Attentional processes and responding to affective faces in youth with borderline personality features

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Attentional processes and responding to affective faces in youth with borderline personality features

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ABSTRACT

This study examined attentional biases for emotional faces in borderline personality disorder (BPD). Twenty-one outpatient youth (aged 15–24 years) meeting three or more DSM-IV BPD criteria and 20 community-derived participants (aged 15–24 years) with no history of psychiatric problems and not meeting any BPD criteria completed a modified dot-probe task that tested automatic (30 ms) and controlled (500 ms) stages of information processing. The findings indicate that, compared with healthy controls, youth with borderline features were faster to respond to congruent rather than incongruent fear stimuli. This effect was independent of state anxiety and was observed during the 30 ms presentation of fearful faces. There was no significant effect for happy or angry faces. Youth with borderline features were also slower to respond to incongruent rather than paired neutral trials, indicating difficulties in disengaging attention from the perceived threat. Such differences were not found for the healthy controls. Thus, youth with borderline features had an attentional bias for fearful faces that reflected difficulty in disengaging attention from threatening information during pre-conscious stages of attention. This finding extends previous research highlighting the diminished capacity for affect regulation and subsequent engagement in behavioural strategies to avoid distress in BPD. Future research should explore the relationship between information processing, emotion regulation in adult BPD samples.

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1. Introduction

Emotional dysregulation is considered a core aspect of borderline personality disorder (BPD) (APA, 2000; Cloninger et al., 1993; Milon and Davis, 1996), and has been substantiated in factor analytic investigation of the symptom structure of this condition (Leichsenring et al., 2011). While difficulties in emotion regulation have been explored in a number of studies (Koenigsberg et al., 2002; Yen et al., 2002), the possible impact of information processing biases for emotional material in BPD has received little empirical attention. Notably, there is evidence that individuals with BPD process neutral information in a negatively biased way (Meyer et al., 2004), remembering more negative words as salient (Ladisch and Feil, 1988). Other studies of social cognitive processes suggest that individuals with BPD have subtle impairments in their perception of emotions in others (Domes et al., 2009), or rate others’ faces as less friendly and more rejecting (Meyer et al., 2004). There is also some evidence for reduced accuracy in the recognition of others’ emotions, including fear (Bland et al., 2004; Levine et al., 1997), alongside evidence for heightened accuracy and sensitivity (earlier detection) for recognising fear (Lynch et al., 2006; Wagner and Linehan, 1999). None of these studies, however, have explored attentional mechanisms involved in facial affect detection in BPD.

Information processing models describe two stages of attention, automatic and strategic (Schneider and Shiffrin, 1977). Automatic (preconscious) processing generally refers to processing that is effortless, capacity free, unintentional, and outside of conscious control. Strategic (conscious) processing is effortful, capacity-limited, intentional, and dependent on conscious control. Although the boundary between automatic and strategic processing is indistinct at best (Moors and De Houwer, 2006), conceptualising attentional biases for emotional material in terms of automatic and strategic processing has been useful in models.
of anxiety (Cisler and Koster, 2010) and schizophrenia (Green and Phillips, 2004). Studies of selective attention to emotional stimuli suggest that healthy individuals more readily attend to emotional, rather than neutral stimuli, in a reflexive or involuntary manner (Dimberg et al., 2000). In particular, facial expressions of emotion, such as anger and fear, are powerful affective signals, due to their evolutionary significance. In humans, visual attention is drawn towards threatening stimuli (versus positive or neutral stimuli) when processed preconsciously (outside of conscious awareness), as evidenced by faster reaction times to threatening stimuli shown for short (100 ms) presentation times that allow only for automatic processing (Koster et al., 2006). Conversely, with longer presentation times for threatening stimuli, attention is orientated away from threat during later stages of processing (Derryberry and Reed, 2002; Koster et al., 2006), suggesting that voluntary controlled attention plays a role in limiting the impact of threatening information. Biases in the automatic processing of threat – e.g., highly sensitive threat perception – might thus play out in faster detection of threat, potentially even when no threat exists (i.e., in ambiguous stimuli). Problems in the strategic, later stages of contextual processing of threat might be reflected in slower directed attention away from threat, and might indicate difficulties in processing a putative threat as innocuous.

Empirical research of these phenomena in anxious individuals has shown that attention to threatening information is strongly prioritised over neutral or positive information (Macleod et al., 1986; Mogg and Bradley, 1998), including studies using emotional face stimuli (Bradley et al., 1998, 2000; Fox et al., 2001). In these dot-probe tasks, participants are shown a pair of stimuli at two different spatial locations on a screen, where one stimulus is threatening and the other stimulus is neutral. After the offset of these stimuli, a dot probe emerges at the location of the threatening stimulus (congruent presentation) or at the location of the neutral stimulus (incongruent presentation). The allocation of attention is measured by the time taken to respond to the dot probe. It is reasoned that responding to the probe will be faster when attention is already allocated to the spatial location where the probe appears. Most probe detection studies (Bar-Haim et al., 2007) have found that anxious individuals respond faster to congruent trials than to incongruent trials, indicating increased vigilance for threat.

Two studies have utilised the dot-probe paradigm in BPD (von Ceuern-Lindenstjerna et al., 2010a, 2010b). The first study suggests that adolescent patients with BPD and adolescent patients with other psychiatric diagnoses showed a stronger orientating bias for negative emotional stimuli compared to non-clinical control group for stimuli presented at 500 ms, as evidenced by positive mean bias scores (calculated by subtracting mean reaction time on congruent trials from mean reaction time on incongruent trials) or vigilance to threat (von Ceuern-Lindenstjerna et al., 2010b). The second study utilising the same sample (von Ceuern-Lindenstjerna et al., 2010a), indicates that borderline pathology is linked to an inability to disengage attention from negative facial expressions during attentional maintenance when in a negative mood at longer presentation times of 1500 ms. Neither study examined orientating to emotional faces at shorter presentation times (e.g., 30 ms) so no conclusions could be reached about preconscious processing of emotional material.

Moreover, rapid responses to probes congruent with threat location might also arise from difficulty disengaging attention from threat, rather than hyper-vigilance (Cisler and Koster, 2010; Derryberry and Reed, 2002). Distinguishing between increased vigilance for threatening information versus disengagement difficulties in BPD is important in understanding how these processes manifest in aberrant emotional experience and control. For example, extreme vigilance associated with heightened sensitivity for negative information might result in frequent anxious states, and engagement in abnormal behavioural strategies to avoid threat, which might consistently interfere with goal-directed behaviour. On the other hand, problems disengaging attention from threat might lead to heightened stress (due to prolonged processing of threat), or intrusive negative thoughts (or rumination) representing equally inadequate coping strategies.

Selective attention to threat in BPD has been previously examined using a modified version of the Stroop test, called the emotional Stroop (Arntz et al., 2000), and using the dot-probe task with conscious (500 ms, 1500 ms) presentation times (von Ceuern-Lindenstjerna et al., 2010a, 2010b). These studies demonstrated attentional bias toward emotionally negative stimuli in clinical groups during conscious presentation of emotional stimuli. Studies by von Ceuern-Lindenstjerna et al. (2010a, 2010b) did not examine preconscious processing of emotional stimuli. In addition, the utility of the Stroop task is limited by the use of word stimuli representing non-specific or social danger. We thus sought to investigate attentional biases for threat in BPD using the dot-probe task using photographs of faces or pictorial scenes, to provide more ecologically relevant representations of social threat (Bradley et al., 2000) and during shorter presentation times to access preconscious stages of information processing.

Furthermore, since BPD has its onset in adolescence or early adulthood (Chanen et al., 2008), and adult BPD samples are thus likely to have had long histories of BPD, recurrent comorbid Axis I conditions, frequent life events, deliberate self-harm attempts and varying amounts of treatment, some of which might have been possibly iatrogenic (Chanen et al., 2007; Chanen and McCutcheon, 2008; Jovev and Jackson, 2006; Zanarini et al., 2005), it is important to investigate selective attention to threat using a younger sample of patients that are presenting with BPD features much earlier in the course of the disorder. This is consistent with the admission criteria and early intervention policy of the specialised program from which participants were recruited (Chanen et al., 2009). Moreover, comparing a younger BPD sample to adults with BPD (> 30 years of age) may not be appropriate. This is because in younger participants brain development may not be complete in the key areas (e.g., frontal lobe) that are at least partially involved in recognising facial emotions (Adolphs et al., 2003; Toga et al., 2006). The present study therefore utilised community control group in the same age range as the clinical participants.

Thus, the aim of this study was to investigate attention to threatening facial stimuli at preconscious and conscious levels of processing, using a modified version of the emotional dot-probe task (Koster et al., 2004). Based on previous findings of selective attention biases in BPD (Arntz et al., 2000; von Ceuern-Lindenstjerna et al., 2010b), and in anxiety disorders using the dot-probe task (Bar-Haim et al., 2007; Mogg and Bradley, 1998), it was hypothesised that young people with BPD features would demonstrate significantly faster response times to congruent than to incongruent fearful faces, relative to the non-clinical control group of the same age range. The disengagement versus hypervigilance hypothesis was also explored in BPD by testing performance of youth with BPD features on variations of the task using both shorter (pre-conscious) and longer (conscious) presentation times.

2. Method

2.1. Participants

Twenty-one outpatients meeting three or more DSM-IV BPD criteria, and aged between 15 and 24 years (mean age = 18.90, S.D. = 3.10 years; 3 male, 18 female) were recruited from the Helping Young People Early (HYPE) program, a specialized early intervention program for BPD (Chanen et al., 2009) at Orygen Youth Health,
Melbourne, Australia. Participants had never received specific treatment for BPD and were physically healthy, based upon medical history. Exclusion criteria included visual impairment (e.g., uncorrected vision or colour blindness), intellectual disability, schizophrenia spectrum or affective psychotic disorder, intoxication with alcohol and/or any other licit or illicit drugs on the day of the procedure, history of head injury, epilepsy, meningitis, encephalitis or a brain infection, loss of consciousness for 10 min or more, seizures, thyroid disorder or other significant medical illness. Twenty healthy controls aged between 16 and 24 years (mean age = 20.40, S.D. = 2.72 years; 7 male, 13 female) were recruited from the local community through advertisements placed at public transport stops, libraries and community centres in the area. In addition to the above exclusion criteria, potential participants in this group were excluded if they had any history of psychiatric problems or any BPD or antisocial PD features.

2. Measures

All participants were screened for medical, neurological, and sensory disorders, as well as demographic information, during a short phone interview.

2.2.1. Diagnostic measures for BPD participants

The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I/P) (First et al., 1997b) was used to assess for psychotic, affective, anxiety, and eating disorders. For the purposes of this study, only the BPD and the Antisocial PD (ASPD) modules of the Diagnostic Interview for DSM-IV Personality Disorders (DIPD) were used. This is a reliable semi-structured interview designed to assess for DSM-IV Axis II disorders (Zanarini et al., 1996). ASPD was assessed because of its overlap with BPD (Paris, 1997).

2.2.2. Screening measures for control participants

The Structured Clinical Interview for DSM-IV Axis I Disorders Non-patient Edition (SCID-I/NP) (First et al., 1996) was administered over the telephone to assess for the presence of Axis I disorders. Diagnostic modules of the SCID-I/NP are the same as those of the SCID-I/P (with the psychotic screen). The only differences between the SCID-I/P and the SCID-I/NP are: (1) the ‘overview’ section in the SCID-I/NP; and (2) no assumption of a primary diagnosis in the SCID-NP.

The McLean Screening Instrument for Borderline Personality Disorder (MSI-BPD) (Zanarini et al., 2003) was used to screen for BPD symptoms in the community sample. The MSI-BPD is a 10-item yes/no questionnaire that is based upon the BPD module of the DIPD. It comprises one question for each of the first eight DSM-IV BPD criteria, and two questions for the ninth criterion (paranoia/dissociation). The MSI is the only instruments designed specifically for the screening of BPD and good psychometric properties have been reported in non-clinical samples (Zanarini et al., 2003).

Screening for antisocial behaviour was conducted using the Structural Clinical Interview for DSM-IV Axis II Disorders Personality Questionnaire (SCID-II-PQ) (First et al., 1997a). Only the 15 items corresponding to Criterion A (chronic conduct disorder) were used, as these items are necessary (but not sufficient) for a diagnosis of antisocial PD.

2.2.3. State anxiety

The State-Trait Anxiety Inventory-State (STAI-S) is a commonly used measure of state anxiety (Spielberger, 1983). It has 20 items describing how a person currently feels, such as: “I am tense; I am worried” and “I feel calm; I feel secure.” All items are rated on a 4-point scale (e.g., from “Almost Never” to “Almost Always”). Higher scores indicate greater anxiety. The STAI-S is appropriate for those who have at least a sixth-grade reading level. Considerable evidence attests to the construct and concurrent validity of the scale.

2.2.4. Dot-probe task

A dot probe task design by Koster et al. (2004) comparing reaction times (RTs) on trials containing neutral information (i.e., two neutral faces) with reaction times on trials containing threatening information (i.e., one neutral and one threatening face), was utilised in this study. Previously reported “congruency” effects could be obtained through faster response to congruent trials (vigilance) or slower response to incongruent trials (distractibility). A comparison of neutral trials seems necessary to determine which component of visual attention is measured. We therefore selected happy (H), angry (A), fearful (F) and neutral (N) face pictures from the collection of black and white Pictures of Facial Affect (Ekman and Friesen, 1976) for use in this task. Six different identities were used (two male and three female). Four possible face combinations (A-H, H-N, F-N, N-N) were constructed using the same identity.

Each trial started with a presentation of a fixation cross for 1000 ms in the middle of the screen. Then two faces appeared side by side on the screen for 500 ms (conscious detection of emotion (Williams et al., 2004)). Immediately (14 ms) after the offset of the face, two pictures a dot probe was presented, replacing one of the faces. Participants were asked to decide, via keyboard press of one of two buttons, whether the dots in the probe were aligned vertically (\(\neq\)) (left index finger—left shift button); or horizontally (\(\neq\)) (right index finger—right shift button). The threat faces and the dot probe were presented equally often at the left or right side of the screen and the order of trials was randomised for each participant. There were a total of 140 test trials (60 congruous, 60 incongruous dot presentations and 20 N-N trials) and 12 practice trials that not used as part of the test trials. The dot-probe task was repeated with faces presented at 30 ms to examine non-conscious trials that contained incongruent C2. ‘Awareness check’ using forced choice affect recognition in non-conscious condition was used following the dot-probe task, where 30 (emotion) faces were presented at 30 ms followed by a mask (neutral face).

2.3. Procedure

All procedures were approved by the Northwestern Mental Health Research Ethics Committee, Melbourne, Australia. After complete description of the study procedure, written informed consent was obtained from each participant and/or from a parent or guardian where appropriate. All tasks were completed in a quiet room. Participants were seated at a desk in front of the laptop computer, orientated to the purpose of the study and instructions of the task. They were encouraged to ask questions or directions if they felt the instructions were unclear prior to starting the task. The dot-probe task was presented using DMDX 10 software, developed by Forster and Forster (http://www.u.arizona.edu/~kforster/dmdx/), on a laptop computer.

Prior to commencing the experimental tasks, the DHQ was administered to all participants. Community participants also completed the screening measures for Axis I and II disorders. For the clinical participants, the diagnostic interview was completed as part of the routine entry assessment for the HYPE clinic. Clinicians are trained to a rigorous standard, using DSM-IV operational criteria, and this standard is maintained via a consensus diagnosis process for each patient, based upon a modified Longitudinal Assessment of Depression (Wilkinson et al., 1991). Inter-rater reliability is not routinely collected. Participants were reimbursed $AUS30 for their time and expenses upon completion of the tasks.

2.4. Data analysis

RT data from the dot probe task were analysed in three ways. First, differences between the two groups were examined on the N-N trials to look for group biases in responses to the task that are independent of the emotional faces. Secondly, the standard congruency effect of threatening faces was examined using ANCOVA models. Independent variables were group (clinical versus non-clinical) and probe location (congruent versus incongruent). State anxiety score was the covariate. The dependent variable was RTs. Separate analyses were conducted for angry, fearful and happy faces, as well as for 30 ms and 500 ms conditions. Interaction effects for location x group were examined. Simple main effects were used to examine significant interactions in more detail. In the analyses where no significant interaction effect was observed, main effects of group and probe location were examined. Notably, participants’ age was unrelated to response times on all trials (all \(p > 0.15\)) and was unrelated to total number of symptoms \((r = 0.09, p = 0.71)\). Age was therefore not included as a covariate in the analyses.

Thirdly, further paired samples t-tests were conducted to test the vigilance versus disengagement hypothesis when a significant congruency effect was observed (Koster et al., 2004). The independent variable was condition, which comprised trials of two neutral faces (N-N) trial versus trials that contained one emotional and one neutral face (e.g., F-N), in both congruent-dot (a dot probe emerges at the location of the threatening face) and incongruent-dot (a dot probe emerges at the location of the neutral face) position. The focus was on whether the congruency effect reflected vigilance for threat or a difficulty to disengage attention from threat. Vigilance for threat should lead to faster responses on congruent trials compared to N-N trials. This would indicate that individuals preferentially hold their attention at the threatening location. Difficulty in disengaging attention would be represented by slower responses on incongruent trials compared to the N-N trials due to the time needed to shift attention from the threatening to the neutral location.

3. Results

3.1. Sample characteristics

Key demographic variables for both groups are reported in Table 1. There were no significant differences between the groups on age and sex (all \(p > 0.05\)). There was a significantly higher proportion of tertiary educated students in the community group and lower proportion of participants born outside of Australia/New Zealand region (all \(p > 0.05\)). All clinical participants had a co-morbid mood and/or anxiety disorder (57% MDE, 48% PTSD, 43% Panic Disorder, 33% Dysthymia, 24% GAD, 14% Social Phobia, 14% Bulimia, 10% Bipolar II, 10%
Specific Phobia). The mean number of DSM-IV BPD criteria met was 5.10 (S.D. = 1.58), with 12 (57.1%) participants meeting the full threshold (five or more criteria), 6 (29%) participants meeting four criteria and 3 (14%) participants meeting three criteria. Eleven (52%) participants were taking antidepressant medication, 2 (10%) were on mood stabilisers and 1 (5%) was on antipsychotic (atypical) medication. One individual (5%) met the full criteria for Antisocial PD, while one individual (5%) met two criteria and three individuals (14%) met three criteria.

3.2. Experiment 1 (500 ms)

Table 2 shows the summary statistics for the 500 ms presentation time for both congruent and incongruent trials for angry, happy and fearful faces for clinical and control groups. Mean RTs for the two neutral faces are also shown. The clinical group was significantly slower than the control group on neutral trials (t(39) = 2.40, p = 0.02). There were no significant interactions for any of the face types (Table 3). Moreover, there was no main effect for ‘location’ observed for any of the face types in Table 3. A significant main effect for ‘group’ reflected significantly slower RTs in the clinical group compared with the control group for angry (F(1, 39) = 5.26, p = 0.03), happy (F(1, 39) = 6.06, p = 0.02) and fearful (F(1, 39) = 4.97, p = 0.03) faces, regardless of the location.

3.3. Experiment 2 (30 ms)

The summary statistics for the 30 ms conditions are shown in Table 4. The two groups did not differ significantly with respect to RTs for the N–N trials (t(39) = 1.53, p = 0.14). There was a significant ‘location × group’ interaction for fearful face trials shown in Table 5. Simple main effects analyses indicated that the BPD group were significantly faster in responding to congruent than incongruent fearful faces (F(1, 38) = 4.582, p = 0.03); this was not apparent in the control group (F(1, 38) = 3.934, p = 0.06).

To examine whether the faster RTs observed during congruent compared to incongruent trials containing fearful faces was due to either vigilance or difficulty disengaging, RTs for trials containing two neutral faces were compared with RTs on incongruent-dot and congruent-dot trials containing one fearful face and one neutral face (Koster et al., 2004). The BPD group was significantly slower on incongruent-dot trials containing fearful faces compared to N–N trials (t(20) = 2.07, p = 0.05), but not on congruent-dot trials containing fearful faces compared to N–N trials (t(20) = -0.05, p = 0.96). This pattern of findings supports the ‘difficulty to disengage’ hypothesis. No such difference was found in the control group for comparison of N–N trial to either incongruent-dot trials (t(20) = -0.05, p = 0.96), or congruent-dot trials (t(20) = 1.25, p = 0.23).

Influence of comorbid diagnoses and medication status on response times for congruent and incongruent trials containing fearful faces was analysed using exploratory analyses restricted to the BPD group. Due to the small sample, mean orientating bias to fearful faces was calculated for each individual by subtracting

Note: RT = response time; S.D. = standard deviation; ms = milliseconds.

Table 1
Demographic characteristics for the BPD and community groups.

<table>
<thead>
<tr>
<th></th>
<th>BPD</th>
<th>Community</th>
<th>χ²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean ± S.D. years)</td>
<td>18.90 ± 3.10</td>
<td>20.40 ± 2.72</td>
<td>t = -1.64</td>
<td>0.12</td>
</tr>
<tr>
<td>Sex (N% female)</td>
<td>18 (86)</td>
<td>13 (65)</td>
<td></td>
<td>2.38</td>
</tr>
<tr>
<td>Accommodation (N%)</td>
<td>0 (5)</td>
<td>0 (5)</td>
<td></td>
<td>4.01</td>
</tr>
<tr>
<td>Country of birth (N%)</td>
<td>20 (95)</td>
<td>13 (68)</td>
<td></td>
<td>4.97</td>
</tr>
<tr>
<td>Employment (%)</td>
<td>Student</td>
<td>Employed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11 (53)</td>
<td>7 (33)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Employed</td>
<td>Unemployed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 (14)</td>
<td>1 (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education (%)</td>
<td>Tertiary</td>
<td>Secondary</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 (5)</td>
<td>13 (62)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Lower-secondary</td>
<td>8 (38)</td>
<td></td>
<td>14.98</td>
</tr>
</tbody>
</table>

Note: N = 19 in community group for all χ² analysis except ‘Sex’ due to missing data.
* Significant at alpha = 0.05 level.
** Significant at alpha = 0.01 level.

Table 2
Summary statistics for neutral, angry, happy and fearful trials presented at 500 ms.

<table>
<thead>
<tr>
<th></th>
<th>Mean (ms)</th>
<th>S.D.</th>
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<tbody>
<tr>
<td>Neutral–Neutral RTs</td>
<td>705.09</td>
<td>147.91</td>
</tr>
<tr>
<td>Clinical</td>
<td>606.97</td>
<td>109.55</td>
</tr>
<tr>
<td>Non-clinical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angry congruent RTs</td>
<td>701.40</td>
<td>166.70</td>
</tr>
<tr>
<td>Clinical</td>
<td>596.41</td>
<td>103.48</td>
</tr>
<tr>
<td>Non-clinical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angry incongruent RTs</td>
<td>726.86</td>
<td>147.76</td>
</tr>
<tr>
<td>Clinical</td>
<td>602.46</td>
<td>110.48</td>
</tr>
<tr>
<td>Non-clinical</td>
<td></td>
<td></td>
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<tr>
<td>Happy congruent RTs</td>
<td>713.25</td>
<td>120.29</td>
</tr>
<tr>
<td>Clinical</td>
<td>591.53</td>
<td>96.58</td>
</tr>
<tr>
<td>Non-clinical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Happy incongruent RTs</td>
<td>715.41</td>
<td>137.60</td>
</tr>
<tr>
<td>Clinical</td>
<td>606.61</td>
<td>119.18</td>
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<tr>
<td>Non-clinical</td>
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<td></td>
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<tr>
<td>Fearful congruent RTs</td>
<td>719.23</td>
<td>141.56</td>
</tr>
<tr>
<td>Clinical</td>
<td>610.79</td>
<td>116.46</td>
</tr>
<tr>
<td>Non-clinical</td>
<td></td>
<td></td>
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<tr>
<td>Fearful incongruent RTs</td>
<td>734.64</td>
<td>139.57</td>
</tr>
<tr>
<td>Clinical</td>
<td>614.08</td>
<td>110.74</td>
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<tr>
<td>Non-clinical</td>
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</table>

Note: RT = response time; S.D. = standard deviation; ms = milliseconds.

Table 3
ANOVA results for angry, happy and fearful trials presented at 500 ms.

<table>
<thead>
<tr>
<th></th>
<th>Pillai’s trace</th>
<th>F</th>
<th>p</th>
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<tr>
<td>Angry</td>
<td></td>
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<tr>
<td>Location</td>
<td>0.004</td>
<td>0.15</td>
<td>0.70</td>
</tr>
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<td>Location × anxiety</td>
<td>0.012</td>
<td>0.46</td>
<td>0.50</td>
</tr>
<tr>
<td>Location × group</td>
<td>0.001</td>
<td>0.04</td>
<td>0.84</td>
</tr>
<tr>
<td>Happy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>0.050</td>
<td>2.01</td>
<td>0.16</td>
</tr>
<tr>
<td>Location × anxiety</td>
<td>0.039</td>
<td>1.56</td>
<td>0.22</td>
</tr>
<tr>
<td>Location × group</td>
<td>0.001</td>
<td>0.03</td>
<td>0.86</td>
</tr>
<tr>
<td>Fearful</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>0.020</td>
<td>0.78</td>
<td>0.38</td>
</tr>
<tr>
<td>Location × anxiety</td>
<td>0.026</td>
<td>1.00</td>
<td>0.32</td>
</tr>
<tr>
<td>Location × group</td>
<td>0.001</td>
<td>0.03</td>
<td>0.87</td>
</tr>
</tbody>
</table>

Note: Location = congruent versus incongruent dot-probe presentation; anxiety = STAI state score; group = clinical versus control.

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mean congruent response time from mean incongruent response time. T-tests were used to examine differences between groups on mean orientating bias to fearful faces.

The role of comorbid diagnoses was firstly examined. No significant difference on mean orientating bias to fearful faces was found comparing BPD group with major depression (N=12, mean=18.28, S.D.=69.37) and BPD without major depression (N=9, mean=44.65, S.D.=68.10); t(19)=−0.87, p=0.40. No significant difference was found comparing BPD with panic disorder (N=9, mean=18.79, S.D.=86.95) and BPD without panic disorder (N=12, mean=37.68, S.D.=53.35); t(19)=−0.62, p=0.55. Similarly, no significant difference was found when comparing BPD group with PTSD diagnosis (N=10, mean=48.41, S.D.=84.60) to BPD without PTSD diagnosis (N=11, mean=12.47, S.D.=47.36); t(19)=1.22, p=0.24. The role of medication was also examined. No significant differences on mean orientating bias to fearful faces was found comparing BPD group on medication (N=13, mean=40.19, S.D.=79.33) and BPD group without medication (N=8, mean=12.34, S.D.=45.12); t(19)=0.90, p=0.38.

Correlational analysis was used to explore the relationship between BPD symptoms and mean orientating bias to fearful faces. Correlations between symptom criteria and mean orientating bias were not significant, all r < 0.20, p > 0.3. Moreover, total BPD score was unrelated to RTs on incongruent trials for fearful faces (r = −0.07, p = 0.78). In addition, individuals meeting four or more BPD criteria (N=9, mean=15.13, S.D.=90.97) did not significantly differ from individuals meeting three BPD criteria (N=12, mean=40.42, S.D.=46.82); t(19)=−0.83, p=0.42.

4. Discussion

This is the first study to examine attentional biases for emotional faces at both automatic and controlled stages of information processing in youth with BPD features, using a modified dot-probe task. Importantly, youth with BPD features had an attentional bias for fearful faces that appeared to reflect difficulty in disengaging attention from threatening information during automatic and preconscious stages of attention. Two aspects of the data support this view. First, the present findings indicate that compared to the healthy control group, youth with BPD features were faster to respond to congruent than to incongruent fear stimuli, which is consistent to the hypothesised pattern of results. This effect was independent of state anxiety and observed in the youth during the 30 ms presentation of fearful faces. Second, BPD youth were slower to respond to incongruent rather than paired neutral trials, indicating difficulties in disengaging attention from the perceived threat. Such differences were not found for the healthy controls.

Moreover, the BPD group were significantly slower than the control group on all trials at the 500 ms presentation time, including presentation of the two neutral faces. This group difference was not observed at 30 ms. Such pattern of findings suggests that the obvious group differences, such as psychopathology and medication status, are not the influencing factors. If group differences in psychopathology or medication status influenced the findings, slower RTs for the clinical group would be also expected on all 30 ms trials, as the dot-probe task itself (identifying vs.) has not changed. It is therefore likely that the faces clearly seen during the longer presentation time (but not during the shorter presentation time of 30 ms) distracted the clinical group, which resulted in the slower RTs during conscious (500 ms) presentations. Such general interference with task performance on all 500 ms trials was observed only for the clinical group.

The attentional system in BPD might be abnormally sensitive to threat-related stimuli (Linehan, 1993) such that attention is directed toward threatening information during early, automatic stages of processing (Williams et al., 1988). This idea is consistent with the view that evaluation of stimuli’s emotional valence takes place automatically, at a very early stage of processing, and in the absence of conscious awareness (Le Doux, 1996; Ohman, 1993). It is assumed that abnormalities in the threat-detection mechanism would therefore lead individuals with BPD symptoms to adopt a hypervigilant mode toward threat (Linehan, 1993). In accordance with other recent research studies (Domes et al., 2008; Jovev et al., 2011), the present findings do not support the assumption of general hypersensitivity to facial emotions in youth with BPD features but rather suggest attentional bias toward threat (e.g., fearful faces).

In addition, emerging BPD pathology might be associated with sustained attention to information initially appraised as being
threatening, such that the attentional system might be biased in favour of threat-related stimuli in the environment through difficulty in disengaging attention from threat stimuli rather than hypervigilance. Thus, further processing of other available information that would contradict this negative appraisal cannot be undertaken within the limited capacity system. This might lead to increased arousal and/or difficulty regulating anxiety associated with the perception of threat, possibly resulting in transient paranoid ideation (APA, 2000) and poor psychosocial functioning (Chanen et al., 2007) that are associated with the disorder. Notably, research suggesting superiority of BPD patients in theory of mind or mentalizing tasks (Arntz et al., 2009; Fertuck et al., 2009; Franzen et al., 2011) have speculated that such improved performance might lead to behaviour that is unexpected for others and thus result in difficulties during social interactions (Franzen et al., 2011). Indeed, difficulty disengaging from threat during preconscious stimulus presentations suggests that further information processing contradicting negative appraisals might be limited during the earliest stages of social communication and might have further consequences on social interaction.

Attentional mechanisms for emotional material have been previously examined in BPD using the emotional Stroop task: Arntz and colleagues (2000) found that BPD patients were significantly slower at colour naming task than non-patient controls, but not compared to patients with Cluster C Personality Disorders. In their study, ‘sexual abuse’ words (e.g., abuse, incest) and ‘non-specific emotional’ words (e.g., war, cancer) showed larger interference scores than ‘self’ or ‘other’ word categories, but unlike the present study, there was no evidence for interference caused by subliminal (masked) stimuli. Notably, preconscious and conscious processes are differentially tapped by the emotional Stroop and the dot-probe paradigms. In emotional Stroop studies, effect sizes for anxious participants have been reported as significantly larger for supraliminal compared to subliminal exposures (Bar-Haim et al., 2007), suggesting that conscious processes play a more prominent role in this paradigm. The reverse pattern was observed in dot-probe studies, with subliminal exposures yielding a combined effect size in anxious individuals that was almost twice as large as that yielded by supraliminal exposures. Conscious processes might thus contribute relatively little to threat-related attentional bias reported in dot-probe studies (Bar-Haim et al., 2007) and is consistent with the claim that the bias observed using the emotional Stroop reflects relatively later, controlled processes, rather than the earlier attentional processes indexed by the dot-probe paradigm (MacLeod et al., 1986). Findings from these two tasks are therefore likely not directly comparable.

In another study utilising the dot-probe paradigm to examine the initial orienting to emotional faces in female adolescents with BPD, von Ceumern-Lindstedtjerna and colleagues (2010) found that adolescent patients with BPD and adolescent patients with other psychiatric diagnoses showed vigilance for negative emotional stimuli compared to a non-clinical control group. Although their study has an advantage of a clinical comparison group, it examined orienting to emotional faces only at longer presentation times (500 ms) so no conclusions could be reached about subliminal processing of emotional material. In addition, hypervigilance versus difficulty disengaging for emotional stimuli was not examined.

It is also of note that differences in emotion regulation might occur between males and females. Females generally perform better at emotion recognition tasks than males (McClure, 2000; Thayer and Johnsen, 2000) and the clinical group in the present study had somewhat more females than the community group (although not significant possibly due to the small sample size). It is therefore possible that the mixing of sexes obscured group differences; however, repeating the analyses only for the female participants did not alter the general pattern of the results. Larger studies explicitly designed to examine gender differences are needed to fully examine this question.

A major strength of this study is the use of the dot-probe task, including supraliminal and subliminal presentations, to examine the attentional mechanisms operating in BPD. The dot-probe task provides more ecologically relevant representations of threat than the Stroop task (Bradley et al., 2000) and is more likely than the Stroop task to tap into pre-attentive processes. A second strength of the study is that we were able to show that a bias towards fearful faces was due to difficulty disengaging as opposed to hypervigilance. A third strength is that we used a young BPD sample, relatively untouched by years of BPD symptoms, recurrent comorbid Axis I conditions, numerous deliberate self-harm attempts and varying amounts of possibly iatrogenic treatment.

Limitations of the current study include firstly, the well-known comorbidity of Axis I disorders in patients with BPD (Zanarini et al., 2004). The specificity of the current findings for BPD cannot be robustly determined, given the lack of a comparative psychiatric control group (e.g., a third group with major depression or anxiety). Larger studies that can include comparison groups of individuals with comorbid PTSD, depression, other personality disorders, and/or no other personality pathology would afford the ability to disentangle the effects of Axis I anxiety and depressive disorders as opposed to personality pathology. Secondly, and as noted, similar attentional biases might underlie anxiety disorders, but the possibility of differential effects of attentional biases on emotion regulatory capacities across disorders is yet to be determined. Thirdly, the effect of medication on the task performance cannot fully be excluded in this study due to the small sample size. Larger studies allowing for comparison of medicated participants versus unmedicated participants would go further in examining this question. Finally, we did not evaluate the complete model (effect > time × group × location) in one test due to the small sample size. The large number of analyses conducted in this study raises the possibility of Type I error, and we emphasise the need for replication.

In sum, this study reports a pre-attentive bias reflecting failure to disengage from fearful stimuli that is independent of state anxiety in young people with BPD features. This finding contributes to previous research by highlighting the diminished capacity for effective regulation of subjective affect and subsequent engagement in behavioural strategies to avoid distress (Yen et al., 2002). Future research should explore the relationship between information processing, emotional arousal and regulation in older samples with more enduring BPD.

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