What's in a Face?

Mentalizing in Borderline Personality Disorder Based on Dynamically Changing Facial Expressions

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Abstract

The mentalization-based approach to borderline personality disorder (BPD) argues that impairments in mentalizing are a key feature of BPD. Most previous research in this area has concentrated on potential impairments in facial emotion recognition in BPD patients. However, these studies have yielded inconsistent results, which may be attributable to methodological differences. This study aimed to address several limitations of previous studies by investigating different parameters involved in emotion recognition in BPD patients using a novel, 2-step dynamically changing facial expression paradigm, taking into account the possible influence of mood, psychotropic medication, and trauma exposure. Twenty-two BPD patients and 22 matched normal controls completed this paradigm. Parameters assessed were accuracy of emotion recognition, reaction time (RT), and level of confidence, both for first and full response and for correct and incorrect responses. Results showed (a) that BPD patients were as accurate in their first, but less accurate in their full emotion recognition than normal controls, (b) a trend for BPD patients to respond more slowly than normal controls, and (c) no significant difference in overall level of confidence between BPD patients and normal controls. Mood and psychotropic medication did not influence these results. Exposure to trauma in BPD patients, however, was negatively related to accuracy at full expression. Although further research is needed, results suggest no general emotion-recognition deficit in BPD patients using a dynamic changing facial recognition paradigm, except for a subgroup of BPD patients with marked trauma who become less accurate when they have to rely more on controlled, reflective processes.

Keywords: mentalization, emotion recognition, social cognition, borderline personality disorder.

What's in a Face? Mentalizing in Borderline Personality Disorder (BPD) Based on Dynamically Changing Facial Expressions

Borderline personality disorder (BPD) is a complex and serious mental disorder characterized by a pervasive pattern of difficulties with emotion regulation, impulse control, and instability in both relationships and in self-image (Skodol et al., 2002). BPD has a lifetime prevalence of up to 6% and shows high comorbidity with mood and anxiety disorders, bipolar disorder, and schizotypal and narcissistic personality disorders (Grant et al., 2008). The BPD diagnosis is very common in outpatient, inpatient, and forensic populations (Black et al., 2007).

The Mentalizing Approach to BPD

In recent years, the mentalizing approach to the understanding and treatment of BPD has gained considerable momentum (Luyten, Fonagy, Lowyck, & Vermote, 2012). *Mentalizing* refers to the imaginative mental activity that enables us to perceive and interpret human behavior in terms of intentional mental states (e.g., desires, feelings, and reasons) of self and others (see Fonagy & Bateman, 2008). The key assumption of the mentalizing approach to BPD is that the defining characteristics of BPD, that is, emotional dysregulation, impulsivity, and interpersonal dysfunction, are rooted in an instability of the reflective, regulatory capacities that mentalizing affords (Fonagy, Luyten, & Bateman, in press). Earlier theoretical formulations held that BPD was associated with general impairments in reflective functioning as assessed with, for instance, the Reflective Functioning Scale (Fonagy, Target, Steele, & Steele, 1998) on the Adult Attachment Interview (George, Kaplan, & Main, 1985). More recent approaches stress that individuals with exhibit marked impairments in some aspects of mentalizing, but not in others (Luyten et al., 2012). Indeed, both neurobiological and experimental studies converge to suggest that mentalizing is not a unitary but a multi-dimensional construct, organized along four dimensions: (a) automatic versus more

controlled mentalizing, (b) cognitive versus affective mentalizing, (c), internally focused versus externally based mentalizing and (d) self-focused versus other-focused mentalizing (Luyten et al., 2012). The specific mentalizing profile that is associated with BPD involves a rapid switch to more automatic and biased mentalizing, that is largely driven by affect, and mostly oriented towards the exterior features of others (such as facial emotional expression, gaze, and posture).

This paper focuses on potential problems with externally based mentalizing in BPD, one of the most striking clinical features of these individuals. Indeed, many authors have noted what is called the "empathy paradox," that is, that while individuals with BPD often demonstrate severe impairments in more controlled, internally focused mentalizing (i.e., when they have to reflect on the wishes, beliefs, and desires of self and others), they often seem hypersensitive to external features of others, such as facial expressions, gaze, and posture (Fertuck et al., 2009; Lynch et al., 2006). This paradox can be understood as an imbalance in mentalizing capacities, leading to *hypermentalizing* (i.e., excessive mentalizing), reflecting excessive attempts to make sense of the mind of others that have little or no relation to their real internal states (Sharp et al., 2011). Studies suggest that hypermentalizing may be rooted in a developmental history marked by inconsistency in the behavior of attachment figures, leading to a constant focus on and hypersensitivity to external signs of the mental states of others (Sharp & Fonagy, 2008). Furthermore, whereas moderate developmental trauma may lead to hypersensitivity to mental states, more serious traumatic circumstances may lead to a combination of hypersensitivity to external features of others and a defensive inhibition of mentalizing about others' underlying mental states, as an adaptive maneuver to limit exposure to a brutalizing psychosocial environment. Congruent with this idea, some evidence suggests that serious trauma is associated with a paradoxical combination of hypervigilance for emotional states and marked deficits in more controlled, reflective functioning (Fonagy & Bateman, 2008).

To date most research on mentalizing in BPD based on external features has relied on a facial emotion-recognition paradigm (FER; for reviews see Daros, Zakzanis, & Ruocco, 2013; Domes, Schulze, & Herpertz, 2009). However, this body of research has yielded remarkably contrasting results. While some studies have found that individuals with BPD are hypersensitive to facial expressions, as shown by their greater accuracy and speed of recognition (Domes et al., 2009; Fertuck et al., 2009; Lynch et al., 2006; Rosenthal et al., 2008; Wagner & Linehan, 1999), in contrast, others reported no differences between individuals with BPD and normal controls in terms of emotion recognition (Domes et al., 2008; Donegan et al., 2003; Matzke, Herpertz, Berger, Fleischer, & Domes, 2014; Minzenberg, Poole, & Vinogradov, 2006). Furthermore, a third group of studies found that BPD patients perform worse on emotion-recognition tasks, thereby suggesting a possible basic deficit in emotion recognition (Bland, Williams, Scharer, & Manning, 2004; Daros et al., 2013; Levine, Marziali, & Hood, 1997). There are several explanations for these apparently divergent findings. First, from a methodological perspective, studies have used qualitatively different stimuli (e.g., still images versus dynamic pictures of faces) and tasks (e.g., forced choice between emotions versus free descriptions). Moreover, studies have employed different paradigms and have often focused on different parameters, such as emotion recognition accuracy versus reaction time analyses. Furthermore, studies suggesting impairments in emotion recognition in BPD seem to have consistently used more static pictures of basic emotions, which may lack ecological validity. By contrast, BPD individuals seem to perform as well as, and sometimes even better than, normal controls on emotion-recognition tasks with greater ecological validity (e.g., involving dynamically changing faces). Second, most studies in this area typically have not systematically controlled for possible confounding variables such as depression, psychotropic medication, and trauma, while these factors have been consistently hypothesized to be negatively related to mentalizing (Fonagy & Bateman, 2008).

The Present Study

This study aims to contribute to the extant literature on externally based mentalization of others in BPD by using a novel two-step, dynamically changing facial expression paradigm distinguishing between different parameters involved in emotion recognition that have often been confounded in previous studies. The paradigm was used in a sample of 22 carefully screened BPD patients and matched normal controls. Further, we simultaneously investigated the possible influence of mood, psychotropic medication, and trauma on (a) reaction time, (b) accuracy and confidence for first response, and (c) accuracy and confidence for full emotion expression. The differentiation between first and full response may be particularly important, as first responses are likely to be driven more by automatic processes, while full emotion expression and the need to provide a final response (having to recall and compare the facial expression at first response with the full emotion expression) call for more controlled processes. From a mentalizing perspective, BPD patients may become increasingly less confident in their response as they need to rely on more controlled mentalizing, which would be reflected in decreasing levels of accuracy and confidence in their response to full emotion expression versus their first response.

Based on mentalizing theory, the following four hypotheses were tested:

1. BPD patients were expected to be at least as accurate and fast as normal controls in emotion recognition based on external features, as reflected in their first correct response;

2. BPD patients were expected to be more confident in their first response compared to normal controls. BPD patients are expected to make judgments based on little information with, relatively speaking, greater confidence (i.e., to jump to conclusions), in part because of their high levels of impulsivity and impairments in effortful control.

3. BPD patients were expected to be less accurate and confident with regard to their response as full emotion expression emerged. Indeed, as more “computational power”, and thus

reliance on controlled mentalizing, is needed to process social information, BPD patients may tend to become more confused and less confident in their judgments;

4. High levels of trauma were expected to impair mentalizing, as expressed in lower levels of accuracy and confidence and longer reaction times for first and, in particular, full response, and this would be evident in both BPD patients and normal controls.

In addition to our four a priori hypotheses, we also compared exploratively on specific emotions along the parameters described in the major study hypotheses (1–4), in both BPD patients and controls.

Methods

Participants and Procedures

Patients in the BPD sample were consecutively admitted patients at the University psychiatric hospital UPC KULeuven, Kortenberg (Belgium), who fulfilled the following inclusion criteria: (a) a primary diagnosis of BPD according to the Structured Clinical Interview for DSM-IV Axis II Disorders (SCID-II), (b) age between 18 and 60 years, and (c) Dutch literacy. Thirty-one patients were screened for BPD; 25 consecutive patients who met the inclusion criteria were asked to participate in the study, and 22 of these patients agreed to participate and were enrolled in the study. After signing informed consent forms, BPD patients were given a packet of questionnaires to complete, and an appointment was scheduled within the next 3 days for the computerized emotion-recognition task (see below). Most of these patients were female (17 female; 5 male) and their mean age was 25.91 years (*SD* = 8.27; range 18–48). Four patients had completed primary school, 10 high school, and 3 higher education (educational level for 5 patients was not reported). As shown in Table 1, in addition to the primary diagnosis of BPD, there was a high level of comorbidity with both Axis I and Axis II disorders as described in DSM-IV.

Participants in the control sample were recruited from the community, to match the characteristics of the BPD group, by a research assistant. Participants were contacted via flyers in university buildings, hospitals, and several community organizations. Thirty-three potential participants were asked to participate, of whom 24 agreed to do so. Two of these participants were excluded because they met criteria for at least one personality disorder based on their scores on the Assessment of DSM-IV Personality Disorders (ADP-IV), a screening tool for personality pathology (see below). The remaining nine potential participants declined participation for a variety of practical reasons or because they no longer felt comfortable to be included in the study when they received the further information that was provided in the informed consent. Control participants were matched to the BPD sample for age, education, and gender. The mean age of control participants (17 female; 5 male) was 25.95 years (*SD* = 8.48; range 18–48). Thirteen participants had obtained a high school diploma degree, while nine had a diploma of higher education. After being provided with the necessary information about the research and signing informed consent forms, control participants were asked to fill in a packet of questionnaires, after which they completed the emotion-recognition task. They were offered €25 for their participation and travel costs.

Testing of the BPD patients took place in the research facility of the University Hospital where they were admitted. Control participants were tested in a similar setting at the Faculty of Psychology and Educational Sciences of KULeuven (Belgium), ensuring similar conditions for testing (see also below).

Measurements

Demographic variables. Both BPD patients and normal controls completed (a) a questionnaire assessing age, gender, and educational level; (b) an emotion-recognition task; and

(c) self-report measures of childhood trauma and severity of depression (see below). For the BPD group, data on current psychotropic medication were gathered from their medical records and were coded by the main researcher (BL) into the following four categories, using the Electronic Medicines Compendium from the Belgian Centre for Pharmacotherapeutic Information: antipsychotics, anxiolytic medication, antidepressants, and mood stabilizers. The number of drugs within one category and the total number of psychotropic medications taken were calculated.

Emotion-recognition task. The dynamically changing face recognition task was developed using FaceMorph software (Morph Age© software package) in collaboration with the Developmental Electrophysiology Laboratory, Yale Child Study Center, Yale University, USA (Bailey et al., 2008). Pictures of the six basic emotions (fear, sadness, disgust, happiness, anger, and surprise) as described by were morphed by 2% steps of intensity from 0–100% intensity (49 steps in total). Three female and three male facial pictures based on the NimStim dataset (Tottenham et al., 2009) were selected and used, yielding 36 sets of faces. Participants sat 60 cm from the computer screen, and the 36 trials were presented in a randomized order. Participants were instructed to press a stop button as soon as they felt they recognized an emotion (reaction time). They were then asked to make a forced choice between the six emotions (first response), and to indicate their confidence in their response on a six-point Likert scale from 1 (*not certain at all*) to 6 (*very certain*). Next, the emotion evolved to the full expression, and again the participants were asked to give a forced choice between the six emotions (accuracy full expression) and to state how confident they were about their score (confidence full expression). Before the morphing task started, a practice trial was provided.

Dependent variables were reaction time, accuracy, and confidence for the first response, and accuracy and confidence for the full response, and this for both correct and incorrect responses.

Childhood Trauma Questionnaire (CTQ). The (CTQ; Bernstein, Ahluvalia, Pogge, & Handelsman, 1997) is a 25-item self-report inventory that assesses early adverse experiences before the age of 18 years and consists of five subscales—emotional abuse, emotional neglect, sexual abuse, physical abuse, and physical neglect—as well as a total score. Each item is scored on a five-point Likert scale, ranging from 1 (*never true*) to 5 (*very often true*). The CTQ has demonstrated good levels of internal reliability and criterion-related validity (Bernstein et al., 1997). The CTQ can be used both dimensionally and categorically, with the following cut-off scores for different types of childhood maltreatment: 13 or higher for emotional abuse, 10 or higher for physical abuse, 8 or higher for sexual abuse, 15 or higher for emotional neglect, and 10 or higher for physical neglect. The CTQ was administered in both the BPD group and the normal controls.

Diagnostic Inventory for Depression (DID). The (DID; Zimmerman, Sheeran, & Young, 2004) is a 38-item self-report scale that assesses both symptom frequency and severity of depression based on DSM-IV criteria. In this study, only the 19-item severity subscale was used. The DID has good convergent and discriminant validity, and high levels of test–retest reliability (Zimmerman et al., 2004). The DID was administered in both the BPD and the control groups.

Structured Clinical Interview for DSM-IV Axis II Disorders. The Structured Clinical Interview for DSM-IV Axis II Disorders (SCID-II) interview (First, Gibbon, Spitzer, Williams, & Benjamin, 1997), which consists of 119 questions, assesses 10 DSM-IV personality disorders (i.e., paranoid, borderline, narcissistic, schizoid, schizotypal, antisocial, histrionic, avoidant, dependent, and obsessive–compulsive), as well as two personality disorders listed in the DSM-IV for research purposes (i.e., depressive, passive-aggressive). The SCID-II was administered only in the BPD group. Two residents in psychiatry were extensively trained in using the SCID-II by a senior psychologist. Training involved sessions learning the SCID-II structure, observing the senior psychologist interviewing three patients, and joint administration of the SCID-II of five patients

followed by a discussion of scores with the trainer afterwards, and supervision of several cases until sufficient reliability was achieved.

Assessment of DSM-IV Personality Disorders (ADP-IV). The (ADP-IV; Schotte, de Doncker, Vankerckhoven, Vertommen, & Cosyns, 1998) was administered only in the control group. The ADP-IV is a personality disorder screening tool consisting of 94 items that represent the 80 criteria of the 10 DSM-IV personality disorders and the 14 research criteria of the depressive and passive-aggressive personality disorders in a randomized order. Each DSM-IV item is scored on a seven-point trait scale, ranging from 1 (*totally disagree*) to 7 (*totally agree*). When a person acknowledges the presence of a given trait by assigning a score of 5 (*rather agree*) or higher on a trait question, he/she also has to answer a distress question, "Has this characteristic ever caused you or others distress or problems?" The answer to this question is rated on a three-point scale: 1 (*totally not*), 2 (*somewhat*), 3 (*most certainly*). The ADP-IV allows for both dimensional and categorical scoring formats. Categorical personality disorder diagnoses are obtained according to the DSM-IV thresholds. In this study the categorical scoring format was used, and subjects were not included in the study when they scored above the respective DSM-IV thresholds.

Psychiatric Diagnosis Screening Questionnaire (PDSQ). The (PDSQ; Zimmerman & Mattia, 2001) is a 111-item self-report instrument designed to screen for the most common DSM-IV Axis I disorders. The PDSQ consists of 13 subscales (major depressive disorder, posttraumatic stress disorder, bulimia/binge eating disorder, obsessive–compulsive disorder, panic disorder, psychosis, agoraphobia, social phobia, alcohol use/dependence, drug abuse/dependence, generalized anxiety disorder, somatization disorder, and hypochondriasis). The PDSQ can be scored both dimensionally and categorically. The PDSQ has been validated against diagnostic criteria and interview-derived diagnoses, and has proven to be a reliable measure (Zimmerman & Mattia, 2001). The PDSQ was administered in both the BPD group and the control group.

Statistical Analyses

First, to test the hypotheses that there would be an effect of group on accuracy, reaction time, and confidence, independent *t* tests were conducted. Effect sizes were calculated based on Cohen's *d*. According to Cohen (1988), $d = 0.2$ is indicative of a small effect size, $d = 0.5$ a medium effect size, and $d = 0.8$ a large effect size. To investigate the influence of trauma, we conducted a series of linear regression analyses with total trauma and each of the different types of trauma (emotional abuse, emotional neglect, sexual abuse, physical abuse, and physical neglect) as independent variables, and the different parameters derived from the morphing task (accuracy of first and full response, reaction time, and confidence in first and full response) as dependent variables, controlling for severity of depression and psychotropic medication. In all analyses the main focus was on results across emotions. In addition, exploratory analyses focused on the specific emotions.

Results

Demographic and Clinical Features

Results showed a high degree of comorbidity between different Axis II diagnoses, and between Axis I and Axis II diagnoses, for the BPD patients (see Table 1). At the time of the study, more than half (52%) of the BPD patients were taking an antipsychotic medication, 29% patients used one antidepressant, and 38% were on multiple antidepressants. Most patients ($n = 21$) were not on mood stabilizers. In addition, while the majority of patients (70%) were not taking an anxiolytic drug, 25% of them were receiving one anxiolytic drug, and one patient used two different types of anxiolytic medication.

-insert Table 1 about here-

There were no significant differences on demographic variables (gender, age, level of education) between both groups[1]. However, BPD patients (M = 24.42) were significantly more depressed (t = 6.64, df = 40, p < .001) than the normal controls (M = 4.81). Similarly, BPD patients (M = 51.86) had experienced in total significantly (t = 4.17, df = 41, p < .001) more traumatic experiences before age 18 than the normal controls (M = 32.67). In addition, in the BPD group scores for emotional abuse (M = 13) and emotional neglect (M = 16) were above the cut-off scores for childhood maltreatment (Bernstein et al., 1997).

Accuracy

First correct responses. As shown in Figure 1, there were no significant differences in accuracy between BPD patients and normal controls for the number of first correct responses across all emotions (M = 26.05, SD = 3.92, vs. M = 26.14, SD = 3.934; t(42) = 0.08, p = 0.94, *ns;* 95% CI [-2.48, 2.30]).

Correct responses at full expression. For full expression, normal controls had higher overall scores (M = 27.91, SD = 3.35 vs. M = 30.23, SD = 3.07; t(42) = 2.39; p = .02; 95% CI [-4.27, -.36]), representing a large effect size (d = 0.97).

-insert Figure 1 about here-

Exploratory analyses focused on the different emotions. There were no significant differences in accuracy for the number of first correct responses, except for fear, for which the BPD group was more accurate (M = 4.00, SD = 1.20) than the normal controls (M = 3.27, SD = 1.12; t(42) = 2.08, p < .05), with a moderate to large effect size (d = 0.63). For the full response, the only significant difference was for normal controls to be more correct in identifying sadness (M =

[1]More detailed information on the description of the groups can be obtained from the first author.

4.45, *SD* = 1.10) than BPD patients (*M* = 3.82, *SD* = 0.80; *t*(42) = 2.20, *p* = .03; *d* = 0.66). There was also a trend for normal controls to have higher scores on disgust (*M* = 4.68, *SD* = 0.65) than BPD patients (*M* = 4.05, *SD* = 1.70; *t*(42) = 1.64, *p* = .11; *d* = 0.49).

Reaction Time

Contrary to expectations, there was a trend for BPD patients to respond more slowly (*M* = 48.64, *SD* = 7.77) than normal controls (*M* = 43.75, *SD* = 10.61; *t*(42) = 1.74, *p* = .09; 95% CI [-0.77; 10.55), representing a medium effect size (*d* = 0.53).

First correct responses. For correctly recognized emotions, there was a small trend for normal controls to recognize emotions faster than the BPD patients, evidenced in lower levels of expression of emotions in the facial images at the first correct response (*M* = 48.49; *SD* = 8.90 vs. *M* = 53.84; *SD* = 9.50; *t*(42) = 1.86, *p* = .07; *d* = 0.58). When we examined, as part of our exploratory analyses, the first correct response for each of the different emotions, normal controls were faster in correctly recognizing happiness (*M* = 36.33, *SD* = 11.28 vs. *M* = 44.47, *SD* = 9.74; *t*(42) = 2.56; *p* < .01; *d* = 0.77) and fear (*M* = 52.26, *SD* = 9.77 vs. *M* = 59.74, *SD* = 12.24; *t*(42) = 2.24; *p* < .05; *d* = 0.68), and there was a clear trend for anger (*M* = 50.74, *SD* = 12.84 vs. *M* = 58.08, *SD* = 12.57; *t*(42) = 1.92; *p* = .06; *d* = 0.58). There were no significant differences for surprise, sadness, or disgust.

First incorrect responses. For incorrect responses, there was no significant difference in reaction time between BPD patients and normal controls across the emotions. For the separate emotions, there was a trend only for sadness (*t*(42) = 1.81, *p* = .08), with normal controls (*M* = 53.86) responding faster than BPD patients (*M* = 66.76).

Level of Confidence

There was no significant difference in overall level of confidence (i.e., across first response and full expression, and for both correct and incorrect responses) between BPD patients (M = 3.97, SD = 0.82) and normal controls (M = 3.71, SD = 0.70; $t(42) = 1.12$; *ns*; 95% CI [-.21; .72]).

First correct responses. There were also no differences between BPD patients and normal controls with regard to their confidence in the first correct response across the emotions (M = 5.52, SD = 0.33 vs. M = 5.48, SD = 0.47; $t(42) = 0.57$; *ns*). This was also the case for the different emotions, with the exception of surprise, which showed a small trend toward BPD patients being more confident than normal controls (M = 4.78, SD = 0.81 vs. M = 4.38, SD = 0.80; t = 1.63; df = 42; p = .11; d = 0.50).

Correct responses at full expression. With regard to level of confidence for the correct response at full expression, there were also no differences between the BPD patients and normal controls (M = 5.62, SD = 0.33 vs. M = 5.48, SD = 0.47; $t(42) = 1.17$; *ns*). Similar results were found for the separate emotions happiness, anxiety, anger, sadness, and disgust. However, there was a significant trend for surprise, whereby BPD patients were more confident than normal controls (M = 5.64; SD = .36 vs. M = 5.36; SD = 0.68; $t(42) = 1.75$; p = 0.09; d = 0.50).

First incorrect responses. With regard to confidence regarding the incorrect responses, there was no difference between BPD patients and normal controls for their first incorrect response (M = 3.27, SD = 0.97 vs. M = 2.89, SD = 0.91; $t(42) = 1.35$, *ns*). Similar results were found for the different emotions, with the exception of sadness, for which BPD patients were more confident about their incorrect response than were normal controls (M = 4.33, SD = .92 vs M = 3.05, SD = 1.60; $t(42) = 3.26$; p = .002; d = 0.98).

Incorrect responses at full expression. For the response at full expression, BPD patients were more confident in their incorrect responses than the normal controls (M = 3.24, SD = 0.99 vs.

M = 2.60, *SD* = 1.05; *t*(42) = 2.07; *p* = .05; *d* = 0.63). This was particularly the case for sadness (*M* = 4.89, *SD* = 0.72 vs *M* = 3.53, *SD* = 2.12; *t*(42) = 2.86; *p* = .01; *d* = 0.86) and surprise (*M* = 4.64, *SD* = 1.69 vs *M* = 3.00, *SD* = 2.53; *t*(42) = 2.52; *p* = .02; *d* = 1.06).

Influence of Mood and Psychotropic Medication

Mood did not correlate with accuracy, reaction time, or level of confidence in the BPD patients. There was, however, a positive trend for mood to be positively related to the accuracy of the first correct response (*r* = .39, *p* = .09) and the first incorrect response (*r* = .41, *p* = .06) in BPD patients. Medication use did not correlate with accuracy, reaction time, or level of confidence for either correct or incorrect responses. In normal controls there was a significant negative correlation between mood and accuracy at full expression (*r* = -.52, *p* < .01) and a tendency for mood to correlate negatively with first correct response (*r* = -.40, *p* = .07) across emotions. However, when we reran all analyses reported above controlling for mood, results were similar.

Influence of Trauma

In BPD patients, when controlling for concurrent levels of depression and psychotropic medication, total childhood trauma was not related to the first correct response. Total childhood trauma was, however, negatively related to the number of correct responses at full expression (*F* = 4.66, *p* = .02, β = -.69), with the combination of severity of depression, psychotropic medication, and total trauma accounting for 48% of the variance (see Table 2). In control subjects, controlling for current levels of depression, total trauma was related neither to the first correct response, nor to the response at full expression.

-insert Table 2 about here-

In both BPD patients and normal controls, further analyses showed that there were no differences in the association between the different types of trauma and either the first correct

response or correct response at full expression, or with reaction time for both correct and incorrect responses. However, neither total trauma nor the different types of trauma had any effect on confidence in the first correct response or either correct or incorrect responses at full expression [2].

Discussion

The mentalization-based approach to BPD has recently attracted much attention, with the argument that impairments in mentalizing, that is, the capacity to understand the self and others in terms of mental states, is a key feature of BPD. Importantly, this approach distinguishes between different aspects of mentalizing (Luyten et al., 2012), suggesting that individuals with BPD may be as accurate or even more accurate to social cues based on *external features of others*, but may become less accurate and less confident as more social information becomes available and they have to rely on more controlled, reflective processes. Results of this study on 22 BPD patients and matched controls using a two-phase dynamic face-morphing paradigm largely confirm these assumptions.

First, results showed that BPD patients were at least as accurate as normal controls in the first recognition of emotions, based on external features. This is important as it contradicts the assumption of a general emotion-recognition deficit in BPD (Guitart-Masip et al., 2009; Unoka, Fogd, Füzy, & Csukly, 2011). If anything, the BPD patients were as accurate and confident in fast emotion recognition as the normal controls. However, BPD patients were actually somewhat slower in responding compared to normal controls, contradicting the view that individuals with BPD show general increased impulsivity.

Second, as social information was augmented with increased expression of emotions in the full response, the BPD patients became less accurate. Thus, increasing the cognitive load—or

[2] Full results can be obtained from the first author.

increasing the complexity of the task (as participants have to recall and compare their initial response to the current facial expression) and not allowing the emotional processing to have priority over outputs—removes the initial advantage of BPD patients and even creates apparent impairment in them (Dyck et al., 2009; Minzenberg et al., 2006). This may be suggestive of interfering processes when processing social information, congruent with the assumption that BPD patients are prone to hypermentalizing (Sharp et al., 2011). However, while our results may suggest hypermentalizing, we stress that the current paradigm does not directly allow assessment of hypermentalizing. Other procedures that do allow direct assessment of hypermentalizing, for instance, the Movie for the Assessment of Social Cognition (Dziobek et al., 2006), should be added in future research. Another explanation that may partly address these findings is that individuals with BPD have more problems with executive function (Fertuck, Lenzenweger, & Clarkin, 2005), perhaps because of elevated amygdala reactivity that has been demonstrated in BPD (Herpertz et al., 2001).

Third, and against expectations, there were no overall differences in levels of confidence between BPD patients and normal controls, contradicting the hypothesis that BPD patients are more prone to "jumping to conclusions." BPD patients were, as noted, also slower in responding. Further research is needed in this context, as these findings may reflect a limitation of the paradigm used. Indeed, the dynamically changing face paradigm might prompt more controlled, reflective functioning (thus disadvantaging BPD patients) as faces change slowly and gradually. Together with the finding that BPD patients were somewhat slower in responding than normal controls, it may be that the BPD patients wanted to take their time before responding in the current paradigm, until they felt confident enough in their response. In situations that are more like real life, and particularly under high arousal conditions, the "jumping to conclusions" phenomenon might be easier to demonstrate. Another possible reason for this unexpected finding may be that the

responses of BPD patients might become more impulsive under serious social stress, but that the current task was not stressful enough to provoke this. Furthermore, the finding that the BPD patients were more confident than normal controls in their incorrect responses at full expression of emotion might point to subtle but important differences between BPD patients and controls in mentalizing skills. Normal controls seemed to sense more readily that their response might have been incorrect, whereas BPD patients seemed to show less awareness of the potential for their response to be incorrect. Indeed, an ability to consider the fallibility of one's mentalizing and the opaqueness of mental states has been assumed to be one of the hallmarks of genuine mentalizing (Fonagy & Bateman, 2008).

Finally, results of this study with regard to individual emotions are speculative at best. BPD patients were faster than normal controls in recognizing fear; this is congruent with the predominance of attachment hyperactivating strategies and higher levels of amygdala activation in BPD patients (Herpertz et al., 2001). In addition, BPD patients showed less confidence in recognizing surprise, which might be related to hypersensitivity to fear; facial expressions of surprise and fear share many features, and BPD patients thus might have been less certain of their response when viewing an expression of surprise. Lastly, BPD patients were more accurate than controls in recognizing sadness, which may be due to the high levels of depression typical of individuals with BPD. Because sad faces may mirror their internal mental state, BPD patients may be more accurate in perceiving sadness in others. These findings contrast somewhat with earlier studies suggesting that mood may impair mentalizing (Fischer-Kern et al., 2008), and the same may be true for psychotropic medication. Therefore, in this study we controlled for mood and use of medication. However, in line with findings of earlier studies on emotion recognition using a dynamic face-morphing paradigm (Domes et al., 2008; Lynch et al., 2006), we did not find an effect.

Although trauma is considered a central factor in contemporary theories of the psychopathology of BPD, very few studies have investigated the potential role of trauma in relation to emotion recognition in BPD (Fertuck et al., 2009). BPD patients in our sample reported significant childhood trauma, but also had a high prevalence of co-occurring posttraumatic stress disorder (47%), which strengthens the conviction that these patients had had a significant history of trauma. Results showed that in BPD patients, early childhood trauma had no impact on the first correct response, but did have a highly significantly negative impact on the accuracy of emotion recognition for the full correct response. By discriminating between the first and full responses, we were able to demonstrate that early adversity does not affect the first response, but does have a negative impact on emotion recognition when there is an increasing cognitive load, and thus probably when BPD patients have to rely more on controlled, reflective processes. This finding is somewhat similar to that of the study of Fertuck and colleagues (2009), who used a static emotion-recognition task and did not find an effect of trauma.

Despite its strength, this study had some limitations. First, one may raise the question whether our sample was not only a highly traumatized group of BPD patients (as described above), but also a highly disturbed group of BPD patients, as they were tested in the context of an inpatient treatment facility and showed a particularly high rate of comorbidity with other Axis II disorders. This may imply that our results may not necessarily generalize to other groups of individuals with BPD, and further research in other samples is therefore needed. Second, given the impact of trauma on emotion recognition, future studies should compare BPD patients with and without substantial trauma to investigate whether these findings are specific for BPD or simply reflect trauma history. In addition, although in the present study there was no relation between trauma and RTs, trauma exposure has been related to a slower speed of information processing (for a review see Scott et al., 2015). Hence, future studies should control for speed of information processing, as difficulties

in emotion processing could influence the RT of traumatized BPD patients. Third, participants in the control sample were recruited from the community, and were matched with regard to gender and age. However, this was not the case for level of education (with 3 BPD patients and 9 controls who had followed higher education). Therefore, we cannot rule out that differences in level of education may have influenced the results. To summarize, results of this study using a two-phase dynamic face-morphing paradigm showed that individuals with BPD were are as accurate and confident in their first emotion recognition as normal controls. Yet, BPD patients were less accurate and less confident in their full emotion expression responses, that is, when they had to rely on more controlled reflective processes (i.e., when they had to compare their initial response to their final response). Although further research is needed, these effects seemed largely attributable to early childhood trauma.

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Table 1

Description of number and percentage of Axis I and Axis II disorders in the BPD group

Axis I diagnoses	*n* (*N*)	%	***Axis II diagnoses***	*n* (*N*)	%
Major mood disorder	12 (17)	70	Avoidant PD	13 (21)	62
PTSD	9 (19)	47	Dependent PD	8 (21)	18
Eating disorder	6 (20)	30	Obsessive–compulsive PD	6 (21)	29
Obsessive–compulsive disorder	6 (20)	30	Passive–aggressive PD	11 (21)	52
Panic disorder	6 (20)	30	Depressive PD	17 (21)	81
Psychosis	8 (19)	42	Paranoid PD	12 (21)	57
Agoraphobia	5 (18)	28	Schizotypal PD	3 (21)	14
Social phobia	14 (17)	82	Schizoid PD	2 (21)	10
Dependence			Histrionic PD	2 (21)	10
Alcohol	9 (18)	50			
Drug	7 (18)	40			
Generalized anxiety disorder	14 (19)	74	Narcissistic PD	3 (20)	15
Somatization	12 (19)	63	Borderline PD	22 (22)	100
Hypochondrias	10 (20)	50	Antisocial PD	0 (21)	0

Note. PD = Personality disorder, PTSD = Posttraumatic stress disorder.

Table 2

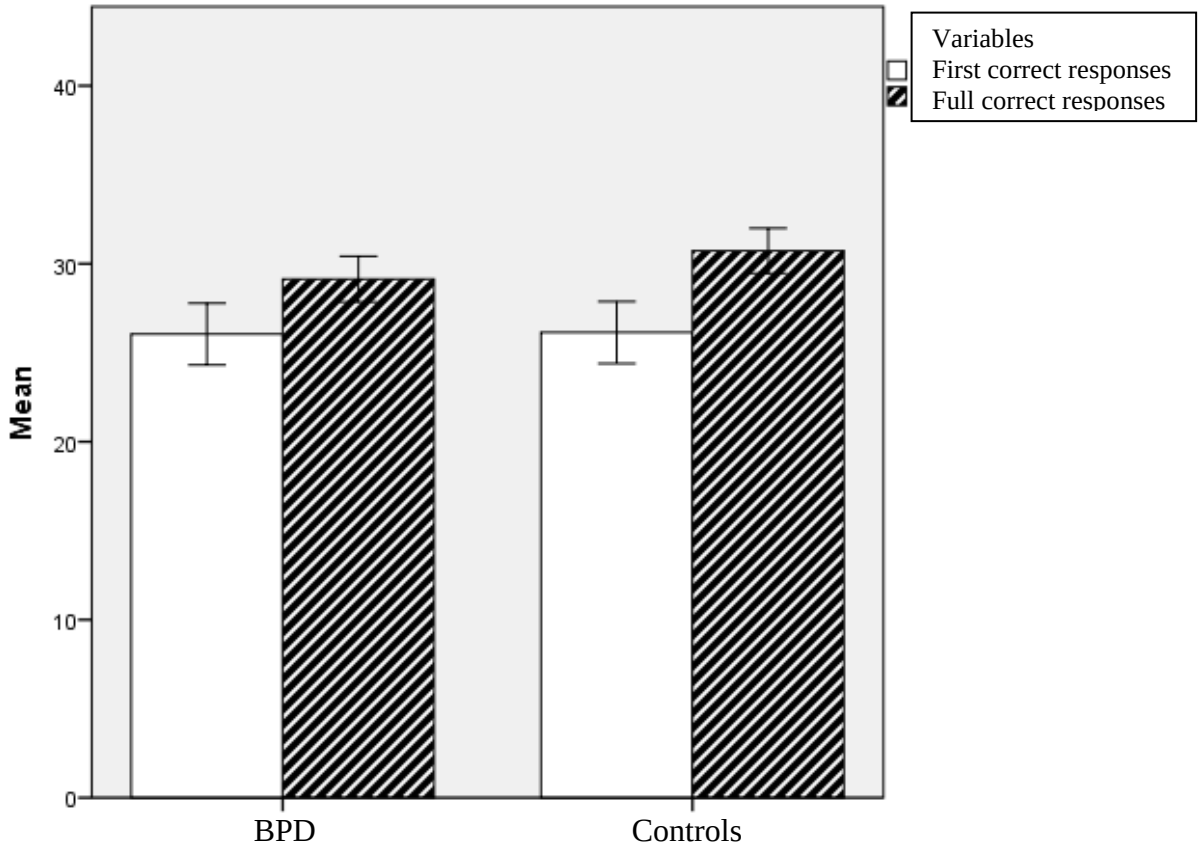
Linear regression analysis of depression, psychotropic medication, and total trauma on accuracy of correct responses at full expression of emotion in the BPD group

	Accuracy			
	R^2	*df*	*F*	*B*
	.48	(3, 15)	4.66	
Depression				.016
Psychotropic medication				-.13*
Total trauma				-.69**

* $p = .05$; ** $p < .01$

Figure 1

Comparison of number of accurate responses in BPD patients and normal controls for first correct responses and correct responses at full expression across emotions



Error Bars: 95%CI