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Assessing Emotion Sensitivity in Female Offenders With Borderline Personality Symptoms: Results From a Fear-Potentiated Startle Paradigm

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An instructed fear-conditioning paradigm was used to measure fear-potentiated startle (FPS) in a sample of 80 Caucasian, female offenders assessed using the Personality Assessment Inventory-Borderline Features Scale (Morey, 1991). As predicted, women with higher levels of Borderline Personality Disorder (BPD) symptoms showed significantly greater FPS than women with lower levels when required to focus attention on the threat-relevant dimension of the experimental stimuli. However, FPS was not greater for women with higher levels of BPD symptoms in the two conditions that required participants to direct attention away from the threat-relevant dimension. These results highlight the importance of attention for moderating the association between BPD symptoms and exaggerated responses to threat-relevant information and may, therefore, help to resolve the inconsistent evidence on emotional reactivity in BPD. Moreover, the potential importance of attentional factors in BPD may shed new light on prominent symptoms of the disorder and existing theoretical perspectives on BPD.

Keywords: borderline personality, female offenders, fear-potentiated startle, instructed fear-conditioning

Borderline Personality Disorder (BPD) is characterized by severe disruptions in self-image, problems with emotion and behavior regulation, and difficulties in the maintenance of functional interpersonal relationships (American Psychiatric Association, 2000). Comprising up to 20% of psychiatric inpatient populations and 2% of the general population (Skodol et al., 2002), individuals meeting diagnostic criteria for BPD represent a significant challenge for clinicians and psychopathologists.

Abnormalities in the processing of emotionally relevant stimuli have been observed in individuals with BPD/borderline traits using both behavioral tasks (e.g., Bland, Williams, Scharer, & Manning, 2004; Domes et al., 2008; Dougherty, Bjork, Huckabee, Moeller, & Swann, 1999; Dyck et al., 2009; Hochhausen, Lorenz, & Newman, 2002; Sieswerda, Arntz, Mertens, & Vertommen, 2007; Wagner & Linehan, 1999) and functional neuroimaging (e.g., Donegan et al., 2003; Johnson, Hurley, Benkelfat, Herpertz, & Taber, 2003; Minzenberg, Fan, New, Tang, & Siever, 2007). Taken together, these studies suggest that that BPD is characterized by heightened sensitivity and/or reactivity to emotion stimuli.

Although data from behavioral and functional imaging studies suggest important differences in the emotion processing of individuals with BPD, findings from research employing psychophysiological measures have been inconsistent. For example, Herpertz and colleagues (Herpertz, Kunert, Schwenger, & Sass, 1999; Herpertz et al., 2000) found significantly reduced skin conductance responses among patients with BPD during emotion picture viewing, although patients with BPD in a study by Kuo and Linehan (2009) showed heightened baseline skin conductance levels relative to controls. Similar inconsistency has been apparent in studies assessing prepulse startle inhibition. Whereas, Grootens et al. (2008) did not find differences in prepulse startle inhibition in patients with BPD versus controls, diminished prepulse startle inhibition has been observed among nonclinical populations with borderline symptoms (e.g., Franklin, Heilbron, Guerry, Bowker, & Blumenthal, 2009). Studies of emotion-modulated startle likewise have yielded mixed results. Hazlett et al. (2007) found that, in comparison with controls, BPD patients exhibited significantly greater emotion-modulated startle when presented with unpleasant emotional words. However, others have failed to find significant differences in emotion-modulated startle between BPD patients and controls while participants were viewing unpleasant picture content (Herpertz, Kunert, Schwenger & Sass, 1999; Herpertz et al., 2000; Vitale, MacCoon & Newman, 2011).

One approach to addressing the inconsistent findings on emotional reactivity in BPD has been to increase the self-relevance of

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the negative emotion stimuli employed. In order to achieve self-relevance, researchers have used emotion stimuli that have particular relevance for individuals with BPD (e.g., rejection, powerless; Korfine & Hooley, 2000; Sieswerda et al., 2007) and have instructed participants "to think about the meaning of the word for them personally" (Hazlett et al., 2006, p. 251). The results of these studies provide preliminary evidence that individuals with BPD respond more strongly or have more difficulty inhibiting emotion responses under these conditions.

Such findings are also consistent with prominent perspectives on BPD, which emphasize the importance of personal sensitivities for initiating dysregulated reactions. According to Beauchaine, Klein, Crowell, Derbidge, and Gatzke-Kopp (2009), the disinhibited reactions associated with BPD reflect a combination of developmentally acquired sensitivities combined with high trait impulsivity that confers a reduced capacity for cognitive control over such reactions. Alternatively, Selby and Joiner (2009) attribute the dysregulated emotion responses of individuals with BPD to an emotion cascade that involves intense rumination and negative affect in response to emotion-eliciting events. In different ways, both of these theories suggest that the emotion dysregulation associated with BPD is a function, not necessarily of the magnitude of the emotion response, but of the tendency for emotion stimuli to capture and hold the individual's attention.

While personally relevant stimuli may be crucial in determining whether or not individuals with BPD display exaggerated emotional reactions, the impact of these stimuli on BPD may actually be a function of a more general problem regulating attention (Posner et al., 2002; Putnam & Silk, 2005). That is, the exaggerated emotional reactions demonstrated by patients with BPD in studies using self-relevant stimuli may occur because personally relevant stimuli are more readily processed, linked to pre-existing attentional biases, and thus more likely to become a person's dominant focus of attention.

In laying out the implications of attentional focus for self-regulation, MacCoon, Wallace, and Newman (2004) proposed that "particular cognitions, emotions, and behaviors can be represented as networks of coactivated neurons" (p. 423) and that virtually any network may become dominant "if their activation levels are enhanced using top-down, selective attention" (p. 423). Within this perspective, there are potentially two ways for a network to become dominant. On the one hand, intrinsically salient stimuli, such as personally relevant cues, will capture attention and establish a dominant network. However, a dominant network may also be established by using capacity-limited resources to increase attention to set-relevant information (e.g., if instructions focus attention on threat-relevant information).

With regard to BPD, MacCoon et al.'s "set dependent restricted gating" (see also Putnam & Silk, 2005, p. 910) model predicts that the emotional reactions of individuals with BPD symptoms will be moderated by their focus of attention. To the extent that personal significance or task instructions activate a dominant, emotion-focused network, they will display exaggerated emotion responses. However, in the event that emotion cues fail to activate a dominant network, either because they lack personal significance or have minimal relevance for one's immediate goals, BPD traits would not be expected to effect a person's emotional reactivity. In other words, observing a significant association between BPD symptoms and exaggerated emotion responses may depend upon the extent to which an emotion-related network has become their dominant focus of attention.

In the present study, we evaluated this general attention-related proposal by examining fear-potentiated startle (FPS) under conditions that either focused attention on a threat-relevant aspect of a stimulus or established an alternative, threat-irrelevant focus of attention. More specifically, we measured startle responses to noise probes during an instructed fear conditioning task. In all three conditions, participants viewed a sequence of colored letters and were told that electric shocks might be delivered following red letters but would never be delivered following green letters. However, only one condition required participants to attend to the threat of shock (i.e., the color of the stimulus) in order to perform the task; the other two conditions established an alternative focus of attention by requiring participants to respond according to the letter case (i.e., upper vs. lower case) or identity (i.e., matched or mismatched the identity of the letter the appeared two letters before).

To the extent that exaggerated emotional responses in BPD are moderated by their focus of attention (i.e., dominant neural networks), it follows that higher levels of BPD symptoms will be associated with greater FPS in the threat-focused condition. Conversely, individuals with elevated BPD symptoms are expected to display normal or reduced FPS when the same threat cues are set-incongruent (i.e., neither goal-relevant nor personally relevant). In other words, we predict that focus of attention will play a significantly greater role in moderating emotion responses to threat-relevant cues among individuals with a high level of BPD symptoms relative to those with a low level of BPD symptoms. Furthermore, given that researchers postulate a link between BPD and Antisocial Personality Disorder (APD) (Beauchaine et al., 2009), and the fact that we use a prison sample, we also examine the extent to which APD impacts the emotional responses in individuals with higher levels of BPD.

Method

Participants

Participants were 80 Caucasian female offenders between the ages of 18–45. A prescreen of institutional files was used to exclude individuals who had performed below the fourth grade level on a standardized measure of reading or math achievement, who scored below 70 on a brief measure of IQ (i.e., the Shipley Institutes of Living Scale; Zachary, 1986), or who had diagnoses of schizophrenia, bipolar disorder, or psychosis not otherwise specified.

Individuals meeting the inclusion criteria were invited to participate in an ongoing study and were presented with the elements of informed consent both orally and in writing. All received $15 for completing an initial interview and an additional $25 for completing the testing session between 1 and 2 weeks following the initial interview. All participants provided written informed consent according to the procedures set forth by the University of Wisconsin–Madison Human Subjects Committee.

Measures

Personality Assessment Inventory (Morey, 1991). The Personality Assessment Inventory (PAI) is a 344-item selfreport measure. Participants are asked to respond on a 5-point scale from "not at all true" to "very true." The Borderline Features Scale (PAI-BOR) is a subscale of the PAI composed of 24 items assessing four major components of BPD: Affective Instability, Identity Problems, Negative Relationships, and Self-Harm. The PAI-BOR has shown to be a reliable and valid indicator of BPD symptoms. Alpha for the full scale was .89 in the current sample.

Structured Clinical Interview for Diagnostic and Statistical Manual Disorders-IV (SCID-IV Research Version; First, Spitzer, Gibbon & Williams, 2002). Participants were assessed for APD symptoms using the SCID-IV Non-Patient edition. Ratings for APD were based on the Diagnostic Statistical Manual-IV (*DSM–IV*) criteria. Cronbach's alpha for the APD total score was .73.

Procedure

Presentation of stimuli and recording of responses were controlled by DMDX (Forster & Forster, 2003) and NeuroScan Synamps2 amplifiers and acquisition software (Compumedics, Charlotte, North Carolina). All participants were tested by one of three female experimenters. Prior to beginning the experiment, the intensity of shocks received during the experimental session was calibrated to a participant's subjective shock sensitivity.

Experimental Task: Instructed Fear-Conditioning Paradigm

During the instructed fear-conditioning paradigm, participants viewed a series of letter cues. Stimuli were presented for 400 ms with a variable intertrial interval between 2 s and 2.8 s. Letter cues were either upper or lower case and colored red or green. Participants were told that in all conditions, electric shocks might be administered on some trials following red letters (threat) but that no shocks would follow green letters (no-threat). Shocks were administered for 200 ms to adjacent fingers on the participant's left hand at 1400 ms poststimulus onset on 20% of threat trials in each condition (10 shocks in each condition).

FPS was assessed under three within-subject experimental conditions: one that made threat processing the primary focus of attention and two that made it peripheral to attention (see Figure 1). In the threat-focused (TF) condition, participants' attention was focused on the threats by requiring them to indicate whether letters indicated threat (red) or no-threat (green) by pressing one of two buttons on each trial. There were two alternative-focus conditions. In the low-load alternative-focus (AF-LL) condition, participant responses indicated whether letters were upper or lower case. In the high-load alternative-focus (AF-HL) condition, participants were instructed to monitor the sequence of letters and indicate whether each letter matched or mismatched the letter that appeared two letters back. Conditions were counterbalanced and the order of condition did not moderate the effects reported below.

Startle Response Elicitation and Measurement

Forty-eight startle-eliciting noise probes (50 ms, 102 dB white noise bursts) were presented 1400 ms after letter onset. Probes were equally distributed across threat/no-threat trials in all three conditions so that participants experienced 16 noise probes (eight threat, eight no-threat) per condition. Probes never occurred in the same trial as shock administration. Startle eyeblink electromyographic activity was sampled at 2000 Hz with a bandpass filter (30–500 Hz; 24 dB/octave roll-off) from electrodes placed on the orbicularis oculi muscle under the right eye. Off-line processing included signal rectification and smoothing (30 Hz low-pass). Startle blink magnitude was scored as the peak response between 20 ms and 120 ms post-onset of probe. Fear response to threat cues was indexed by FPS, calculated as the difference in blink-response magnitude to probes following threat versus no-threat trials in each of the three task conditions.

Results

Using SPSS (version 16, SPSS Inc., 2007), we analyzed FPS within a General Linear Model (GLM) that had condition as a within-subject categorical factor, PAI-BOR total score (*z*-score) as

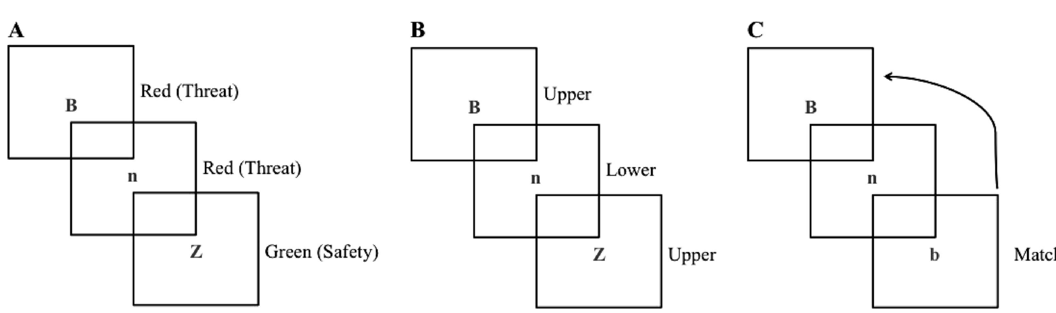

Figure 1. Participants view a series of upper/lower case letter stimuli colored red/green. [Note: Figure shows letters in black and white, but in the actual task all letters in all conditions were colored either red or green.] In all three conditions, electric shocks are administered after some red letters but never green letters. In the threat-focused condition, participants respond (via two buttons) to indicate letter color. In alternative focus/low load condition, participants respond to indicate letter case. In alternative focus/high load condition, participants respond to indicate letter match between current letter and the one presented two letters back. White noise "startle probes" are presented following some letter stimuli to measure fear-potentiated startle (FPS).

a between-subjects quantitative factor, and APD (z-score) as a continuous covariate. As predicted by the set-dependent restricted gating model, the relationship between BPD and FPS was moderated by condition (BPD × Condition interaction), $F(2, 154) = 3.73$, $p = .037$, $\eta_p^2 = .042$.[1]

Follow-up tests of orthogonal interaction contrasts indicated that BPD interacted with the focus of attention (i.e., TF vs. AF conditions), $F(1, 77) = 4.99$, $p = .028$, $\eta_p^2 = .061$. This interaction contrast demonstrating different BPD effects on fear across the threat-focused versus alternative-focus conditions is displayed in Figure 2. A second interaction contrast examining the effects of the AF-LL versus AF-HL condition on BPD was not significant, $F(1, 77) = 1.22$, $p = .27$, $\eta_p^2 = .016$.

Follow-up simple effect tests for the significant attentional focus interaction contrast indicated that the relationship between BPD and FPS was significant in the threat-focused condition, $B = 10.85$, $p = .001$, such that female offenders high on BPD showed greater FPS responses. BPD was nonsignificantly related to FPS in the AF conditions ($B = 2.86$, $p = .19$).

Lastly, neither the omnibus interaction ($p = .303$) nor the interaction contrasts involving APD[2] were significant. This suggests that in this sample, there was no effect of APD on FPS and that the BPD effect is independent of APD. However, there was a main effect of APD, $F(1, 77) = 6.124$, $p = .016$, $\eta_p^2 = .074$, such that individuals high on APD displayed significantly less startle potentiation across condition.

Discussion

The current study was designed to address the inconsistent laboratory evidence concerning emotion dysregulation in BPD and clarify the circumstances that moderate their exaggerated response to emotional stimuli. More specifically, we evaluated the hypothesis that individuals with high levels of BPD symptoms exhibit exaggerated emotion responses under conditions that cause them to focus attention on threat-relevant information. As predicted, BPD symptoms were positively and significantly associated with FPS magnitude in the threat focus condition, which required participants to focus on the stimulus dimension (i.e., color) that predicted electric shocks. It is noteworthy that this effect occurred even though the stimuli were not BPD-specific or ideographic. That is, instructing participants to allocate attention to generic emotion stimuli was sufficient to reveal their heightened reactivity to salient emotion cues. Conversely, BPD symptoms were unrelated to FPS in the alternative focus conditions that directed participants to focus attention away from the possibility of shock (i.e., to focus on letter case rather than the colored boxes that were associated with electric shocks). Thus, as predicted, the exaggerated emotion responding of individuals with high BPD scores was moderated by their attentional focus and this factor may be crucial for understanding the situation-specific nature of their dysregulated physiological reactions to emotion stimuli.

The specificity of these findings fits well with MacCoon et al.'s (2004) set-dependent restricted gating model. Specifically, individuals with high BPD symptoms displayed exaggerated emotional responses when experimental instructions were used to establish threat as a dominant network. The fact that this was accomplished using a top-down focusing manipulation as opposed to a bottom-up, attention biasing procedure (e.g., the use of self-relevant stimuli; Hazlett et al., 2006), suggests that the process of actively directing attention to affective information may be a core factor mediating emotional reactivity in individuals with BPD symptoms. In other words, once a stimulus is successfully gated into awareness (whether through top-down or bottom-up pathways) and activates a dominant, emotion-related network, individuals with BPD features are prone to overrespond to the stimulus. However, if the probability of establishing such a focus is reduced by increasing the salience of other attentional foci or directing attention elsewhere, then the tendency to overrespond is minimized or eliminated.

The potential importance of attentional factors in BPD also fits well with salient features of the clinical syndrome such as "splitting" or the tendency to perceive events in an all-or-none fashion. Once a person or situation is viewed in a positive light, set-dependent restricted gating associated with BPD may act as a filter so that attention is only allocated to set congruent features that serve to further idealize the person/situation. However, if circumstances were to alter the dominant set, so that the person or situation is now viewed in a negative light, then the same restricting gating would make it difficult for individuals with BPD symptoms to perceive any redeeming qualities. Though the current study did not manipulate or measure rumination per se, our discussion of restricted gating has much in common with Selby and Joiner's (2009) depiction of emotion-cascades in BPD. According to the emotion cascade model, a relatively minor event, such as a critical comment or interpersonal snub, initiates an excessive focus on the meaning and feelings associated with the event (i.e., rumination). Once dominant, it is extremely difficult for the person with BPD to curtail this ruminative process. Over time, individuals with BPD learn to initiate an alternative, often risky, behavior in order to dislodge the ruminative process. Though this solution appears to be effective in controlling the rumination, it tends to be associated with other unfortunate consequences.

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[1] Supplementary analyses including the subscales of BPD [Affective Instability (AI), Identity Problems (IP), Negative Relationships (NR), and Self-Harm (SH)] indicated that this effect was not uniquely associated with any particular subscale (AI: $p = .37$, IP: $p = .61$, NR: $p = .85$, SH: $p = .32$). Additionally, categorical analyses of BPD using the standard cutoff of a T-score of 70 or higher to classify participants as having BPD (see Jacobo, Blais, Baity, & Harley, 2007; Stein, Pinsker-Aspen, & Hilsenroth, 2007), replicated the results reported using the continuous approach [Omnibus Interaction: $F(2, 156) = 3.11$, $p = .048$, $\eta_p^2 = .038$; Focus Contrast (TF vs. AF): $F(1, 78) = 5.10$, $p = .027$, $\eta_p^2 = .061$].

[2] In addition to APD, we examined if other measures of antisocial behavior might account for the BPD effect. As such, we examined the effect of psychopathy [as measured by Hare's Psychopathy Checklist-Revised; PCL-R (2003)]. Although slightly more important than APD, controlling for psychopathy did little to reduce the crucial interaction effect involving BPD ($p = .058$). Moreover, previous research reports that BPD is more associated with the Impulsive-Antisocial (Factor 2) features of psychopathy than with the Interpersonal-Affective (Factor 1) psychopathy symptoms (Salekin, Rogers, & Sewell, 1997). Thus, we also re-examined the BPD effect while controlling for the unique variance associated with the two PCL-R factors. However, inclusion of the psychopathy factors did not remove the crucial interaction effect for BPD ($p = .094$). Overall, our findings indicate that the reported association between BPD and FPS is largely independent of psychopathy and antisocial behavior.

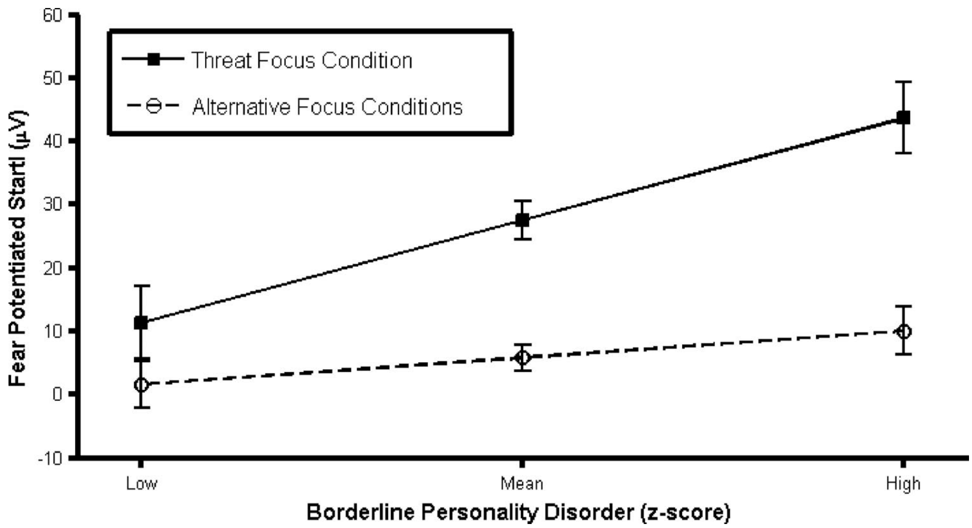

Figure 2. Focus of attention significantly moderated the BPD effect on FPS. Female offenders high on BPD displayed significantly higher FPS than low BPD offenders in the threat-focused condition. High and low BPD offenders displayed comparable FPS in the alternative-focus conditions. FPS was calculated as startle response during red/threat minus green/no-threat letter trials. FPS means displayed for low, mean, and high BPD were generated from the GLM and calculated at 1.5 standard deviations below and above the sample mean on BPD total scores. Error bars represent the standard error for the point estimate.

Given that the attention-focus manipulation in the present study was sufficient to alter emotional reactivity in individuals high on BPD symptoms, it is possible that an attention abnormality may predispose a person to BPD symptoms. In fact, in contrast with other psychiatric groups (i.e., schizophrenia, bipolar disorder), patients with BPD display abnormally large P50, N100, and P200 responses (Grootens et al., 2008). Notably, such findings indicate that BPD patients may be distinguished by differences in both early attention processes (as indexed by the N100 and P200) and preattention processes (as indexed by P50).

While attentional focus appears essential to multiple theoretical and symptom-based perspectives on BPD, it is not the only cognitive mechanism that can influence emotion responding and behavior; specifically executive functions such as cognitive control have also been considered as a key factor in BPD (Beauchaine et al., 2009; Posner et al., 2002). Cognitive control involves the use of attention to inhibit a prepotent response in favor or a less dominant but more desirable response (Botvinick, Braver, Barch, Carter, & Cohen, 2001). Beauchaine and colleagues (2009) have made a compelling case that a deficit in cognitive control could explain the disinhibited emotional reactions and impulsive behaviors associated with BPD as well as the significant overlap that exists between BPD and antisocial personality traits. More specifically, individuals with BPD display disinhibited responses because, once a reaction or urge occurs to them, they are less able to use cognitive control to select an alternative, more adaptive response.

Based on this model, it follows that individuals with BPD would be especially prone to disinhibited emotion responses in the alternative focus conditions because participants in these conditions are required to suppress attention to the salient emotion cues and, instead, focus on the goal-relevant letter stimuli. However, we found no relationship between BPD and FPS during either alternative focus condition. Additionally, if BPD and APD symptoms were due to the same underlying process, then we would expect that our BPD findings would be mediated by antisocial traits and visa versa. However, we found no evidence of such overlap (i.e., shared variance) in the present study. In fact our BPD findings were independent of antisocial traits and individuals high on antisocial traits displayed a very different pattern of results (i.e., significantly less FPS across task conditions).

Despite the fact that poor cognitive control does not appear to account for the primary deficit in BPD female offenders in this study, it is possible that an early attention process, like the one proposed by the restricted gating model may give rise to a cognitive control deficit under certain circumstances. For example, a strong tendency to orient attention to a dominant network may leave insufficient attentional resources to activate and refocus attention on alternative networks (see Wallace & Newman, 1997). In fact, attentional models suggest that these early (e.g., restricted gating attentional filter) and late cognitive processes (e.g., cognitive control) occur as stages on a continuum and are often difficult to disentangle. Nonetheless, at both stages, once a neural network becomes dominant it would be difficult to alter (i.e., because of poor cognitive control or resulting affective dysregulation).

Although these data are consistent with other research in the field, as well as with current theoretical models of BPD, this study is not without limitations. First among these is the use of a nonpatient sample. Despite this, the focus on a nonclinical sample actually allows us to generalize results beyond the more commonly used inpatient samples. This is an important step if we believe that the processes underlying BPD are not specific to a clinical setting. In a similar vein, although the use of an offender sample raises questions about the generalizability of our findings, the results of the current study are consistent with research conducted using both inpatient groups and noninstitutionalized populations. Thus, it seems that the results observed here are not specific to an offender population. Second, participants in this study were assessed using the PAI-BOR. Although a valid and reliable assessment tool, scores on the measure alone are not sufficient for a confident diagnosis of BPD. Nevertheless, the percentage of scores with "significant" BPD symptoms (i.e., T-score of 70 or above on the PAI, Morey, 1991) in the current study exceeds those found in other nonpatient samples [Current study: percent over 70 on the PAI: 46%; for example, Baer and Sauer (2011): 30%; Trull (1995): 14%].

These findings are notable in several respects. First, the fact that BPD symptoms were positively and significantly associated with FPS appears consistent with evidence that suggests these symptoms are associated with difficulty inhibiting affective responses. Second, our findings also raise the important possibility that attention moderates the emotional responses associated with BPD and highlight the role that research on attention processes may play in resolving apparent inconsistencies in the field. Research from the cognitive-affective neuroscience perspective, as outlined by Putnam and Silk (2005) (see also MacCoon et al., 2004), raises the possibility of characterizing a general style that predisposes individuals with BPD to respond in an exaggerated set-congruent manner. In light of these findings, it would be informative to examine whether individuals with BPD display differences in response to focusing manipulations that do not involve emotional stimuli. To the extent that BPD is associated with such differences, it would further support the importance of a specific attentional abnormality in the etiology of BPD symptomatology.

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