirmatory factor analyses. Although the BIS-11 subscales generated from models were, as predicted, associated primarily with the socially deviant features of psychopathy, these subscales exhibited a pattern of associations with externalizing pathology that was generally inconsistent with expectations. These results call into question the validity of previously reported BIS-11 factor models. The findings are discussed within the context of the externalizing spectrum of pathology and the construct validation of impulsivity measures.

Keywords: impulsive behaviors, externalization, offenders, construct validation

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Impulsivity can be described as the tendency to act suddenly, with little deliberation, and in ways that are harmful (Moeller, 2009). Impulsive acts typically occur in response to the individual's failure to resist urges or temptations that emerge from internal or external stimuli (American Psychiatric Association, 2000). Impulsivity is associated with a wide range of psychiatric disorders and plays a fundamental role in some types of aggressive and self-injurious behavior (Coccaro, Posternack, & Zimmerman, 2005; Paris, 2005). Indeed, impulsivity has been considered a major element of personality trait constellations thought to underlie such misbehavior (Gorenstein & Newman, 1980; Krueger, Markon, Patrick, Benning, & Kramer, 2007). There is evidence that

disinhibitory personality traits are part of a broad spectrum of externalizing pathology that encompasses disorders such as substance abuse, attention deficits, and antisocial or even psychopathic personality (Krueger, Hicks, Patrick, Carlson, Iacono, & McGue, 2002; Patrick, Hicks, Krueger, & Lang, 2005).

Despite the importance of impulsivity to models of psychopathology, it is unclear whether this construct is one-dimensional or multidimensional. Bechara (2005) hypothesized that two dimensions, specifically impulsive and reflective dimensions, explain an individual's tendency to engage in impulsive behavior. The impulsive dimension (or system) is predominantly affective and operates in response to environmental incentives. In contrast, the reflective system is primarily cognitive and modulates affective reactions through memory and attention. Impulsive behavior is thought to result from a strong impulsive system relative to a weak reflective system. An alternative four dimensional conceptualization has been advanced by Whiteside and Lynam (2001, 2003), who propose that impulsive behavior reflects personality traits that have strong affective (high urgency and sensation-seeking), cognitive (low premeditation), and behavioral (low perseverance) components.

Uncovering the factors that underlie impulsivity has considerable implications for both theory and practice. Smith and colleagues have argued that the identification of one-dimensional factors within multifaceted constructs is critical for understanding causal processes (Smith, 2005; Smith, McCarthy, & Zapolski, 2009) and may specify targets for treatment (Kalivas & Volkow, 2005). For example, cognitive-behavioral therapies for impulsive substance use primarily target patterns of thinking (e.g., Carroll, 1998), whereas certain pharmacological interventions (e.g., naltrexone) target the affective component of impulsivity by modifying reactions to established reinforcement schedules (Jayaram-Lindstrom, Jammarberg, Beck, & Franck, 2008).

Evaluation of the structure of impulsivity has progressed through research on one of the best validated measures of this construct, the Barratt Impulsiveness Scale (BIS-11; Patton, Stanford, & Barratt, 1995). Early versions of the BIS were created to operationalize behavior and personality tendencies thought to reflect impulsivity. Research within diverse samples (e.g., college students, mental health patients) suggested that the instrument contains three factors representing (1) behavioral impulsivity (Motor impulsivity), (2) concentration difficulties (Attention impulsivity), and (3) a tendency to act without reflection (Non-planning) (Stanford, Mathias, Dougherty, Lake, Anderson, & Patton, 2009). However, subsequent work failed to replicate this model. In two studies, Haden and Shiva (2008, 2009) evaluated the BIS-11 within samples of male forensic inpatients ($N = 436$; $N = 327$). The original three-factor BIS model fit more poorly than a two-factor model developed by the authors in which factors represented (1) the tendency to act without thinking (Non-planning) and (2) physical restlessness/impulsive action (Motor impulsivity). Similarly, Ireland and Archer (2008) found that the original three-factor model poorly fit BIS data from a UK sample ($N = 1{,}103$) of incarcerated offenders. These authors developed a new three-factor model by creating item parcels (e.g., summed groupings of 2–3 items). This three-factor parcel model, comprising (1) the tendency to act without thinking (Non-planning), (2) impulsive action (Behavioral impulsivity), and (3) concentration

TABLE 1
BIS-11 Item Assignments for Different Factor Models.

BIS-11 Items	Ireland & Archer (2008)	Patton el al. (1995)[a]	Haden & Shiva (2009)
1. Plan tasks carefully.	N	N	N
2. Act without thinking.	B	B	B
3. Happy-go-lucky.			N
4. Racing thoughts.	B	A	B
5. Plan trips in advance.	N	N	N
6. Self-controlled.	N	B	N
7. Concentrate easily.	N	A	N
8. Regular saving.	N	N	N
9. Hard to sit still.	A	B	B
10. Careful thinker.	N	A	N
11. Job security.			N
12. Say things without thinking.	B	B	B
13. Think about complex problems.	N	A	N
14. Change jobs.	B	N	
15. Act on impulse.	B	B	B
16. Easily bored when solving problems.	A	A	B
17. Regular medical/dental check-ups.	N	N	
18. Act on spur of the moment.	B	B	B
19. Steady thinker.	N	A	N
20. Change where I live.			B
21. Impulsive buying.	B	B	B
22. Finish what I start.	N	N	
23. Walk/move fast.	A	B	
24. Solve problems by trial-and-error/I like puzzles.[b]			N
25. Spend/charge more than earn.	B	N	B
26. Talk fast.	A	B	
27. Outside thoughts when thinking.	A	A	B
28. More interested in present than future.	B	N	
29. Restless at lectures or talks.	A	B	B
30. Plan for the future/I am future oriented.[b]	N	N	N

Note. N = Non-planning; B = Behavioral/Motor; A = Attention/Distractibility.

[a] As reported in Ireland and Archer (2008).

[b] There were minor differences in the item content used between the current study and Haden and Shiva (2009).

difficulties (Distractibility) achieved acceptable fit in men but not women. As shown in the Table 1, although Ireland and Archer's factor labels are similar to those proposed by Patton et al. (1995), nearly half of the items are assigned to factors different than the original model.

As these examples suggest, inconsistencies in BIS-11 research have led to less clarity about the structure of impulsivity than one would hope. Both exploratory and confirmatory factor analytic techniques have been applied to the BIS-11 items, subsets of items, and parcels of 2 to 3 items (e.g., Haden & Shiva, 2009; Ireland & Archer, 2008; Patton et al., 1995). Although item parceling can address some of the problems inherent in the analysis of individual items (Bandalos, 2002), this approach increases the chances that a poorly fitting model will be identified as acceptable (Cooke, Mitchie, & Skeem, 2007). In addition, samples used to recover the most promising BIS-11 factor models have varied according to setting (e.g., clinical, correctional) and culture; such sampling characteristics may affect replication (Cooke, Michie, Hart, & Clark, 2005; Lenzenweger, 2006). Continued research is needed because empirical replication provides critical evidence for construct validation (Smith, 2005).

The first objective of this study was to evaluate the replicability of previously reported BIS-11 factor models using a sample of North American offenders. We tested the fit of the three-factor parcel model (Ireland & Archer, 2008), the original three-factor item model (Patton et al., 1995), and the two-factor model identified by Haden and Shiva (2008, 2009). Because Ireland and Archer (2008) developed their three-factor parcel model through relatively rigorous exploratory and confirmatory analyses with a large offender sample, we hypothesized that we would replicate their findings.

Our second objective was to examine the convergent validity of subscales measuring the putative factors of each model. Factor analysis may capitalize on chance, so the validity of any proposed model should be evaluated with multiple sources of information (Gorsuch, 1983). Although the externalizing spectrum encompasses a wide range of pathology, the associations between elements within the spectrum may not be similar. Confidence in the validity of BIS-11 factors will be increased if such factors exhibit differences in their associations with other variables. We had two major hypotheses.

Hypothesis 1: Psychopathy. There is wide consensus in the literature that impulsivity (Hare, 1991, 2003) or weak impulse control (Cleckley, 1941) is associated with psychopathy. Indeed, some have conceptualized psychopathy as an externalizing/disinhibitory disorder (e.g., Patrick et al., 2005). Thus, we predicted that all BIS-11 subscale scores would correlate positively with the total score on Hare's (1991, 2003) Psychopathy Checklist – Revised (PCL-R). Further, the PCL-R has two major scales: the interpersonal/affective scale (Factor 1) is associated with indicators of low stress reactivity and elevated interpersonal dominance (Poythress, Edens, & Lilienfeld, 1998; Verona, Patrick, & Joiner, 2001), whereas the social deviance scale (Factor 2) is associated with behaviors such as substance abuse, aggression, and criminal activity (Patrick et al., 2005; Skeem & Mulvey, 2001). We predicted that BIS-11 subscales would be positively associated with Factor 2 and negligibly (if not negatively) associated with Factor 1 (see Edens and McDermott, 2010).

Hypothesis 2: Specific symptom constellations. Although impulsivity is associated with a wide range of psychopathology, some disorders may be differentially associated with facets of impulsivity (Krueger et al., 2007). To examine this possibility, we used selected subscales from the Personality Assessment Inventory (PAI; Morey, 2007) to test several specific hypotheses. First, because criminal and stimulus-seeking behaviors are associated with a failure to appreciate consequences (Lykken, 1995) and obsessive tendencies are characterized by excessive planning (e.g., Keen, Brown, & Wheatley, 2008), we expected the BIS Non-planning subscales to be more positively associated with PAI antisocial behavior and stimulus-seeking and more negatively associated with PAI obsessive tendencies relative to the other BIS subscales. Second, because distractibility and concentration difficulties are prominent features of anxiety and depressive disorders (Akiskal, 2009) we predicted that the BIS Distractibility subscale would demonstrate relatively strong associations with PAI depressive and anxiety cognitive subscales. Third, given prior results (Joska & Stein, 2008; Paris, 2005), we expected the BIS-11 Behavioral impulsivity subscales to demonstrate relatively strong associations with subscales measuring manic overactivity and self-harming behavior.

METHOD

Participants. Caucasian and African-American offenders were recruited from U.S. correctional and residential drug treatment facilities during a large study of antisocial personality disorder and psychopathology (see Poythress et al., 2008). Offenders were included if they were English-speaking, 21 years of age or older, not taking anti-psychotic drugs, and without intellectual impairment (I.Q. < 70). Of the participants recruited, 1,583 (male, $n = 1{,}316$; female, $n = 267$) were administered the instruments analyzed here.

Materials: The BIS-11 is a 30-item questionnaire designed to assess impulsivity. BIS-11 items were written at a 4th grade reading level and contain behavioral and personality descriptions of impulsive tendencies ($\alpha = .86$ in the current sample).

The Personality Assessment Inventory (PAI; Morey, 2007) is a 344-item self-report measure (4th grade reading level) designed to assess mental illness and personality. The Inconsistency and Infrequency validity scales were used to identify atypical responding. Only specific PAI subscales were analyzed, including the Antisocial Features-Antisocial Behaviors (ANT-A), Antisocial Features-Sensation Seeking (ANT-S), Anxiety-Related

Disorders-Obsessive-Compulsive (ARD-O), Anxiety-Cognitive (ANX-C), Depression-Cognitive (DEP-C), Mania-Activity Level (MAN-A), and Borderline Features-Self Harm (BOR-S) subscales. Based on qualitative comparisons, the item content between these subscales and the BIS-11 was not redundant. Internal consistencies (αs) of these 8-item subscales ranged from $\alpha = .54$ (MAN-A) to $\alpha = .83$ (ANX-C); the mean inter-item correlations (r_{ii}) ranged from $r_{ii} = .13$ (MAN-A) to $r_{ii} = .38$ (ANX-C).

The Psychopathy Checklist Revised (PCL-R; Hare, 1991, 2003) was administered to most ($n = 1{,}473$) participants. The PCL-R provides clinical ratings of 20 features of psychopathy, based on interview and chart information. The instrument has relatively strong psychometric properties and is useful for predicting recidivism (Hare, 2003). The PCL-R total and factor scores were used here. Reliabilities in the current sample were $\alpha = .82$ (Total), $\alpha = .81$ (Factor 1), and $\alpha = .65$ (Factor 2). Intra-class correlation coefficients (ICC) on the total score for a subsample of cases ($n = 51$) indicate acceptable inter-rater reliability ($ICC_1 = .88$).

Quick Test (Ammons & Ammons, 1962). The Quick Test uses a picture-identification paradigm to evaluate intellectual functioning. Quick test scores correlate significantly with Wechsler Adult Intelligence Test-Revised (WAIS-R; Wechsler, 1981) scores and predict intelligence in offenders (Craig & Olsen, 1988; Doss, Head, Blackburn, & Robertson, 1986).

Procedures: Prior to the start of data collection, research assistants (RAs) completed standardized training on the procedures, which included specialized instruction on PCL-R administration (delivered by Stephen Hart). Research assistants then completed at least 10 training cases and were required to achieve acceptable inter-rater reliability (ICC > .80) with the criterion scores. They also participated in periodic retraining throughout the course of the study.

Potentially eligible participants were randomly selected from lists of individuals at each site who met inclusion criteria. Interviews were conducted in private and informed consent was obtained using procedures approved by a university institutional review board. Participants were individually administered the protocol. Participants were allowed to complete the self-report questionnaires themselves if they (a) had either a General Equivalency Diploma or had completed the 10th grade in regular curriculum classes and (b) demonstrated adequate ability to read a few items. A standardized screen for reading comprehension was administered to participants who did not meet these criteria. Research assistants read questionnaire items aloud to 44 participants whose reading comprehension was below a 7th grade level.

RESULTS

Prior to conducting the analyses, participants with elevated ($T \geq 80$) PAI Inconsistency or Infrequency scores ($n = 38$) were removed, as were those who were multivariate outliers on the BIS-11 (i.e., elevated squared Mahalanobis distance, $n = 62$). The final sample size was 1,482 (male, $n = 1{,}232$; female, $n = 250$).

Model-fitting. Confirmatory Factor Analyses (CFA), using maximum likelihood estimation, was calculated using AMOS software (Arbuckle, 2006). Maximum likelihood estimation was used because the sample was relatively large and contained multivariate normal data (Byrne, 2001). Fit was judged acceptable when the majority of fit indices revealed the following values (Byrne, 2001): Goodness of Fit Index (GFI) > .90, Comparative Fit Index (CFI) > .90, Root Mean Square Error of Approximation (RMSEA) < .10, and the Standardized Root Mean Square Residual (SRMR) < .08. Although these values are lower than the cutoffs sometimes reported in the literature (e.g., CFI > .95, RMSEA < .05), stringent criteria are more likely to reject adequate fitting models and slightly less stringent thresholds (e.g., CFI/GFI =.91–.94; RMSEA = .08–.09) on a combination of indicators does not dramatically alter error rates (see Hu & Bentler, 1999). Other researchers have used similar cutoffs to identify acceptable fitting models (Skeem, Mulvey, & Grisso, 2003), although models deemed acceptable using these thresholds must be viewed with caution.

We evaluated Ireland and Archer's (2008) three-factor parcel model based on 26 of the 30 BIS-11 items (see Table 1). CFAs revealed acceptable fit for this model (GFI = .96, CFI = .94, RMSEA = .087 [90% confidence interval = .078–.096], SRMR = .05).[1] Although these results were encouraging, we evaluated the possibility that the parcels biased the results because they may be indifferent to the content of the actual items contained within them (see Cooke et al., 2007). Hence, to test this possibility, we randomly swapped items between the parcels to create an incorrect model. Nine items were moved to an item parcel on a different factor, and we re-calculated the parcels with these changes. We re-calculated a CFA to evaluate the fit of Ireland and Archer's (2008) parcel model to this incorrect model. The incorrect model achieved acceptable fit: GFI = .96, CFI = .95, RMSEA = .081 (90% confidence interval = .072–.090), SRMR = .04. In light of this finding, we evaluated the three-factor item model on which Ireland and Archer (2008) had based their parcel model. Individual items, as opposed to parcels, were used as factor indicators. The item model did not adequately fit the data: (GFI = .89, CFI = .83, RMSEA = .065 [90% confidence interval = .063–.068], SRMR = .06).

Next, a CFA was calculated to test the fit of the three-factor item model proposed by Patton et al. (2005). Results identified inadequate fit within the sample (GFI = .82, CFI = .74, RMSEA = .081 [90% confidence interval = .078–.083], SRMR = .08). We then evaluated the two-dimensional item model proposed by Haden and Shiva (2008, 2009), using 24

[1] Ireland and Archer (2008) found that their three-factor parcel model did not fit well in females. This model achieved questionable fit, due to the relatively poor RMSEA and SRMR values, when tested with females from the current sample (GFI = .935, CFI = .911, RMSEA = .099 [90% confidence interval = .076–.123], SRMR = .079).

items; here too, the results revealed poor fit (GFI = .78, CFI =.69, RMSEA = .091 [90% confidence interval = .088–.093], SRMR = .08).

Exploratory Factor Analysis and Confirmation

Given that no previously developed model adequately fit the data (without the "leg up" provided by parceling), we completed an exploratory principal axis factor analysis on all of the BIS-11 items in a randomly selected subsample (n = 715) of the current sample. We used Varimax rotation, which is orthogonal, in an attempt to recover a simple structure. Information provided by the scree test, eigenvalues greater than 1, and pattern of item loadings suggested a three-factor structure (accounting for 39% of the variance) (Table 2). The 20 items with strong (≥.40) primary loadings and no marked secondary loadings (>.40) reflected three factors of Non-planning, Motor, and Cognitive impulsivity. Nevertheless, attempts to confirm this 20-item three-factor model, using CFA in the participants not used in the exploratory factor analysis (n = 767), were unsuccessful (GFI = .89; CFI = .85; RMSEA = .073 [90% CI = .068–.078], SRMR = .073). Evaluation of the modifications indices suggested that correlating the error terms for two pairs of items (items 4 and 27; items 16 and 13) would improve fit; these modifications did not result in an acceptable fit.

External Validation. Reliability analyses were calculated to evaluate each BIS-11 subscale prior to the validation analyses. Because none of the models fit the data significantly better than another, we completed analyses for all three models tested. For the original three-factor model, the internal consistency and inter-item correlations were $\alpha = .77/r_{ii} = .53$ (Non-planning), $\alpha = .76/r_{ii} = .51$ (Behavioral), and $\alpha = .63/r_{ii} = .36$ (Distractibility). The values for the three-factor Patton et al. (1995) model were $\alpha = .72/r_{ii} = .22$ (Non-planning), $\alpha = .72/r_{ii} = .28$ (Motor), and $\alpha = .79/r_{ii} = .28$ (Attention). Lastly, the Haden and Shiva (2009) subscales were $\alpha = .85/r_{ii} = .32$ (Non-planning) and $\alpha = .75/r_{ii} = .19$ (Motor). As these results suggest, the revised models were somewhat more internally consistent than the original model.

To test Hypothesis 1, we calculated Pearson correlations between the BIS-11 and the PCL-R indices. Correlations were compared by statistically testing for the difference between dependent correlations and by effect size magnitude ($r > |.10|$) (Cohen, 1988). Because PCL-R factor scores were moderately correlated (r = .48, $p < .001$), their shared relationship could potentially obscure associations with external variables. Therefore, we analyzed the residualized scores, scores obtained by removing the shared variance within the factors. Table 3 reveals that the expected associations between the BIS subscales and the PCL-R were obtained. The PCL-R total and Factor 2 residualized scores were significantly and positively associated with all BIS indices. PCL-R Factor 1 residualized scores, in contrast, were negatively associated with all BIS subscales.

TABLE 2
Exploratory Factor Analysis (Varimax rotation) for Subsample 1.

BIS-11 Items	Motor	Cognitive	Non-Planning
15. Act on impulse.	**.63**	.17	.30
18. Act on spur of the moment.	**.62**	.09	.26
27. Outside thoughts when thinking.	**.62**	.13	.11
16. Easily bored when solving problems.	**.59**	.29	−.01
9. Hard to sit still.	**.55**	.19	−.02
4. Racing thoughts.	**.55**	.11	−.07
12. Say things without thinking.	**.50**	.23	.17
29. Restless at lectures or talks.	**.50**	.23	.14
2. Act without thinking.	**.50**	.30	.24
26. Talk fast.	.45	−.07	.12
21. Impulsive buying.	.42	.02	.40
23. Walk/move fast.	.34	−.18	.06
20. Change where I live.	.33	.03	.31
10. Careful thinker.	.14	**.65**	.22
7. Concentrate easily.	.35	**.63**	.10
19. Steady thinker.	.22	**.58**	.04
22. Finish what I start.	.15	**.52**	.22
6. Self-controlled.	.23	**.52**	.19
1. Plan tasks carefully.	.11	**.49**	.36
13. Think about complex problems.	−.02	**.46**	.01
5. Plan trips in advance.	.06	.44	.42
3. Happy-go-lucky.	−.05	−.29	−.02
24. Solve problems by trial-and-error.	.29	−.29	.05
17. Regular medical/dental check-ups.	−.08	.24	.22
11. Job security.	.09	.47	.55
8. Regular saving.	.08	.39	**.50**
30. Plan for future.	−.03	.34	**.48**
25. Spend/charge more than earn.	.37	.10	**.44**
14. Change jobs.	.30	.08	.39
28. More interested in present than future.	.15	−.04	.25

Note. n = 715. Bold-faced type indicates primary item assignments.

With respect to Hypothesis 2 (Part 1), contrary to expectations, the BIS Non-planning subscales did not display relatively strong associations with PAI Antisocial Behavior or Sensation Seeking subscales. However, in keeping with expectations, BIS Non-planning associations with PAI Obsessive-Compulsive tendencies were significantly ($p <$ .01) and substantively different than the other BIS subscales. Findings generally were inconsistent with expectations for the BIS Distractability subscales (Hypothesis 2, Part 2). That is, although the Attention subscale for the Patton et al. (1995) model was, as expected, differentially associated with PAI anxiety-related cognitive difficulties when compared to the

TABLE 3
Convergent validity of the BIS-11 Total and subscale scores.

	BIS-11								
		Ireland & Archer (2009)			Patton et al., (1995)			Haden & Shiva (2009)	
	Total	Non	Dis	Beh	Non	Att.	Motor	Non	Motor
PCL-R[a]									
Total	.14**	.06	.13**	.15**	.10**	.15**	.09**	.06*	.16**
Factor 1-Interpersonal/Affective	−.15**	−.16**	−.06**	−.10**	−.12**	−.09**	−.16**	−.18**	−.10**
Factor 2-Social Deviance	.30**	.24**	.20**	.26**	.23**	.26**	.26**	.25**	.28**
PAI subscales[b]									
Antisocial behaviors (ANT-A)	.44**	.34**	.27**	.42**	.37**	.40**	.31**	.34**	.42**
Sensation seeking (ANT-S)	.47**	.25**	.39**	.49**	.31**	.50**	.30**	.27**	.50**
Obsessive Compulsive (ARD-O)	−.04	−.22**	.15**	.07**	−.17**	.08**	−.02	−.21**	.10**
Anxiety-Cognitive (ANX-C)	.47**	.36**	.39**	.42**	.32**	.42**	.48**	.33**	.48**
Depression-Cognitive (DEP-C)	.56**	.52**	.37**	.45**	.46**	.44**	.56**	.49**	.51**
Activity Level (MAN-A)	.37**	.13**	.43**	.40**	.20**	.45**	.26**	.16**	.42**
Self-harm (BOR-A)	.49**	.47**	.42**	.64**	.55**	.60**	.44**	.50**	.62**

Note. PCL-R = Psychopathy Checklist Revised; PAI = Personality Assessment Inventory.
* $p < .05$; ** $p < .01$.
[a] $N = 1{,}408$-$1{,}482$. [b] $N = 1{,}482$.

Non-planning scale, there were no other differential relationships with anxiety- and depressive-related cognitive difficulties.

Results for the BIS subscales measuring Behavior/Motor impulsivity subscales (Hypothesis 2, Part 3) exhibited differences across the models. For two models (Ireland & Archer, 2008; Haden & Shiva, 2009), the Behavior/Motor subscales generally (not always) manifested differential associations with PAI manic-activity level and self-harm. This was not the case for the Patton et al. (1995) Motor subscale.

DISCUSSION

In keeping with past research, the current results suggest that the factor structure of the BIS-11 is inconclusive, at least in U.S. offenders. Two factor models previously reported in the literature (Haden & Shiva, 2008, 2009; Patton et al., 1995) exhibited poor fit in confirmatory analyses. Although the Ireland and Archer (2008) three-factor parcel model appeared acceptable, this seems to be a function of the leniency of parceling itself (see Cooke et al., 2007), given that (a) an unparcelled version of this model did not fit the data, and (b) a pseudo-version of this model in which some items were randomly assigned to different parcels achieved "adequate" fit. Attempts to recover a new factor structure within the current sample were unsuccessful; a three-factor model recovered with exploratory techniques did not replicate with confirmatory analysis in an independent subsample. In sum, we were unable to discern any sensible structure for the BIS-11.

Beyond structure, our findings are consistent with the external validity of some components of leading BIS-11 models and inconsistent with others. On one hand, as expected, most BIS-11 subscale scores across models related positively to the PCL-R – particularly its socially deviant lifestyle, but not interpersonal/affective, subscale. Our findings are consistent with work suggesting that impulsivity or 'disinhibition' is key to externalizing disorders and is especially associated with antisocial behavior (Patrick et al., 2005; Krueger et al., 2007).

On the other hand, beyond these global results, we found little evidence that the BIS-11 subscales exhibited differential patterns of relationships with external variables. Although the Non-planning subscales for all models displayed negative relationships with obsessive-compulsive tendencies, the expected relationships with antisocial behavior and sensation seeking were not observed. Similarly, theoretically coherent associations generally were not obtained for the Attention/Distractibility subscales of the Ireland and Archer (2008) and Patton et al. (1995) models. The Behavioral/Motor subscales demonstrated expected relationships only 50% of the time. The collective pattern of evidence casts doubt on the construct validity of these models (see Smith et al., 2009).

The lack of replication of earlier factor models may have occurred for a number of reasons. One compelling possibility is that BIS-11 may not adequately capture the nature of impulsivity. Attempts to study the structure of impulsivity by examining BIS-11 items assume that the items provide a reasonably comprehensive assessment of the construct. The BIS has been widely studied (Stanford et al., 2009), but does not incorporate recent conceptualizations of impulsive behavior. In particular, recent work emphasizes the importance of affect for impulsive behavior. Affective processes, such as emotional reactions to stimuli, urgency, and sensation-seeking, are thought to play a critical role in regulating, and de-regulating, behavior (Bechara, 2005; Whiteside &

Lynam, 2001, 2003). However, affective components of impulsivity are not well represented, if at all, in the BIS-11 items. Clinicians using the BIS-11 in evaluations should consider this limitation and explore alternative instruments that may capture a more diverse representation of the construct (e.g., UPPS impulsive behavior scale; Whiteside & Lynam, 2003).

A second possibility is that the BIS-11 item content may not generalize well to our target population. Our sample comprised Caucasian and African American offenders. Some items contain content that does not have the same meaning across cultures (e.g., "happy go lucky") or settings (e.g., "job security"), which raises concerns about the generalizability of BIS-11 findings. Future research with offenders is needed to explore the possibility that high rates of disinhibited behavior in this population signals that impulsivity operates differently here than among non-offenders. This is key, given the likely disproportionate representation of externalizing psychopathology among offenders (see Krueger et al., 2007).

A third possibility is that methodological flaws prevented discernment of a coherent BIS-11 structure and pattern of relations with external variables in this study. This possibility seems unlikely to fully explain our results. First, our results are in keeping with pronounced inconsistency in past findings on the BIS-11. Second, this study had a number of strengths, including a large sample, confirmatory analytic techniques, and a set of reliably measured, theoretically meaningful external variables. Thus, we have a reasonable degree of confidence in our findings pertaining to the BIS-11's factor structure and its convergent validity. Still, we recommend that future studies incorporate a broader array of external variables that draw from a variety of methodologies, modalities, and disciplines (e.g., biological, psychophysiological, and behavioral indices). Such research will be vital both for advancing theoretical understanding of impulsivity and for developing targeted interventions for antisocial behavior.

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