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Blinded by our emotions: The impact of borderline personality disorder and affect on emotion recognition sensitivity

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Abstract

Previous studies have demonstrated abnormalities in emotion recognition within individuals diagnosed with borderline personality disorder (BPD). However, it is yet unknown how much these abnormalities can be attributed to emotional states or *affect*. Therefore, the current study aimed to investigate the independent effects of BPD, positive affect, and negative affect on emotion recognition sensitivity. We recruited a mixed, transdiagnostic community sample of 118 adults diagnosed with either a personality disorder, only an affective disorder, or without psychopathology. Participants completed self-report assessments of positive and negative affect and two behavioral assessments of emotion recognition sensitivity. We found that both positive and negative affect predict lower overall emotion recognition sensitivity in both tasks, beyond the effect of BPD. We did not find a significant, independent effect of the diagnosis of BPD. Additionally, we found that the diagnosis of BPD moderated the relationship between negative affect and emotion recognition sensitivity within one task. Findings from the present study suggest that sensitivity to other people's emotional expressions may be influenced by affect beyond the effect of the BPD diagnosis. The implications for future research efforts on emotion recognition and BPD are discussed.

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Borderline personality disorder (BPD) is a serious psychiatric disorder characterized by instability of emotions, interpersonal relationships, identity, and behaviors (American Psychiatric Association, 2013). As relationship disturbance is a central feature of BPD (Gunderson, 2007), more research is needed to identify the mechanisms underlying interpersonal dysfunction in BPD. In particular, empirical research that uses objective and performance-based measures of social functioning may more precisely characterize the interpersonal difficulties associated with BPD (Lazarus, Cheavens, Festa, & Rosenthal, 2014), which would allow for more targeted and nuanced interventions that could augment existing empirically supported interventions for BPD symptomology.

One potential target process driving interpersonal dysfunction in BPD is *emotion recognition* (Domes, Schulze, & Herpertz, 2009; Lynch et al., 2006), as identifying other people's emotional expressions accurately is a key component of developing and maintaining healthy relationships (Mayer, Salovey, Caruso & Sitarenios, 2001), and problems with emotion recognition are known to lead to serious psychosocial problems such as aggression (Dodge, 1993), poor relationship quality (Carton, Kessler, & Pape, 1999), and general psychiatric distress (Crick & Dodge, 1994). Current theoretical models of the etiology of BPD propose that disturbances in emotional processing are central to the disorder (Linehan, 1993). According to this perspective, individuals with BPD may have difficulty identifying and appropriately responding to emotionally salient stimuli in the environment, such as other people's expressions of emotion. Other models of BPD propose that symptoms of the disorder are reflections of social cognitive impairments (Bateman & Fonagy, 2006; Fonagy & Luyten, 2009). These different perspectives both lead to the hypothesis that BPD is related to deficits in emotion recognition.

To test this hypothesis, previous investigations have studied how individuals with BPD perform on emotion recognition behavioral tasks compared to healthy or clinical control groups (Domes et al., 2009; Lazarus et al., 2014; Roepke, Vater, Preißler, Heekeren, & Dziobek, 2012). While this work has demonstrated abnormal emotion recognition within BPD, the nature of these abnormalities is yet unclear (Daros et al., 2013; Domes et al., 2009; Lazarus et al., 2014; Roepke, Vater, Preißler, Heekeren, & Dziobek, 2013). For example, one study found that individuals with BPD perceive other people's facial expressions of emotion with higher accuracy (Wagner & Linehan, 1999) compared to control subjects. Other studies found that BPD was associated with higher sensitivity to emotional expressions at lower intensity compared to control participants (Domes et al., 2009; Lynch et al., 2006). These findings supported the biosocial theory (Linehan, 1993), which proposes that individuals with BPD have a dispositional heightened sensitivity to emotional stimuli (Lynch et al., 2006; Zanarini & Frankenburg, 2007). On the other hand, other studies found poorer recognition within BPD (Merkl et al., 2010; Unoka, Fogd, Füzy, & Csukly, 2011) or problems perceiving specific emotional expressions (for a meta-analytic review, see Daros, Zakzanis, & Ruocco, 2013). Collectively, these findings suggest that BPD may be associated with abnormalities in perceiving others' emotional expressions, but research has yet to precisely characterize the relationship between BPD and emotion recognition. One unanswered question in this literature is how much problems perceiving other people's emotions can be attributed to borderline personality pathology or to state-related biases that individuals with BPD may experience (Daros et al., 2013; Lazarus et al., 2014).

Research on emotion recognition in BPD has yet to determine how much current emotional states, or *affect*, account for differences in emotion recognition ability. Previous research in healthy samples has demonstrated that positive and negative affect can impact various processes involved in emotion recognition (Hristova & Grinberg, 2015; Jackson & Arlegui-Prieto, 2016; Schmid & Mast, 2010). Findings from this research demonstrate that perceivers' affect can influence, and even impair, the ability to correctly recognize others' emotions. As individuals with BPD often report high intensity and fluctuation of affect (Ebner-Priemer et al., 2007), participants' current emotional state may contribute to their performance on emotion recognition tasks (Daros et al., 2013; Domes et al., 2009). Differences in participants' affective states may even explain some of the mixed findings in the BPD and emotion recognition literature (Lazarus et al., 2014). However, there is a lack of research distinguishing the extent to which individual differences in emotion recognition can be accounted for by the influence of BPD pathology, levels of state affect, or their interaction.

In sum, BPD may be associated with difficulties in emotion recognition, a key social cognitive process within healthy interpersonal functioning. However, findings from previous studies of BPD and emotion recognition have been mixed and have yet to investigate the role of participants' affect within emotion recognition to understand how much variability in emotion recognition is attributed to BPD pathology or levels of state affect (Daros et al., 2013; Domes et al., 2009). Furthermore, this previous research has been limited by assessing emotion recognition with paradigms that use static images of faces with exaggerated emotional expressions, which may be too simplistic to adequately capture psychological processes required within real-life contexts (Dziobek, 2012). Because BPD patients may only show social cognitive deficits within complex or ecologically valid behavioral tasks (Roepke et al., 2013), it is important to study emotion recognition in this population with tasks that use dynamic, nuanced stimuli that represent real social interactions (Lynch et al., 2006).

The present study

The present study investigated the independent effects of BPD, positive affect, and negative affect on the ability to accurately identify emotions from facial expressions. As previous research has shown effects of BPD and affect on sensitivity to other people's emotional expressions, we chose emotion recognition sensitivity as the main outcome measure. The aims of this study were (1) to test the effect of BPD on emotion recognition sensitivity, (2) to test the additional effects of positive and negative affect on emotion recognition sensitivity, and (3) to explore the effects of the interactions between diagnosis of BPD and state positive and negative affect on emotion recognition sensitivity. For these aims, we recruited a mixed, transdiagnostic community sample of adults diagnosed with or without psychopathology. Participants completed self-report measures of positive and negative affect and then two behavioral assessments of emotion recognition sensitivity designed to simulate naturalistic social settings with different levels of complexity. Based on previous research (Domes et al., 2009; Jackson & Arlegui-Prieto, 2016), we hypothesized that BPD, positive affect, and negative affect would have independent effects on emotion recognition sensitivity. Alternatively, it could be possible that state affect alone influences emotion recognition sensitivity and borderline personality pathology does not have an effect beyond participants' emotional state. Although investigating the interaction effects is an exploratory aim, we predict that the interaction between negative affect and BPD will have a significant effect on emotion recognition sensitivity, in line with hypothesized models of these relationships (Daros et al., 2013). By studying the relative contributions of BPD and current emotional states to emotion recognition, we hoped to shed light on potential mechanisms underlying interpersonal dysfunction in BPD.

Methods

Participants

Participants were recruited from the community using online and newspaper listings, flyers, and an institutional review board–approved participant registry from a medical center that specializes in the treatment of mood and personality disorders. Individuals between 18 years and 60 years of age who responded to study advertisements were screened over the phone. Adults who met inclusion criteria during the phone screen ($n = 126$) completed in-person diagnostic interviews using the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) (First, Spitzer, Gibbon, & Williams, 2002) and Structured Clinical Interview for DSM-IV Axis II Disorders (SCID-II) (First, Gibbon, Spitzer, Williams, & Benjamin, 1997), described below. Participants met inclusion criteria if they were between the ages of 18 and 60 and had no symptoms of current psychosis or mania.

Of the 126 participants who underwent structured diagnostic assessments, 118 qualified for the study. Eight participants were excluded from the rest of the study due to diagnosis of current mania or failure to complete the measures included in this study. The sample was primarily female (66.9%), African American (51.7%), had less than a college degree (59.8%), and earned less than 20,000 (60.5%). The mean age was 36.9 (standard deviation (SD) = 11.7). At the time of the study, 33% of the sample met criteria for

Table 1. Clinical descriptives.

Depressive disorder	33.0% ($n = 38$)
Current major depressive disorder	22.9% ($n = 27$)
Bipolar disorder	3.3% ($n = 4$)
Anxiety disorder	45.2% ($n = 52$)
Panic disorder	8.4% ($n = 10$)
Social phobia	15.2% ($n = 18$)
PTSD	15.3% ($n = 18$)
GAD	20.4% ($n = 24$)
Substance use disorder	16.1% ($n = 19$)
Eating disorders	6.2% ($n = 7$)
Current personality disorder	37.1% ($n = 43$)
Borderline personality disorder	27.1% (n=32)

Note. PTSD = Post-Traumatic Stress disorder; GAD = Generalized Anxiety Disorder.

at least one depressive disorder (22.9% with current major depressive disorder, $n = 27$), 45.2% met criteria for at least one anxiety disorder, and 37.1% met criteria for a personality disorder (27.1% with BPD, $n = 32$). Forty-eight participants did not meet criteria for any psychopathology. See Table 1 for detailed clinical information of the present sample.

Measures

Diagnostic assessment. SCID-I (First et al., 2002) was used to assess whether participants met criteria for current or lifetime Axis-I diagnoses. Diagnostic interviews were conducted by trained diagnostic assessors under the direct supervision of a clinical psychologist (M.Z.R.). SCID-II (First et al., 1997) was used to assess diagnostic symptoms of personality disorders. Participants first completed a patient self-report questionnaire (SCID-II-PQ) to assess the presence or absence of specific symptoms of personality disorders, which demonstrates excellent interrater reliability (κs between .85 and .95, median interclass correlation = .97; Farmer & Chapman, 2002). For the current study, items endorsed on the SCID-II-PQ were further evaluated using the standard SCID-II interview. This two-stage assessment process is commonly conducted, with studies suggesting a low false-negative rate for nonendorsed SCID-II-PQ items (Jacobsberg, Perry, & Frances, 1995).

Multimorph facial affect recognition task. This task is an established, computer-based behavioral assessment in which participants observe a picture of a face morph from a neutral facial expression to one of sadness, happiness, surprise, anger, fear, or disgust (Blair, Colledge, Murray, & Mitchell, 2001). Thirty-six trials were presented (six for each of six emotions: anger, fear, sadness, surprise, happiness, and disgust). Participants are instructed to classify the emotion as soon as they are able to do so as the face morphs from 0% expression to 100% expression over 39 stages. The measure of emotion recognition sensitivity is the mean number of stages to correct classification of emotion across all six emotional expressions (i.e., overall emotion recognition sensitivity) and within each emotional expression. This task has been validated in studies of individuals with psychopathic traits (Blair et al., 2001). In this study, the Cronbach's α was .903.

Virtual reality emotion sensitivity task. The virtual reality emotion sensitivity task (V-REST) was used to assess emotion recognition sensitivity using three-dimensional, virtual environments that simulate realistic social settings (Kim, Geiger, Herr, & Rosenthal, 2010; Kim et al., 2015). It has shown high convergent and divergent validity with other established behavioral assessments of emotion recognition (Kim et al., 2015). In the V-REST, participants identified one of six basic emotions (i.e., happiness, fear, anger, disgust, sadness, surprise) as quickly as possible in a simulated encounter with an avatar. Each trial began with the avatar displaying a neutral face, which gradually morphed into a full emotional expression over 40 s. There were 24 trials, including six emotions presented in random order by both a male and female avatar in both a home setting and a doctor's office. The GameStudio A6 rendering engine (Conitec, Germany) was used as the VR software platform. Emotion recognition sensitivity was measured by the number of seconds it took participants to identify the correct emotion within 40 s, from stimulus onset to the full expression. In this task, emotion recognition sensitivity was assessed by the average number of seconds it took the participant to recognize correct emotions across all six emotional expressions (i.e., overall emotion recognition sensitivity) and within each emotional expression. In this study, Cronbach's α was .87. All of the measures of V-REST emotion recognition sensitivity were significantly correlated with the measures from the multimorph facial affect recognition Task within each corresponding emotional expression (see Supplementary Table), demonstrating high convergent validity between the two tasks. Both the V-REST and multimorph measure emotion recognition sensitivity with similar methods, but the V-REST uses more complex, ecologically valid stimuli that simulate social environments found in daily life (e.g., interacting with someone at a doctor's office).

Positive and negative affect schedule. The positive and negative affect schedule (PANAS) consists of two 10-item self-report questionnaires that measure activation of current positive and negative emotional states (Watson, Clark, & Tellegen, 1988). Respondents were given a list of emotional states (e.g., "inspired" or "nervous") and asked to indicate to what extent they felt that emotion in the present moment using a 5-point Likert-type scale (1 = *Very slightly or not at all*, 5 = *Extremely*). The PANAS produces two subscales: *negative affect*, a measure of subjective distress and unpleasant feelings, and *positive affect*, a measure of subjective enthusiasm, activity, and pleasant feelings. The internal reliability for the validation samples was good ($\alpha = .84–.90$). In the current study, Cronbach's α was .86 for the whole PANAS, .92 for the positive affect scale, and .84 for the negative affect scale.

Study procedure

Participants deemed eligible through the phone screen came for an in-office appointment. At that time, they gave voluntary, written informed consent and completed diagnostic interviews. Individuals who met full inclusion criteria participated in the laboratory experimental procedure. In this procedure, participants sat in a quiet room in front of a computer screen and were oriented to the experiment by a trained research assistant. They filled out the self-report PANAS scale to obtain a baseline measure of state affect and then completed the V-REST and the multimorph task. Participants also completed other self-report questionnaires that are beyond the scope of this article and are described elsewhere (Neacsiu, Fang, Rodriguez, & Rosenthal, 2018). The study took up to 8 hr per participant, and upon completion, participants received US$100 for compensation and were fully debriefed.

Data analysis

Our analyses addressed the three aims of the study: (1) to test the effect of BPD on emotion recognition sensitivity, (2) to test the additional effects of positive and negative state affect on emotion recognition sensitivity, and (3) to explore the effects of the interactions between diagnosis of BPD and state positive and negative affect on emotion recognition sensitivity. We conducted hierarchical multiple regression analyses in three steps, according to these aims. First, we entered diagnosis of BPD in the first step, then added positive affect and negative affect in the second step, and the interactions between BPD and positive and negative affect in the third step as predictors of overall emotion recognition sensitivity (i.e., average score across all six facial expressions). Second, we conducted these three-step hierarchical regression analyses for the sensitivity scores for each facial expression of emotion (anger, disgust, fear, happiness, sadness, and surprise) as the outcome measures. We conducted these two sets of regression analyses with the data from both the V-REST and the multimorph task. Finally, to explore potential differences among different diagnostic groups within our sample, we conducted an analysis of covariance (ANCOVA) to test the effects of diagnosis (healthy vs. BPD vs. other psychopathology) on overall emotion recognition sensitivity, controlling for positive and negative state affect.

Prior to conducting analyses, Shapiro–Wilk tests were conducted on dependent variables to ensure the data were normally distributed. Considering the significant correlations between BPD and negative affect ($r\,(117) = .42, p < .001$) and positive affect ($r\,(117) = -.23, p = .006$), all continuous predictors were mean-centered to reduce multicollinearity. Tests to see whether the data met the assumption of collinearity indicated that multicollinearity was not a concern, as the lowest tolerance was .96 and highest variance inflation factor (VIF) was 3.81 across the regression analyses. Due to the multiple regression analyses conducted in this study, we used a hierarchical approach to the Benjamini–Hochberg procedure to control for the false discovery rate for the parent level of regression analyses and the level of coefficient analyses only for the significant regression models (Benjamini & Hochberg, 1995; Yekutieli, 2008). The Benjamini–Hochberg procedure was also applied to the model change analyses. Missing values were not included in analyses.

Results

Group differences in affect and emotion recognition sensitivity

Results from analysis of variance (ANOVA) revealed that individuals with BPD reported significantly lower positive affect (mean (M) = 23.94, SD = 8.84) than individuals without BPD (M = 30.09, $SD = 11.14$; $F(1, 122) = 8.53, p = .004$). Individuals with BPD reported significantly higher negative affect ($M = 17.06$, $SD = 7.90$) than individuals without BPD ($M = 11.99$, $SD = 3.63$; $F(1, 122) = 24.01$, $p < .001$). Individuals with BPD took an average of 22.48 s ($SD = 4.86$) to guess the correct emotion in the V-REST task and 27.74 ($SD = 5.41$) stages in the multimorph task. Individuals without BPD took an average of 22.50 s ($SD = 5.58$) to guess the correct emotion in the V-REST task and 28.16 ($SD = 5.70$) stages in the multimorph task. Results from ANOVA revealed no significant differences between individuals with and without BPD on both measures of emotion recognition sensitivity (all $p > .05$).

Main results

Analyses were conducted to test the main hypotheses that BPD has a significant impact on emotion recognition sensitivity (Aim 1), and positive and negative state affect have independent impacts on emotion recognition sensitivity (Aim 2). We also explored whether the interactions between BPD and state affect had an effect on emotion recognition sensitivity (Aim 3). The results are presented in this order below for both the V-REST and multimorph task. See Table 2 for results from regression analyses in the V-REST, and see Table 3 for results from the multimorph task.

Borderline personality disorder. In the V-REST task, the analyses from the first step of the regression models revealed that BPD did not account for a significant amount of variance in overall emotion recognition sensitivity ($p = .988$) or sensitivity to expressions of specific emotions: anger ($p = .876$), disgust, ($p = .751$), fear ($p = .597$), happiness ($p = .852$), sadness ($p = .426$), or surprise ($p = .822$). Similarly in the multimorph task, the analyses from the first step of the regression models revealed that BPD did not account for a significant amount of variance in overall emotion recognition sensitivity ($p = .710$), sensitivity to expressions of anger ($p = .806$), disgust ($p = .783$), fear ($p = .001$), happiness ($p = .835$), sadness ($p = .909$), or surprise ($p = .512$).

Results from the ANCOVAs revealed that, controlling for state affect, there was no significant effect of diagnosis (healthy vs. BPD vs. other psychopathology) on overall emotion recognition sensitivity as assessed by the V-REST task ($p = .635$) and the multimorph task ($p = .976$).

State affect. In the V-REST task, the analyses from the second steps of the models revealed that BPD, negative affect, and positive affect together predicted a significant amount of variance in overall emotion recognition sensitivity, $F(3, 114) = 7.79$, $p < .001$, and sensitivity to expressions of anger, $F(3, 114) = 10.38$, $p < .001$; fear, $F(3, 114) = 4.90$, $p = .003$; happiness, $F(3, 114) = 10.16$, $p < .001$; and sadness, $F(4, 114) = 6.35$, $p = .002$. The addition of negative and positive affect leads to a significant increase in R^2 for overall emotion recognition sensitivity, $F(2, 114) = 11.69$, $p < .001$; sensitivity to anger, $F(2, 114) = 15.56$, $p < .001$; fear, $F(2, 114) = 7.20$, $p = .001$; happiness, $F(2, 114) = 15.22$, $p < .001$; and sadness, $F(2, 114) = 9.16$, $p < .001$. See Table 2 for results from coefficient analyses for the individual predictors. Positive affect independently predicted a significant amount of variance in overall emotion recognition sensitivity ($p < .001$), sensitivity to expressions of anger ($p < .001$), fear ($p < .001$), and sadness ($p = .001$). Negative affect independently predicted a significant amount of variance in overall emotion recognition sensitivity ($p = .007$) and sensitivity to happiness ($p < .001$). BPD, positive affect, and negative affect together did not predict sensitivity to disgust ($p = .172$) or surprise ($p = .353$). BPD was not a significant predictor of emotion recognition sensitivity independent of affect (all $p > .05$). Furthermore, the addition of positive and negative affect did not lead to a significant increase in R^2 for disgust ($p = .087$) or surprise ($p = .202$).

In the multimorph task, the analyses from the second steps of the models revealed that BPD, negative affect, and positive affect together predicted a significant amount of variance in overall emotion recognition sensitivity, $F(3, 118) = 7.80$, $p < .001$, and sensitivity to expressions of anger, $F(3, 116) = 4.91$, $p = .003$; happiness, $F(3, 118) = 6.98$, $p < .001$, sadness; $F(3, 118) = 3.43$, $p = .019$; and surprise, $F(3, 118) = 9.60$, $p < .001$. The addition of negative and positive affect led to a significant increase in R^2 for overall emotion recognition sensitivity, $F(2, 118) = 11.62$, $p < .001$; sensitivity to anger, $F(2, 116) = 7.33$, $p = .001$; happiness, $F(2, 118) = 10.45$, $p < .001$; and sadness, $F(2, 118) = 5.14$, $p = .007$. See Table 3 for results from coefficient analyses for the individual predictors. Positive affect independently predicted a significant amount of variance in overall emotion recognition sensitivity ($p < .001$), sensitivity to expressions of anger ($p < .001$), happiness ($p < .001$), sadness ($p = .005$), and surprise ($p < .001$). BPD, positive affect, and negative affect together did not predict sensitivity to disgust

Table 2. Results from regression analysis with positive affect, negative affect, and diagnosis as predictors of emotion recognition sensitivity in the V-REST.

	Overall			Anger			Disgust			Fear			Happiness			Sadness			Surprise		
	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3
	β	β	β	β	β	β	β	β	β	β	β	β	β	β	β	β	β	β	β	β	β
BPD	−.001	−.03	.01	−.02	.02	.07	−.03	−.02	.05	.60	−.47	−.13	−.02	−.19	−.16	.07	.05	.05	.02	−.02	.01
Positive affect		.33*	.23*		.47*	.38*		.19	.14		3.28*	2.76*		.12	.08		.31*	.32*		.10	.09
Negative affect		.26*	.54*		.17	.35		.08	.47*		1.62	2.28		.48*	.59*		.22	.39		.14	.35
Negative Affect × BPD			.09			−.24			−.50*			−1.66			−.15			−.21			−.27
Positive Affect × BPD			.09			.13			.13			.57			.10			−.03			.03
R^2	.00	.17*	.21*	.00	.22*	.24*	.00	.04	.13*	.00	.11*	.14*	.00	.21*	.22*	.01	.14*	.16*	.00	.03	.05
F for change in R^2	.00	11.69*	2.88	.02	15.56*	1.96	.10	2.49	5.26*	.28	7.20*	1.45	.04	15.22*	.84	.64	9.16*	.93	.05	1.62	1.25

Note. V-REST: virtual reality emotion sensitivity task; BPD = borderline personality disorder.
*Significant based on the Benjamini–Hochberg procedure.

Table 3. Results from regression analysis with positive affect, negative affect, and diagnosis as predictors of emotion recognition sensitivity in the multimorph facial affect recognition task.

	Overall			Anger			Disgust			Fear			Happiness			Sadness			Surprise		
	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3
	β	β	β	β	β	β	β	β	β	β	β	β	β	β	β	β	β	β	β	β	β
BPD	−.03	−.03	.01	−.02	.04	.01	.01	.03	.04	.03	.03	.03	−.02	.03	.02	−.01	.01	−.04	−.06	.01	−.03
Positive affect		.40*	.45*		.34*	.41*		.21	.20		.18	.18		.38*	.41*		.26*	.33		.44*	.50*
Negative affect		.09	.30		.04	.29		.07	.27		.11	.16		.12	.37		.11	.21		.09	.24
Negative affect × BPD			−.24			−.29			−.24			−.07			−.30			−.09			−.16
Positive Affect × BPD			−.11			−.15			.02			−.01			−.08			−.16			−.16
R^2	.00	.17*	.19*	.00	.11*	.16*	.00	.05	.06	.00	.04	.05	.00	.15*	.19*	.00	.08*	.10	.00	.20*	.22*
F for change in R^2	.14	11.62*	2.00	.06	7.33*	3.10	.01	2.87	.96	.08	2.61	.12	.04	10.45*	2.46	.01	5.14*	1.36	.43	14.13*	2.00

Note. BPD = borderline personality disorder.
*Significant based on the Benjamini–Hochberg procedure.

($p = .130$) or fear ($p = .157$). BPD and negative affect were not a significant predictor of emotion recognition sensitivity independent of positive affect (all $p > .05$). The addition of positive and negative affect did not lead to a significant increase in R^2 for disgust ($p = .061$) or fear ($p = .078$).

Interactions between BPD and state affect. In the V-REST task, the analyses from the full model revealed that BPD, negative affect, positive affect, and the interactions among BPD and negative and positive affect together predicted a significant amount of variance in overall emotion recognition sensitivity, $F(5, 112) = 5.98$, $p < .001$, and sensitivity to anger, $F(5, 112) = 7.12$, $p < .001$; fear, $F(5, 112) = 3.55$, $p = .005$; disgust, $F(5, 112) = 3.20$, $p = .010$; happiness, $F(5, 112) = 6.41$, $p < .001$; and sadness, $F(5, 112) = 4.18$, $p = .002$. The addition of the interactions among BPD and negative and positive affect leads to a significant increase in R^2 for disgust, $F(2, 112) = 5.26$, $p = .007$. See Table 2 for results from coefficient analyses for the individual predictors. The interaction between negative affect and BPD had an independent effect on disgust ($p = .002$). Specifically, in individuals without BPD, the relationship between negative affect and sensitivity to disgust is significant, $F(1, 84) = 7.91$, $p = .006$; $R^2 = .086$. However, this relationship was not significant within individuals diagnosed with BPD, $F(1, 30) = 1.158$, $p = .290$; $R^2 = .037$. None of the interaction terms nor BPD were significant predictors of emotion recognition sensitivity independent of affect (all $p > .05$). BPD, negative affect, positive affect, and the interactions among BPD and negative and positive affect together did not predict sensitivity to surprise ($p = .332$). The addition of the interactions did not lead to a significant increase in R^2 for overall emotion recognition sensitivity ($p = .060$), or sensitivity to anger ($p = .145$), fear ($p = .239$), happiness ($p = .437$), sadness ($p = .399$), and surprise ($p = .290$).

In the multimorph task, the analyses from the full model revealed that BPD, negative affect, positive affect, and the interactions among BPD and negative and positive affect together predicted a significant amount of variance in overall emotion recognition sensitivity, $F(5, 116) = 5.56$, $p < .001$, and sensitivity to anger, $F(5, 116) = 4.91$, $p = .003$; happiness, $F(3, 118) = 6.98$, $p < .001$; and surprise, $F(5, 116) = 6.66$, $p < .001$. See Table 3 for results from coefficient analyses for the individual predictors. BPD, negative affect, and the interaction terms were not significant predictors of emotion recognition sensitivity independent of positive affect (all ps $> .05$). BPD, negative affect, positive affect, and the interactions among BPD and negative and positive affect together did not predict sensitivity to disgust ($p = .184$), fear ($p = .368$), or sadness ($p = .261$). The addition of the interactions did not lead to a significant increase in R^2 for emotion recognition sensitivity (all $p > .048$).

Discussion

The current study investigated the effects of BPD and both positive and negative affect on sensitivity to other people's emotional expressions (i.e., *emotion recognition sensitivity*) within a transdiagnostic, community sample. Overall, results indicated that higher activation of positive and negative affect independently predicted less emotion recognition sensitivity (i.e., slower to correctly classify these facial expressions of emotion). Contrary to our hypothesis, we did not find an independent effect of the diagnosis of BPD on emotion recognition sensitivity. However, we found a significant interaction between BPD and negative affect only within sensitivity to expressions of disgust, assessed by the V-REST. Collectively, these findings suggest that current emotional states (i.e., state affect) are associated with lower sensitivity to other people's emotional expressions.

In line with previous findings (Hristova & Grinberg, 2015; Jackson & Arlegui-Prieto, 2016; Schmid & Mast, 2010), current results suggest that high activation of either positive or negative affective states is associated with an impaired ability to recognize other people's emotional expressions. These results could be attributed to a *mood-congruence effect*, in which a person's emotional state leads them to selectively attend and encode stimuli in the environment that is consistent with that emotion (Forgas & Bower, 1987). Our findings using the V-REST task suggest a mood-congruent bias associated with reduced sensitivity to emotional expressions of the opposite valence, as high activation of positive affect predicted decreased sensitivity to facial expressions of anger, fear, and sadness, while high activation of negative affect predicted decreased sensitivity to happy facial expressions. However, these types of mood-congruent biases were not found using the multimorph task. The discrepancy between the two tasks may be due to their differences in the social complexity, as the V-REST is an interactive behavioral task with more complex information about social context (e.g., office and home settings). Previous research has suggested that social judgments may be particularly vulnerable to the influence of affect within social situations that are complex or unusual (Forgas, 1995), so the V-REST may demonstrate stronger mood-congruent effects. Beside mood-congruent effects on recognizing emotions of a specific valence, our findings across the two tasks could be interpreted as a form of mood congruent effect based on the *intensity* of the emotional expressions. Some authors have argued that being in a highly negative or positive emotional state activates associations with high emotional intensity in general, which facilitates perception of emotion with the same intensity (Hristova & Grinberg, 2015). This interpretation could explain why our participants with high affect activation could better recognize avatars' emotions at later stages of the morph, when emotional expressions were more extreme. Therefore, intense states of affect may lead to attentional biases within the process of perceiving and interpreting other people's facial expressions of emotion. Alternatively, these results could be interpreted in line with evidence that high states of emotional arousal can trigger a state of personal distress and orient attention toward the self (Eisenberg, 2000). Personal distress would impair empathy or processes involved in identifying other people's emotions. Further research is needed to clarify the mechanisms that explain why elevated emotional states are related to lower sensitivity to other people's emotional expressions.

Contrary to our hypothesis, we did not find a significant, independent effect of BPD on emotion recognition sensitivity beyond the effects of positive and negative affect. This null finding further suggests that participants' current emotional state may play a key role in emotion recognition sensitivity and not simply the diagnosis of BPD. However, we found a significant interaction between diagnosis of BPD and negative affect, in which negative affect had a significant association with sensitivity to expressions of disgust within individuals without BPD. This relationship was not significant within individuals with BPD. This finding is in line with other research suggesting that individuals with BPD show abnormal performance within complex or ecologically valid tasks (Roepke et al., 2013). Therefore, other social deficits associated with BPD may confound the relationship between negative affect and their performance on the V-REST in particular. However, this finding must be interpreted with caution as it was only found using the emotion recognition sensitivity measure in V-REST in our small sample of individuals with BPD with high self-reported negative emotion. Taken together, the findings within both behavioral tasks suggest that positive and negative affect predict emotion recognition sensitivity beyond the effect of BPD. Further research efforts with larger samples of individuals diagnosed with BPD would benefit from investigating other factors that may drive emotion recognition problems within this disorder as well as account for the potential confounding effects of affect in different types of emotion recognition assessment.

Results from the current study suggest that both positive and negative state affect contribute more significantly to deficits in emotion recognition than global BPD symptomology. These findings have both implications for research and treatment for this disorder. Current interventions for interpersonal difficulties within BPD (e.g., dialectical behavior therapy; Linehan, 1993) focus on addressing interpersonal difficulties using approaches to clarify interpersonal goals and effectively communicate needs. However, the current findings suggest that interpersonal effectiveness training may benefit from additional attention to managing state affect in the context of interpersonal interactions. Additionally, the current study shows that both negative and positive affect may be related to disruptions in emotion recognition; however, most current interventions focus on regulation of negative emotions. People with interpersonal difficulties may also benefit from training in how to regulate positive emotions as well.

In addition to these clinical implications, current findings have important implications for future research on emotion recognition within BPD. First, to capture the nuanced nature of the interaction between BPD, affect, and emotion recognition, it is important to use ecologically valid measures of emotion recognition that capture dynamic and fluid processes involved in recognition and response to emotional expressions in real life. Second, because affect significantly impacts emotion recognition abilities, investigations of interpersonal dysfunction within BPD should carefully assess and control for state affect. Doing so may reduce the likelihood of continued contradictory findings relating to emotion recognition abilities in BPD. Finally, as indicated by current findings, social cognitive deficits in BPD are complex and vary by emotion and context. Therefore, more work using alternate methods of examining the interaction between affect and emotion recognition (e.g., mood induction paradigms to elicit specific emotions; daily monitoring methodologies to capture deficits in real time) will help future research to better characterize in what context interpersonal dysfunction occurs for individuals with BPD.

This study had several limitations worth considering. First, state affect was assessed with the PANAS, a self-report questionnaire, without an objective measure of arousal or emotion. Although self-report may be subject to biases, this type of assessment is considered an important measure of subjective emotional states that converges with other emotional behaviors and processes (Barrett, Mesquita, Ochsner, & Gross, 2007). Second, our sample was drawn from the urban community that has access to our clinic, and due to the high prevalence of psychopathology within our sample, findings may not generalize to the general population. Furthermore, a self-selection bias may be a shortcoming of this research, as participants in this study were willing and able to participate in interviews and experimental computer tasks in our clinic for a considerable financial compensation. A third limitation is that reliability statistics were not conducted for this study, although all of our assessors were trained by the same licensed clinician who is an expert in diagnostic interviews. Finally, another potential limitation of this study is the small number of individuals who met full criteria for BPD in our study ($n = 32$). However, a review of 10 studies demonstrated a medium effect of BPD on emotion recognition ($d = .45$) with sample sizes of 13 to 43 ($M = 26.6$) participants with BPD. As our sample size was within this range, we predicted that we would find an effect of BPD on emotion recognition sensitivity. To address these limitations of this study, these findings should be replicated in larger, representative samples with BPD.

Conclusion

To our knowledge, this is the first study to systematically investigate the relative roles of BPD and current emotional states within *emotion recognition sensitivity*. Findings from the present study indicated that positive and negative affect significantly predicted emotion recognition sensitivity. However, BPD did not predict emotion recognition sensitivity. Results have important implications for future research on emotion recognition within BPD, as researchers should account for potential confounding effects of participants' current emotional states on social cognitive processes.

Declaration of Conflicting Interests

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Supplemental material

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