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Toward Validation of a Borderline Personality Disorder–Relevant Picture Set

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Abstract

This investigation sought to validate a stimulus set previously adapted by expert consensus from the International Affective Picture System to be unpleasant and evocative to individuals with borderline personality disorder (BPD). This set was rated as significantly more arousing by 22 individuals diagnosed with BPD compared to 22 healthy controls, though this mean difference appeared to be driven by differences in ratings for a small subset of pictures. The present BPD sample did not rate the BPD-specific picture set as more arousing than a previous BPD sample (Herpertz, Kunert, Schwenger, & Sass, 1999) had rated a different set of unpleasant, but non-BPD-specific International Affective Picture System images. Future BPD-specific image sets may benefit from including images that more closely target BPD sensitivities and features.

Keywords

borderline personality disorder; cue reactivity; subjective arousal; International Affective Picture System; stimulus set

Borderline personality disorder (BPD) is a complex psychological disorder characterized by intense and rapidly shifting affective states, impulsivity, and high reactivity to emotional stimuli (Koenigsberg et al., 2002; Links, Heslegrave, & van Reekum, 1999; Lynch et al., 2006). Psychophysiological and functional MRI laboratory studies seeking to better understand BPD pathology have frequently employed cue reactivity, or stress test paradigms in order to better understand how individuals with BPD process and respond to stimuli in their environment. Commonly employed stimuli include unpleasant and pleasant pictures (Herpertz, Dietrich, et al., 2001; Herpertz et al., 2000; Herpertz, Werth, et al., 2001; Koenigsberg et al., 2009), emotionally evocative video clips and vignettes (e.g., Austin, Riniolo, & Porges, 2007; Herpertz et al., 1997; Kuo & Linehan, 2009; Limberg, Barnow, Freyberger, & Hamm, 2011), images of facial expressions (Donegan et al., 2003; Lynch et al., 2006), stressors such as arithmetic tasks (e.g., Gratz, Rosenthal, Tull, Lejuez, & Gunderson, 2010; Gratz, Tull, Matusiewicz, Breetz, & Lejuez, 2013; Weinberg, Klonsky, & Hajcak, 2009), and personalized scripts recounting stressful situations (e.g., Kuo & Linehan, 2009; Schmahl et al., 2004; Welch, Linehan, Sylvers, Chittams, & Rizvi, 2008). Often, however, these stimuli fail to produce significant differences in subjective arousal between

individuals with BPD and those without BPD. Thus, while some studies have shown differences in subjectively reported arousal between individuals with BPD and non-BPD controls (Herpertz et al., 1999; Herpertz et al., 2000; Weinberg et al., 2009), many have not (Austin et al., 2007; Herpertz, Dietrich, et al., 2001; Kuo & Linehan, 2009; Suvak et al., 2012).

A potential explanation for this, as noted by Suvak and colleagues (2012), is that the stimuli used in psychophysiological studies of BPD do not have sufficient impact, or are not specifically targeting BPD sensitivities to the degree necessary to elicit distinct responses from individuals with BPD. This question may be further complicated by BPD's complex etiology and polythetic presentation (Crowell, Beauchaine, & Linehan, 2009; Gunderson & Links, 2009), such that individual differences in sensitivities may mean that some individuals with BPD are sensitive to one type of stimuli, but not another.

It has been speculated that a stimulus set that taps into multiple BPD sensitivities may be most effective for reliably eliciting subjective and physiological responses from individuals with BPD in cue reactivity paradigms (Herpertz et al., 2002; Sloan et al., 2010). Previous studies have incorporated a range of visual stimuli with unpleasant, pleasant, and neutral valence taken from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008) with varying results (Herpertz, Dietrich, et al., 2001; Herpertz et al., 2002; Herpertz et al., 2000; Herpertz, Werth, et al., 2001; Koenigsberg et al., 2009). Challenges in eliciting autonomic hyper-reactivity to IAPS images in individuals with BPD led Herpertz et al. to suggest that picture stimuli specifically germane to BPD may be necessary to trigger physiological dysregulation concomitant with BPD (Herpertz et al., 1999; Herpertz, Werth, et al., 2001).

Sloan et al. (2010) responded to the perceived need for a BPD-specific stimuli set by developing a picture subset from the IAPS designed to be pertinent to core themes frequently noted in clinical observations of BPD. To do this, Sloan and colleagues had 19 BPD experts rate 90 preselected IAPS images clearly depicting interpersonal and social content. Ratings were based on the extent to which the images portrayed or implied a situation that an individual with BPD would identify as relevant to his or her experience. Experts were instructed to rate the images using Likert-scales reflecting four distinct constructs: arousal (very calm to very aroused), valence (very unpleasant to very pleasant), the degree to which the image was self-referential (i.e., depicting a situation that reflects the issues or concerns of a person with BPD), and the degree to which the image represented an ideal-other (i.e., depicting qualities that a person with BPD would like to possess). The 90 images were ranked in terms of their mean rater-given, self-referential scores. Images with the highest mean self-referential ratings included images of women being attacked, distressed individuals, and images involving substance use. As anticipated by the authors, images rated by the BPD experts as high in self-referential content, also tended to be rated by the experts as highly unpleasant and highly arousing.

To date, however, this picture set has not been validated with individuals diagnosed with BPD. As such, it is not clear whether this picture set is more evocative to individuals with BPD than to people without BPD, or if this picture set is any more evocative than

unpleasant, pleasant, or neutrally valenced subsets of IAPS images that are commonly used in cue reactivity studies, and not selected based on their relevance to BPD. As such, the present investigation had three aims: (a) to examine the extent to which a BPD-specific picture set based on Sloan et al.'s (2010) results evoked more subjective arousal in individuals with BPD compared to healthy controls and normative ratings for these images; (b) to investigate whether this BPD specific image set was more evocative to individuals with BPD than subsets of IAPS images with unpleasant, pleasant, or neutral valence that are not specific to BPD; and (c) to explore whether individual differences in BPD symptom severity and difficulties in emotion regulation were potential sources of heterogeneity in subjective reports of arousal to IAPS images.

The following hypotheses corresponding to these aims predicted (a) that the present sample of individuals with BPD would report greater subjective arousal in response to the BPD-specific IAPS image set compared to our control participants and normative ratings, and (b) that the present sample of individuals with BPD would report greater arousal to the BPD-specific IAPS images than a previous sample of individuals with BPD reported in response to non-BPD specific subsets of IAPS images that were unpleasant, pleasant, and neutral in valence (Herpertz et al., 1999). Because Aim C represents an exploratory component of the study, no a priori hypotheses were made.

Method

Participants

Individuals with BPD in the present study ($n = 22$) were recruited from the Rutgers University dialectical behavior therapy clinic, and from several dialectical behavior therapy clinics in the central New Jersey area. Control group participants ($n = 22$) were recruited from the same geographical area. Participants were assessed for psychopathology using the Structured Clinical Interview for *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text revision; *DSM-IV-TR*) Axis I Disorders (SCID-I; First, Spitzer, Gibbon, & Williams, 2002), and Structured Clinical Interview for *DSM-IV-TR* Axis II Disorders (SCID-II; First, Gibbon, Spitzer, Williams, & Benjamin, 1997). BPD and control group participants were matched based on sex and age.

The comparison set of reported subjective arousal scores for unpleasant, pleasant, and neutrally valenced non-BPD-specific IAPS images by individuals with BPD came from Herpertz et al. (1999). Their sample ($n = 24$) consisted of treatment seeking women meeting *DSM-III-R* criteria for BPD (American Psychiatric Association, 1987).

Inclusion/Exclusion Criteria

Study inclusion criteria for BPD participants in the present investigation included a *DSM-IV-TR* (American Psychiatric Association, 2000) diagnosis of BPD confirmed by structured clinical interview using the SCID-II. Because psychiatric comorbidity is typical in BPD, to ensure we recruited a BPD sample reflecting the BPD population, co-occurring Axis I and Axis II disorders were allowed for BPD participants, with the exception of psychotic

disorders such as schizophrenia. Any current or lifetime *DSM-IV-TR* disorder diagnosis was exclusionary for control participants.

Because the parent study involved physiological recording, serious medical (e.g., pacemaker, cardiac arrhythmia) or neurological conditions (e.g., Parkinson's disease, multiple sclerosis), and medications directly affecting the cardiovascular system (such as hypertension medicines) were exclusionary for both groups. However, to avoid inadvertently excluding participants with more severe BPD who would be more likely to be prescribed psychiatric medication, psychiatric medications were allowed in the BPD group. Considerable care was taken, however, to schedule experimental sessions to minimize possible acute effects of medication on self-reported arousal. For example, if a participant took a benzodiazepine prior to their scheduled day of study participation, their experimental session would be rescheduled.

The Herpertz et al. (1999) study required a *DSM-III-R* diagnosis of BPD, although they excluded women with BPD who did not meet the *DSM-III-R* BPD criteria of affective instability (Item 6) and impulsive behavior (Item 4 and/or Item 5). Individuals diagnosed with a comorbid organic mental disorder, schizophrenia, a paranoid disorder, current alcohol or other drug abuse, or histrionic or antisocial personality disorder, were also excluded. Their participants were screened for drugs such as antidepressants, anticholinergics, beta-blockers, and neuroleptics.

Stimuli

Sloan and colleagues' (2010) top 36 most self-referential pictures, according to the BPD experts utilized in their study, were initially selected for the present study to fill a 6-min cue presentation block. However, because eight of these images were similar in that they depicted interpersonal violence, three of which contained the same actors in slightly different poses, four of these images (IAPS Images 6530, 6540, 6550, and 6560) were replaced by other highly ranked, self-referential pictures (IAPS Images 2053, 2271, 2800, and 9405).

The Herpertz et al. (1999) study used three sets of IAPS images, with unpleasant (e.g., wild animals attacking, aimed guns, and mutilated bodies), pleasant (e.g., sport scenes, pets, and romantic couples), and neutral valence (e.g., household objects). Each of their sets contained six images; none of which overlapped with the BPD-specific IAPS images selected by Sloan et al. (2010) and used in the present investigation.

Normative arousal rating data for the images contained in the BPD relevant IAPS image set were obtained from the IAPS' developers (Lang et al., 2008) who utilized a sample of 50 women and 50 men ($N = 100$) and the Self-Assessment Manikin (described below) to attain normative arousal scores for each image.

Procedures

The day of the present study, participants completed a battery of questionnaires that included the Borderline Symptom List (BSL-23; Bohus et al., 2009) and Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004), two well-validated and reliable measures

gauging BPD severity and emotion dysregulation. After completing questionnaires participants were seated in a comfortable chair located 2.5 m in front of a large computer screen in a sound attenuated, dimly lit room. Noninvasive physiological sensors were affixed to the arms, left leg, and right hand.

Participants first performed a standardized low-demand “vanilla” task for 6 min, wherein they viewed colored rectangles on a computer screen while silently counting the number of blue rectangles (Jennings, Kamarck, Stewart, Eddy, & Johnson, 1992). This procedure provided the basal physiology measures for the parent study. Following this, participants viewed 36 pictures from Sloan et al.'s (2010) BPD-specific IAPS picture set for a total of 6 min. During this task participants viewed each image for 5 s (order randomized), followed by 5 s of black screen at which time they verbally reported their subjective arousal to each image using the Self-Assessment Manikin (Bradley & Lang, 1994), a standardized 9-point Likert scale where 1 represents *lowest arousal* and 9 represents *greatest arousal*.

Herpertz et al. (1999) seated their participants in a comfortable chair and presented images for 6 s each in three blocks (unpleasant, pleasant, and neutral), with image order randomized within each block. Each image was presented for 6 s. After each slide, subjective ratings of arousal were recorded with the Self-Assessment Manikin using the same rating structure as the present study and Sloan et al. (2010).

Analyses

Between groups differences in subjective arousal were tested using Students' *t* tests. The association between subjective arousal and BPD symptomology characterized by total scores on the BSL-23 and DERS was tested using Pearson's *r* coefficient.

Results

Sample Characteristics

The BPD and control groups in the present investigation were successfully matched on age and sex ($p > .05$). Participants in the BPD group were on average 27.9 years of age ($SD = 8.1$), while participants in the control group were on average 27.1 ($SD = 7.7$). Both groups were 81.8% female. Herpertz et al.'s (1999) BPD group was similar in age, with an average age of 28.0 years ($SD = 6.1$), and 100% female.

As is typical with this disorder, participants with BPD in the present study exhibited a high degree of psychiatric comorbidity. Nineteen of 22 participants had a co-occurring psychological diagnosis or diagnoses. Five participants with BPD also met diagnostic criteria for one or more personality disorders in addition to BPD. Fourteen of 22 participants in the BPD group reported current use of prescribed psychiatric medications, including antipsychotics or mood stabilizers ($n = 7$), benzodiazepines ($n = 4$), nonbenzodiazepine anxiolytic or sleep aids ($n = 3$), selective serotonin reuptake inhibitors ($n = 6$), a serotonin agonist/reuptake inhibitors ($n = 3$), bupropion ($n = 1$), and stimulants for attention-deficit/hyperactivity disorder ($n = 2$). Psychopathology was exclusionary for controls, and none reported use of psychiatric medications.

Herpertz et al. (1999) did not report psychiatric comorbidity for disorders they did not exclude for (i.e., disorders other than organic mental disorders, schizophrenia, paranoid disorders, and current alcohol or other drug abuse) or medications not excluded for (i.e., medication other than antidepressants, anticholinergics, beta-blockers, and neuroleptics).

Borderline Symptom List and Difficulties in Emotion Regulation Scale Ratings

Participants in the present study with BPD reported significantly more BPD symptoms on the BSL-23 (possible range = 0–92) than controls, $t(42) = 6.66, p < .05, d = 2.06$, with participants with BPD scoring a mean total of 40.3 ($SD = 21.8$) and controls scoring 6.8 ($SD = 8.8$) symptoms.

Participants with BPD also reported significantly more difficulties with emotion regulation as measured by the DERS (possible range = 0–180) than controls, $t(42) = 8.46, p < .05, d = 2.61$, with participants with BPD scoring a mean total of 103.0 ($SD = 22.1$) and controls scoring 58.8 ($SD = 10.6$). Total BSL-23 and DERS scores were highly correlated, $r = .77, p < .05, d = 2.41$.

Subjective Arousal to Emotionally Evocative Pictures

Mean arousal ratings for each image by the present study's BPD and control group participants, as well as Sloan et al.'s (2010) BPD experts, are reported in Table 1, along with normative arousal ratings for each image (Lang et al., 2008). Also in Table 1, arousal ratings comparisons for each image are shown between BPD and control group participants with effect sizes expressed as Cohen's d , with $d = .20$ interpreted as a small effect, $d = .50$ interpreted as a medium effect, and $d = .80$ interpreted as a large effect (Cohen, 1988).

Hypothesis 1: As predicted, participants with BPD reported a significantly higher mean level of subjective arousal to the BPD-specific image set than controls, $t(42) = 2.03, p < .05, d = .63$, scoring an average arousal rating of 5.0 ($SD = 1.3$), while control group participants scored an average arousal rating of 4.2 ($SD = 1.3$). At the level of individual images, participants with BPD rated seven of the 36 images as significantly more arousing than controls (Images 2271, 2276, 2399, 2410, 2441, 2800, and 6311). A number of directionally concordant medium effect size differences that did not reach statistical significance were also observed between participants with BPD and controls (Images 2130, 2250, 2595, 2710, 2715, 3022, 4635, and 9041). The present BPD group's mean arousal rating for the BPD relevant IAPS image set did not differ significantly from the average normative ratings for this set, as reported by Lang et al. (2008), $t(48) = 0.17, ns, d = .05$.

Hypothesis 2: The second hypothesis was partially supported. Participants with BPD in the present investigation rated the BPD relevant image set ($M = 5.0, SD = 1.3$) as significantly more arousing than participants in Herpertz et al.'s (1999) study rated pleasant ($M = 3.9, SD = 1.8$), $t(44) = 2.39, p < .05, d = .74$, and neutral ($M = 3.3, SD = 1.8$), $t(44) = 3.68, p < .05, d = 1.14$, IAPS image sets. Contrary to our prediction, however, there were no significant differences between the present participants' arousal ratings of the BPD specific IAPS images compared to Herpertz et al. (1999)

participants' rating of generic unpleasant IAPS images ($M = 5.5$, $SD = 1.9$), $t(44) = -1.02$, ns , $d = .31$.

Exploratory analysis—Within the BPD group, BPD symptomology was not significantly associated with mean subjective arousal characterized by total scores on the BSL-23, $r(22) = .08$, ns , $d = .16$, or DERS, $r(22) = .30$, $p = ns$, $d = .63$.

Discussion

The present investigation sought to validate a set of IAPS images previously selected by BPD experts to be especially evocative to individuals with BPD (Sloan et al., 2010). The development and validation of such image sets is important because studies of BPD affective reactivity have the potential to inform knowledge of this disorder and lead to treatment improvements, yet reliably evoking affective responses in individuals with BPD in laboratory settings has proven difficult.

Sloan et al.'s (2010) BPD-specific IAPS picture set was assessed using new data comparing subjective arousal ratings of the BPD-specific IAPS picture set by persons with BPD, and controls without psychopathology. We also compared the present BPD group's arousal ratings of the BPD picture set to data reported on an earlier BPD sample (by Herpertz et al., 1999) that provided arousal ratings of IAPS images that had been selected to be unpleasant, pleasant, or neutral in valence according to normative ratings with no consideration given to BPD sensitivities.

As hypothesized, individuals with BPD in the present investigation, on average, rated the BPD specific image set as significantly more arousing than did controls. Thus, at the level of mean, the Sloan et al. (2010) picture set invoked higher levels of subjectively perceived arousal in persons with BPD compared to those without this disorder. At the same time, several additional results qualified the interpretation of this observed mean level difference. First, participants with BPD in the present study rated the BPD-relevant IAPS image set as more arousing than an earlier sample of person's with BPD had rated pleasant and neutrally valenced IAPS image sets, but not a nonoverlapping unpleasant set of IAPS images (Herpertz et al., 1999), wherein valence was classified based on normative IAPS data (Lang et al., 2008). This suggests that the group differences observed in the present study could have been due to the “unpleasant” nature of the BPD-relevant image set, rather than its specificity to BPD per se. Because the present study did not include a comparison set of unpleasant IAPS images not selected by Sloan et al. (2010), this possibility was not directly tested.

Second, at the level of individual IAPS images, the BPD sample's arousal ratings were similar to normative arousal ratings previously reported by the IAPS' developers (see Lang et al., 2008) for these images (see Table 1). Additionally, participants with BPD in the present study rated less than a quarter of the individual images as significantly more arousing than controls, and nonsignificant, small to medium effect size differences were observed for the rest of the images. It is therefore likely that the difference at the level of the mean was driven by differences in arousal ratings for a subset of the images, although failure

of some of the medium effect size differences to achieve statistical significance may be attributable to power limitations associated with sample size.

It is notable that of the seven images that the present participants with BPD rated as significantly more arousing than controls, all but one depicted individuals in emotional distress, either crying or expressing negative affect through posture and gesture. Images depicting interpersonal conflict and violence, however, were not rated as significantly more arousing by the BPD group than controls. More work is needed to determine the specific kinds of images that are most evocative to individuals with BPD.

There was no significant association between subjective arousal and BPD symptom severity, suggesting individual differences in symptom severity were not sources of heterogeneity in subjective reports of arousal to IAPS images. The relationship between subjective arousal and emotion dysregulation was also not statistically significant, but had a medium effect size, leaving this question open to further consideration. Nevertheless, the above observations imply that images depicting interpersonal and social content taken from the IAPS may be insufficient for eliciting a distinctive subjective response from people with BPD in cue reactivity paradigms.

Taken together, the present findings suggest the BPD specific image set derived from the IAPS may have limited capacity to trigger states characterizing cognitive and physiological affective dysregulation in individuals with BPD. The range of images available in the IAPS may not be sufficient to effectively target BPD sensitivities, and thus the BPD experts in Sloan et al. (2010) had a limited range of material to rate. For instance, themes of abandonment, as well as nonsuicidal self-injury and suicide were not well represented in the set investigated in the Sloan et al. because they do not feature heavily in the IAPS. This suggests the development of an effective BPD specific picture set may require the collection and validation of a corps of novel images that closely focus on depicting BPD markers such as frantic efforts to avoid abandonment, unstable interpersonal relationships, transient dissociative episodes, nonsuicidal self-injury, and suicide.

Some limitations to this study also should be noted. The BPD samples in the present investigation, and in Herpertz et al.'s (1999) study represent groups of individuals who were assessed in different places, and at different times. While Herpertz et al. excluded participants with certain comorbid Axis II disorders (histrionic and antisocial personality disorders), such Axis II comorbidity was not exclusionary in the present BPD sample. Further, Herpertz et al. only included people with BPD who met the affective instability and impulsive behavior criteria. The present study did not have these inclusion criteria, although they were endorsed by the majority of the present BPD sample (data not shown). The present investigation and Herpertz et al. diagnosed BPD using different versions of the DSM—the *DSM-IV-TR* and *DSM-III-R*, respectively. Although the wording of diagnostic criteria is slightly different between these versions of DSM, and *transient, stress-related paranoid ideation or severe dissociative symptoms* was added to *DSM-IV-TR*, the diagnostic criteria are much the same. Also, while the present study allowed for antidepressant medication, Herpertz et al. excluded participants on such medications. Finally, while the present investigation included 18% male participants, Herpertz et al.'s

sample was entirely female. Although BPD is diagnosed more often in women than men, the disorder affects both sexes and appears to present similarly in women and men (American Psychiatric Association, 2000). It is nevertheless possible that between sex differences in subjective arousal exist.

In summary, the present study found that a BPD specific picture set derived from the IAPS, and based on the preliminary work of Sloan and colleagues (2010), produced significantly greater average levels of subjective arousal in individuals with BPD compared to the present sample of healthy controls. This mean level difference appeared to have been driven by differences in arousal ratings for a subset of the images that primarily depicted emotional distress. Notably though, the present sample of individuals with BPD did not rate the BPD-specific image set as more arousing than did the IAPS normative sample, nor did they rate the BPD-specific image set as more arousing than a previous sample of individuals with BPD rated a set of unpleasantly valenced IAPS images (Herpertz et al., 1999). It is suggested that future BPD specific picture sets developed for cue reactivity paradigms will benefit from including more images that more closely target BPD sensitivities and features.

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Table 1
BPD Expert, BPD Participant, Control Participant, and Normative Arousal Ratings in Order of Arousal Rating by BPD Participants

IAPS picture number	BPD expert arousal rating ^a	BPD participant arousal rating ^a	Control participant arousal rating ^a	Normative arousal rating ^b	r^{a-y}	d^{x-y}
2800	8.39 (.78)	7.50 (1.77)	5.68 (2.44)	5.49 (2.11)	2.83 *	.87
6350	8.22 (1.00)	7.32 (1.67)	6.68 (2.30)	7.29 (1.87)	1.05	.32
6313	8.44 (.86)	7.09 (2.11)	6.86 (2.25)	6.94 (2.23)	.35	.11
9405	8.22 (1.31)	7.05 (2.34)	6.86 (2.14)	6.08 (2.40)	.27	.08
2053	8.11 (1.41)	6.77 (1.80)	5.95 (1.84)	5.25 (2.46)	1.49	.46
6315	8.35 (.93)	6.14 (2.19)	6.41 (2.38)	6.38 (2.39)	-.40	.12
4635	7.78 (1.22)	6.09 (1.87)	4.82 (2.36)	4.23 (2.35)	1.98	.61
6311	7.50 (1.54)	5.91 (2.49)	3.86 (2.14)	4.95 (2.27)	2.92 *	.90
2710	7.39 (1.85)	5.86 (2.21)	4.82 (1.97)	5.46 (2.29)	1.66	.51
6360	8.00 (.84)	5.82 (2.17)	5.73 (2.14)	6.33 (2.51)	.14	.04
2141	7.47 (1.12)	5.77 (2.51)	5.55 (2.39)	5.00 (2.03)	.31	.10
9041	7.67 (.91)	5.68 (1.91)	4.55 (2.52)	4.64 (2.26)	1.68	.52
2120	8.21 (.92)	5.45 (2.20)	5.14 (2.21)	5.18 (2.52)	.48	.15
2900	7.33 (.91)	5.41 (2.02)	4.86 (2.41)	5.09 (2.15)	.81	.25
4621	7.61 (.85)	5.32 (1.84)	4.41 (2.17)	4.92 (2.24)	1.50	.46
4660	7.61 (1.04)	5.23 (2.39)	4.95 (2.21)	6.58 (1.88)	.39	.12
2276	7.05 (1.13)	5.18 (2.02)	3.45 (1.79)	4.63 (1.93)	3.00 *	.93
3022	7.67 (.97)	5.18 (2.30)	4.09 (1.95)	5.88 (2.08)	1.70	.52
4650	7.61 (.98)	4.73 (2.00)	4.23 (2.00)	5.67 (2.14)	.83	.26
6561	7.33 (.84)	4.68 (2.32)	4.68 (2.12)	4.99 (2.19)	.00	.00
2752	7.11 (1.88)	4.68 (1.98)	3.82 (1.92)	4.30 (1.94)	1.47	.45
2810	7.00 (1.50)	4.64 (2.11)	4.36 (2.08)	4.47 (1.92)	.43	.13
2271	6.53 (1.22)	4.64 (2.04)	2.91 (1.69)	3.74 (1.69)	3.06 *	.94
2130	7.37 (1.54)	4.50 (2.09)	3.55 (1.70)	5.02 (2.00)	1.66	.51
2410	6.76 (1.03)	4.27 (2.07)	3.06 (1.50)	4.13 (2.29)	2.25 *	.69
2100	7.42 (1.12)	4.27 (2.16)	3.59 (1.68)	4.53 (2.57)	1.17	.36
2399	6.61 (1.42)	4.09 (1.80)	2.95 (1.62)	3.93 (2.01)	2.20 *	.68

IAPS picture number	BPD expert arousal rating ^a	BPD participant arousal rating ^x	Control participant arousal rating ^y	Normative arousal rating ^q	t^{x-y}	d^{x-y}
2441	6.83 (1.30)	3.91 (2.04)	2.41 (1.37)	3.62 (1.96)	2.86 *	.88
2110	7.37 (.96)	3.86 (1.64)	3.18 (1.74)	4.53 (2.25)	1.34	.41
2745	6.50 (.99)	3.82 (2.15)	3.36 (1.68)	5.17 (2.14)	.78	.24
2702	6.56 (1.58)	3.73 (2.05)	3.14 (1.61)	3.92 (2.34)	1.06	.33
2250	6.00 (1.60)	3.50 (1.85)	2.27 (1.49)	4.19 (2.28)	2.43	.75
2715	5.06 (1.86)	3.36 (1.94)	2.50 (1.10)	4.35 (2.27)	1.82	.56
2025	5.74 (1.88)	3.27 (1.67)	2.50 (1.63)	4.30 (2.16)	1.56	.48
2272	5.89 (1.79)	3.18 (1.94)	2.36 (1.68)	3.74 (1.94)	1.50	.46
2595	5.50 (1.58)	2.91 (1.97)	1.91 (1.27)	3.71 (1.88)	2.00	.62
<i>M</i>	7.23 (.86)	5.02 (1.33)	4.21 (1.33)	4.96 (2.16)		

Note. BPD = borderline personality disorder; IAPS = International Affective Picture System. *SD* in parentheses; *df* = 42. Arousal ratings Likert scale = 1–9.

^aReported in Sloan et al. (2010).

^bReported in Lang et al. (2008).

* $p < .05$.