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Successful Psychotherapy Reduces Hypervigilance in Borderline Personality Disorder

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Abstract. The aims of the present study were to investigate whether selective attention in borderline personality disorder (BPD) is content-specific and influenced by treatment. Comparisons were made between emotional Stroop interferences of stimulus types that were related and unrelated to hypothesized BPD schemas (1) of patients with BPD ($n = 24$) and nonpatient controls ($n = 23$), and (2) of BPD patients ($n = 16$) at start and end of an intensive, 3-year lasting treatment. Patients with BPD showed general hypervigilance, i.e. attentional biases for both schema related and unrelated emotional stimuli. Hypervigilance was completely reduced to normalized levels in recovered patients ($n = 6$), but not in non-recovered patients ($n = 10$) at the end of treatment. The findings support the possibility of structural change in BPD.

Keywords: Selective attention, modified Stroop test, emotions, information processing, psychotherapy.

Introduction

According to cognitive views, patients with borderline personality disorder (BPD) show dysfunctional schemas and information processing biases resulting in anxiety and hypervigilance. In particular, Pretzer (1990) describes three schemas (core beliefs) that seem to be central in BPD, i.e. "I am powerless and vulnerable", "I am inherently unacceptable", and "The world is dangerous and malevolent". Regarding the world as dangerous and themselves as relatively powerless and unacceptable, borderline patients can be assumed to feel like a child left alone in a dangerous place (see also, Arntz, 1994). Several empirical findings are in line with this anxious side of BPD. Comorbidity studies of patients with BPD demonstrate that anxiety disorders and anxious cluster personality disorders (PDs) are highly prevalent in BPD (Zanarini et al., 1998a, b). Furthermore, many patients with BPD report histories of childhood traumas (e.g. Herman, Perry and Van der Kolk, 1989; Zanarini et al., 2000).

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Cognitive theory places anxiety and related biases for threat primarily in an early information processing stage. In this stage, information enters the cognitive system and anxious individuals selectively focus their attention on the origins of threat (i.e. selective attention) (e.g. MacLeod, 1991). Attending to stimuli that are real threats has survival value. However, attending to stimuli that are not really threatening, is not adaptive. The latter is thought to lead anxious individuals into a vicious circle of more attention and more anxiety. Selective attention has been found to characterize anxiety disorders (Williams, Watts, MacLeod and Mathews, 1997), to predict their emergence (MacLeod and Hagan, 1992; van den Hout, Tenney, Huygens and Merckelbach, 1995), and to cause dysfunctional anxiety (MacLeod, Rutherford, Campbell, Ebsworthy and Holker, 2002).

Previous studies on selective attention in BPD (Arntz, Appels and Sieswerda, 2000; Sieswerda, Arntz, Mertens and Vertommen, 2006; Waller and Button, in press) consistently found evidence for attentional biases in BPD. These studies successfully applied an emotional Stroop task, and found that the responses of BPD patients to emotional words were slower than to neutral words. Moreover, this response latency for emotional words in BPD patients was larger than in nonpatients. These findings are in line with a neurobiological study on BPD finding enhanced activation in the amygdala and the fusiform gyrus in the perceptual cortex, associated with anxiety and increased attention for emotionally relevant stimuli respectively (Herpertz et al., 2001).

It is currently unclear whether BPD patients selectively attend to content-specific stimuli or whether they show general hypervigilance to any emotional cue. Two studies (viz. Sieswerda et al., 2006; Waller and Button, in press) found selective attention for certain stimulus types in BPD, which was not found in normal, and axis I or axis II patient controls. Sieswerda et al. (2006) found a bias specifically for negative stimuli associated with the three core beliefs formulated by Pretzer (1990) (e.g. powerless, unacceptable, malevolent) and not for control negative emotional stimuli that were not associated with these core beliefs (e.g. stingy). Waller and Button (in press) found a bias for stimuli related to self-criticism (e.g. failure, stupid), and not for stimuli related to physical threat, nor for stimuli related to other-criticism (e.g. ridiculed, humiliated). Arntz et al. (2000) could not demonstrate a specific attentional bias in BPD, and found that these patients as well as Cluster C PD patients attended to negative emotional stimuli in general. The issue of content-specificity is important for several reasons. A specific bias conflicts with the popular hypothesis that patients with BPD show a general, possibly congenital, hyper-emotionality (e.g. Linehan, 1993). Finding a specific attentional bias would further differentiate BPD from other disorders and provide more focus to treatments for BPD.

Another important but uninvestigated question is whether selective attention in BPD patients has decreased after successful treatment. A decreased bias in a longitudinal design would more convincingly demonstrate that selective attention is characteristic for BPD than cross-sectional studies, because this design rules out confounding effects of uncontrolled between-subject differences. Moreover, a decreased bias in recovered BPD patients hints at a fundamental change by treatment. Selective attention for emotional stimuli, as measured by an emotional Stroop task, has been found to correlate with functioning on fundamental levels. fMRI studies with healthy volunteers (Whalen et al., 1998) and patients with PTSD (Shin et al., 2001) have found that emotional Stroop tasks in particular recruit the rostral anterior cingulate cortex, a part of the brain that has been suggested to be involved in regulatory responses to emotional stimuli. It therefore seems justifiable to conclude that finding a decrease in selective attention in BPD

patients who are successfully treated would support the hypothesis that fundamental changes in BPD are possible, and would do so more strongly than a demonstration of a decrease in self-report measures alone. Such a finding would also support the attainability of fundamental change that is aimed for in new treatments for BPD, for example, Beckian therapies (Arntz, 1994; Layden, Newman, Freeman and Morse, 1993; Pretzer, 1990) and Schema Focused Therapy (Young, Klosko and Weishaar, 2003; Arntz, 2004), which aim to replace maladaptive basic assumptions or schema modes by healthier alternatives, and psychodynamic treatments like Transference Focused Psychotherapy (Clarkin, Yeomans and Kernberg, 1999), which target integration of split object representations.

Selective attention has been shown to decrease after successful treatment in several other disorders, including social phobia (Lundh and Öst, 2001; Mattia, Heimberg and Hope, 1993), spider phobia (Côté and Bouchard, 2005; Lavy and van den Hout, 1993; Lavy, van den Hout and Arntz, 1993; van den Hout, Tenney, Huygens and de Jong, 1997; Watts, McKenna, Sharrock and Trezise, 1986), obsessive-compulsive disorder (Foa and McNally, 1986), general anxiety disorder (Mathews, Mogg, Kenthish and Eysenck, 1995; Mogg, Bradley, Millar and White, 1995), anorexia nervosa (Ball, 1999), bulimia nervosa (Cooper and Fairburn, 1994), major depressive disorder (Segal and Gemar, 1997), and somatoform disorders (Lupke and Ehlert, 1998). However, decrease of selective attention not always appears to coincide with decrease of symptoms (Carter, Bulik, McIntosh and Joyce, 2000; Devineni, Blanchard, Hickling and Buckley, 2004; Kampman, Keijsers, Verbraak, Näring and Hoogduin, 2002). Although some authors therefore conclude that selective attention is not a useful measure for therapy evaluation, an alternative explanation for the absence of a bias decrease in some studies might be a lack of structural changes, presumably leaving the patient at a relatively high risk for relapse.

In sum, the present study was designed to test the following hypotheses. First, BPD is characterized by a content-specific attentional bias as opposed to a bias for emotional stimuli in general. Second, successful treatment of BPD results in a concomitant decrease of (content-specific or general) bias. The hypotheses were tested for both supra- and subliminal stimuli because it has been assumed that threat related stimuli are attended to automatically and independently of awareness (e.g. Beck, 1976).

Method

Sample

The experimental group consisted of 24 outpatients with BPD from a Community Mental Health Centre starting treatment for BPD. Sixteen of these patients completed the treatment and were tested at end of treatment. At that time, six of them scored below a dysfunctional cut-off score of 15 on the Borderline Personality Disorder Severity Index (BPDSI: Giesen-Bloo, Wachters, Schouten and Arntz, submitted) and were regarded as recovered. Nonpatient controls (NPs) were 23 persons without psychopathology who were recruited by advertisements.

Participants were screened with Dutch versions of the SCID-I (First, Spitzer, Gibbon and Williams, 1997; Groenestijn, Akkerhuis, Kupka, Schneider and Nolen, 1999) and SCID-II interviews (Spitzer, First, Gibbon and Williams, 1995; Weertman, Arntz and Kerkhofs, 2000) for DSM-IV (APA, 1994) axis I and II disorders, the BPD Symptom Checklist 47 (BPD-47: Arntz and Dreessen, 1992) or the BPDSI (Giesen-Bloo et al., submitted). Participants who

Table 1. Demographic and diagnostic variables at screening for the BPD group, the NP group, and the sub-group of patients with BPD that were tested at start and end of treatment[1]

	Group		
Variable	BPD ($n = 24$)	NP ($n = 23$)	BPD sub-group ($n = 16$)
M age	29.6 (7.2)	34 (11)	28.8 (6.6)
% female	88 (21)	91 (21)	81 (13)
% low – middle level education[2]	71 (19)	57 (13)	75 (12)
% employed or student[3]	75 (18)	78 (18)	82 (13)
% married/cohabiting	42 (10)	48 (11)	44 (7)
SCID-I[4]			
% substance	42 (10)	0 (–)	44 (7)
% mood	71 (17)	0 (–)	81 (13)
% anxiety	96 (23)	0 (–)	94 (15)
% dissociation	25 (6)	0 (–)	31 (5)
% somatoform	29 (7)	0 (–)	31 (5)
% eating	25 (6)	0 (–)	13 (2)
M # current disorders	3.9 (1.2)	0 (–)	3.8 (1.3)
SCID-II			
% cluster A	25 (6)	0 (–)	25 (4)
% cluster B	100 (24)	0 (–)	100 (16)
% cluster C	42 (10)	0 (–)	44 (7)
M # disorders	2.1 (1.4)	0 (–)	2.2 (1.4)

[1]Standard deviations or frequencies are between parentheses. [2]From no education up to and including vocational or technical training < 18 years; other participants had vocational or technical training ⩾ 18 years, up to and including university education. [3]Other participants were unemployed and not student. [4]Participants did not have any current psychotic disorder.

were thought to have dissociative disorders were additionally screened with the SCID-D (Steinberg, 1993). Patients in the BPD group had BPD according to DSM-IV criteria as main diagnosis and a BPDSI score ⩾ 20. They were not allowed to have a (current) psycho-organic disorder, attention-deficit/hyperactivity disorder, severe addiction needing clinical detoxification, bipolar disorder, psychotic disorder, dissociative identity disorder, or antisocial personality disorder. NPs were not allowed to have any current axis I or II disorder, to meet any of the DSM-IV BPD criteria, a BPD-47 score ⩾ 80, and more than one axis I disorder in complete remission. General exclusion criteria were age < 18 and > 60 years, intoxication by alcohol or drugs during testing, IQ below 80, vision problems, and not being native speaker of Dutch. The control group was matched to the BPD group on age and sex.

Table 1 presents the demographic and diagnostic characteristics at screening for the BPD group that started treatment, the NPs, and the subgroup of BPD patients that were assessed at start and end of treatment. The BPD and NP group differed in terms of educational level such that the patients were somewhat less educated than the normal controls; the groups were furthermore quite similar on demographic variables. Axis I disorders most frequently diagnosed among the BPD patients were anxiety and mood disorders. Almost half of the BPD patients had an additional cluster C PD and about a quarter had a comorbid cluster A PD.

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Design

The study consisted of two sub-studies both with mixed between-within subjects designs. Independent variables of the first study were: Group (BPD, NP), Stimulus Type (three types of emotional schema related stimuli and two types of emotional schema unrelated stimuli), and Presentation (supraliminal, subliminal). The second study compared recovered to non-recovered BPD patients (Group), at start and end of treatment (Time), the same five types of stimuli (Stimulus Type), presented supra or subliminally (Presentation). The dependent variable in both studies was Emotional Stroop Interference (ESI) score, i.e. the participant's mean reaction time (RT) on the emotional stimuli of a certain type minus the participant's mean RT on the neutral stimuli.

Psychological treatment

The patients participated in a randomized clinical trial (Giesen-Bloo et al., 2006) that compared Schema Focused Therapy (Young et al., 2003), a cognitive behavioral treatment with experiential elements, to Transference Focused Psychotherapy (Clarkin et al., 1999), a psychodynamic treatment based on Kernberg's model of borderline personality organization. Both treatments aim at structural change in BPD. Treatments lasted 3 years with a frequency of two sessions a week, and were given by experienced psychotherapists receiving supervision by experts (viz. Jeffrey Young or Frank Yeomans) and participating in frequent peer supervision.

Material

Diagnostics. Dutch-language versions of the SCID-I (First et al., 1997; Groenestijn et al., 1999), the SCID-D (Steinberg, 1993), and SCID-II (First, Spitzer, Gibbon, Williams and Benjamin, 1994; Weertman et al., 2000) were used to assess DSM-IV diagnoses. The SCID-II has a good test-retest interrater reliability (Weertman, Arntz, Dreessen, Velzen and Vertommen, 2003). Current severity of BPD symptoms was measured with the BPDSI (Arntz et al., 2003; Giesen-Bloo et al., submitted) and the BPD-47 (Arntz and Dreessen, 1992). The BPDSI is a semi-structured interview assessing frequency and severity of DSM-IV BPD symptom manifestations during the past 3 months (range: 0–90). The BPDSI has an excellent interrater reliability (ICCs $\geqslant .93$) and internal consistency (Cronbach's αs $\geqslant .85$), and a good discriminant (ps $< .001$) and concurrent validity ($.60 \leqslant r$s $\leqslant .85$) (Arntz et al., 2003; Giesen-Bloo et al., submitted). The BPDSI's dysfunctional cut-off score of 15, derived using formulas of Jacobson and Truax (1991), has high specificity and sensitivity (Arntz et al., 2003; Giesen-Bloo et al., submitted). The BPD-47 is a self-report questionnaire consisting of 47 5-point Likert scale items on which participants can indicate to what degree they are currently troubled by a wide range of DSM-IV BPD symptoms (range: 5–235). The BPD-47 has a very good internal consistency (Cronbach's $\alpha = .94$) (Arntz et al., 2003).

Anxiety measurement. State and trait anxiety were assessed with the Dutch-language version of the State-Trait Anxiety Inventory (STAI: Spielberger, Gorsuch and Lusthene, 1970; Van der Ploeg, 1980) (subscale ranges: 20–80). This is a reliable and valid questionnaire (Hermans, 1994). Participants have to report on two scales, each consisting of 20 4-point Likert items, to what degree they feel anxious or tense at the moment or in general.

Emotional Stroop task. Cognitive biases for schema related and unrelated emotional stimuli were assessed with a computerized emotional Stroop task with one-by-one trials. Although the emotional Stroop task has been criticized in the past for not controlling for response bias (e.g. Dalgleish and Watts, 1990), more recent findings show that Stroop-like interferences are not caused by response biases (e.g. Luo, 1999). A particular advantage of using this task was the possibility to relate current outcomes to earlier emotional Stroop findings.

Each trial of the Stroop task began with the presentation of a white cross at the center of a black computer screen for 0.5 s. This was followed by the stimulus word written in red, blue, green or yellow capitals after 0.5 s. Subliminally presented words stayed on the screen for 14 ms, after which the letters of the word were replaced by an array of masks in the same colour as the word. Participants were asked to name as quickly as possible the colour of the stimulus word (supraliminal presentation) or the post-stimulus masks (subliminal presentation). The experimenter pressed an error button in case of a wrong voice response. The word or mask was presented until the S responded, with a maximum presentation time of 2 s. The next trial started 2.5 s after the previous stimulus word had appeared.

Seven types of Dutch word stimuli were presented in the Stroop task: negative words related to the BPD schemas on powerlessness (e.g. powerless, vulnerable, helpless), being unacceptable (e.g. unwanted, damned, wrong), or malevolence (e.g. malevolent, hostile, unfaithful), negative words not related to the BPD schemas but related to stinginess (e.g. inflexible, greedy, stingy), or to physical threat (e.g. pain, cancer, accident), neutral words referring to abstract academic themes (e.g. abstract, culture, theory), or house interiors (e.g. curtain, table, sofa). The stimulus types consisted of 12 different words each and were matched on mean number of syllables ($M = 2.4$, range 1–3). Words were not matched on frequency of use because this has been shown not to influence response latencies (Foa and McNally, 1986; McNally, Riemann and Kim, 1990; Watts et al., 1986). Words had been systematically selected on degree of specificity and emotional valence from a larger pool of words from previous research, lexicons, and the authors' own imaginations. Specificity of the person related stimuli (not house interior words) was judged by seven therapists with clinical and theoretical knowledge of BPD related schemas. 69%–92% of the stimuli were correctly classified. Ten non-therapists judged the emotional valences of the stimuli. Schema related and schema unrelated stimulus types were rated equally negative, $t(9) = 0.72$, *ns*, and both more negatively, $t(9)\text{s} = 9.58$, $p\text{s} < .005$, one-tailed, than the neutral type. Separate emotional stimulus types did differ in emotional valence. The following sequential order was obtained based on valence ratings: malevolence $<$ physical threat $\leqslant$ unacceptable $=$ stinginess $\leqslant$ powerlessness.

Stroop stimuli were presented four times, in four blocks with 84 trials each. Before these blocks, participants practised with 8 trials with neutral filler words. The stimuli were divided into two sets with 6 words per stimulus type each and equal mean syllable length per stimulus type. One set was presented supraliminally and the other was presented subliminally. For BPD patients, subliminally presented words at start of treatment were presented supraliminally at the end of treatment, and vice versa. Effects of stimulus set were controlled for by balancing the conditions within and between the groups. Within the blocks, stimuli appeared in random order and in random colour, but with maximally two consecutive trials with the same presentation mode (supraliminal, subliminal), stimulus type, or colour, and with each colour used equally frequently.

Awareness task. Awareness for subliminally presented stimuli was checked in a detection task with two blocks of 28 trials each, which were presented in random order. In each block, participants had to detect whether subliminally presented stimuli were nonsense words (14 trials) or real words (14 trials) by pressing one of two buttons of a response box. The 28 real words formed a representative subset of the subliminally presented words in the preceding Stroop task (per block two words per stimulus type and equal number of syllables per stimulus type). Nonsense words were created from the same letters as the real words, were pronounceable, and matched to the real words on syllable number and first and last letter. Order of the blocks was balanced within and between the groups. The detection task started with 8 practice trials.

Apparatus

The task was run on a AMD 500 Hz PC with an Elsa graphical adapter and a 17 inch Eizo F57 monitor. A Stroop monitor interface connected the computer to a microphone, an error button, and a two-button response box. Software programs running on Windows NT4 randomized and presented the stimuli, and recorded RTs. Accuracy of presenting and recording was 0.5 ms. The room was illuminated indirectly and dimly, at a predetermined level.

Procedure

All participants were tested individually. Participants were screened in one to six sessions with a biographical checklist, the SCID-interviews, the BPDSI (patients) or BPD-47 (NPs). If participants fulfilled the inclusion criteria, the study was described to them and written informed consent was obtained. Because of problems with development of the task software, 18 patients were tested and again administered the BPDSI when they were already in treatment for 5–7 months. This was, however, still in the first treatment phase and all were still well above the criterion BPDSI score. Six other patients and the NPs performed the Stroop-experiment within one month after the interviews, which was before the treatment started. Participants first completed the STAI. Then, after having received instructions for the Stroop task, participants started with two Stroop task blocks, followed by one awareness task block, a short break, again two similar Stroop blocks, and a second awareness task block. Sixteen of the initial 24 patients completed treatment and were administered the BPDSI and the Stroop-experiment again 30–34 months after start of the treatment. For the patients, the Stroop-experiments formed a part of a larger 3-monthly administered test battery with varying items. They participated in exchange for free treatment. The NPs received 5 euros per hour for their participation. Participants spent about 50 minutes on the Stroop-experiment.

Data analysis

ESI-scores were computed with only the RTs of colour-naming responses that were correct (99% of the RTs) and not shorter than 300 ms or longer than 3*SD* above the average per participant and presentation condition (98% of the correct RTs). ESI-scores that differed more than 2*SD* from the mean in their condition of Group, Stimulus, and Presentation were regarded as outliers, and trimmed to that mean score $\pm 2SD$. ESI-scores of subliminal presentations of

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Table 2. Mean scores (*SD*) on the questionnaires at start of treatment of the BPD group, the NP group, and the recovered and non-recovered BPD sub-groups, and of the recovered and non-recovered BPD sub-groups at end of treatment

	Start of treatment				End of treatment	
Variable	BPD ($n = 24$)	NP ($n = 23$)	Recovered BPD ($n = 6$)	Non-recovered BPD ($n = 10$)	Recovered BPD ($n = 6$)	Non-recovered BPD ($n = 10$)
BPD-47	97 (28)	50 (5.0)	93 (28)	99 (34)	63 (12)	93 (23)
BPDSI	28 (11)	–	26 (11)	29 (13)	10 (3.1)	26 (8.4)
STAI						
state	53 (12)	26 (6.4)	51 (12)	56 (15)	38 (11)	55 (12)
trait	60 (10)	28 (6.8)	58 (6.3)	59 (13)	–	–

participants whose hit rate in the awareness task were >.50 and high in comparison to hit rates of the other participants were excluded.

ESI-scores of supra- and subliminal presentations were analyzed separately with mixed repeated measures analyzes, optionally with follow-up simple or deviation contrasts, or covariates. Moreover, effect sizes (Cohen's η^2) were computed for the predicted effects that either were significant ($p < .05$) or approached significance ($.05 < p < .10$). Note that η^2 of .01–.05 is considered as a small effect, η^2 of .06–.13 as a medium effect, and $\eta^2 \geqslant .14$ as a large effect (Cohen, 1988).

The first hypothesis (content-specificity) would be supported by an interaction effect of Group and Stimulus Type in the first sub-study with BPD patients showing relatively high scores for the schema related stimuli as compared to the NPs. The second hypothesis (decrease of bias) would be supported by an interaction effect of Group and Time, and possibly Stimulus Type, in the second sub-study with recovered patients showing a decrease or more decrease of (specific) bias from start to end of treatment than non-recovered patients.

Results

BPD group at start of treatment versus NP group

Scores on questionnaires. Scores on the BPD-47, BPDSI, and STAI subscales are listed in Table 2. The BPD group at start of treatment showed higher scores than the NP group on all administered questionnaires, *p*s < .0005.

Supraliminally presented stimuli. ESI-scores for the supraliminally presented stimuli of the BPD group at start of treatment and the NP group are presented in the left graph of Figure 1. Analysis of the ESI-scores with the factors Group and Stimulus yielded a significant main effect of Group, $F(1,45) = 11.2$, $p < .005$, $\eta^2 = .20$, and trends for a main effect of Stimulus Type, $F_{GG}(2.9, 128.6) = 2.47$, $p = .07$, $\eta^2 = .052$, and an interaction effect of Group and Stimulus Type, FGG(2.9, 128.6) = 2.15, $p = .10$, $\eta^2 = .046$. BPD patients had higher ESI-scores than NPs. ESI-scores appeared to be relatively low for powerless words, $F(1,45) = 5.33$, $p < .05$, $\eta^2 = .11$, and a trend was found for relatively high ESI-scores for stingy words, $F(1,45) = 3.03$, $p = .09$, $\eta^2 = .063$ (deviation contrasts). Follow-up one-tailed *t*-tests showed that the interaction

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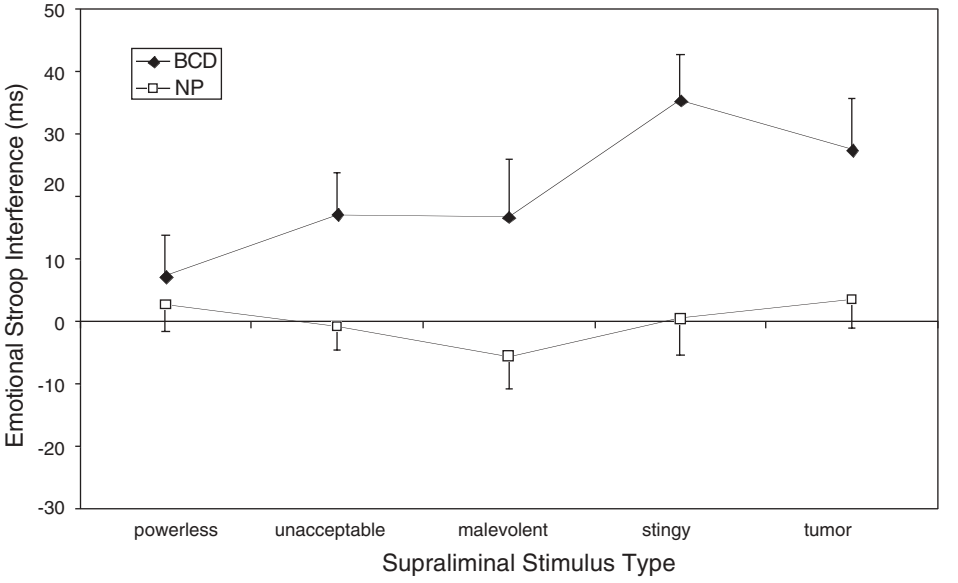

Figure 1. Mean interference (ESI) scores (ms) with standard errors of the BPD ($n = 24$) and NP ($n = 23$) group per stimulus type for supraliminally presented stimuli

effect did not support the first hypothesis: the patients had higher ESI-scores than the NPs for schema related words except powerless words, ts > 2.13, ps $< .05$, but also for schema unrelated stimulus types, ts > 2.48, ps $< .01$.

Not expecting high ESI-scores for the stingy words in the BPD group, and suspecting that this stimulus type might be related to the unacceptableness schema, we did a correlation analysis within the BPD group. It appeared that ESI-scores for stingy and unacceptable words were indeed relatively highly correlated, $\rho(n = 24) = .61$, $p < .005$. Some other schema related and unrelated stimulus types were also correlated, but less strongly: powerless and physical threat words, $\rho(n = 24) = .47$, $p < .05$, and malevolent and physical threat words, $\rho(n = 24) = .41$, $p < .05$.

The ESI-scores were not reanalyzed with STAI-state and -trait scores as covariates because the overlap in scores on these scales of the two groups was too small. Such an ANCOVA would remove too much of the group differences (see, Miller and Chapman, 2001).

Subliminally presented stimuli. Mean hit rate in the awareness task ($M = .48$, $SD = .11$, range (0.15–0.78)) was not greater than .50, $t(46) = -1.08$, *ns*, one-tailed. The highest mean hitrate was, however, rather high and close to the mean hit rate plus 3 *SD*. ESI-scores for the subliminally presented stimuli of the participant with this hit rate were therefore excluded from the analyzes. ESI-scores for the subliminal stimuli of the BPD group at start of treatment and the NP group are presented in the right graph of Figure 1.

Analysis of the ESI-scores with the factors Group and Stimulus Type yielded no significant main or interaction effect of Group and/or Stimulus, Fs < 1.79, *ns*. An ANCOVA with STAI-state and -trait scores was again not performed because of small overlap in these scores between

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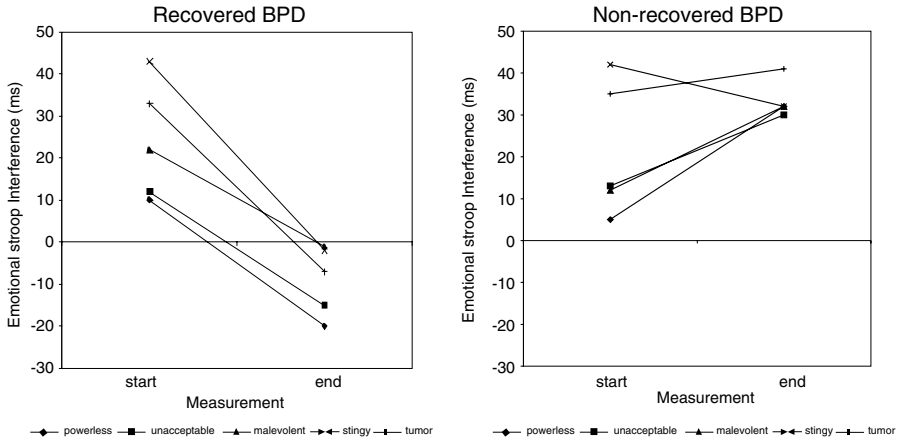

Figure 2. Mean interference (ESI) scores (ms) of the recovered BPD ($n = 6$) and non-recovered BPD group ($n = 10$) for supraliminally presented stimuli at start and end of treatment

the groups. The hypothesis on content specificity was thus also not supported by the group's ESI-scores for subliminally presented schema related and unrelated stimuli.

Recovered patients versus non-recovered patients

Scores on questionnaires. Scores on the BPD-47, BPDSI, and STAI subscales of the recovered and non-recovered patients are listed in Table 2. At start of treatment, the (to be) recovered BPD sub-group showed equally high mean scores on all administered questionnaires as the (to be) non-recovered BPD sub-group. At end of treatment, besides showing lower mean scores on the BPDSI, $p < .0005$, the recovered group showed lower scores than the non-recovered group on the STAI-state subscale as well, $p < .05$.

Supraliminally presented stimuli. ESI-scores for the supraliminal stimuli of the recovered and non-recovered BPD group at start and end of treatment are presented in Figure 2. Analysis of these scores with the factors Group, Time, and Stimulus Type yielded a trend for a main effect of Time, $F(1,14) = 3.32$, $p = .09$, $\eta^2 = .19$, a main effect of Stimulus Type, $F(4,56) = 2.76$, $p < .05$, $\eta^2 = .16$, and an interaction effect of Group and Time, $F(1,14) = 9.14$, $p < .01$, $\eta^2 = .40$. The three-way interaction was not significant, $F(4,56) < 1$, *ns*. Patients showed lower ESI-scores at end than at start of treatment. ESI-scores for powerless words were relatively low, $F(1,14) = 9.66$, $p < .01$, $\eta^2 = .41$, and a trend was found for relatively high ESI-scores for physical threat words, $F(1,14) = 3.14$, $p = .10$, $\eta^2 = .18$ (deviation contrasts). The interaction between Group and Time was in the hypothesized direction: patients that were recovered at the end of treatment showed a significant and general decrease in ESI-scores from start to end of treatment, $F(1,5) = 11.12$, $p < .05$, $\eta^2 = .69$, whereas ESI-scores of the non-recovered patients did not change, $F(1,9) < 1$, *ns*.

We did not control for state and trait anxiety at start and end of treatment. Covarying for STAI-state and -trait scores at start and end of treatment would remove the group effect because decreases in these scores are too highly correlated to decrease in BPDSI-scores.

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It is highly unlikely that the observed effects were caused by medication use. From the patients who had been using medication at start of treatment (50%), most did not recover from additive psychological treatment. Most patients who did recover had not been using medication, both at start of treatment (83%) and at end of treatment (100%). Therefore, use of medication cannot have caused the hypervigilance reduction in the recovered group after treatment.

Subliminally presented stimuli. Mean hit rates in the awareness task at start of treatment ($M = 0.51$, $SD = 0.06$, range (0.43–0.67)) and at the end of treatment ($M = 0.50$, $SD = 0.06$, range, 0.43–0.61) were both not greater than .50, $t(15)$s < 0.78, *ns*, one-tailed, and highest hitrates were rather low and below the mean hitrate plus 3 SD. All subjects were therefore included in the analysis.

Analysis of the ESI-scores for the subliminally presented stimuli did not support the second hypothesis: the effects with the factor Time were all nonsignificant, Fs < 1.45, *ns*. The analysis only yielded a significant main effect of Stimulus Type, $F_{GG}(2.13, 29.75) = 3.47$, $p < .05$, $\eta^2 = .20$. ESI-scores for subliminally presented powerless words were relatively high, $F(1,14) = 5.00$, $p < .05$, $\eta^2 = .26$, and those for stingy words were relatively low, $F(1,14) = 5.03$, $p < .05$, $\eta^2 = .26$.

Discussion

Several studies (Arntz et al., 2000; Sieswerda et al., 2006; Waller and Button, in press) have demonstrated that patients with BPD are characterized by selective attention for certain emotional stimuli or by a general kind of hypervigilance. The present study has investigated selective attention in BPD and hypothesized that attentional bias in BPD is schema specific and decreases under the influence of treatments that focus on fundamental change in personality.

The present study again confirmed that patients with BPD are characterized by selective attention for emotionally negative stimuli but, contrary to our hypothesis, the patients with BPD in the present study did not show a content specific bias. Patients with BPD were not found to show selective attention for schema related stimulus types only, but also for schema unrelated stimuli, such as stimuli related to being stingy or physical threats. This absence of specific biases is not in line with observations in two previous studies (Sieswerda et al., 2006; Waller and Button, in press). Differences in patient samples and tasks might give some leads for explanations of these divergent findings. The patients in the present study were all outpatients whereas those who showed specific biases were mostly inpatients. Specific biases are perhaps only shown by patients with more severe BPD symptoms. Another difference was that a majority (71%) of the patients in the present study had a depressive disorder in contrast to a minority (44%) of those of Sieswerda et al. (2006). Depressive mood has been shown to negatively interfere with Stroop effects (Bradley, Mogg, White and Millar, 1995), possibly also with content-specific effects. Besides patient factors, task features might also have influenced the findings. An emotional Stroop task presenting a mixture of both negative and positive stimuli (see for example, Sieswerda et al., 2006) or a card Stroop as applied by Waller and Button (in press) might be more sensitive for specific biases. The latter, however, might be more related to late instead of early information processing phases. Specific biases might also be more consistently found when not only the qualifier (e.g. "unacceptable") would be presented, but also the object (e.g. "I"). A primed Stroop task in which the objects are presented prior

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to the target stimuli (see, Segal and Gemar, 1997) might be an alternative. Follow-up studies addressing these issues have to be performed, before coming up with theoretical conclusions.

The unexpected bias for stinginess words in BPD patients might be explained by an excessive sensitivity for rejection and punishment. The correlation of interference scores of the stinginess words with those of the unacceptability words supports this (see also, Waller and Button, in press). A study on beliefs suggested that BPD patients are more characterized by self-rejecting beliefs than by powerlessness and vulnerability beliefs, which were more specific to dependent PD (Arntz, Dreessen, Schouten and Weertman, 2004). This may explain the rather low interference scores we found for the powerlessness category.

Hypervigilance in BPD was not demonstrated with subliminal stimuli. This is at odds with the assumption that threat related stimuli are attended to automatically and independently of awareness. This finding furthermore contradicts with biases for subliminal stimuli found in anxiety patients with subliminal tasks (Lundh, Wikstrom, Westerlund and Öst, 1999; Mogg, Kentish and Bradley, 1993). Although we did find differential effects for the different types of subliminal stimuli for the whole sample, the stimuli might have been too complex to be processed differentially by the groups.

The most important result of this study was that a reduction of hypervigilance was found in recovered patients but not in non-recovered patients. BPD patients that could be regarded as recovered on the basis of their low BPD symptom level at the end of treatment showed a decrease in hypervigilance to the level of persons without psychopathology, whereas treatment did not reduce selective attention in patients in whom the BPD symptoms sustained from start to end of treatment. Note that reduction of hypervigilance within the group of recovered patients was independent of medication use, but that in the total sample recovery was negatively associated with medication use. Because medication was not randomized, it is unclear what the cause of this association is. Although medication use at start of treatment was not associated with severity (see also Giesen-Bloo et al., 2006), patients using medication might be more difficult to treat. Another possibility might be that medication interferes with psychological treatment of BPD. There is one randomized study that indicates that this may be the case (Simpson et al., 2004).

This study cannot rule out that hypervigilance is simply an epiphenomenon instead of a causal or maintenance factor. However, other studies indicate that this is not the case. Two prospective studies have shown that selective attention for (subliminal) threat stimuli predicts non-adaptive responses to subsequent stressful situations (Macleod and Hagan, 1992; van den Hout et al., 1995), and a recent study showed that experimentally manipulated attentional bias influences mood responses to stress (Macleod et al., 2002). Attentional bias may have a similar role in maintaining BPD.

This longitudinal study thus demonstrates more strongly than before that hypervigilance is truly characteristic of BPD, which may, at least partly, explain the emotional regulation problems in BPD. This finding is in line with cognitive theories and findings on comorbidity and childhood trauma, stressing the central role of threat bias, anxiety, and hypervigilance in this disorder.

Picturing a patient with BPD as an individual who feels threatened might not only be justified, but also beneficial. Stroop interference can be assumed to tap cognitive processes more directly and independently of demand characteristics than measures depending on introspection and self-report. More than one-third of the treated patients of the sample studied improved on this measure to the level of nonpatients. Realizing that reducing hypervigilance means a change in

basic cognitive processes and that BPD has long been considered untreatable, this is very good news for patients with BPD and their therapists, and is promising for change oriented clinical treatments. Accepting "hyper-emotionality" as an inborn personality characteristic may be premature. Aiming for fundamental change, besides symptom reduction, seems warranted. Anxiety reducing techniques like exposure and cognitive therapy might be helpful, but more fundamental schema change through the therapeutic relationship and processing of childhood traumas are probably the most effective in this respect (see, for example, Young et al., 2003; Arntz, 2004). Future studies should focus on replication and extension (e.g. stability) of these findings, and how to enlarge success rates and efficiency of change oriented treatments.

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