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## Dissociation of explicit and implicit measures of the behavioral inhibition and activation system in borderline personality disorder

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### ABSTRACT

Patients with borderline personality disorder (BPD) suffer from various impairments in emotional functioning such as affective instability, inappropriate anger and unstable relationships. These deficits may influence two fundamental motivational systems, the behavioral inhibition system (BIS) and behavioral activation system (BAS). To investigate behavioral intentions and possible impairments in BPD we applied an implicit joystick task to measure implicit behavioral tendencies in response to facial expressions (happiness, sadness, anger, fear and neutral) in 25 patients with BPD and matched 25 healthy controls (HC). Additionally, we evaluated explicit approach and avoidance reactions to these social stimuli, emotion recognition abilities and subjective behavioral ratings. Our data analysis suggests that, although BPD patients accurately identified facial emotional expressions and reacted to them similarly as HC in the joystick task, they had significantly stronger avoidance tendencies in the rating task, especially for happiness and fear. On top of this they exhibited increased BIS sensitivity and decreased BAS sensitivity in the self-report measures. Possible influences are maladaptive cognitive schemas, high negative affect, insecure attachment style and a negative evaluation bias. The observed dysfunctional avoidance ratings may influence the appraisal of socially relevant stimuli and therefore adds further knowledge on social interaction problems in BPD.

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### 1. Introduction

Patients with borderline personality disorder (BPD) suffer from various symptoms such as impulsivity, inappropriate anger, unstable relationships and affective instability (Carpenter and Trull, 2013; Crowell et al., 2009). The latter has been proposed as a core symptom of BPD (Herpertz et al., 1997), including excessive reactivity to psychosocial cues, frequent affective category shifts and overdramatic expression of one's own affective experience (Koenigsberg, 2010; Roepke et al., 2012). Disturbed emotional processing may distort correct interpretation and adequate reaction to emotional information and social signals given by others and thus can elicit interpersonal and behavioral disturbances.

Interpersonal relationships in BPD are characterized as being preoccupied, unresolved and fearful (for review see Agrawal et al., 2004). It is assumed that these types of relationships are caused by

maladaptive cognitive schemas (Beck et al., 2004) with beliefs of rejection and abandonment (Arntz and Veen, 2001; Ayduk et al., 2008; Butler et al., 2002; Miano et al., 2013). Patients tend to evaluate others as malevolent and mischievous and generally mistrust others (Barnow et al., 2009; Franzen et al., 2011; Sieswerda et al., 2005). A consequence of negative beliefs is biased interpretations of emotional and social stimuli (Baer et al., 2012). For instance, faces as an important "conductor" of social information are evaluated as less trustworthy and less approachable by borderline patients (Barnow et al., 2009; Nicol et al., 2013).

Neuroimaging and lesion studies suggest that emotions can be processed on a conscious, cognitive level, but also on a non-conscious level by implicit sensory encoding (Barrett et al., 2004; Morris et al., 1998; Scheuerecker et al., 2007; Viviani, 2013). As these two opposed processes involve distinct neural pathways, they can be differentially involved in the psychopathology of BPD. Emotional processing in BPD has been mainly studied by using explicit emotion recognition tasks which presented mixed results, ranging from an impairment in recognizing negative facial expressions (Bland et al., 2004; Daros et al., 2013; Levine et al., 1997; Unoka et al., 2011) to an emotion-specific effect pointing to exaggerated anger perception (Domes et al., 2008;

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Dyck et al., 2009). Implicit emotion processing has been addressed only in a few studies. Those studies mainly involved attentional tasks with emotional pictures as distractors where BPD patients revealed longer reaction times during emotional distraction (Hagenhoff et al., 2013; Krause-Utz et al., 2012; von Ceumern-Lindenstjerna et al., 2010) or a virtual trust game where the effect of emotional face expressions on the patients' behavior had been assessed (Franzen et al., 2011).

Amongst other dimensions, human behavioral responses and affective reactions to external stimuli incorporate two divergent directions: approach and avoidance, as proposed by Gray (1970, 1981, 1987, 1994) who introduced the concept of the behavioral approach (BAS) and behavioral inhibition system (BIS). The BAS is stimulated by reward and non-punishment and precipitates the induction of activity, whereas the BIS is activated by punishing or novel stimuli leading to inhibition of ongoing behavior and increased arousal (Puca et al., 2006). Recently, Gray and McNaughton (2000) published a revision of this theory by adding a third, Fight/Flight/Freeze-System (FFFS). However, there are only measures to assess the BIS and BAS sensitivity and none to differentiate to FFFS from the BIS (Bijttebier et al., 2009).

High BIS or BAS sensitivities are supposed to be associated with specific personality dimensions and psychopathologies (Fowles, 1988; Gray, 1982) and they contribute to internalizing and externalizing problems resulting in a psychiatric disorder with its social problems (Bijttebier et al., 2009). In two studies with a non-clinical sample of undergraduate students using BIS/BAS questionnaires cluster C PD symptoms were positively associated with BIS sensitivity, cluster B features were correlated with BAS sensitivity and borderline symptoms with BIS sensitivity (Pastor et al., 2007; Taylor et al., 2006). Experimental studies measuring behavioral tendencies in patients with psychiatric disorders have demonstrated enhanced avoidance tendencies in socially anxious individuals (Heuer et al., 2007), spider phobics (Rinck and Becker, 2007) and depressed patients (Seidel et al., 2010a).

Beyond explicit self-rating scales (Carver and White, 1994), BAS and BIS have been examined through motor reactions to affective stimuli and thus evaluating the implicit processing. Cacioppo et al. (1993) demonstrated that the implicit evaluation of a stimulus is linked to arm extension and flexion when employing a joystick task. Thus, negative assessment is associated with pushing the joystick and positive judgment by pulling (Duckworth et al., 2002; Neumann and Strack, 2000).

In this study we aimed to make a comparison between explicit and implicit measures of socioemotional processing in borderline personality disorder. Based on previous findings of unstable relationships (Agrawal et al., 2004; Levy et al., 2005) dominated by distrust and fear of abandonment (Beck et al., 2004; Butler et al., 2002; Pretzer, 1990), it was hypothesized that BPD patients would show avoidance of emotional expressions irrespective of task instructions. Still, we expected stronger avoidance tendencies in the explicit condition as a result of maladaptive cognitive schemas. We also hypothesized that the extent of approach and avoidance would be associated with attachment impairment. We applied a joystick task as in the study of Cacioppo et al. (1993) to evaluate implicit behavioral tendencies. To assess explicit expectations of one's own behavior, we used a rating task.

## 2. Methods

### 2.1. Sample

Twenty five patients diagnosed with borderline personality disorder (BPD), meeting the DSM IV criteria for BPD, were recruited from psychiatric inpatient services of the University Hospital Aachen and the Kreisklinikum Siegen, Germany. The clinical diagnosis of BPD was confirmed by an experienced psychiatrist.

Co-occurring diagnoses were determined by the German version of the Structured Clinical Interview for axis I disorders (SCID I; Wittchen et al., 1997) and

the Inventory of Clinical Personality Accentuations for axis II disorders (ICP; Andresen, 2006) and can be found in Table 1. One patient did not fill out the ICP questionnaire. Exclusion criteria, based on the SCID I, were current and life-time substance dependence, a current diagnosis of a psychotic disorder or life-time diagnosis of schizophrenia. Twenty patients were taking medication at the time of testing: 10 patients were taking antidepressants [selective serotonin reuptake inhibitors, SSRI,  $n=4$ ; serotonin-norepinephrine re-uptake inhibitors, SNRI,  $n=5$ ; MAO-inhibitors, MAO-I,  $n=1$ ], four patients were taking low-dose neuroleptics [typical neuroleptics,  $n=1$ ; atypical neuroleptics,  $n=3$ ] and six patients were receiving a combination of antidepressants and neuroleptics. Five patients were medication-free. Fifteen patients reported past trauma experience or PTSD.

Twenty five healthy controls (HC), matched for age, gender and parental education, were recruited via advertisements. All HC were free of psychiatric illnesses as assessed with the German short version of the SCID I. All subjects gave written informed consent and the protocol was approved by the local ethics committee. Sociodemographic characteristics (gender, age, education, and parental education) of the BPD and HC group can be found in Table 2.

### 2.2. Materials and procedure

#### 2.2.1. Tasks

2.2.1.1. *Rating task.* We presented 16 photographs of each of five facial expressions (happiness, sadness, anger, fear, neutral, total  $n=80$ ) from a standardized stimulus set (Gur et al., 2002). Participants were asked to rate based on the emotional

**Table 1**

Co-occurring axis I and axis II diagnoses in the BPD group ( $n=25$ ), based on the Structured Clinical Interview for axis I disorders and the Inventory of Clinical Personality Accentuations for axis II disorders.

	%	N
<i>Axis I diagnoses: lifetime or current</i>		
History of major depression	60	15
Current major depression	40	10
History of mania	12	3
Current mania	0	0
Bipolar I/II	0	0
Substance abuse	44	11
Panic disorder	24	6
Generalized anxiety disorder	24	6
Agoraphobia	16	4
Social phobia	24	6
Simple phobia	8	2
Past trauma experience or PTSD	60	15
Obsessive-compulsive disorder	24	6
Eating disorder	36	9
<i>Axis II diagnoses</i>		
<b>Cluster A</b>		
Paranoid	4	1
Schizoid	48	12
Schizotypal	12	3
<b>Cluster B</b>		
Histrionic	8	2
Antisocial	8	2
Narcissistic	4	1
<b>Cluster C</b>		
Avoidant	36	9
Obsessive-compulsive	16	4
Dependent	32	8

**Table 2**

Sociodemographic characteristics of the BPD and HC group. BPD, borderline personality disorder; HC, healthy controls.

	BPD group ( $n=25$ )		HC group ( $n=25$ )		p-Value
	Mean	S.D.	Mean	S.D.	
Gender (F:M)	20:5		20:5		
Age (years)	26.80	8.65	26.88	9.37	0.98
Education (years)	13.46	2.87	14.38	2.42	0.23
Paternal education (years)	13.45	2.11	13.17	2.98	0.73
Maternal education (years)	12.95	1.79	12.94	2.81	0.99

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