Social-emotion recognition in borderline personality disorder

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Abstract

Borderline personality disorder (BPD) is characterized by interpersonal disturbances, but the neurocognitive aspects of these symptoms are poorly understood. We hypothesized that patients with BPD have impaired perception of emotional expressions, which are related to symptoms of interpersonal dysfunction. To control potential confounding factors, this study excluded subjects with comorbid diagnoses known to be associated with impaired affect perception. We tested 43 outpatients with BPD and 26 healthy controls on emotion recognition tasks (facial, prosodic, and integrated facial/prosodic), nonemotional facial feature recognition, and interpersonal antagonism (Buss-Durkee Hostility Index). Patients with BPD showed normal ability to recognize isolated facial or prosodic emotions but had impaired recognition of emotions in integrated facial/prosodic stimuli, as well as impaired discrimination of nonemotional facial features. In patients with BPD, impaired recognition of integrated emotional stimuli was associated with interpersonal antagonism, particularly suspiciousness and assaultiveness. These results suggest that patients with BPD have deficits in higher order integration of social information, which may be related to some of the more serious symptoms of the disorder.

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1. Introduction

Borderline personality disorder (BPD) is a serious, chronic psychiatric disorder characterized by disruptions of mood, impulse control, and interpersonal relations. Although the first 2 problems have been extensively studied, the neurocognitive aspects of interpersonal disturbance in BPD remain poorly addressed. However, the emerging empirical literature and methodology of social cognitive neuroscience provide new constructs and tools to investigate these phenomena [1]. One fundamental neurocognitive function necessary to the establishment and maintenance of interpersonal relations is the ability to recognize social signals, such as emotional expressions. For instance, facial expressions serve as important signals that help regulate subjective emotional experience and behavior [2]. Vocal expressions are also important, such as prosody, which has been classically defined as the aspect of speech that communicates meaning by variation in stress and pitch, independent of lexical and syntactic content [3]. Similarly to facial expression, prosody has a feature of emotional expression that serves an important role in interpersonal communication.

The performance of psychiatric patients on tests on facial and prosodic emotion recognition has been increasingly investigated. For instance, patients with schizophrenia consistently exhibit deficits in the recognition of facial emotion (reviewed in Edwards et al [4]). Facial emotion recognition deficits are also observed in depression [5-8] and intermittent explosive disorder [9], and abnormal neural responses to facial emotion have been demonstrated in posttraumatic stress disorder (PTSD) [10,11]. Emotion recognition deficits have been associated with interpersonal disturbances in schizophrenia [12], alcoholism [13], and psychopathy [14].

Two studies on facial emotion recognition have been reported to date in BPD. In the first study [15], 30 outpatients with BPD showed significantly less accurate facial emotion recognition when tested using a self-paced, multiple-choice format. Emotion recognition performance was unrelated to self-reported affect intensity, level of emotion awareness, and ability to coordinate mixed emotions. In the second study [16], 21 women with BPD and histories of childhood sexual abuse were compared with 21 women without BPD who also reported childhood sexual abuse and a control group of 20 women with neither BPD

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nor childhood abuse. Facial emotion recognition was tested using a self-paced, free-response format. In that study, the BPD group was more accurate than the other 2 groups in recognizing fearful facial expressions, which was related to a response bias toward fear. Results of a functional brain imaging study suggest that the negative attributional bias of patients with BPD may be related to heightened amygdala responsivity to facial emotion [17].

These studies suggest that patients with BPD exhibit impaired or altered facial emotion recognition. However, some questions remain. It is unclear whether social-emotion recognition deficits in BPD exist primarily in one or more sensory modes individually or alternatively in higher level heteromodal integration of emotional perceptions. In addition, the relative role of speed versus accuracy in emotion processing remains to be assessed. Patients with BPD may exhibit a lower accuracy compared with nonpsychiatric subjects on emotion recognition tests because of excessively rapid responding (which could be consistent with the prominent behavioral impulsivity exhibited by these patients). Conversely, to achieve accurate performance on these tests, subjects with BPD may need to take a relatively longer time to adequately process the stimuli. These alterations could confer a functional impairment if patients with BPD do not optimize speed and accuracy in processing emotional expressions as they unfold at the rapid pace that is typical in real-world interpersonal contexts.

The possible effects of common comorbidities with BPD also need to be considered. The disruptive effects of BPD often are associated with comorbid psychiatric disorders, such as major depression, PTSD, or substance dependence [18], which are also associated with impaired emotion perception (cited above). These disorders are therefore potential confounds when attempting to identify core characteristics of BPD. Although patients with BPD frequently present with such features that are important to address clinically, they are not essential to the diagnosis of BPD itself. Thus, a complete understanding of emotion perception in BPD requires that some studies be conducted excluding these comorbid disorders. The present study was designed with such exclusion criteria.

The relationship of social-emotional processing with interpersonal dysfunction in BPD also remains unclear. The interpersonal disturbances in BPD often consist of emotions, thoughts, and behaviors that are antagonistic in nature. For example, patients with BPD exhibit a significant degree of hostility [19], suspiciousness [20], and aggressive behavior [21,22], which are reliably assessed with the Buss-Durkee Hostility Inventory (BDHI) [23]. Although other forms of interpersonal dysfunction are also seen in BPD, we have chosen to focus on symptoms of antagonism because of the public health impact of these symptoms in the general population [24,25].

In the present study, we evaluated clinically stable outpatient adults with BPD on their ability to recognize isolated facial and prosodic emotions (in both speed and accuracy), as well as on a heteromodal emotion recognition task combining these 2 sensory features. A facial recognition task was also used to evaluate the perception of social but nonemotional facial stimuli. Finally, we addressed the relationship of social neurocognition with interpersonal dysfunction in BPD. We hypothesized that patients with BPD would exhibit multiple social-emotional processing deficits, which would be related to interpersonal antagonism.

2. Methods

2.1. Subjects

For this study, 43 adults with BPD and 26 control subjects were recruited from outpatient mental health clinics and the community. The patient recruitment included referrals made from the investigators’ outpatient clinician colleagues and recruitment from the community through advertisements placed on the Internet. This sample also participated in other studies reported elsewhere [26]. The BPD group was similar to the control group in age, sex ratio, ethnicity distribution, parental education, and employment status (Table 1). We excluded subjects younger than 18 or older than 60 years and those with a history of neurologic disease, schizophrenia, schizo-affective disorder, or bipolar disorder, as well as subjects with current PTSD, major depressive disorder, or substance dependence. We also excluded subjects with uncorrected impairments in visual or auditory acuity. Subjects with BPD were clinically stable during the study: none were hospitalized in the month before the study nor had psychotic or dissociative symptoms at the time of study. The mean Global Assessment of Function was 56 ± 9, and 77% were being treated with psychiatric medication (Table 1). Diagnostic evaluation included the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I), and the SCID-II screening questionnaire and interview for DSM-IV Axis II disorders [27,28]. Twenty-one (49%) of the BPD subjects were randomly chosen for videotaping of their diagnostic interview, which was reviewed by a second SCID-trained diagnostican (with a PhD in clinical psychology). Interrater agreement for BPD criteria was high (κ = .81). Comorbid Axis I diagnoses included dysthymic disorder.

<table>
<thead>
<tr>
<th>Variable</th>
<th>BPD (n = 43)</th>
<th>Control (n = 26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>35 ± 13</td>
<td>34 ± 9</td>
</tr>
<tr>
<td>Sex (% female)</td>
<td>88</td>
<td>89</td>
</tr>
<tr>
<td>Education (y)</td>
<td>14 ± 3*</td>
<td>16 ± 2</td>
</tr>
<tr>
<td>Parental education (y)</td>
<td>15 ± 3</td>
<td>15 ± 2</td>
</tr>
<tr>
<td>Ethnicity (W, B, L, As, Nat) (%)</td>
<td>77, 7, 5, 9, 2</td>
<td>77, 8, 4, 12, 0</td>
</tr>
<tr>
<td>On medications at study (%)</td>
<td>77</td>
<td>N/A</td>
</tr>
<tr>
<td>Global Assessment of Function</td>
<td>56 ± 9</td>
<td>N/A</td>
</tr>
<tr>
<td>Age at symptom onset</td>
<td>12 ± 6</td>
<td>N/A</td>
</tr>
</tbody>
</table>

W indicates white; B, black; L, Latino; As, Asian; Nat, Native American. Group totals for ethnicity greater than 100% because of rounding. * P < .05.
(n = 6), panic disorder (n = 2), bulimia (n = 2), gender identity disorder (n = 1), amphetamine abuse (n = 1), and cannabis abuse (n = 1). Comorbid personality disorder diagnoses included avoidant (n = 19), paranoid (n = 10), dependent (n = 8), obsessive-compulsive (n = 6), antisocial (n = 5), narcissistic (n = 5), schizotypal (n = 4), histrionic (n = 3), and schizoid (n = 3).

Control subjects (n = 26) were also recruited from the community. Exclusion criteria were similar to those for the BPD group and also included any past or present psychiatric diagnosis or treatment, including current substance abuse. Prospective control subjects were screened for Axis I disorders using a modified version of the SCID-I nonpatient version and for personality disorders using the SCID-II screening questionnaire. No control subject met more than one DSM-IV criterion for BPD nor was near the screening threshold for other personality disorders. After complete description of the study to the subjects, written informed consent was obtained.

2.2. Measures

Bell-Lysaker Emotion Recognition Test (BLERT) [29]. This test of integrated facial/prosodic emotion recognition presents 21 videotaped vignettes, each 10 seconds in length. In each vignette, the actor portrays 1 of 7 emotional states: happiness, sadness, anger, fear, disgust, surprise, or neutral. These categories are identical to those presented in the Ekman Facial Emotion Recognition Test (see below). Each vignette provides both prosodic and facial expressions of emotion, and each emotion is portrayed in 3 vignettes. Subjects state which emotion each vignette portrays while referring to a card listing these 7 choices. The experimenter is seated behind the subject, out of view, and manually records subject responses. Total accuracy is scored for each emotion category. This test has been used in patients with schizophrenia and substance abuse [29].

Ekman Facial Emotion Recognition Test [30]. This set of 98 digitized photos was presented in a computerized format. Seven facial emotions (the same as for the BLERT mentioned above) were presented, 14 times each, in random order, preceded by 12 practice trials. Subjects were instructed to state as quickly as possible which emotion is portrayed by each picture while referring to a card listing these 7 choices. The reaction time (RT) after onset of each stimulus was measured by a voice-activated timer. Each face remained visible on screen until automatically terminated by the subject’s vocal response. The test administrator, seated behind the subject, recorded the subject’s categorical response on a keyboard, triggering the next trial. Vocalizations other than categorical emotion choices were entered as a null choice, and these trials were excluded from analysis. This occurred on less than 5% of trials for all subjects. Measures include accuracy and reaction time (RT on correct trials) for each of the 7 emotion categories.

Prosodic Emotion Recognition Test [31]. This test of vocal emotion recognition originates from the Florida Affect Battery—Revised. Sentences with emotionally neutral content (e.g., “The chairs are made of wood”) are expressed using 5 prosodic emotions (happy, sad, surprised, angry, or neutral), with each emotion expressed 4 times in random order (20 trials total). Subjects are instructed to state as quickly as possible which emotion is portrayed by each sentence while referring to a card listing these 5 choices. For this study, the 20 test items were recorded by a professional voice actor and digitized for computerized presentation. These stimuli were presented through audio headphones in random order, preceded by 2 practice trials. Instructions to the subject, trial structure, and response coding were similar to that used for the Ekman Facial Emotion Recognition Test; subjects were additionally instructed “Pay attention to the speaker’s tone of voice, not to what he says but to how he says it.” Measures include accuracy and reaction time (RT on correct trials) for each of 5 emotion categories. The original Prosodic Emotion Recognition Test from the Florida Affect Battery—Revised has been used in studies of patients with focal brain injury [32], dementia [33], and schizophrenia [34].

Benton Facial Recognition Test—Long Form [35]. This test of facial feature matching is a widely used clinical measure of face perception (using nonemotional facial stimuli). A series of gray-scale photographs of nonfamous individuals’ faces (printed on heavy paper) are presented in an un-paced manner. Subjects are asked to match each target face with 1 of 6 (and later, 3 of 6) faces shown on the same page, below the target. Task difficulty increases progressively over the course of the test. There are a total of 22 trials. The total score was entered into the analyses.

Nonsocial neurocognitive tests of RT. To assist in parsing facial and prosodic emotion recognition from more general differences in overall processing speed, we administered 2 RT tests as controls. To control for visual and vocal speed on the facial emotion recognition test, we used a simple visual-vocal RT test. The letter B was presented on a computer monitor at randomly varying delays of 0.25, 0.5, 1, or 2 seconds. Subjects were instructed to say “B” into a microphone as quickly as possible upon seeing the stimulus. To control for auditory and language processing speed in the Prosodic Emotion Recognition Test, we used a computerized vocal sentence completion test (with all items containing emotionally neutral prosodic and semantic content). The trial structure for each of these tests was identical to that for the tests for which they served as control measures. RTs were recorded by computer. During data analysis of group differences on the facial and prosodic affect recognition tests, subjects’ mean RTs on each of these control tasks were entered as covariates in the analysis of covariance of facial and prosodic emotion recognition RTs, respectively.

BDHI [36]. BPD subjects completed the BDHI as a measure of interpersonal antagonism. This 75-item self-report questionnaire measures suspiciousness, hostility, anger, irritability, negativism, and guilt, as well as aggres-
sive (verbal and physical) behavior. Subjects rate items as true or false as applied to themselves. The total score (hostility) was entered into the analyses.

3. Results

To conduct a preliminary overall test of significance, we computed a composite score of accuracy on the 4 tests of social perception, consisting of each subject’s mean z score on these 4 tests. The BPD group scored significantly lower on this composite measure (z = −0.5 ± 0.9) than controls (z = 0.0 ± 0.6) (t_{63} = 2.32, P = .02). As outlined below, we then tested for significant differences between the 2 subject groups on each measure. For each measure that showed significant group differences, we computed its correlation with total hostility scores in the BPD group.

3.1. Recognition of integrated facial/prosodic emotion

On the BLERT, the BPD group showed significantly lower accuracy than the control group: 78% ± 12% versus 84% ± 11% (t_{66} = −2.23, P = .03). In the BPD group, BLERT accuracy was inversely correlated with total hostility scores (r = −0.40, P < .01). This was primarily because of significant correlations of BLERT performance with the following hostility subscales: suspiciousness (r = −0.43, P = .005) and assault (r = −0.43, P = .006). No other hostility subscales were correlated at a significant level (all r < 0.30, P = .07).

3.2. Facial feature recognition

On the Benton Facial Recognition Test, the BPD group showed significantly lower accuracy than the control group: 46 ± 4 versus 48 ± 3 (t_{66} = −2.54, P = .013). In the BPD group, facial feature recognition was unrelated to hostility (r = −0.03).

3.3. Recognition of isolated facial and vocal emotions

On the Ekman Facial Emotion Recognition Test, there was no significant difference between the BPD and control groups, in accuracy (t_{66} = 1.08, P = .28) or RT (F_{1,65} = 1.67, P = .10). Similarly, on the Prosodic Emotion Recognition Test, there was no significant difference between the BPD and control groups, in accuracy (t_{66} = 1.05, P = .30) or RT (F_{1,57} = 1.58, P = .12). Furthermore, there were no significant group by emotion interactions on either test (P > .6), which indicates that the overall pattern of difficulty for different emotions did not differ between BPD and healthy individuals. Additional exploratory analyses of subjects’ responses to each emotion found no significant differences between the BPD and control groups in accuracy or response rates for any individual facial or prosodic emotion (all P > .25). Finally, there were no significant correlations between speed and accuracy on either of these 2 tasks in the BPD group (r < 0.15, not significant), suggesting no apparent speed-accuracy tradeoffs in BPD subjects’ performance of these tasks.

4. Discussion

This study is the first of its kind to report on multiple measures of social-emotion perception in BPD, including comparison of the ability to recognize emotions in isolated sensory modes versus integrated heteromodal perception. To our knowledge, it is also the first to address the relationship of emotion recognition with interpersonal disturbances that are commonly observed in BPD. The BPD group showed poorer recognition of facial and vocal emotions when these were displayed together, but not when these expressions were presented in isolation. Interestingly, the mean accuracy of the BPD group on the BLERT (78%) was nearly identical to that reported in subjects with substance abuse disorders (77%) [29], which are frequently comorbid with BPD [37]. The present findings suggest that patients with BPD may exhibit particular problems with higher order heteromodal integration of emotional displays by others. In addition, the BPD group exhibited problems in the recognition of people’s facial features. Although the average group performance for subjects with BPD was not into the clinically impaired range, it was significantly worse than that of the control group, which was well matched on personal demographic and parental education and socioeconomic factors. This finding is somewhat unexpected, as patients with BPD are not known to misidentify individuals in clinical settings, and the perception of facial identity has not been previously tested in patients with BPD to our knowledge.

The present results suggest that patients with BPD may have subtle deficits in the processing of social stimuli that extend beyond the range of emotional expressions. This could reflect dysfunction in brain areas (eg, early visual cortical areas) that are common to the processing of expressive and structural facial features, which support the recognition of facial emotion and facial identity, respectively. Dysfunction in these areas could possibly result in functional deficits in both types of face processing. Alternatively, there is increasing evidence that patients with BPD have structural and functional deficits in components of the divergent pathways that process these 2 types of information from faces, suggesting coexisting deficits. For example, patients with BPD exhibit serotonergic dysfunction in the superior temporal gyrus, with impaired in vivo serotonin synthesis [38] and impaired metabolic activation in response to fenfluramine [39]. Patients with BPD also have impaired resting metabolism in the fusiform gyrus [40]. The superior temporal and fusiform gyri are key cortical sites in the processing of expressive and structural facial features, respectively [1]. In the orbitofrontal cortex, an area that shows selective responses to facial expressions of anger [41], patients with BPD have been found to exhibit volume loss [42], impaired resting metabolism [43], and impaired metabolic response to serotonergic agents fenfluramine [39,44] and m-CPP [45]. These findings suggest that patients with BPD may have pathology in multiple areas subserving the processing of facial information, both...
expression and structural. A third distinct possibility is that dysfunction in a third neural element affects both the expressive and structural face processing pathways in the cortex. The ascending brainstem serotoninergic system (implicated above) is a clear target for testing this hypothesis because this system has diffuse connections throughout the neocortex, and central serotoninergic dysfunction is well established in BPD [46]. Harmer et al have found that recognition of fearful facial expressions by healthy adults is enhanced with administration of either tryptophan [47] or selective serotonin reuptake inhibitors [48] and decreased with tryptophan depletion [49]. In addition, it is normalized in remitted depressed subjects with selective serotonin reuptake inhibitors [50]. These studies were all conducted in a double-blind, placebo-controlled manner and suggest that serotoninergic activity modulates social-emotional processing in both normal and depressed individuals and therefore may contribute to social-emotional processing deficits in BPD as well.

In addition, deficits in processing of integrated facial/prosodic emotions were associated with interpersonal hostility, especially suspiciousness and assaultiveness. This suggests that individual differences in the patients’ higher order integration of emotional perceptions may be related to the wide variation in interpersonal dysfunction observed clinically. This is also consistent with the findings of impaired serotoninergic modulation of activity in the orbitofrontal cortex in BPD patients with impulsive aggression [44,45]. The present finding might also imply that patients with BPD are less likely to be antagonistic in structured contexts such as clinic appointments, where interpersonal contacts are more predictable and easier to decode, than in day-to-day interactions in the community.

The BPD group’s speed, accuracy, and pattern of errors were equivalent to those of healthy subjects, when subjects were only required to identify isolated facial or prosodic emotions. This suggests that when processed in isolation, facial and prosodic emotion recognition are normal, on average, among patients with BPD.

The results on the isolated facial emotion recognition task were discrepant with those of the other 2 studies of facial emotion recognition in patients with BPD, which found deficits among the BPD groups [15,16]. It may be that, in performing the tasks presented in the other studies, the BPD subjects exhibited excessively rapid responding relative to the comparison groups, with increased errors as a result. This would be consistent with the prominent behavioral impulsivity observed in these patients in clinical settings. However, in the present study, we did not find evidence of a significant speed-accuracy trade-off within the BPD group, which suggests that in our sample, the patients with BPD were not exhibiting excessively rapid responding with accuracy decrements as a result. Alternate explanations for the divergence of our facial emotion recognition test results from that of other studies may include study sample differences in psychiatric comorbidity. By excluding several of the Axis I disorders that are found commonly in BPD, our resulting sample lacked comorbid diagnoses that may contribute to emotion recognition deficits [5-11]. In addition, differences in task demands may have affected performance as well. In the present facial emotion recognition task, by emphasizing both speed and accuracy, the effects of negatively valenced attributions by subjects with BPD on categorical emotion judgments may have been minimized. For those effects to manifest, greater deliberation, that is, slower, more elaborated processing, may be required. Resolution of this issue will be aided by emotion-recognition tasks that parametrically vary the processing time available to subjects.

4.1. Study limitations

By design, the present study excluded patients with BPD who were comorbid for current diagnoses of major depression, PTSD, bipolar spectrum disorders, or substance dependence. Although these exclusion criteria precluded confounding effects of these disorders on the results, they also limit our ability to generalize these findings to the community population of patients with BPD overall because these other disorders are frequently found comorbidly in patients with BPD. In addition, these conditions may be more frequent in patients with more severe manifestations of BPD. Thus, additional studies will be needed to assess how such comorbid conditions might alter the findings of this study.

Similarly, this study did not include a clinical comparison group; therefore, it is unclear whether these findings are specific to patients with BPD or may reflect nonspecific symptoms that are also found in other disorders. In addition, the study sample was also composed largely of women. Although females are generally overrepresented among patients with BPD in clinical settings [51], it remains less clear how the present findings relate to men with BPD.

A large percentage of the current sample was composed of individuals in active treatment with psychotropic medication. The effects of these medications on social neurocognitive functions remain to be fully characterized. However, the studies cited above which found serotoninergic modulation of facial emotion recognition [47-50] suggest that performance on the current tests may have been remediated by psychopharmacologic treatment in many of these subjects. This could resolve the discrepancy between this study and the 2 prior studies of patients with BPD facial emotion recognition [15,16]. It seems unlikely that the present group differences in the higher order social neurocognitive functions are an artifact of the medicating exposure of patients with BPD. Psychiatric medication would not be expected to confer selective deleterious effects on heteromodal versus isolated emotion recognition performance, although this remains to be tested empirically. Future studies may benefit from testing patients with BPD who are not currently in treatment with psychiatric medication. Finally, although our digitized version of the
prosody recognition test was replicated from a standard test of prosody using a professional voice actor, the psychometric properties of this version have not been established.

4.2. Conclusion

Patients with BPD exhibit poorer recognition of social-emotional cues when these involve higher order heteromodal integration of socioemotional expressions, whereas unimodal emotion perception may be spared. These deficits in the integration of emotional perceptions are associated with some of the more serious interpersonal symptoms observed in this disorder, notably suspiciousness and assaultiveness, and may be responsible for some of the heterogeneity in interpersonal dysfunction observed clinically in BPD.

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References


