

RECOGNITION OF FACIAL AFFECT IN BORDERLINE PERSONALITY DISORDER

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Patients with Borderline Personality Disorder (BPD) have been described as emotionally hyperresponsive, especially to anger and fear in social contexts. The aim was to investigate whether BPD patients are more sensitive but less accurate in terms of basic emotion recognition, and show a bias towards perceiving anger and fear when evaluating ambiguous facial expressions.

Twenty-five women with BPD were compared with healthy controls on two different facial emotion recognition tasks. The first task allowed the assessment of the subjective detection threshold as well as the number of evaluation errors on six basic emotions. The second task assessed a response bias to blends of basic emotions.

BPD patients showed no general deficit on the affect recognition task, but did show enhanced learning over the course of the experiment. For ambiguous emotional stimuli, we found a bias towards the perception of anger in the BPD patients but not towards fear.

BPD patients are accurate in perceiving facial emotions, and are probably more sensitive to familiar facial expressions. They show a bias towards perceiving anger, when socio-affective cues are ambiguous. Interpersonal training should focus on the differentiation of ambiguous emotion in order to reduce a biased appraisal of others.

Borderline personality disorder (BPD) is characterized by major difficulties in emotion regulation, especially for anger and anxiety (DSM-IV; American Psychiatric Association, 1994). Clinical observations suggest that patients with BPD often experience these emotions as uncontrollable and overwhelming, triggering impulsive and self-aggressive behavior (Herpertz et

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al., 1997). These observations have led to the assumption that BPD patients may be described as emotionally hyperresponsive, showing intensified reactions to emotional stimuli as a result of an attenuated threshold and/or inadequate abilities to regulate affective states. Furthermore, BPD patients have been described as hypersensitive in the interpersonal context, sometimes misinterpreting ambiguous subtle social cues following a negativity bias (Wagner & Linehan, 1999).

Emotional hyperresponsivity in BPD is not generally supported by experimental studies. For example, earlier studies from our laboratory have shown that BPD patients do not exhibit increased psychophysiological responses (e.g., potentiation of the startle response) to negative pictures (Herpertz, Kunert, Schwenger, & Sass, 1999; Herpertz et al., 2000), but do show an enhanced amygdala activation to aversive stimulation (Herpertz et al., 2001) when compared with healthy controls. The latter finding of neurofunctional abnormalities is also supported by Donegan and colleagues, who reported elevated amygdala activation to pictures of facial affect, even when the faces presented were of neutral valence (Donegan et al., 2003). The authors conclude that there might be a hypersensitivity to social cues, especially facial expressions, which results in emotional responses even in the face of neutral stimuli.

Few studies have addressed the processing of facial expressions in BPD, up to now. Levine, Marziali, and Hood (1997) found a general deficit in female BPD patients when labeling pictures of facial affect. More specifically, BPD patients made more errors in this study when labeling pictures of angry, fearful, and disgusted faces compared to normal controls (Levine et al., 1997). These results were confirmed in a recent study by Bland, Williams, Scharer, and Manning (2004) by showing a negative association of affect recognition accuracy with self-reported intensity of emotional responses to everyday experiences. Another study, by Wagner and Linehan (1999), extended these results. They found a tendency toward heightened sensitivity on fear recognition in BPD patients indicated by an enhanced rate of false alarms for fearful stimuli. Furthermore, Wagner and Linehan found BPD patients to be less accurate in appraising neutral faces (Wagner & Linehan, 1999). These results were interpreted as probably reflecting a negativity bias when appraising social cues. In a recently published study, Lynch and coworkers demonstrated a generally lowered detection threshold for emotional facial expressions, supporting the idea that BPD patients show a heightened emotional sensitivity in the social context (Lynch et al., 2006).

In sum, the empirical data is controversial, showing both higher sensitivity to social-affective stimuli and attenuated accuracy in facial affect recognition in BPD.

In order to assess sensitivity to social-affective cues in a different, more naturalistic way, we chose two paradigms using ambiguous social stimuli. In the first paradigm, initially neutral faces were presented, which gradually developed a specific emotion in small steps. This procedure of an emo-

tional intensification in small steps allowed the determination of subjectively becoming aware of a particular emotion, and the assessment of the individual turning point in the recognition process at which the probability of errors increases. In the second paradigm, blends of emotional expressions were presented in order to test for a possible bias in processing ambiguous social cues.

Based on the above-mentioned theoretical assumptions and previous studies, we expected BPD patients to be more sensitive towards expressed negative emotions, especially to fearful and angry faces. This higher sensitivity should result in lower-intensity thresholds of emotion detection. On the other hand, BPD patients were assumed to present, in general, more errors when appraising the particular emotions. Finally, we hypothesized that BPD is associated with a bias towards anger and fear, indicating social rejection respective social threat when evaluating ambiguous social affective stimuli.

METHODS

PARTICIPANTS

In the present study, 25 women with BPD were compared to 25 healthy women, matched for age, education, and IQ at the group level (Table 1). BPD patients were inpatients and met diagnostic criteria for BPD in the International Personality Disorder Examination (IPDE, DSM-IV version; Loranger et al., 1994), controls were shown not to meet more than one diagnostic criterion for BPD. To rule out possible effects of gender on facial affect recognition (Hall & Matsumoto, 2004) and gender differences in clinical symptoms (Johnson et al., 2003), only women were included in this study. Participants were excluded if they showed major somatic illness, neurological signs and substance abuse during the last 6 months. BPD patients were not included if they exhibited comorbid schizophrenia, major depression, panic disorder, generalized anxiety disorder, and social

TABLE 1. Demographic and Clinical Characteristics of the Borderline Patients (BPD) and the Healthy Controls (HC)

	BPD (n = 25)		HC (n = 25)		t-test	
	m	(SD)	m	(SD)	t	p
Age	26.00	(7.21)	25.96	(4.51)	0.024	.981
Education	10.96	(1.59)	11.28	(1.57)	-0.716	.478
IQ	114.16	(18.92)	114.68	(15.35)	-0.107	.915
BDI	29.37	(12.55)	7.00	(5.73)	8.108	<.001
STAI	61.32	(8.91)	39.16	(9.42)	8.543	<.001
PANAS-P	28.20	(5.82)	37.08	(4.02)	-6.280	<.001
PANAS-N	31.20	(9.16)	23.08	(6.86)	3.547	<.001
SCL-90 GSI	1.62	(0.65)	0.35	(0.35)	8.567	<.001
BIS-10	80.80	(10.40)	70.36	(10.14)	3.592	<.001

phobia, because these disorders are known to influence facial recognition. Of the BPD patients, 10 were taking psychoactive medication (8 selective serotonin reuptake inhibitor (SSRI), 1 tricyclic antidepressant, and 1 atypical neuroleptic), 16 reported a history of sexual abuse, all of these patients reported symptoms of posttraumatic stress disorder (PTSD), and 11 met criteria for current PTSD.

The study protocol was approved by the institutional review board of the Medical Faculty of the University of Rostock. All participants gave written informed consent before participation.

CLINICAL ASSESSMENT

A set of standard clinical questionnaires was used to assess clinical characteristics and symptom severity in the BPD patients. General psychopathology was measured with the Symptom Checklist (SCL-90-R; Franke, 1995), the trait version of the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988), the State-Trait Anxiety Inventory (STAI; Laux, Glanzmann, Schaffner, & Spielberger, 1981), the Barratt Impulsiveness Scale (BIS-10; Patton, Stanford, & Barratt, 1995) and the Beck Depression Inventory (BDI; Beck, Hautzinger, Bailer, Worall, & Keller, 1995). To cover the severity of BPD-specific symptoms, we employed the Borderline Symptom List (BSL; Bohus, Limberger, Sender, Gratwohl, & Stieglitz, 2001).

EMOTION RECOGNITION TASK

In order to examine sensitivity to facial affect in a more naturalistic way, we employed a procedure with neutral faces, which “developed” a specific emotion in a pseudo-continuous way (Blair, Colledge, Murray, & Mitchell, 2001; Coupland, Singh, Sustrik, Ting, & Blair, 2003). For this task, slides of the six basic emotions (fear, sadness, disgust, happiness, anger, surprise) were chosen from the “Pictures of Facial Affect” (Eckman & Friesen, 1976). Using a computer program, they were electronically morphed by 5% steps of intensity from 0% to 100% of intensity. Three female and three male pictures were chosen, resulting in 36 sets of faces (6 emotions × 6 faces) with 21 pictures each. Each picture of a particular set was presented for one second, beginning with 0% intensity and increasing up to 100% in 5% steps. Participants were instructed to press a stop button when they felt subjectively certain of becoming “aware of the emotion the face is beginning to show.” This instruction was intended to reduce false alarms. After stopping the presentation, a forced choice between the six basic emotions was asked for. As dependent variables, we recorded the emotion intensity at which the presentation was stopped and the emotion category chosen after stopping. The 36 trials of one block were presented

in a randomized order and were presented three times, resulting in 108 trials.

MIXED EMOTIONS FORCED-CHOICE TASK

This task was based on a paradigm previously described by Calder et al. (Calder, Young, Rowland, & Perrett, 1996). Slides of a male and a female actor were chosen from the "Pictures of Facial Affect" (Eckman & Friesen, 1976) and were morphed from one emotional expression to another in 10% steps, resulting in series of 9 pictures showing blends of two basic emotions, for example: 90% anger/10% fear, 80% anger/20% fear, 70% anger/30% fear, etc. The expressions morphed were anger to disgust, anger to sadness, anger to fear, anger to happiness, fear to disgust, fear to sadness, and fear to happiness. The pictures were projected separately on a screen in a randomized order. In a forced-choice decision task, participants were asked to choose as quickly as possible which particular emotion the face displayed. A corresponding button press stopped the presentation and another face was displayed. Pictures were randomly presented within blocks of 18 faces of one particular blend of two emotions. In total, 21 blocks were presented (7 conditions, 3 repetitions). Button presses and response latencies were recorded on a PC for further processing.

STATISTICS

Emotion Recognition Task. To minimize the effect of guessing, all trials that were not stopped by a button press before an intensity of 100% had been reached were excluded from further analyses. Through this, less than 5 percent of all trials, mean \pm s.e.; borderline patients: 4.9 \pm 1.3; healthy controls: 4.6 \pm 1.4; $t(48) = 0.19$, $p = .850$, had to be excluded. In a second step, mean intensity levels and mean error rates were calculated for both groups and for all facial emotions. Intensity levels were calculated for correct answers only. To test for emotion-specific group effects, we calculated two-way repeated measures ANOVAs (group \times valence) for intensity and error rates. To further explore the possibility of differential effects of "learning" over the course of the experiment, three-way repeated measures ANOVAs (group \times valence \times block) were calculated. Post-hoc analyses included one-way ANOVAs for repeated measures for both groups with regard to the block factor.

Mixed Emotions Forced-Choice Task. The mean probability of answering "anger" and "anxiety" as a function of affect intensity in the particular pair of emotions (e.g., anger and disgust) was calculated. Mean reaction times were calculated in the same way. Group effects were tested for statistical significance using two-way ANOVAs for each particular pair of emotions.

For all analyses, statistical significance was set at $p < .05$. In the case of inhomogeneity of variance, the Greenhouse-Geisser correction was applied. Post-hoc single comparisons were carried out using Student's t-tests

with Bonferroni correction for multiple testing. All calculations were conducted using SPSS for Windows (Version 11).

RESULTS

GROUP CHARACTERISTICS

Group characteristics are shown in Table 1. There were no group differences in age, years of education, and IQ (all $p > .50$). BPD patients reported significantly more unspecific psychiatric symptoms, depression, trait anxiety, impulsiveness, attenuated positive affect, and augmented negative affect (all $p < .001$). As expected, the patients also reported significantly more symptoms of BPD in the BSL compared to the healthy controls ($p < .001$).

EMOTION RECOGNITION TASK

BPD patients showed a comparable overall detection threshold, as revealed by a nonsignificant main effect of group on stopping intensities, $F = .009$, $p = .925$, $df = 1,48$. Furthermore, there was no interaction of group and valence, $F = 1.362$, $p = .239$, $df = 5,249$, reflecting comparable profiles of stopping intensities. Only the main effect of valence was highly significant, $F = 83.920$, $p < .001$, $df = 5,240$, with the happy faces most easily detected.

With regard to labeling errors, there was a significant interaction of group and valence, $F = 3.072$, $p = .020$, $df = 3.76,180.61$, although the main effect of group membership turned out not to be significant, $F = .802$, $p = .375$, $df = 1,48$. Post-hoc analysis revealed that BPD patients made significantly more errors on the trials showing surprised faces, $T = 3.113$, $p = .003$, $df = 48$. In addition, the happy faces produced the lowest error rates, reflected by a significant main effect of valence, $F = 43.415$, $p = .000$, $df = 3.76,180.61$ (Figure 1).

Testing for differences in “learning” over the course of the experiment, we found a significant group by block interaction, $F = 3.760$, $p = .045$, $df = 1.33,63.83$. The BPD group showed a significant reduction of stopping intensity over the course of the experiment, $F = 13.417$, $p = .000$, $df = 1.36, 32.85$, whereas the healthy controls did not, $F = 2.185$, $p = .144$, $df = 1.30, 31.14$ (Figure 2a). Interestingly, there was no such interaction with regard to the errors when labeling the presented faces, $F = .053$, $p = .949$, $df = 2,96$ (Figure 2b).

MIXED EMOTIONS FORCED-CHOICE TASK

In order to test for an overall tendency to choose the “anger” category, we compared the response profiles using separate MANOVAs. There was no significant multivariate group effect in either of the profiles tested. Since a

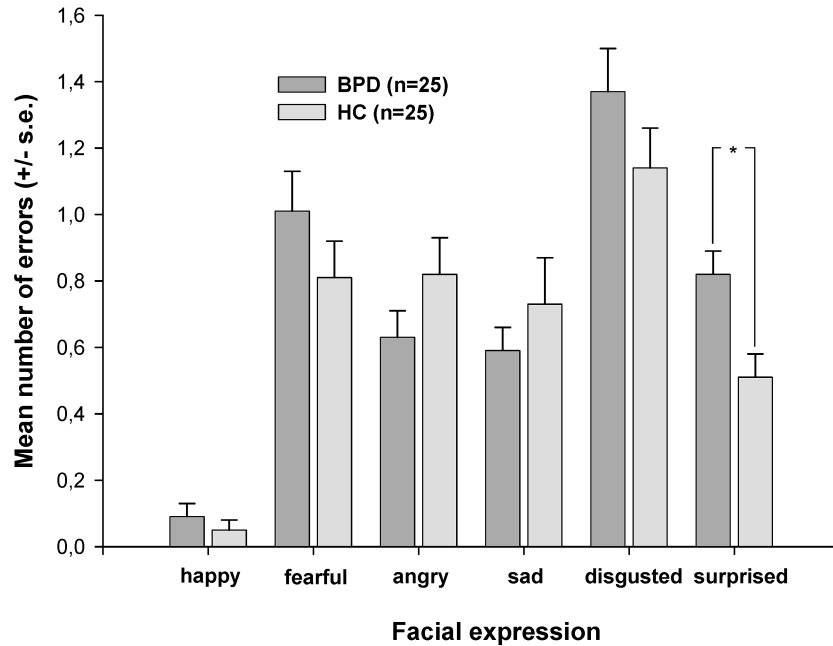


FIGURE 1. Mean number of errors for different facial emotions and group membership. Compared to the healthy controls (HC), borderline patients (BPD) showed more errors when evaluating surprised faces. * $p < .05$ (two-sided)

response bias is more likely to occur when ambiguity is high, i.e., in the medium intensity range of the blended emotions, we inspected data for univariate group differences. As expected, the BPD patients were more likely to respond “anger,” when anger and disgust faces were blended with a proportion of 50% anger: 50% disgust, $F = 5.764$, $p = .020$, $df = 1,48$. This was also true for the 40% anger: 60% happiness facial expressions, $F = 6.201$, $p = .016$, $df = 1,48$ (Figure 3).

Inspecting for group differences in response latencies using separate MANOVAs, we found a trend towards higher response latencies in the anger/sadness condition for the BPD patients, $F = 2.024$, $p = .062$, $df = 9,40$. Again, the univariate group difference was significant for the most ambiguous blend of 50% anger: 50% sadness, $F = 11.140$, $p = .002$, $df = 1,48$. No other group effect reached the significance level of $p < .05$.

In addition, we tested for the expected bias to respond with “fear” when other emotions are blended with fear. In the MANOVAs, we found no significant multivariate group effects, as well as no univariate differences. This was also the case for the response latencies.

EFFECTS OF MEDICATION AND COMORBIDITY

The BPD group was divided either with regard to medication and PTSD comorbidity. The resulting subgroups were compared using separate ANOVAs,

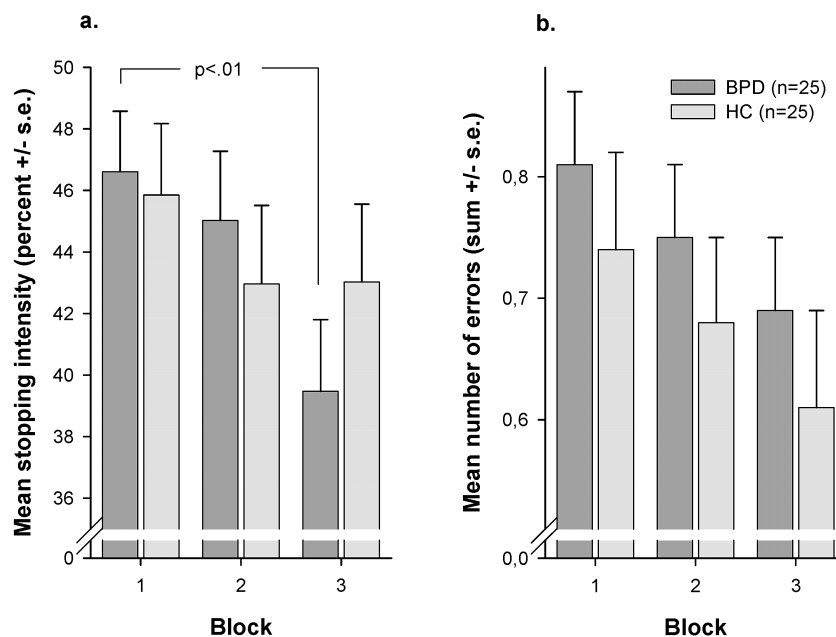


FIGURE 2. Mean stopping intensity (a) and number of errors (b) over the course of the experiment divided by group membership. Borderline patients (BPD) showed enhanced reduction of stopping intensity compared to the healthy controls (HC), whereas no such interaction was observed for the number of errors made.

MANOVAs or t-tests. We did not find any significant effect of medication and comorbidity on sensitivity (detection threshold) and accuracy (number of errors) in the emotion recognition task and in the mixed emotions task (all $p > .10$). Furthermore, there were no differences between the groups with regard to age, education, IQ and severity of symptoms measured by the SCL-90 GSI (all $p > .10$).

DISCUSSION

In sum, our results suggest that there is no general deficit in BPD patients in accurately processing emotional facial expressions. The BPD patients showed normal subjective sensitivity to facial emotions, which is reflected by detection thresholds comparable to those of the healthy participants. Also, there was no differential hypersensitivity for specific emotions. However, the BPD patients showed subtle deficits in labeling the emotion displayed. This was specifically the case for surprised faces. Surprise and fear are the two emotions most difficult to differentiate (Rapcsak et al., 2000). Therefore, the group difference for the surprised faces might reflect an effect of difficulty and therefore sensitivity of this specific category of items.

More interestingly, the BPD patients showed a significant reduction in stopping intensity over the course of the experiment, which might reflect

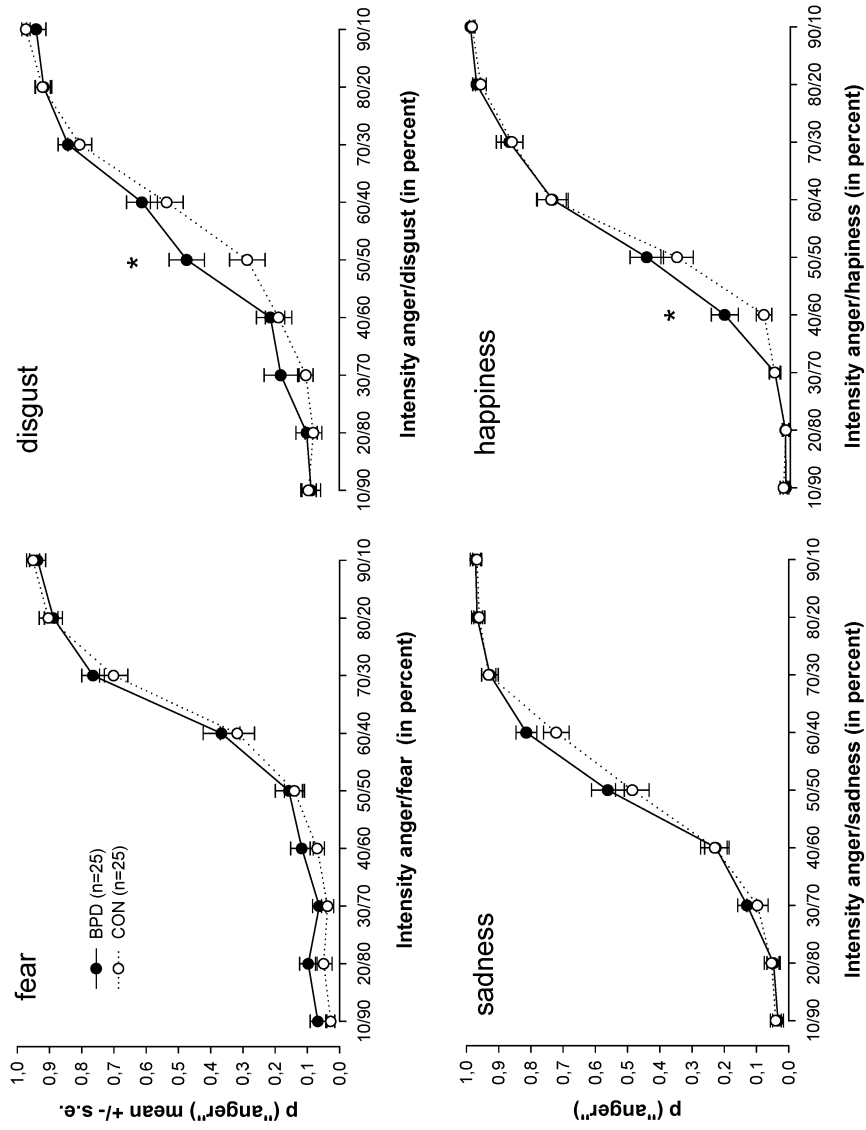


FIGURE 3. Mean probability of responding "anger" as a function of different emotional blends and group membership. Borderline patients (BPD) were more likely to respond "anger" compared to the healthy controls (HC) when anger was blended with disgust and happiness. * $p < .05$ (single-sided; corrected for multiple comparison)

a form of learning about the specific emotional characteristics of the individual faces displayed. Interestingly, this effect was not found for the healthy controls. Thus, reduction in stopping intensity might reflect enhanced empathic sensitivity for familiar persons. Another interpretation might be that BPD patients become less stringent over the course of the experiment, which should in turn have produced more errors when evaluating the presented faces. Our data do not support the latter interpretation, as the BPD patients showed a reduction in errors from the beginning to the end of the experiment comparable to the healthy controls. Therefore, the present results suggest that BPD patients may develop enhanced sensitivity after becoming familiar with people's specific expressive characteristics. Our data indicate that this sensitivity effect is not restricted to negative emotions but rather reflects a general ability.

In the mixed emotions paradigm, the BPD patients were biased towards the perception of anger when the faces displayed highly ambiguous blends of basic emotions. BPD is often associated with an attributional style of anticipating rejection in social situations. Our results support the assumption that this cognitive style might guide the perception and evaluation of subtle social cues of facial affect. This attributional style might contribute to the unstable social relationships often reported by BPD patients. Another possible interpretation is that BPD patients are more likely to evaluate ambiguous social cues as more threatening.

Our findings are in contrast to those previously reported by Bland et al. (2004) and Levine et al. (1997), who showed impairments in affect recognition in BPD, especially for expressions of negative emotions. Nevertheless, the present results do not support the general heightened sensitivity to facial expressions recently reported by Lynch et al. (2006) either. This inconsistency might be due to differences in sample characteristics (e.g., PTSD comorbidity) and/or subtle differences in the experimental protocol (stopping the presentation with the first response vs. allowing multiple responses). However, the results obtained using the paradigm with ambiguous blends of emotional expressions extend the previously reported results on basic emotion recognition. The observed bias towards the perception of anger in BPD patients might be interpreted as corroborating the lower detection threshold for anger (Lynch et al., 2006) and the negativity bias suggested by Wagner et al. (1999). In line with a negativity bias in appraising social cues, a study with healthy students by Meyer, Pilkonis, & Beevers (2004) revealed that borderline personality features assessed with the SCID-II screening questionnaire were associated with negative face appraisals (e.g., tendencies to rate faces as less friendly and more rejecting).

The above-reported results of Donegan et al. (2003) on amygdala hyperreactivity in response to neutral faces might be explained in terms of this negativity or anger bias: BPD patients probably tend to interpret neutral faces as negative or angry and therefore anticipate rejection or threat, which might be reflected by the enhanced emotional response of the limbic system, including the amygdala.

The present study has some limitations. Comorbidity is a common phenomenon in BPD. Thus, the exclusion of several axis-I disorders that might have an impact on facial emotion recognition impairs the generalizability of the reported results. In addition, it seems possible, that patients with comorbid PTSD (which were included in the study) are differentially affected by certain expressions, e.g., fearful faces (cf. Shin et al., 2005). However, there were no differences between PTSD and non-PTSD BPD patients with regard to sensitivity, accuracy, and response tendencies. Another limitation is the inclusion of medicated patients. Although there have been a few studies reporting selective effects of psychoactive medication on facial emotion recognition (Blair & Curran, 1999; Coupland et al., 2003), we were not able to show any modulatory effect of medication in our sample of BPD patients.

Deficits in facial affect recognition have been reported in several psychiatric disorders, including depression, schizophrenia, developmental disorders, and others (Bolte & Poustka, 2003; Feinberg, Rifkin, Schaffer, & Walker, 1986; Kohler et al., 2003). Our results draw a more complex picture of face recognition in BPD: On the one hand, there seems to be an enhanced preparedness to learn about the emotional facial characteristics of others in BPD patients, which might be a prerequisite of premature certainty about others' emotional states and associated intentions. However, the differentiation of ambiguous emotions seems to be biased towards the anticipation of social rejection or threat, which might motivate placing a focus on socio-perceptual training for these specific deficits.

From the clinical perspective, both aspects of emotion recognition have to be considered a major factor in the pathogenesis of BPD and the therapeutic alliance with BPD patients. It is an interesting question for the future how the reported laboratory effects relate to everyday social interactions. Finally, even more naturalistic paradigms of social cognition, for example with real social interactions could be a valuable approach for future studies.

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