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Identification of Mental States and Interpersonal Functioning in Borderline Personality Disorder

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Atypical identification of mental states in the self and others has been proposed to underlie interpersonal difficulties in borderline personality disorder (BPD), yet no previous empirical research has directly examined associations between these constructs. We examine 3 mental state identification measures and their associations with experience-sampling measures of interpersonal functioning in participants with BPD relative to a healthy comparison (HC) group. We also included a clinical comparison group diagnosed with avoidant personality disorder (APD) to test the specificity of this constellation of difficulties to BPD. When categorizing blended emotional expressions, the BPD group identified anger at a lower threshold than did the HC and APD groups, but no group differences emerged in the threshold for identifying happiness. These results are consistent with enhanced social threat identification and not general negativity biases in BPD. The Reading the Mind in the Eyes Test (RMET) showed no group differences in general mental state identification abilities. Alexithymia scores were higher in both BPD and APD relative to the HC group, and difficulty identifying one's own emotions was higher in BPD compared to APD and HC. Within the BPD group, lower RMET scores were associated with lower anger identification thresholds and higher alexithymia scores. Moreover, lower anger identification thresholds, lower RMET scores, and higher alexithymia scores were all associated with greater levels of interpersonal difficulties in daily life. Research linking measures of mental state identification with experience-sampling measures of interpersonal functioning can help clarify the role of mental state identification in BPD symptoms.

Keywords: borderline personality disorder, avoidant personality disorder, experience sampling, alexithymia

The ability to accurately identify (or decode) the cognitive or affective states being experienced by the self and others is crucial to effective interpersonal functioning, and abnormalities in this process have been proposed to be a central problem in borderline personality disorder (BPD; e.g., Bateman & Fonagy, 2004; Levy & Blatt, 1999; Young, Klosko, & Weishaar, 2003). Whereas several previous studies have examined mental state identification measures in BPD versus healthy comparison (HC) groups, with conflicting results, no prior studies have focused on the convergent validity of these measures, nor on their relations with interpersonal functioning. Moreover, little research has tested whether observed diagnostic group differences are specific to BPD, leaving open the possibility that they are more broadly associated with psychopathology involving impairment and distress in interpersonal contexts.

To address these gaps in the literature, we measure three aspects of mental state identification: identification of social threat in

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blended facial expressions of emotion, identification of others' mental states more broadly, and alexithymia. We examine the interrelation between these measures, as well as their association with experience-sampling measures of interpersonal functioning in daily life. Our sample includes, in addition to individuals diagnosed with BPD and a healthy comparison (HC) group, a clinical comparison group diagnosed with avoidant personality disorder (APD), which is similar to BPD in chronicity and psychosocial impairment (Torgersen, Kringlen, & Cramer, 2001; Wilberg, Karterud, Pedersen, & Urnes, 2009). Inclusion of this group allowed us to examine the specificity of observed findings to BPD.

Identification of Threatening and Nonthreatening Mental States in Others

Evidence has suggested that individuals with BPD more readily identify signals of potential threat in others' emotional expressions (Domes, Schulze, & Herpertz, 2009). When exposed to neutral facial images, they show greater amygdala activation relative to HC individuals (Donegan et al., 2003). They also judge images of faces as more unapproachable and untrustworthy (Nicol, Pope, Sprengelmeyer, Young, & Hall, 2013). Research on identification of threatening mental states has largely focused on the idea that individuals with BPD show enhanced ability to identify facial expressions of anger relative to their ability to identify positive expressions or nonthreatening negative expressions such as sadness or fear. In a study that presented neutral faces gradually morphing into basic emotional expressions, participants with BPD became able to identify increasingly subtle signs of anger over the course of the experiment, demonstrating a form of learning not observed in the HC group (Domes et al., 2008). Moreover, when viewing photographs depicting blended emotional expressions (anger mixed with sadness or happiness), participants with BPD identified the faces as angry significantly more often than HC participants did. Using similar stimuli, Veague and Hooley (2014) found that women with BPD showed heightened sensitivity to male anger in that they correctly identified it at a lower intensity than did the HC group and showed a bias toward attributing anger to neutral male faces.

Perhaps the high rates of childhood abuse reported by individuals with BPD (Westphal et al., 2013: Zanarini, 2000) contribute to the enhanced anger identification associated with this disorder. Children and young adults with a history of early abuse have been found to show increased sensitivity to angry expressions relative to their nonabused peers: They identify morphed facial expressions as angry when the anger is present at a lower intensity (e.g., 20% anger and 80% a different expression; Gibb, Schofield, & Coles, 2009; Pollak & Kistler, 2002). The association of abuse history with anger identification does not generalize to other negative emotions or to emotions in general and is presumed to emerge because expressions of anger serve as a signal for danger.

However, evidence has been mixed as to whether people with BPD display increased sensitivity to others' emotional cues more broadly—as reflected in heightened identification of both anger and nonthreatening mental states in others. Lynch et al. (2006) displayed images that shifted every 450 ms from a neutral expression toward a basic emotion and asked participants to classify the emotion displayed as soon as they recognized it. Those with BPD were significantly faster and more accurate in identifying all emotions compared to HC participants. Yet, because this task centrally involved time pressure, it may have confounded sensitivity to emotional expressions with a tendency to respond quickly or impulsively. Moreover, a subsequent study (Domes et al., 2008) did not replicate these findings.

A more common method for assessing identification of others' mental states is the revised Reading the Mind in the Eyes Test (RMET; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). Participants select the most appropriate descriptors for expressions shown in photographs of actors' eye regions depicting a wide range of positive, negative, and neutral mental states. Some studies have found enhanced mental state identification among individuals with BPD on the RMET: Fertuck et al. (2009) found enhanced RMET performance in BPD across all mental states; Frick et al. (2012) found it for negative and positive (but not neutral) mental states; and Scott, Levy, Adams, and Stevenson (2011) found it for only negative mental states. Other studies have found no differences between BPD and HC groups on the RMET (Preiβler, Dziobek, Ritter, Heekeren, & Roepke, 2010; Schilling et al., 2012). Still others using somewhat different methods have even shown a deficit in identification of specific negative mental states in individuals with BPD (Daros, Zakzanis, & Ruocco, 2013; Meyer & Morey, 2015; Unoka, Fogd, Füzy, & Csukly, 2011). In sum, the question of whether and how BPD is associated with the accuracy of identifying others' mental states remains unanswered.

Alexithymia

Another critical component of social functioning, alongside identification of others' mental states, is the ability to understand and name one's own mental states. Alexithymia refers to an inability to identify and describe one's own feelings and a tendency to focus on observable actions rather than internal processes (Bagby, Parker, & Taylor, 1994). Alexithymia is also associated with atypical responding to emotional cues in others. Cook, Brewer, Shah, and Bird (2013) found that those higher in alexithymia were less precise in categorizing morphed facial expression stimuli. Vermeulen, Luminet, and Corneille (2006) showed that alexithymia predicted slower responding to negative words primed by an angry (but not neutral, happy, or sad) face. This result suggests that alexithymia may be associated with a disruption in processing of threatening affective information, consistent with the observed association between alexithymia and trauma exposure (Zlotnick, Mattia, & Zimmerman, 2001).

Research has consistently found a positive association between alexithymia and symptoms of BPD in both clinical and nonclinical samples (Evren, Cinar, & Evren, 2012; Gaher, Hofman, Simons, & Hunsaker, 2013; New et al., 2012; Zlotnick et al., 2001). New et al. (2012) found higher alexithymia scores in participants with BPD and APD relative to an HC group; further, those with BPD scored significantly higher compared to those with APD on the subscale assessing difficulty in identifying feelings.

Present Study

We examine three measures of mental state identification and experience-sampling measures of interpersonal functioning in individuals diagnosed with BPD or APD and an HC group. Our aim is to help clarify the nature of atypical mental state identification

in BPD and its ramifications for daily life interpersonal experiences, including thoughts/feelings about significant others, perceptions of social experiences, temper outbursts, and feelings of emotional or social disconnection.

To measure identification of social threat in others' mental states, we adapted the methods used by Pollak and Kistler (2002). These authors found that abused children identified digitally blended photographs of different facial expressions as angry (rather than fearful or sad) more readily than did their nonabused peers but did not show a general negativity bias; namely, there were no group differences in the threshold for identifying faces as happy (rather than fearful or sad). We predicted that similar patterns would differentiate the BPD group from the HC group and that the tendency to identify others' mixed emotional expressions as angry would be associated with interpersonal difficulties in daily life. It was unclear to us whether the APD group would also show heightened identification of anger relative to the HC group. The elevated sensitivity to rejection associated with both BPD and APD (Berenson et al., 2016) suggests that both groups may readily notice signs of others' disapproval (including anger). However, the emotion dysregulation that is characteristic of individuals with BPD, and/or a history of early trauma, may contribute to their willingness to jump to the conclusion that others are threatening. Individuals with APD would not necessarily share this tendency and, because of their low self-confidence and pervasive avoidance of confrontation, may tend to second-guess themselves before making such a judgment.

We assessed general mental state identification using the RMET (Baron-Cohen et al., 2001). Because prior studies of RMET performance in BPD have shown conflicting results, we did not have specific hypotheses regarding between-groups differences and instead focused on the convergent and predictive validity of RMET performance. In assessing convergent validity, we reasoned that if enhanced threat identification conceptually overlaps with enhanced mental state identification in general, then these two measures should be positively correlated. If, instead, threat identification and mental state identification reflect different processes, they may be negatively correlated or uncorrelated. To assess predictive validity, we examined the association between identification of others' mental states and interpersonal functioning. Higher RMET scores should predict poorer interpersonal functioning if they reflect a mechanism for psychopathology in BPD but not if they reflect adaptive abilities.

We expected our research to replicate the findings of New et al. (2012) regarding alexithymia severity in BPD, APD, and an HC group, extending this research to more generalizable samples without the previous study's relatively strict exclusion criteria for frequently comorbid disorders. We also predicted that alexithymia would be associated with impaired identification of others' mental states as assessed with the RMET. Finally, we predicted that alexithymia would be associated with interpersonal difficulties in daily life.

Method

Participants and Recruitment

This study was part of a larger project for which participant recruitment procedures have been previously published (Gadassi, Snir, Berenson, Downey, & Rafaeli, 2014). After a telephone prescreening, adults from a U.S. urban community were invited for an interview that included the Structured Interview for the Diagnosis of Personality Disorders (Pfohl, Blum, & Zimmerman, 1997) and the Structured Clinical Interview for *DSM–IV* Axis I Disorders (First, Gibbon, Spitzer, & Williams, 1996). The interviews demonstrated good interrater reliability (average $\kappa = .83$ for personality disorders and .86 for Axis I disorders). All participants provided written informed consent.

Because BPD rarely occurs alone (Dolan-Sewell, Krueger, & Shea, 2001; Shea et al., 2004), a sample that excludes a range of concurrent diagnoses and treatments would be unable to yield conclusions applicable to most individuals with this disorder. Primary psychotic disorder, current substance intoxication or withdrawal, and cognitive impairment or illiteracy were exclusion criteria for all three groups because these conditions are likely to interfere with providing useful data. Participants were not excluded from the BPD or APD groups for use of psychotropic medication or for other coexisting disorders. Given that BPD and APD commonly co-occur, a BPD sample that excludes APD would be less generalizable to actual patient populations. Participants who met criteria for both BPD and APD were included in the BPD group. The HC group was required to meet fewer than three criteria for any specific personality disorder (and fewer than 11 criteria in total), have no psychiatric diagnoses or psychotropic medication use for at least 1 year prior to the interview, and have a Global Assessment of Functioning (American Psychiatric Association, 2000) score above 79. Participants eligible for the APD group were required to meet criteria for APD and to not meet criteria for any Cluster B personality disorder.

In total, 173 participants completed our measures of mental state identification. The BPD group included 64 participants (51 female). Sixteen participants (12 female) in the BPD group also met criteria for APD. The APD group included 49 (26 female) participants, and the HC group comprised 60 participants (43 female). The APD group had a greater percentage of male participants than di the other two groups, $\chi^2(3, N = 173) = 9.49$, $p = .009$.

Participants were ages 18–64 years ($M = 32.12$, $SD = 10.6$). They identified as White (47.4%), Black (21.4%), Hispanic/Latino (15.0%), Asian (10.4%), and other/multiple backgrounds (5.8%). There were no between-groups differences in age or race/ethnicity. Participants had completed between 10 and 20 years of education ($M = 16.08$, $SD = 2.7$), with the HC group completing more years ($M = 17.3$) than had the BPD and APD groups ($M = 15.3$ and $M = 15.6$, respectively). Current rates of treatment (including psychiatric medication and psychotherapy or counseling) were significantly higher in the BPD (68.8%) and APD (57.1%) groups than in the HC group (3.3%). The BPD and APD groups did not differ from one another in treatment rates. Both the BPD ($M = 5.4$, $SE = .19$) and APD ($M = 5.2$, $SE = .22$) groups reported more negative state mood prior to completing the study tasks than did the HC group ($M = 2.9$, $SE = .19$; both $ps < .001$). The BPD and APD groups did not differ from one another in state mood ($t < 1$).

Table 1 presents Axis I diagnoses for the BPD and the APD groups according to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; American Psychiatric Association, 2000). Supplemental analyses excluding the nine participants with

Table 1
Current DSM-IV Axis I Diagnoses

Disorder	Borderline PD[a] *n* (%)	Avoidant PD[b] *n* (%)	χ^2
Major depressive disorder	25 (39.7)	15 (30.6)	1.00
Bipolar disorder	7 (10.9)	2 (4.1)	1.78
Dysthymic disorder	14 (21.9)	11 (22.4)	.01
Social phobia	26 (40.6)	49 (100.0)	40.36***
Posttraumatic stress disorder	19 (29.7)	2 (4.1)	12.03***
Panic disorder	5 (7.8)	3 (6.1)	.12
Agoraphobia without history of panic disorder	3 (4.7)	1 (2.0)	.57
Obsessive–compulsive disorder	5 (7.8)	3 (6.1)	.12
Generalized anxiety disorder	29 (45.3)	17 (34.7)	1.30
Bulimia	1 (1.6)	0 (0)	.77
Binge eating disorder	2 (3.1)	2 (4.1)	.07
Substance dependence	13 (20.3)	2 (4.1)	6.35**
Substance abuse	8 (12.5)	2 (4.1)	2.44

Note. *DSM-IV* = *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.); PD = personality disorder.
[a] $N = 64$. [b] $N = 49$.
** $p < .01$. *** $p < .001$.

bipolar disorder yielded the same conclusions as did the analyses presented for the full sample, thus ruling out the mood instability associated with bipolar disorder as an alternative explanation for our study results.

Procedure

Following the diagnostic interview, eligible individuals returned for a second lab visit, at which they were trained to use a personal digital assistant (PDA) to complete the experience-sampling diary and given a written manual and instructions to take home. Research staff contacted them weekly to encourage regular diary completion. At the end of the 21-day diary period, participants returned to the lab for a third visit and were compensated. During the second and third lab visits, participants completed cognitive tasks and questionnaires. The emotion identification task and RMET were completed during the second lab visit. The Toronto Alexithymia Scale (TAS; Bagby et al., 1994) was included in a packet of questionnaires completed between the first and second lab visits. Prior publications based on other aspects of the data set do not overlap with the present analyses.

Experimental Tasks

Identification of social threat in photographs of blended emotions. An emotion identification task was conducted using digital images that had been created from graded blends of prototypical emotion expressions. Stimuli were identical to those used in Pollak and Kistler (2002): 40 images were digitally created from four prototype images of a male and a female model, each expressing happiness, anger, fear, and sadness. The original grayscale images were of two models from Ekman and Friesen (1976). Pairs of images (happiness–fearfulness, happiness–sadness, anger–fearfulness, and anger–sadness) were blended in 10% increments to create a linear continuum of nine images between the prototypical expressions such that the middle image consisted of a 50–50 blend. Participants were asked to identify the facial expression in each of the blended images, which were presented in a random order. Each trial began with a central fixation cross for 250 ms, followed by a blank screen for 250 ms and then the facial image, which remained in view until the participant selected an answer using a four-button response box labeled with the response options *Afraid, Angry, Happy,* and *Sad.* For each blend, the five images ranging from 30% to 70% were presented eight times, whereas the six images closest to (and including) the prototypes were presented four times each.

Identification of others' mental states. The Revised Reading the Mind in the Eyes Test for Adults (RMET; Baron-Cohen et al., 2001) asks participants to select, from four choices provided, the most appropriate label for the mental state (e.g., "compassion") shown in 36 photographs of actors' eye regions. Each photograph was presented in the center of a computer screen with a white background, above four mental state response options. Participants used a response box to select their answers and a paper glossary for unfamiliar terms. The RMET has shown good test–retest reliability (intraclass correlation = .83) in previous research (Vellante et al., 2013).

The 36 trials for the RMET were presented in randomized order, and the total number of correct responses was computed. We also computed the percentage correct for positive, neutral, or negative RMET stimuli as classified in previous research (Scott et al., 2011).

Self-Report Measures

Toronto Alexithymia Scale (TAS; Bagby et al., 1994). The TAS assesses alexithymia with 20 statements rated on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Items are divided into three subscales: (1) Difficulty Identifying Feelings (e.g., "When I am upset, I don't know if I am sad, frightened, or angry"); (2) Difficulty Describing Feelings (e.g., "It is difficult for me to find the right words for my feelings"); and (3) Externally Oriented Thinking, or a lack of focus on internal emotional experiences (e.g., "I prefer to just let things happen rather than to understand why they turned out that way"). Internal consistency for the total scale was .90, and for the three subscales, .92, .86, and .65, respectively.

Experience-sampling diary. A 3-week computerized experience-sampling diary assessed affect, thoughts, experiences, and behaviors with questions that were developed to have high face validity in capturing the difficulties common among individuals with BPD. The Intel adaptation of Barrett and Barrett's (2001) Experience Sampling Program software was configured to run on handheld Zire21 PDAs. Audible prompts were emitted by the PDA five times daily at random intervals, for 21 days. The prompt occurred every 15 s for up to 10 min or until the participant responded to the device. Each entry took 5–10 min.

We excluded the following participants from diary analyses: 10 participants (three BPD, five APD, two HC) who withdrew from the study without completing the diary; four participants (two BPD, one APD, one HC) who completed fewer than 27 diary entries (two *SD*s below the sample average, the standard practice for exclusion in diary research); and five participants (four BPD, one HC) who completed an earlier, slightly different, version of the diary. The sample size for the analyses we report is 154 (55 BPD, 43 APD, 56 HC). The mean number of completed entries for this sample was $M = 73.57$ ($SD = 19.55$); groups did not differ significantly in number of completed entries.

The experience-sampling diary measured the following aspects of interpersonal functioning: relational *thoughts/feelings*, perception of social experiences, and disconnection.

Relational thoughts/feelings. In each diary entry, participants were asked to think of someone important in their lives and to rate a set of items regarding their feelings toward this person at the present moment on a scale ranging from 0 (*not at all*) to 4 (*extremely*). Scales were computed as the mean of mean scores for each included item over the entire diary period. Three items assessed *positive relational thoughts/feelings:* "Do you feel content with this person?" "Do you feel cared for by this person?" and "Do you feel this person is worthwhile?" ($\alpha = .95$). Three items assessed *negative relational thoughts/feelings:* "Do you feel angry with this person?" "Do you feel irritated with this person?" and "Do you feel this person is bad?" ($\alpha = .92$).

Perception of social experiences. Participants viewed a list of social, personal, and practical experiences and checked any that had occurred since their last diary entry. We established whether any item from each category of experiences (described next) was endorsed in each entry and then computed the percentage of times each category was endorsed across the diary period. *Positive social perceptions* included three items: "Someone helped/supported me," "Positive interaction with an acquaintance/stranger," and "Positive interaction with an important person in my life." The percentages of diaries in which these items were endorsed were intercorrelated between .53 and .73. *Negative social perceptions* included four items: "Was criticized/judged," "Was insulted," "Was excluded," and "Someone let me down." The percentages of diaries in which these items were endorsed showed intercorrelations that ranged from .51 to .83. *Temper outbursts* was assessed in two items: "Hit/smashed/kicked something" and "Lost my temper." The percentages of diaries in which these items were endorsed were correlated .71.

Disconnection. Two aspects of social or emotional alienation were assessed using state mood items on a 5-point scale ranging from 0 (*not at all*) to 4 (*extremely*). Scales were computed as the mean of mean scores for each included item over the entire diary period. *Emotional detachment* was computed as the mean of ratings to two items: "Numb" and "Unreal" ($\alpha = .92$). *Mistrust* was computed as the mean of "Suspicious" and "Mistrustful" ($\alpha = .98$).

Results

Identification of Social Threat in Categorization of Others' Emotions

A multilogit model, $logit(\Pr(choosing\ emotion\ E_i) = \beta i_0 + \beta_{i1} \times Intensity,$ examined the relationship between the intensity of the emotions present in each blended image and the particular emotion the participant identified in the image. In this model, E_i represents the four emotion categories (anger, sadness, fear, happiness); intensity is the intensity of one emotion in the pair (from 10% to 90%); and β_{i0} and β_{i1} represent the emotion intensity intercept and slope, respectively. In anger–sadness and anger–fear blends, the emotion intensity is of anger; in happiness–sadness and happiness–fear blends, the emotion intensity is of happiness.

We used this model to estimate the threshold (or category boundary) for each emotion pair for each individual, as illustrated in Figure 1 for the anger–fear pair. As the intensity of anger increased, the probability of identifying the face as "angry" increased, and the probability of identifying it as "afraid" decreased. The threshold for identifying anger was defined as the emotion intensity at which the probability of choosing "angry" became equal with the probability of choosing "afraid," where IA = anger intensity; β_{A0} and β_{A1} were the intercept and slope for choosing "angry," respectively; β_{S0} and β_{S1} were the intercept and slope for choosing "sad," respectively; and β_{H0} and β_{H1} were the intercept and slope for choosing "happy" respectively (fear was the reference level). Hence, we computed the threshold for identifying anger as

$$\Pr(Choosing\ "Angry") = \frac{\exp(\beta_{A0} + \beta_{A1} * IA)}{1 + \exp(\beta_{A0} + \beta_{A1} * IA) + \exp(\beta_{S0} + \beta_{S1} * IA) + \exp(\beta_{H0} + \beta_{H1} * IA)},$$

such that $\exp(\beta_{A0} + \beta_{A1} * LA) = 1$ and $IA = -\frac{\beta_{A0}}{\beta_{A1}}$.

To ensure reliable threshold estimates, we required that each statistical model show good fit (significant likelihood ratio $p <$

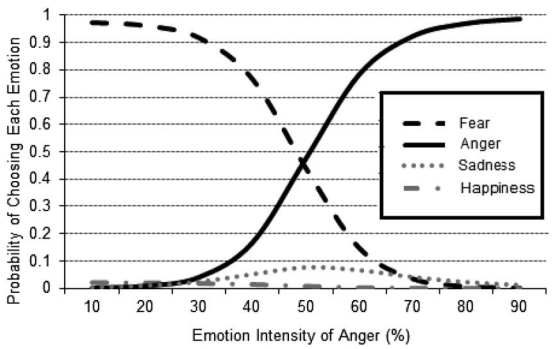

Figure 1. Illustration of the estimation of category threshold for anger-fear blends. Threshold is defined as the intensity of anger at which the probability of choosing "angry" equals the probability of choosing "afraid".

.05) and that the coefficients for emotion intensity be statistically significant predictors ($p < .05$). Estimates that did not meet these criteria were excluded from analysis, resulting in sample sizes of $n = 169$ for anger–fear blends; $n = 160$ for anger–sadness blends; $n = 128$ for happiness–fear blends; and $n = 161$ for happiness–sadness blends. Exclusion rates did not differ with diagnosis (for all four, $\chi^2 < 2.768$, $p > .05$).

The first two rows of Table 2 show the threshold at which each group identified anger in the photographs blended with fear or sadness, statistically adjusting for sex and age. A significant group difference emerged for the anger–fear blends, with the BPD group identifying these images as angry at a significantly lower threshold than did the HC group, $t(164) = -3.09$, $p = .002$, $\eta_p^2 = .06$, and the APD group, $t(164) = -2.04$, $p = .04$, $\eta_p^2 = .03$. The APD and HC groups did not differ from one another, $t(164) = -.78$, $p = .44$, $\eta_p^2 = .00$. The BPD group also identified the anger–sadness blends as angry at a significantly lower threshold than did the HC group, $t(155) = -2.91$, $p = .04$, $\eta_p^2 = .03$, and the APD group, $t(155) = -3.30$, $p = .03$, $\eta_p^2 = .03$, whereas the APD and HC groups again did not differ from one another, $t(155) = .40$, $p = .79$, $\eta_p^2 = .00$. As shown in the third and fourth rows of Table 2, no notable group differences were apparent in categorization of the happiness–fear and happiness–sadness blends. Results were unchanged when we included as covariates depression symptoms, education level, and the median response time for categorizing the blended expression.

Identification of Others' Mental States

Table 3 presents group mean scores for the RMET and the subsets of items identified by Scott et al. (2011), including age and sex as covariates. No group differences were statistically significant. These results remained unchanged when we adjusted statistically for depression symptoms, education level, and median response time for answering the RMET items.

Alexithymia

Table 4 shows the mean scores for each group on the TAS and its subscales, with age and sex as covariates. For the scale as a whole, both the BPD group, $t(167) = 8.98$, $p < .001$, $\eta_p^2 = .33$, and the APD group, $t(167) = 7.11$, $p < .001$, $\eta_p^2 = .23$, scored higher than did the HC group but did not differ from one another, $t(167) = 1.18$, $p = .24$, $\eta_p^2 = .01$. Group differences also emerged for the three subscales, with both the BPD and APD groups scoring higher than did the HC group (all ts > 4, $p < .001$). Difficulty Identifying Feelings (DIF) was the only subscale on which the BPD group scored higher than did the APD group, $t(167) = 2.62$, $p = .01$, $\eta_p^2 = .04$. The BPD and APD groups did not differ on either the Difficulty Describing Feelings (DDF) or the Externally Oriented Thinking (EOT) subscales (both ts < 1, *ns*).

Interrelations Between the Mental State Identification Tasks

Partial correlations between the previously described measures (adjusting for age and sex) are shown in Table 5. A lower threshold for seeing anger in anger–fear and anger–sadness blends was associated with poorer accuracy in identifying others' mental states on the RMET. Higher alexithymia scores were also associated with poorer performance on the RMET.

Interpersonal Functioning

Group means for the interpersonal functioning measures are shown in Table 6. Compared to the HC group, both the BPD and APD groups reported fewer positive and more negative relational thoughts/feelings, perceived more frequent negative social cues, and experienced more emotional detachment and mistrust (all ts > 4, $p < .001$). The BPD group also reported a significantly higher frequency of temper outbursts than did the APD group, $t(149) = 2.67$, $p < .01$, $\eta_p^2 = .05$, and HC group, $t(149) = 4.41$, $p < .001$, $\eta_p^2 = .12$. The APD and HC groups did not differ in temper outburst frequency, $t(149) = 1.35$, $p = .18$, $\eta_p^2 = .01$.

Associations of Mental State Identification With Interpersonal Functioning

Partial correlations examined the association of interpersonal functioning with measures of mental state identification (adjusting for sex and age). Across the entire sample, interpersonal difficulties (i.e., lower ratings on positive items and higher ratings on negative items) were significantly associated with identifying anger at a lower threshold in anger–fear blends, poorer RMET performance, and higher alexithymia scores. Because these associations would have been influenced by between-groups differences, we also examined them separately for each group.

BPD. Within the BPD group, identifying anger at a lower threshold in anger–fear continua was associated with negative relational thoughts/feelings ($r = -.43$, $p < .001$), perception of negative social cues ($r = -.33$, $p < .05$), and temper outbursts ($r = -.36$, $p < .01$). Identifying anger at a lower threshold in anger–sadness continua was associated with negative relational thoughts/feelings ($r = -.42$, $p < .01$), perception of negative social cues ($r = -.29$, $p < .05$), and more mistrust ($r = -.29$, $p <$

Table 2
Mean (With Standard Error) Emotion Categorization Thresholds by Group Adjusting for Age and Sex

Emotion threshold	BPD	APD	HC	Group effect
Anger (vs. fear)	$46.72\ (1.09)_a$	$50.19\ (1.27)_b$	$51.50\ (1.10)_b$	$F(2, 164) = 5.01$, $p = .01$, $\eta_p^2 = .06$
Anger (vs. sadness)	$45.32\ (.98)_a$	$48.62\ (1.14)_b$	$48.23\ (.98)_b$	$F(2, 155) = 3.12$, $p = .05$, $\eta_p^2 = .04$
Happiness (vs. fear)	50.66 (1.18)	50.97 (1.42)	51.07 (1.31)	$F(2, 123) = .03$, $p = .97$, $\eta_p^2 = .00$
Happiness (vs. sadness)	51.56 (1.44)	50.32 (1.60)	52.09 (1.48)	$F(2, 156) = .34$, $p = .71$, $\eta_p^2 = .00$

Note. Means with different subscripts are significantly different at $p < .05$. BPD = borderline personality disorder; APD = avoidant personality disorder; HC = healthy comparison.

Table 3
Mean (With Standard Error) Scores on the Reading the Mind in the Eyes Test (RMET) by Group, Adjusting for Age and Sex

RMET score or percentage	BPD	APD	HC	Group effect
Total score	26.36 (.50)	26.80 (.58)	27.73 (.52)	$F(2, 168) = 1.87$, $p = .16$, $\eta_p^2 = .02$
Total %	73.2 (1.4)	74.4 (1.6)	77.0 (1.4)	$F(2, 168) = 1.87$, $p = .16$, $\eta_p^2 = .02$
Neutral %	70.6 (1.7)	71.3 (2.0)	75.2 (1.8)	$F(2, 168) = 1.97$, $p = .14$, $\eta_p^2 = .02$
Negative %	76.7 (2.0)	79.3 (2.2)	82.1 (2.0)	$F(2, 168) = 1.99$, $p = .14$, $\eta_p^2 = .02$
Positive %	74.3 (2.1)	75.1 (2.4)	74.8 (2.1)	$F(2, 168) = .03$, $p = .97$, $\eta_p^2 = .00$

Note. BPD = borderline personality disorder; APD = avoidant personality disorder; HC = healthy comparison.

.05). No interpersonal functioning measures were associated with happiness identification thresholds.

Total RMET scores were inversely associated with negative relational thoughts/feelings ($r = -.35$, $p < .05$), perceiving negative social cues ($r = -.38$, $p < .01$), temper outbursts ($r = -.36$, $p < .01$), emotional detachment ($r = -.36$, $p < .01$), and mistrust ($r = -.40$, $p < .01$). Analyses conducted separately by RMET item valence suggest that these associations are largely carried by associations with performance on the neutral and positive (rather than negative) RMET items. Identification of negative mental states on the RMET was not significantly associated with any of the measures of interpersonal functioning.

Alexithymia was significantly associated with emotional detachment ($r = .47$, $p < .001$) and mistrust ($r = .29$, $p < .05$). Emotional detachment was associated with all three alexithymia subscales: DIF ($r = .41$, $p < .01$), DDF ($r = .37$, $p < .01$), and EOT ($r = .35$, $p < .05$). The DDF subscale was associated with mistrust ($r = .34$, $p < .01$), less frequent perception of positive social cues ($r = -.30$, $p < .05$), and temper outbursts ($r = .28$, $p < .05$).

APD. No significant associations emerged between lab measures of mental state identification and interpersonal difficulties in daily life among individuals in the APD group. However, interpersonal difficulties were significantly associated with alexithymia scores in this group. Higher total alexithymia scores were associated with less positive relational thoughts/feelings ($r = -.55$, $p < .001$), more negative relational thoughts/feelings ($r = .42$, $p < .01$), more perceptions of negative social cues ($r = .31$, $p < .05$), temper outbursts ($r = .36$, $p < .05$), emotional detachment ($r = .39$, $p < .05$) and mistrust ($r = .45$, $p < .01$). All three subscales were inversely correlated with positive relational thoughts/feelings: DIF ($r = -.46$), DDF ($r = -.47$), and EOT ($r = -.42$, all ps $< .01$). Both DIF and DDF were also associated with more negative relational thoughts/feelings: DIF ($r = .49$, $p < .01$), DDF ($r = .32$, $p < .05$); emotional detachment: DIF ($r = .48$, $p < .01$), DDF ($r = .34$, $p < .05$); and mistrust: DIF ($r = .51$, $p < .001$), DDF ($r = .38$, $p < .05$). Both DDF and EOT were associated with more temper outbursts (rs = .32 and .34, respectively, both ps $< .05$).

HC. Only three modest associations were found between mental state identification and experience-sampling measures of interpersonal functioning in the HC group. This group had few complaints or problems in their interpersonal lives, and the small ups-and-downs they experienced may be more related to transient circumstances than to persistent difficulties in mental state identification. Nevertheless, more frequently perceiving positive social cues was associated with diminished identification of anger (a higher threshold) in anger–fear blends ($r = .31$, $p < .05$); emotional detachment was significantly associated with total alexithymia ($r = .27$, $p < .05$) and the DDF subscale ($r = .31$, $p < .05$).

Discussion

This research examined three measures of mental state identification in BPD, APD, and an HC group. It is the first to address the interrelation among mental state identification measures and their association with experience-sampling measures of interpersonal functioning. Relative to individuals in the HC and APD groups, those with BPD showed enhanced anger identification—characterized by seeing blended faces as "angry" when the anger was present at a lower intensity—but not enhanced identification of negative emotions more generally. Moreover, among those with BPD, enhanced anger identification was associated with more interpersonal difficulties in daily life, particularly the tendency to perceive more negative social cues, experience more mistrust and negative thoughts or feelings about significant others, and to exhibit more frequent temper outbursts.

By contrast, the APD group did not significantly differ from the HC group in terms of anger identification threshold. Moreover, although individuals with APD reported high levels of interpersonal problems in daily life, these problems were not associated with heightened anger identification or with poorer RMET perfor-

Table 4
Mean (With Standard Error) Scores on the Toronto Alexithymia Scale (TAS) by Group, Adjusting for Age and Sex

TAS Scale	BPD	APD	HC	Group effect
Total	$54.10\ (1.49)_a$	$51.37\ (1.72)_a$	$35.06\ (1.51)_b$	$F(2, 168) = 45.99$, $p < .001$, $\eta_p^2 = .36$
Difficulty Identifying Feelings	$19.70\ (.72)_a$	$16.77\ (.83)_b$	$9.68\ (.73)_c$	$F(2, 168) = 50.18$, $p < .001$, $\eta_p^2 = .38$
Difficulty Describing Feelings	$15.09\ (.59)_a$	$15.11\ (.68)_a$	$9.74\ (.59)_b$	$F(2, 168) = 26.32$, $p < .001$, $\eta_p^2 = .24$
Externally Oriented Thinking	$19.31\ (.59)_a$	$19.49\ (.68)_a$	$15.54\ (.60)_b$	$F(2, 168) = 12.82$, $p < .001$, $\eta_p^2 = .13$

Note. Means with different subscripts are significantly different at $p < .05$. BPD = borderline personality disorder; APD = avoidant personality disorder; HC = healthy comparison.

Table 5
Correlations Among Measures of Mental State Identification, Adjusting for Age and Sex, in the Total Sample (Above the Diagonal) and BPD Group (Below the Diagonal)

Measure	1	2	3	4	5	6
1. Anger perception threshold (vs. fear)	—	.42*	.10	.06	.18*	−.16*
2. Anger perception threshold (vs. sadness)	.53*	—	−.03	.12	.16*	−.07
3. Happiness perception threshold (vs. fear)	.10	.07	—	.68*	.16	.01
4. Happiness perception threshold (vs. sadness)	.11	.12	.82*	—	.11	−.10
5. RMET total	.28*	.56*	.07	.04	—	−.28*
6. TAS total	−.07	−.11	.01	−.08	−.31*	—

Note. BPD = borderline personality disorder; RMET = Reading the Mind in the Eyes Test; TAS = Toronto Alexithymia Scale.
* $p < .05$.

mance, as they were within the BPD group. These results add to the literature suggesting that the tendency to identify social threat when trying to read others' mental states is among the core cognitive processes contributing to symptoms in BPD (Domes et al., 2009) and further suggest that the association of BPD with heightened social threat identification is not better explained by factors shared with APD (such as the presence of psychopathology, high psychosocial impairment, or negative mood).

In assessing general mental state identification using the RMET, we found no significant group differences in performance—either for the test as a whole or for subsets of items categorized by valence—adding another null result to the mixed body of literature on this task in BPD. A lower anger identification threshold in the emotion categorization task was associated with poorer RMET performance. Although causal conclusions cannot be drawn from these correlations, enhanced sensitivity to social threat may reflect a process that ultimately distorts, rather than improves, mental state identification. Finally, because our results link better performance on the RMET with lower alexithymia scores and fewer interpersonal difficulties, they are inconsistent with the notion that superior RMET performance would contribute to interpersonal dysfunction in BPD. Taken together, our results add to the literature casting doubt on the idea that a generally enhanced ability to read others' mental states is a central characteristic of BPD (e.g., Flury, Ickes, & Schweinle, 2008; Schilling et al., 2012). People with BPD may feel more subjectively certain about their perceptions of others' mental states without actually being more accurate (Schilling et al., 2012). They may also respond more strongly to the emotions they identify in others without necessarily interpreting them correctly (New et al., 2012).

Our data showed heightened alexithymia in both BPD and APD relative to the HC group, as well as specifically heightened difficulty identifying one's own emotions in BPD relative to APD and HC. In fully replicating New et al. (2012), our results extend their findings to more generalizable BPD and APD samples without exclusions for frequently co-occurring disorders. In addition, our results showed that alexithymia is associated with poorer performance on the RMET, as well as interpersonal difficulties, across diagnostic groups. Consistent with its conceptual definition, alexithymia was associated with experience-sampling reports of feeling detached from one's own emotions. Additionally, in both personality disorder samples, alexithymia was associated with feelings of mistrust in daily life, whereas difficulty expressing feelings verbally was associated with more frequent temper outbursts.

Limitations and Future Directions

We used a small subset of existing mental state identification measures. Future research should examine additional measures and their relationship to interpersonal functioning to clarify whether discordant findings from studies using different procedures reflect the ability of different measures to tap distinct BPD vulnerabilities (Dyck et al., 2009; Weinstein et al., 2016).

Experience sampling eliminates the memory biases of retrospective reports but is still subject to self-report bias. Future research should use alternative assessments of interpersonal functioning such as informant reports or random audio or video samples of the social environment.

Table 6
Mean (With Standard Error) Diary Measures of Interpersonal Functioning by Group, Adjusting for Age and Sex

Variable	BPD	APD	HC	Group effect
Positive relational thoughts/feelings	$2.27\ (.10)_a$	$2.42\ (.12)_a$	$3.14\ (.10)_b$	$F(2, 149) = 21.67$, $p = .000$, $\eta_p^2 = .23$
Perceived positive social cues	$.43\ (.04)_a$	$.41\ (.05)_a$	$.49\ (.04)_a$	$F(2, 149) = 1.06$, $p = .35$, $\eta_p^2 = .01$
Negative relational thoughts/feelings	$.86\ (.07)_a$	$.72\ (.08)_a$	$.21\ (.06)_b$	$F(2, 149) = 28.22$, $p = .000$, $\eta_p^2 = .28$
Perceived negative social cues	$.27\ (.03)_a$	$.27\ (.03)_a$	$.10\ (.03)_b$	$F(2, 149) = 15.13$, $p = .000$, $\eta_p^2 = .17$
Temper outbursts	$.11\ (.02)_a$	$.06\ (.02)_b$	$.03\ (.02)_b$	$F(2, 149) = 9.94$, $p = .000$, $\eta_p^2 = .12$
Emotional detachment	$.83\ (.09)_a$	$.81\ (.11)_a$	$.05\ (.09)_b$	$F(2, 149) = 22.94$, $p = .000$, $\eta_p^2 = .24$
Mistrust	$.78\ (.10)_a$	$.80\ (.11)_a$	$.06\ (.10)_b$	$F(2, 149) = 18.57$, $p = .000$, $\eta_p^2 = .20$

Note. Means with different subscripts are significantly different at $p < .05$. BPD = borderline personality disorder; APD = avoidant personality disorder; HC = healthy comparison.

Finally, further research is needed to determine whether our findings would replicate in samples with different characteristics. Although the majority of participants in the BPD and APD groups were receiving treatment, participants were recruited from the community and are not representative of a clinical sample. High rates of co-occurring disorders are a strength of our study from the standpoint of generalizability but may have somehow influenced our results.

Concluding Comments

By demonstrating that sensitivity to social threat cues, inaccurate decoding of others' mental states, and alexithymia are all associated with interpersonal difficulties among people with BPD, the present study lends conceptual support for the notion that treatments targeting mental state identification may potentially alleviate symptoms of this disorder. It is interesting that research showing that RMET performance is better when reading the expressions of individuals said to be part of one's ingroup (Stevenson, Soto, & Adams, 2012) suggests that the relationship between feeling alienated or apart and having difficulty decoding mental states is likely to be bidirectional. Therefore, in addition to interventions to improve mental state identification, interventions to build social connections and enhance close relationships may also be helpful.

The literature on mental state identification in BPD is complicated by piecemeal studies with conflicting results and untested assumptions about the relevance of observed differences between BPD and healthy groups for understanding BPD symptomatology. Studies examining the associations among different measures of mental state identification, as well as the associations of these measures with proposed correlates of mental state identification in daily life, can help bring the clarity needed to facilitate the translation of research findings in this area into treatment advances.

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