

Emotional Reactions to Standardized Stimuli in Women With Borderline Personality Disorder

Stronger Negative Affect, But No Differences in Reactivity

Gitta A. Jacob, PhD,* Kathrin Hellstern, MA,* Nicole Ower, MA,* Mona Pillmann, MA,*
Corinna N. Scheel, MA,* Nicolas Rüsç, MD,* and Klaus Lieb, MD*†

Abstract: Emotional dysregulation is hypothesized to be a core feature of borderline personality disorder (BPD). In this study, we investigated the course of emotions in response to standardized emotion inductions in BPD. A total of 26 female BPD patients, 28 matched healthy control subjects, and 15 female patients with major depressive disorder listened to short stories inducing an angry, joyful, or neutral mood. Before and immediately after each story as well as 3 and 6 minutes later, participants rated their current anger, joy, anxiety, shame, and sadness. All 3 groups showed the same increase and decrease of emotions. However, strong group differences in the general level of all negative emotions occurred. While sadness was stronger both in BPD and major depressive disorder as compared with healthy controls, all other negative emotions were significantly increased in BPD only independent of comorbid depression. Extreme negative affectivity may be a more appropriate description of BPD-related emotional problems than emotional hyperreactivity.

Key Words: Borderline personality disorder, emotional dysregulation, anger, joy.

(*J Nerv Ment Dis* 2009;197: 808–815)

Emotional dysregulation is hypothesized to be a core feature of borderline personality disorder (BPD) (Lieb et al., 2004). It is shown to be of prognostic relevance for the development of a BPD (Tragesser et al., 2007) and criterion 6 (affective instability) of DSM-IV (American Psychiatric Association, 2000) is strongly related to it. Emotional dysregulation is usually characterized by strong emotional reactivity. According to the prominent model of Linehan (1993), emotions are said to be easily triggered in BPD patients, to rise quickly to an abnormally high level and to last longer than in healthy individuals. While emotional dysregulation is related to negative emotions in general, anger and rage are seen as prominent emotions in BPD (criterion 8 in DSM-IV).

Despite its high importance in BPD, emotional dysregulation has not been investigated very intensively so far (Arntz, 2005). The existing studies render mixed results and do currently not allow for clear conclusions to be drawn about the character of emotional responding in BPD (Rosenthal et al., 2008).

Some studies show higher reactivity of negative emotions in BPD. Herpertz et al. (1998) showed higher self-rated scores over a broad range of emotions in response to an emotional short story in BPD patients compared with patients with avoidant personality

disorder. Levine et al. (1997) found a more intense experience of negative emotions in BPD subjects than in non-BPD controls. Koenigsberg et al. (2002) reported increased self-reported affective lability of anger, anxiety, and oscillation between depression and anxiety in BPD subjects compared with other personality disordered patients, while self-rated affective intensity was not associated with BPD in this study. Arntz et al. (2005) found stronger increases in fear as a reaction to an emotional film in BPD patients as compared with healthy and Cluster C personality disordered controls. Different fMRI-studies have shown significantly increased amygdala activation in response to facial expressions of different emotions (Donegan et al., 2003) and to emotionally aversive pictures taken from the International Affective Picture System (IAPS; Lang et al., 1997; Herpertz et al., 2001). In a field study with frequent measurement points, Stiglmayr et al. (2005) reported stronger self-rated aversive tension in BPD subjects and a stronger fluctuation of tension over time as compared with healthy controls (HCs). In a similar design, Stein (1996) found greater negative affect and more fluctuations in negative affect over time in BPD as compared with HCs and patients with anorexia nervosa.

Other studies report basically higher negative emotionality in BPD over all types of negative emotions, independently of the presence of actual emotional stimuli. BPD groups typically indicate high levels of trait anger (e.g., Gardner et al., 1991; Linehan et al., 1994) and anxiety sensitivity (Gratz et al., 2008). Rüsç et al. (2007) found elevated state and trait shame and other negative emotions in BPD subjects as compared with HC subjects and to women with social phobia. In an experimental study on the evaluation of noninterpersonal emotional situations by Sieswerda et al. (2005), patients with BPD appeared to be characterized best by a generally negative evaluative style.

However, contrary to the hypothesis of increased emotional reactivity, some studies have in fact shown emotional hyporeactivity in BPD. Renneberg et al. (2005) investigated facial emotion expressions in reaction to emotional films and found reduced facial expressiveness in BPD patients. Herpertz and colleagues did not find elevated startle reactions in BPD patients in a neutral and emotional condition (Herpertz and Koetting, 2005; Herpertz et al., 2000), and Herpertz et al. (1999) even reported psychophysiological hypoaousal in BPD patients. Similarly to the study of Herpertz et al. (1999), Schmahl et al. (2004) found—contrary to predictions—no evidence of increased physiological arousal in BPD, and even fewer fluctuations in skin conductance in patients as compared with HC subjects while subjects listened to abandonment scripts.

So far, hardly any study has investigated the actual course of emotional responding in BPD with an experimental design. However, this is the core idea of the emotion dysregulation model in BPD as stated by Linehan (1993). Therefore, we tested the emotional reactivity to an anger stimulus in BPD as compared with HCs in a pilot study (Jacob et al., 2008). We chose to investigate the specific emotion of anger, as anger plays a prominent role in BPD (criterion 8 in DSM-IV). Moreover, previous studies often aimed to induce

*Department of Psychiatry and Psychotherapy, University Medical Center Freiburg, Freiburg, Germany; and †Department of Psychiatry and Psychotherapy, University Medical Center Mainz, Mainz, Germany.

Send reprint requests to Gitta A. Jacob, PhD, Department of Psychiatry and Psychotherapy, University Medical Center, Freiburg, Hauptstrasse 5, D 79104 Freiburg, Germany. E-mail: gitta.jacob@uniklinik-freiburg.de.

Copyright © 2009 by Lippincott Williams & Wilkins

ISSN: 0022-3018/09/19711-0808

DOI: 10.1097/NMD.0b013e3181bea44d

broad negative emotional states, but rarely specific emotions. In the pilot study, 27 women with BPD and 26 HC women listened to a short story that validly induced anger, and rated different emotions immediately before and after listening to the story, as well as 3 minutes later. The results only partially supported the hypotheses of increased emotional reactivity in BPD, as the anger reaction was prolonged in BPD, but not stronger.

With the present study, we aimed to investigate this in more detail by replicating our pilot study with a more elaborate design: Firstly, we added a joy-inducing and an emotionally neutral short story. Joy has the opposite emotional valence of anger, and research on positive emotions is lacking not only in BPD, but in general in experimental research on psychopathology. Secondly, we included a group of patients with major depression (MDD) as a second control group in addition to HC. Thirdly, to follow the emotional reactions in more detail, we added a fourth measurement point 6 minutes after the end of each story. To be occupied in a neutral way for 6 minutes after each story, subjects performed a so-called “nondemanding task,” which captures attention without being demanding in any way.

METHOD

Subjects

A total of 26 women with BPD, 28 women HC women, and 15 women with MDD participated in the study. Group characteristics are given in Table 1. Both patient groups were recruited from the Department of Psychiatry and Psychotherapy, University Medical Center Freiburg, Germany, the Reha-Klinik Glotterbad (Glottertal), and the Michael-Balint-Klinik (Königsfeld/Black Forest). Healthy participants were recruited directly by the authors and through bulletin-board appeals. Psychiatric diagnoses on axis I and II were made with SCID-I (First et al., 1997; German version by Wittchen et al., 1997) and SCID II (First et al., 1996; German version by Fydrich et al., 1997). Exclusion criteria for both patient groups were a lifetime history of schizophrenia or bipolar-I-disorder. In addition, a current diagnosis of substance use disorder was an exclusion criterion to avoid influence of either acute drug effects or withdrawal symptoms. A further exclusion criterion of the MDD group was any cluster-B personality disorder. All participants were informed in detail of the study’s purpose before giving written informed consent. The study was approved by the local ethics board of the University of Freiburg.

Although the HC group was matched in age with the BPD group, the MDD control group was significantly older. With regard to level of education, HC showed a significantly higher level of education than the 2 patient groups. Therefore, these 2 variables were included as covariates in the multivariate analysis of covariance (MANCOVA) calculations on the course of emotions.

About 50% of both patient groups reported current axis I comorbidity (MDD: $n = 8$ [35%]; BPD: $n = 15$ [58%]). In the MDD group, 6 patients (40%) were diagnosed with current dysthymia, 2 (13%) reported current PTSD, and 3 (20%) reported an anxiety disorder. In the BPD group, 10 (39%) were diagnosed with current major depression, 12 (46%) with dysthymia, 10 (39%) with an anxiety disorder, 7 (27%) with PTSD, 2 (8%) with obsessive-compulsive disorder, and 3 (12%) with bulimia nervosa. About 12 (46%) of BPD subjects and 2 (13%) of MDD reported comorbid personality disorders (PD). In the BPD group, 9 (35%) were diagnosed with avoidant PD, 3 (12%) with dependent and paranoid PD each, as well as 1 (4%) with obsessive-compulsive PD and 1 (4%) with schizotypal PD. Of the MDD subjects, 1 (7%) was diagnosed with avoidant PD and 1 with avoidant and dependent PD. None of the HC group reported a current diagnosis on axis I or axis II.

TABLE 1. Sociodemographic and Psychometric Characteristics of Women With Borderline Personality Disorder (BPD), Women With Major Depressive Disorder (MDD), and Healthy Control Subjects (HC)

	<i>M (SD), BPD (n = 26)</i>	<i>M (SD), HC (n = 28)</i>	<i>M (SD), MDD (n = 15)</i>	<i>p</i>
Age	30.5 (8.8)	30.5 (7.3)	40.6 (8.1)	<0.001*
Education				
Years of education	12.9 (3.1)	14.8 (2.9)	12.5 (2.5)	0.020**
Depression				
BDI	26.5 (13.5)	3.3 (3.6)	21.5 (9.1)	<0.001*
BPD severity				
BSL	190.8 (73.2)	33.5 (22.8)	122.5 (48.4)	<0.001*
	BPD (%)	HC (%)	MDD (%)	
Family status				
Stable relationship	10 (38.5%)	23 (82.1%)	8 (53.3%)	
Single	16 (61.5%)	5 (17.9%)	7 (46.7%)	
Household				
Alone	7 (26.9%)	7 (25.0%)	6 (40%)	
With family and/or children	9 (34.6%)	15 (53.6%)	8 (53.3%)	
With parents	3 (11.5%)		1 (6.7%)	
Flat share	5 (19.2%)	6 (21.4%)		
Other	2 (7.7%)			
Occupation				
Student	6 (23.1%)	11 (39.3%)	1 (6.7%)	
Employee	7 (26.9%)	15 (53.6%)	7 (46.7%)	
Housewife	2 (7.7%)	1 (3.6%)	3 (20%)	
Jobless	3 (11.5%)	1 (3.6%)	4 (26.7%)	
Retired	4 (15.4%)			
Other	4 (15.4%)			

BDI indicates beck depression inventory; BSL, borderline symptom list.
*: Group differences are significant with $p < .05$.
**: Group differences are significant with $p < .01$.

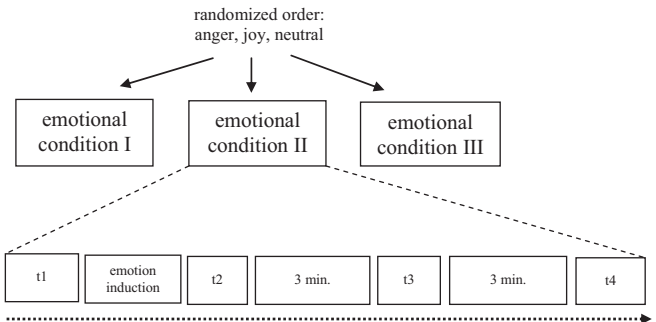


FIGURE 1. Experimental procedure. Points of emotion ratings: t1, before emotion induction; t2, immediately after emotion induction; t3, 3 minutes after emotion induction; t4, 6 minutes after emotion induction.

Procedure and Materials

Experimental Procedure

The experimental procedure is depicted in Figure 1. Two emotions (anger and joy) were induced by aurally presented standardized short stories that each lasted for about 4 minutes. To control for order effects, the 2 emotional stories and the addi-

tional neutral story were presented in randomized order. The stories were recorded by a professional voice actor and presented via headphones.

Before each story, immediately afterwards, and 3 and 6 minutes later, participants rated the current state of the 5 emotions anger, joy, anxiety, sadness, and shame. To control for additional effects of the experimental situation, participants also rated their current levels of boredom and annoyance due to the situation. In between t2 and t4, the color of the screen changed every 5 seconds and the participants were asked to count the frequency of the different colors. This nondemanding boring task, also called “vanilla baseline” (Jennings et al., 1992), captures the subject’s attention without any intellectual and emotional impact to avoid uncontrollable mechanisms that may possibly change the subject’s state.

The length of the time intervals were chosen based on our pilot study (Jacob et al., 2008) in BPD patients and HCs and on Ekman’s (1994) considerations concerning the length of emotional reactions. Thus, we expected these intervals to be most conducive to find possible differences in emotional reactivity between BPD and HC subjects.

Emotion Induction

Stories are in general an effective means of mood induction (Westermann et al., 1996), and they are probably more appropriate to elicit specific emotions than static pictures of varying content (e.g., IAPS; Lang et al., 1997) or human faces (e.g., Ekman and Friesen, 1979; Tottenham et al., 2002). Therefore, we constructed 2 short stories to induce anger and joy and 1 story to induce a neutral mood state. Participants were instructed to listen to the stories by putting themselves into the protagonists’ positions and feelings. The stories were each 4 minutes long, had been recorded with a professional voice actor, and were presented to the participants via headphones in random order.

In the anger story, the protagonist meets a friend in the morning to discuss a job interview that she expects to occur in the afternoon. The job interview is very important to her, as she needs a job urgently. Over the course of the discussion, the protagonist is asked to lend her bicycle to the friend for some hours. The protagonist is hesitant to do so, because her friend has proven to be unreliable several times already and she herself plans to go to the job interview by bike. Finally, she gives her bicycle to the friend after reassuring herself several times that the friend will bring it back on time. In the afternoon, the friend fails to return the bicycle or to call. At the appointed deadline for the return of the bike the protagonist uses her cell phone to call her friend. The friend tells her that she met another friend, started talking, and lost track of time. The story covers different aspects suitable to induce anger. The protagonist’s problem is caused by the actions of another person which in turn hinder her from achieving an important goal. The other person is acting this way because of unimportant reasons (Ellsworth and Scherer, 2002; Roseman and Kaiser, 2001). This story was already used and validated in our pilot study (Jacob et al., 2008).

In the joy story, the protagonist awakes in the morning with the resonance of a pleasant dream in mind. Surrounded by beautiful natural scenery (sunshine, warmth, animals in a rural environment), she prepares a meal for herself and a friend whom she expects to come for a visit so that they can plan a trip together which the friend has won in a quiz program. She looks forward to the trip, reflects on the long friendship with her friend, and recalls nice memories and jokes associated with her. The story ends with the friend arriving in a warm interpersonal atmosphere.

In the neutral story, the protagonist begins her usual work day with emotionally neutral everyday activities like preparing breakfast, getting the newspaper, reading the weather forecast, scheduling

her day, etc. Both the joy and the neutral stories were developed and validated by one of the authors (M.P.).

Assessment of Emotions

Current emotions were assessed at 4 time points by computer-based self ratings with 10-cm long visual analogue scales including the poles “not present” and “very strong”: Before the emotion induction (t1), immediately afterward (t2), and 3 (t3) and 6 minutes (t4) after t2 (Fig. 1). The answer points were measured and transformed into numerical values from 0 to 10. The 5 items covered the emotions of anger, joy, anxiety, sadness, and shame; 2 additional items covered the control variables—boredom and annoyance—caused by the experimental situation. Other emotions besides anger and joy were added to investigate whether the stories induced specifically anger and joy or additional emotions as well. We considered anxiety and sadness important because these 2 are basic negative emotions, which might be strongly related to any other negative emotion such as anger. Shame is prominent in BPD, but often underestimated in its impact (Rüsch et al., 2007). We also added boredom and annoyance, as participants of the pilot study reported these sensations to be induced by the somewhat boring and longish experimental procedure. To avoid habituation effects, the order of items was randomized each time.

Data Analytic Strategies

All statistics were calculated with SPSS (Statistical Packages for the Social Sciences, Version 14.0). Mean and standard deviations were calculated for all variables. Group differences in sociodemographic and psychometric variables were calculated with ANOVA. To test for effects of time, group, and the interaction time X group in the course of emotions, MANCOVAs with all emotions for the 3 different experimental conditions were conducted with age and years of education as covariates. To investigate the course of emotions and the interaction time X group in the emotional conditions more precisely by controlling for the course of emotions in the neutral conditions and for general differences between subjects, we also calculated MANCOVAs for each emotional conditions with difference scores between neutral story responses and emotional story responses.

RESULTS

Induction of Anger and Joy

The courses of anger and joy in the 3 emotional conditions in the 3 study groups are depicted in Figure 2, whereas results of the multivariate analyses can be found in Table 2.

Anger increased strongly in reaction to the anger inducing story ($d = 2.4$) and decreased afterward back to the basic level. In reaction to the joy inducing story, anger decreased first slightly ($d = -0.12$) and increased later, resulting in a weaker, but significant effect for time. No significant effect for time was found for anger in the neutral story. A significant group effect for anger appeared in all 3 conditions; contrasts revealed significant differences between BPD and HC only. No significant interaction time X group appeared in any condition.

Joy increased during the joy induction ($d = 1.3$) and decreased back below the basic level afterwards, with a significant time effect. Changes in joy were not significant in both of the other conditions. Neither a main effect for group nor an interaction effect time X group was found in any condition.

Changes in Other Emotions

The courses of sadness, anxiety, and shame are depicted in Figure 3, while results of the MANCOVAs are presented in Table 2.

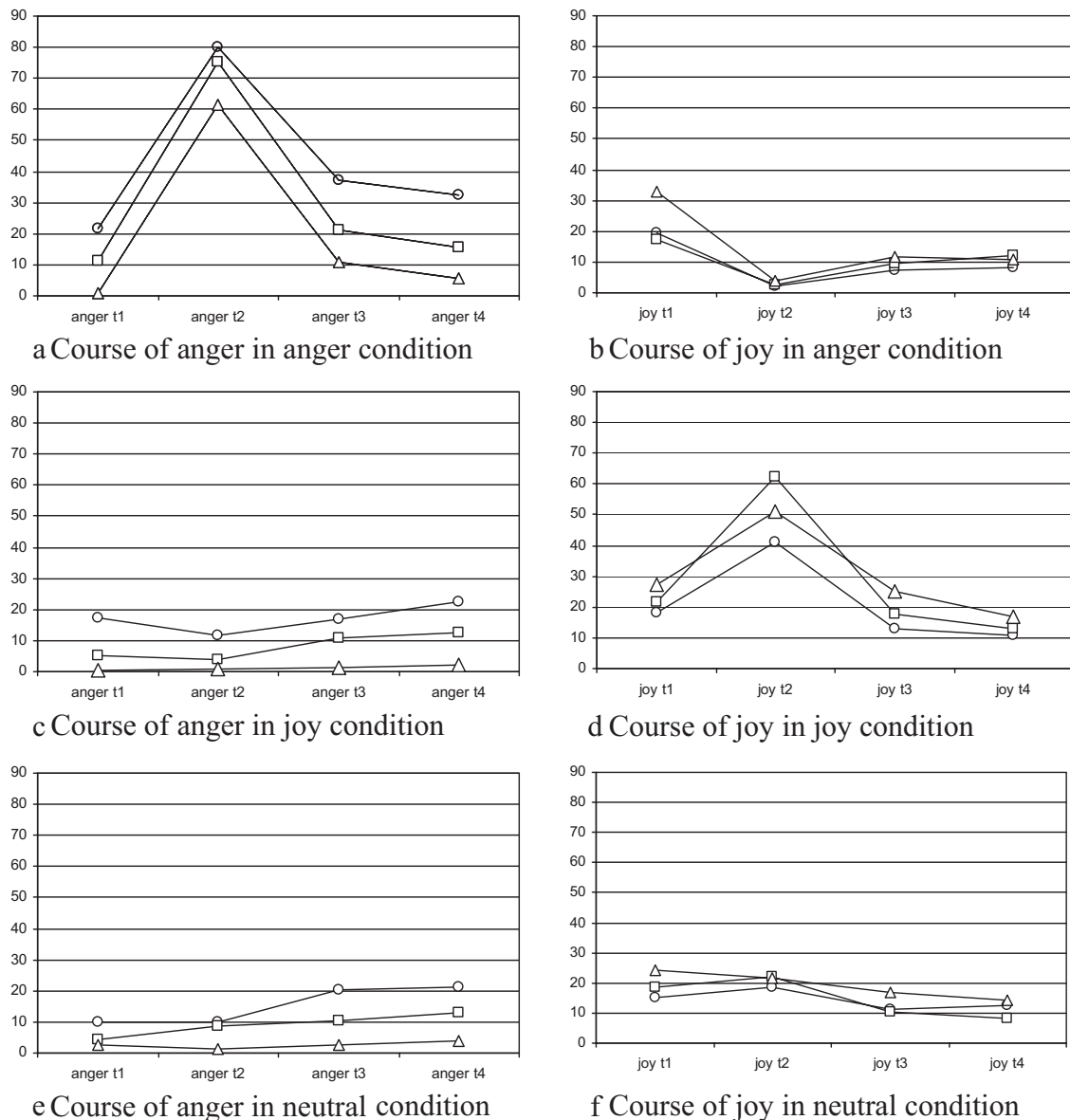


FIGURE 2. Ratings of anger and joy. Anger and joy ratings on a 0 to 100 visual analogue scale at t1 (baseline, before emotion induction), t2 (after emotion induction), t3 (3 minutes later), and t4 (6 minutes later) in 26 patients with borderline personality disorder (circles), 28 healthy controls (triangles), and 15 patients with major depressive disorder (quadrates).

Changes of these emotions were slow, with d -values for the change t2–t1 ranging between 0 and 0.5.

Sadness did not show main effects for time or interaction effects time X group in any condition. However, in all 3 conditions a significant main effect for group appeared for sadness. Contrasts indicated significant differences between BPD and HC in all 3 conditions, and significant differences between MDD and HC in the anger as well as the neutral condition.

Anxiety showed significant main effects for time in both the anger and the joy condition. While it first increased and then decreased again in the anger condition, it slightly decreased with the joy induction. In all 3 conditions, anxiety showed a significant main effect for the group. Contrasts showed significantly stronger anxiety in BPD as compared with HC and MDD in both the anger and joy condition, and a significant difference between BPD and HC only in

the neutral condition. No interaction time X group was significant for anxiety.

Shame showed a significant time effect with a slight decrease only in the anger condition, and significant main effects for group in all conditions. Similar to anxiety, contrasts indicated significant differences between BPD and both HC and MDD for all conditions. As in all other emotions, none of the interactions time X group was significant.

As expected, boredom increased over the course of each condition in all groups simultaneously, as reflected in significant main effects for time in all 3 conditions, and neither significant main effects for group nor for the interaction time X group (Table 2). Annoyance also increased over each condition; in addition, it was raised by the anger induction, similar to anger. Also similar to anger, significant main effects for group appeared in annoyance, with

TABLE 2. Results of the MANCOVA With All Emotions at t1 (Baseline), t2 (After Emotion Induction), t3 (3 min Later), and t4 (6 min Later) in 26 Patients With Borderline Personality Disorder (BPD), 28 Healthy Control Participants (HC), and 15 Major Depressive Disorder (MDD)

	Main Effect Time			Main Effect Group			Interaction Group ^a Time		
	<i>F</i>	<i>df</i>	<i>p</i>	<i>F</i>	<i>df</i>	<i>p</i>	<i>F</i>	<i>df</i>	<i>p</i>
Anger induction									
Multivariate	3.2	21, 564	<0.001**	2.3	14, 114	0.007**	1.0	42, 1146	0.544
Anger	10.2	3, 192	<0.001**	8.4	2, 64	0.001**†	0.9	6, 192	0.471
Sadness	1.5	3, 192	0.207	6.0	2, 64	0.004**†‡	0.8	6, 192	0.538
Anxiety	4.0	3, 192	0.008**	10.1	2, 64	<0.001**†§	0.8	6, 192	0.552
Joy	0.8	3, 192	0.506	1.0	2, 64	0.360	1.1	6, 192	0.355
Shame	3.8	3, 192	0.012**	7.5	2, 64	0.001**†§	1.5	6, 192	0.187
Boredom	8.0	3, 192	<0.001**	1.5	2, 64	0.260	1.3	6, 192	0.277
Annoyance	4.0	3, 192	0.009**	3.8	2, 64	0.027**†	1.3	6, 192	0.244
Joy induction									
Multivariate	1.9	21, 546	0.007**	2.3	14, 110	0.007**	1.0	42, 82	0.637
Anger	2.8	3, 186	0.040**	5.5	2, 62	.006**†	0.5	6, 186	0.844
Sadness	1.3	3, 186	0.290	7.9	2, 62	0.001**†	1.1	6, 186	0.360
Anxiety	3.6	3, 186	0.015**	10.0	2, 62	<0.001**†§	1.2	6, 186	0.308
Joy	3.2	3, 186	0.026**	2.2	2, 62	0.124	0.7	6, 186	0.650
Shame	1.5	3, 186	0.203	10.1	2, 62	<0.001**†§	<0.1	6, 186	>0.999
Boredom	2.0	3, 186	0.113	1.7	2, 62	0.183	1.4	6, 186	0.199
Annoyance	3.1	3, 186	0.028**	5.5	2, 62	0.006**†	2.3	6, 186	0.035*
Neutral story									
Multivariate	2.0	21, 564	0.005**	2.1	14, 114	0.015**	1.2	42, 1146	0.170
Anger	2.2	3, 192	0.088	3.1	2, 64	0.050†	1.9	6, 192	0.091
Sadness	<0.1	3, 192	0.988	6.2	2, 64	0.003**‡	1.5	6, 192	0.176
Anxiety	0.7	3, 192	0.576	6.4	2, 64	0.003**†	0.5	6, 192	0.803
Joy	1.9	3, 192	0.139	0.7	2, 64	0.498	1.3	6, 192	0.256
Shame	2.3	3, 192	0.075	8.1	2, 64	0.001**†§	2.0	6, 192	0.063
Boredom	6.9	3, 192	<0.001**	1.1	2, 64	0.329	0.9	6, 192	0.472
Annoyance	6.6	3, 192	<0.001**	4.3	2, 64	0.017**†	1.3	6, 192	0.269

†Significant contrast between BPD and HC ($p < 5\%$).‡Significant contrast between MDD and HC ($p < 5\%$).§Significant contrast between BPD and MDD ($p < 5\%$).*: $p < .05$.**: $p < .01$.

contrasts showing significant differences only between BPD and HC. Finally, the interaction time X group for annoyance in the joy condition showed a p -level of 3.5%. As the interaction was not significant at the multivariate level, however, this cannot be interpreted as a significant interaction.

To control for the influence of comorbid depression in BPD on the interaction time X group, we also calculated MANCOVAs with BDI as a further covariate and with “pure” groups respectively, by excluding those BPD patients suffering from comorbid major depression. The pattern of results did not change; particularly again no significant interaction effects for time X group appeared.

To investigate the course of emotions and the interaction time X group in the emotional conditions more precisely by controlling for the neutral story responses, we also calculated MANCOVAs for both emotional conditions with difference scores between emotional and neutral story responses. All main effects for group disappeared, and no interaction effect time X group was found both in multivariate and univariate tests. For the anger condition, the main effect for time was multivariately highly significant ($F = 2.0$; $df = 21$; 564; $p = 0.006$); according to the univariate tests, this was due to significant main effects only for anger ($F = 10.2$; $df = 3$; $p < 0.001$)

and annoyance ($F = 3.5$; $df = 3$; $p = 0.017$). By contrast, the joy condition did not show any significant main or interaction effect any more, not even for time.

DISCUSSION

This study investigated differential effects of anger and joy inductions on patients with BPD as compared with healthy and depressive control subjects. The main aim was to test Linehan’s (1993) hypothesis of emotional dysregulation in BPD in the meaning of more intense and prolonged emotional reactions to given emotional stimuli.

In general, the induction of anger worked very well. The joy induction increased joy significantly; however, when calculating with difference scores between joy and neutral stories’ responses, this time effect was not significant any more.

However, the 3 groups did not react differentially to the emotion inductions, even when BPD patients with comorbid MDD were excluded from the analysis. Instead, the most striking results were strong main effects for group in all negative emotions across all emotional conditions, with specific patterns for BPD and MDD.

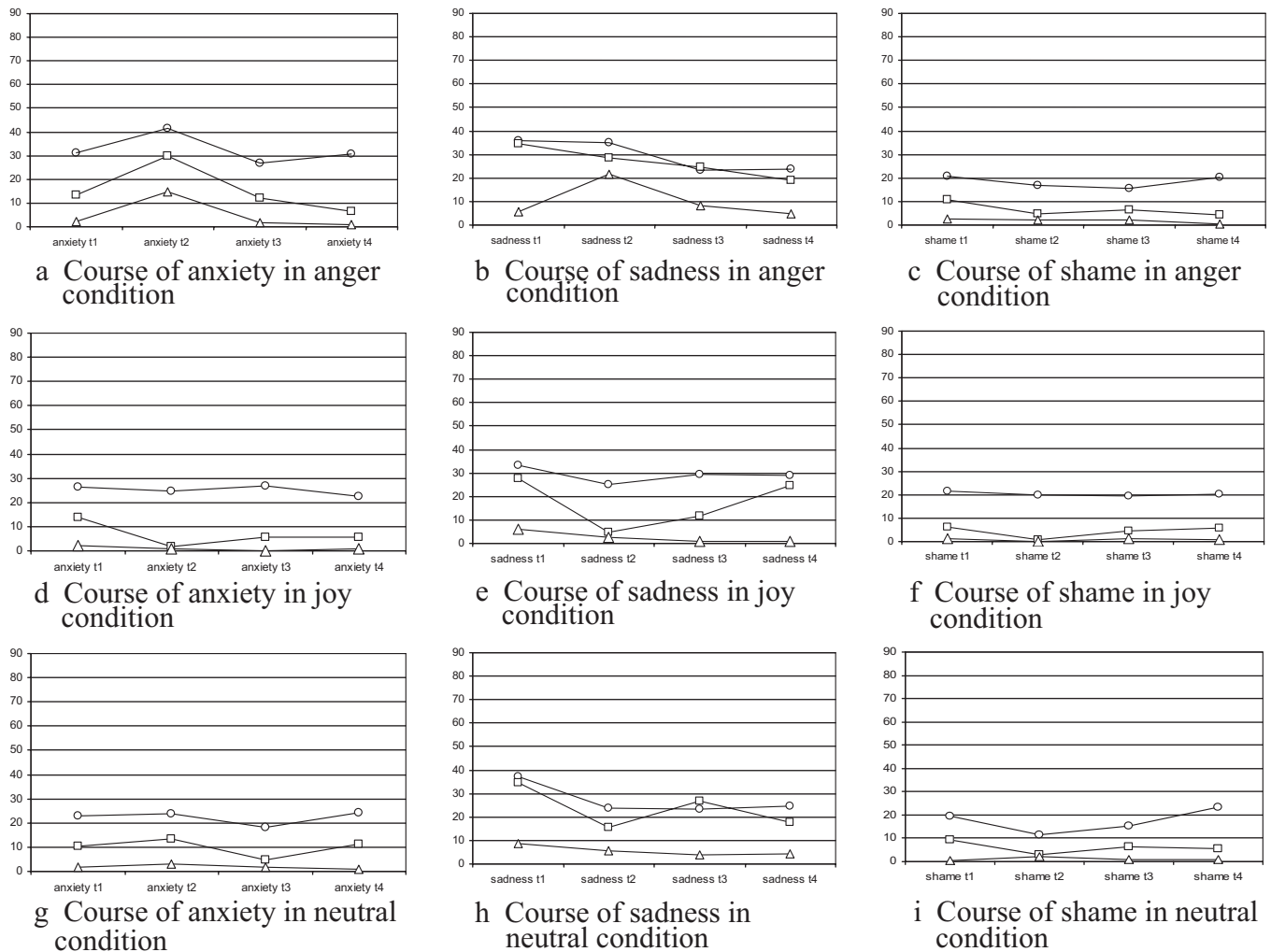


FIGURE 3. Ratings of other emotions. Anxiety, sadness, and shame ratings on a 0 to 100 visual analogue scale at t1 (baseline, before emotion induction), t2 (after emotion induction), t3 (3 minutes later), and t4 (6 minutes later) in 26 patients with borderline personality disorder (circles), 28 healthy controls (triangles), and 15 patients with major depressive disorder (squares).

For sadness, MDD and BPD showed higher values than HC, whereas for anxiety and shame, BPD showed stronger values than both HC and MDD. In anger, only the difference between BPD and HC was significant. Interestingly, these patterns were only found in negative emotions. No group differences in joy were found across all conditions.

These results do not confirm Linehan's (1993) hypothesis of emotional dysregulation in BPD being characterized by stronger and prolonged emotional reactions. Instead, a model of generally stronger negative affectivity in BPD fits the data well. This model is in line with the results of Levine et al. (1997) showing significantly greater intensity of negative emotions in BPD as compared with controls, but no differences in the intensity of positive emotions. Some other experimental findings also indicate that BPD is characterized by generally more negative emotional responses (Arntz et al., 2000; 2005; Sieswerda et al., 2005) and by a general negativity bias in emotional style and emotion recognition (Levine et al., 1997; Minzenberg et al., 2006; Rüscher et al., 2007; Wagner and Linehan, 1999; Staebler et al., 2009). The possibly high significance of this phenomenon is highlighted by a study of Rosenthal et al. (2005) who

found negative affectivity to be a better predictor of BPD symptoms than childhood sexual abuse.

A generally more negative affective style could explain different BPD-related problems as well or even better than high amplitudes of emotional reactions. From positive psychology, a relationship between positive affectivity and different factors contributing to a healthy and happy life is well known. While BPD patients are known to be vulnerable to stress (Glaser et al., 2008), depression (Zanarini et al., 1998), and a low level of social functioning (Skodol et al., 2002), positive emotions increase stress resilience (Tugade and Fredrickson, 2004; Tugade et al., 2004) and sociability (Eid et al., 2003), and buffer against depression (Wichers et al., 2007). Within BPD symptoms, negative feelings are strongly associated with typical severe behavioral problems such as self-injuring behavior (Kamphuis et al., 2007).

However, most psychiatric disorders are mainly or in part characterized by elevated negative emotions. This raises the question whether the results are specific for BPD, particularly when taking the high comorbidity of BPD with depression and anxiety disorders (Zanarini et al., 1998) into account. Our findings, partic-

ularly with regard to contrasts in the group effects, suggest the wide range of negative emotions to be specific for BPD rather than 1 specific negative emotion. Concerning sadness, which can be regarded as the main depressive affect, BPD and MDD were both significantly stronger than HC, but no significant difference appeared between BPD and MDD. All other negative emotions were not significantly stronger in MDD as compared with HC; however, all of them were significantly elevated in BPD as compared with HC, and for anxiety and shame, BPD reported even higher levels than MDD. This pattern was not substantially different when BPD with comorbid major depression was excluded from the analysis or when BDI values were introduced as a covariate. As MDD was the only patient control group in this study, it is not possible to extrapolate this conclusion to other disorders. However, previous research supports the idea of a broad range of negative emotions being increased in BPD including anxiety (Gratz et al., 2008), anger (Gardner et al., 1991), and shame (Rüsch et al., 2007). In addition, the observed wide range of elevated negative emotions fits well with Widiger's (Widiger and Mullins-Sweatt, 2009) conceptualization of borderline pathology as extreme levels of neuroticism, or—perhaps more accurately—of extreme levels of Negative Affect in Telle-geen's (1993) model of personality.

The results of the present study differ from the pilot study results with respect to the interaction time X group in the anger condition, which was found only in the pilot study. One possible explanation for this difference is the distinction between anger induced by the story and annoyance induced by the boring experimental situation in the present study but not in the pilot study. Boredom and annoyance caused by the experimental situation might have mixed into the pilot study anger ratings, resulting in a reduced decrease of anger ratings after the anger induction. This idea is supported (a) by the relative weakness of the respective effect in the pilot study and (b) by the MANCOVA interaction effect time X group in the neutral story for annoyance in the present study, which was significant albeit only in the univariate test. Stronger annoyance by a boring situation, such as the present experiment, would not be striking in BPD, as research shows reduced frustration tolerance and executive control in this group (Özlem et al., 2008; Reich and Zanarini, 2001).

However, even if BPD patients did not show altered emotional reactions to our standardized emotional stimuli, this does not at all imply a lack of altered emotional reactivity to any emotional stimulus. There are probably special BPD-specific emotional stimuli triggering emotional hyperreactivity, such as interpersonal stimuli or specific schema-related cues (Arntz et al., 2005; Sieswerda et al., 2007). Maybe emotional reactivity in BPD is altered only above a certain threshold of emotional intensity, and our inductions were not strong enough to reach this level. Further research is needed to clarify whether the assumption of stronger and more intense emotional reactions differentially applies to BPD specific emotional triggers such as abandonment- or abuse-related stimuli.

This study has several limitations. First, we relied on self-reports only, and did not include other levels and variables of emotional responding, such as psychophysiological parameters, although a combination of different variable levels would be optimal (Rosenthal et al., 2008). It is conceivable that the reported high negative affectivity in BPD is an expression of a general trait-like response style rather than due to a more substantive cause. However, although it is important to consider this, there is finally no definite way or method to ascertain. Secondly, we investigated inductions of joy and anger only, and did not induce other important emotions such as sadness, anxiety, or shame, although they play an important role in BPD as well. Thirdly, we studied women only; thus, the results cannot be generalized to men. In addition, we excluded

patients with current substance use disorder. We finally do not know whether results can be generalized to BPD patients with comorbid substance use disorder. Fourth, the MDD control group could not be age-matched with the other groups. This potentially limits the significance of the results, although Barrick et al. (1989) report only very small age effects on emotions and we controlled for age by introducing it as a covariate into the MANCOVA.

Further research should shed more light on the characteristics of emotional reactivity in BPD by including other emotions as well as additional measures of emotional reactivity. In addition, with regard to increasing evidence for generally increased negative emotions in BPD, previous research should focus more strongly on possibilities of decreasing negative emotions in BPD. All types of psychotherapy for BPD aim to reduce negative emotions implicitly or explicitly; however, basic research in this field is still lacking.

ACKNOWLEDGMENTS

The authors thank the Balint-Klinik, Königsfeld/Black Forest (Haag G, PhD, [Director], Khattab H, MA, Dreesen J, MA) as well as the Reha-Klinik Glotterbad, Glottertal (Geigges W, MD, [Director], Schmidt G, MD), for their invaluable help in recruiting patients.

REFERENCES

- American Psychiatric Association (2000) *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV-TR* (4th ed, Text Revision). Washington (DC): American Psychiatric Association.
- Arntz A (2005) Introduction to special issue: Cognition and emotion in borderline personality disorder. *J Behav Ther Exp Psychiatry*. 36:167–172.
- Arntz A, Appels C, Sieswerda S (2000) Hypervigilance in borderline disorder: A test with the emotional Stroop paradigm. *J Pers Disord*. 14:366–373.
- Arntz A, Klokman J, Sieswerda S (2005) An experimental test of the schema mode model of borderline personality disorder. *J Behav Ther Exp Psychiatry*. 36:226–239.
- Barrick AL, Hutchinson RL, Deckers LH (1989) Age effects on positive and negative emotions. *J Soc Behav Pers*. 4:421–429.
- Donegan NH, Sanislow CA, Blumberg HP, Fulbright RK, Lacadie C, Skudlarski P, Gore JC, Olson IR, McGlashan TH, Wexler BE (2003) Amygdala hyperreactivity in borderline personality disorder: Implications for emotional dysregulation. *Biol Psychiatry*. 54:1284–1293.
- Eid M, Riemann R, Angleitner A, Borkenau P (2003) Sociability and positive emotionality: Genetic and environmental contributions to the covariation between different facets of extraversion. *J Pers*. 71:319–346.
- Ekman P (1994) All emotions are basic. In P Ekman, J Davidson, (Eds), *The Nature of Emotion* (pp 15–17). New York (NY): Oxford University.
- Ekman P, Friesen WV (1979) *Pictures of Facial Affect*. Palo Alto (CA): Consulting Psychologists.
- Ellsworth PC, Scherer KR (2002) Appraisal processes in emotion. In RJ Davidson, KR Scherer, HH Goldsmith, (Eds), *Handbook of Affective Sciences* (pp 572–595). New York (NY): Oxford University Press.
- First MB, Spitzer RL, Gibbon M, Williams JB (1997) *Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I), Clinician's Version, User's Guide*. Washington (DC): American Psychiatric Press.
- First MB, Spitzer RL, Gibbon M, Williams JBW (1996) *User's Guide for the Structured Clinical Interview for DSM-IV Personality Disorders (SCID-II)*. Washington (DC): American Psychiatric Press.
- Fydrich T, Renneberg B, Schmitz B, Wittchen HU (1997) *Strukturiertes Klinisches Interview für DSM-IV, Achse II: Persönlichkeitsstörungen*. Göttingen (Germany): Hogrefe.
- Gardner DL, Leibenluft E, O'Leary KM, Cowdry RW (1991) Self-ratings of anger and hostility in borderline personality disorder. *J Nerv Ment Dis*. 179:157–161.
- Glaser JP, Van Os JV, Mengelers R, Myin-Germeys I (2008) A momentary assessment study of the reputed emotional phenotype associated with borderline personality disorder. *Psychol Med*. 38:1231–1239.
- Gratz KL, Tull MT, Gunderson JG (2008) Preliminary data on the relationship between anxiety sensitivity and borderline personality disorder: The role of experiential avoidance. *J Psychiatr Res*. 42:550–559.

- Herpertz SC, Dietrich TM, Wenning B, Krings T, Erberich SG, Willmes K, Thron A, Sass H (2001) Evidence of abnormal amygdala functioning in borderline personality disorder: A functional MRI study. *Biol Psychiatry*. 50:292–298.
- Herpertz SC, Koetting K (2005) Startle response in inpatients with borderline personality disorder vs. healthy controls. *J Neural Transm*. 112:1097–1106.
- Herpertz SC, Kunert HJ, Schwenger UB, Sass H (1999) Affective responsiveness in borderline personality disorder: A psychophysiological approach. *Am J Psychiatry*. 156:1550–1556.
- Herpertz SC, Schwenger UB, Kunert HJ, Lukas G, Gretzer U, Nuttmann J, Schuerkens A, Sass H (2000) Emotional responses in patients with borderline as compared with avoidant personality disorder. *J Pers Disord*. 14:339–351.
- Herpertz S, Gretzer A, Muhlbaier V, Steinmeyer EM, Sass H (1998) Experimental detection of inadequate affect regulation in patients with self-mutilating behavior [in German]. *Nervenarzt*. 69:410–418.
- Jacob GA, Günzler C, Zimmermann S, Scheel CN, Rüsch N, Leonhart R, Nerb J, Lieb K (2008) Time course of anger and other emotions in women with borderline personality disorder—A preliminary study. *J Behav Ther Exp Psychiatry*. 39:391–402.
- Jennings JR, Kamarck T, Stewart C, Eddy M, Johnson P (1992) Alternate cardiovascular baseline assessment techniques: Vanilla or resting baseline. *Psychophysiology*. 29:742–750.
- Kamphuis JH, Ruyling SB, Reijntjes AH (2007) Testing the emotion regulation hypothesis among self-injuring females: Evidence for differences across mood states. *J Nerv Ment Dis*. 195:912–918.
- Koenigsberg HW, Harvey PD, Mitropoulou V, Schmeidler J, New AS, Goodman M, Silverman JM, Serby M, Schopick F, Siever LJ (2002) Characterizing affective instability in borderline personality disorder. *Am J Psychiatry*. 159:784–788.
- Lang PJ, Bradley MM, Cuthbert BN (1997) *International Affective Picture System (IAPS): Technical Manual and Affective Ratings*. Gainesville (FL): Center of Research in Psychophysiology.
- Levine D, Marziali E, Hood J (1997) Emotion processing in borderline personality disorders. *J Nerv Ment Dis*. 185:240–246.
- Lieb K, Zanarini MC, Schmahl C, Linehan MM, Bohus M (2004) Borderline personality disorder. *Lancet*. 364:453–461.
- Linehan MM (1993) *Cognitive-Behavioral Treatment of Borderline Personality Disorder*. New York (NY): Guilford.
- Linehan MM, Tutek DA, Heard HL, Armstrong HE (1994) Interpersonal outcome of cognitive behavioral treatment for chronically suicidal borderline patients. *Am J Psychiatry*. 151:1771–1776.
- Minzenberg MJ, Poole JH, Vinogradov S (2006) Social-emotion recognition in borderline personality disorder. *Compr Psychiatry*. 47:468–474.
- Özlem A, Zayas V, Downey G, Cole AB, Shoda Y, Mischel W (2008) Rejection sensitivity and executive control: Joint predictors of borderline personality features. *J Res Pers*. 42:151–168.
- Reich DB, Zanarini MC (2001) Developmental aspects of borderline personality disorder. *Harv Rev Psychiatry*. 9:294–301.
- Renneberg B, Heyn K, Gebhard R, Bachmann S (2005) Facial expression of emotions in borderline personality disorder and depression. *J Behav Ther Exp Psychiatry*. 36:183–196.
- Roseman IJ, Kaiser S (2001) Applications of appraisal theory to understanding, diagnosing and treating emotional pathology. In K Scherer, A Schorr, T Johnstone, (Eds), *Appraisal Processes in Emotion* (pp 249–271). New York (NY): Oxford University Press.
- Rosenthal MZ, Cheavens JS, Lejuez CW, Lynch TR (2005) Thought suppression mediates the relationship between negative affect and borderline personality disorder symptoms. *Behav Res Ther*. 43:1173–1185.
- Rosenthal MZ, Gratz KL, Kosson DS, Cheavens JS, Lejuez CW, Lynch TR (2008) Borderline personality disorder and emotional responding: A review of the research literature. *Clin Psychol Rev*. 28:75–91.
- Rüsch N, Lieb K, Goettler I, Hermann C, Schramm E, Richter H, Jacob GA, Corrigan PW, Bohus M (2007) Shame and implicit self-concept in women with borderline personality disorder. *Am J Psychiatry*. 164:500–508.
- Schmahl CG, Elzinga BM, Ebner UW, Simms T, Sanislow C, Vermetten E, McGlashan TH, Bremner JD (2004) Psychophysiological reactivity to traumatic and abandonment scripts in borderline personality and posttraumatic stress disorders: A preliminary report. *Psychiatry Res*. 126:33–42.
- Sieswerda S, Arntz A, Mertens I, Vertommen S (2007) Hypervigilance in patients with borderline personality disorder: Specificity, automaticity and predictors. *Behav Res Ther*. 45:1011–1024.
- Sieswerda S, Arntz A, Wolfis M (2005) Evaluations of emotional noninterpersonal stimuli by patients with borderline personality disorder. *J Behav Ther Exp Psychiatry*. 36:209–225.
- Skodol AE, Gunderson JG, McGlashan TH, Dyck IR, Stout RL, Bender DS, Grilo CM, Shea MT, Zanarini MC, Morey LC, Sanislow CA, Oldham JM (2002) Functional impairment in patients with schizotypal, borderline, avoidant, or obsessive-compulsive personality disorder. *Am J Psychiatry*. 159:276–83.
- Staebler K, Gebhard R, Barnett W, Renneberg B (2009) Emotional responses in borderline personality disorder and depression. Assessment during an acute crisis and 8 months later. *J Behav Ther Exp Psychiatry*. 40:85–97.
- Stein KF (1996) Affect instability in adults with a borderline personality disorder. *Arch Psychiatr Nurs*. 10:32–40.
- Stiglmayr CE, Grathwol T, Linehan MM, Ihorst G, Fahrenberg J, Bohus M (2005) Aversive tension in patients with borderline personality disorder: A computer-based controlled field study. *Acta Psychiatr Scand*. 111:372–379.
- Tellegen A (1993) Folk concepts and psychological concepts of personality and personality disorder. *Psychol Inq*. 4:122–130.
- Tottenham N, Borscheid A, Ellertsen K, Marcus DJ, Nelson CA (2002) Categorization of facial expressions in children and adults: Establishing a larger stimulus set. Poster presented at: the Cognitive Neuroscience Society Annual Meeting, San Francisco.
- Tragesser SL, Solhan M, Schwartz-Mette R, Trull TJ (2007) The role of affective instability and impulsivity in predicting future BPD features. *J Pers Disord*. 21:603–614.
- Tugade MM, Fredrickson BL (2004) Resilient individuals use positive emotions to bounce back from negative emotional experiences. *J Pers Soc Psychol*. 86:320–333.
- Tugade MM, Fredrickson BL, Barrett LF (2004) Psychological resilience and positive emotional granularity: Examining the benefits of positive emotions on coping and health. *J Pers*. 72:1161–1190.
- Wagner AW, Linehan MM (1999) Facial expression recognition ability among women with borderline personality disorder: Implications for emotion regulation? *J Pers Disord*. 13:329–344.
- Westermann R, Spies K, Stahl G, Hesse FW (1996) Relative effectiveness and validity of mood induction procedures: A meta-analysis. *Eur J Soc Psychol*. 26:557–580.
- Wichers MC, Myin-Germeys I, Jacobs N, Peeters F, Kenis G, Derom C, Vlietinck R, Delespaul P, van Os J (2007) Evidence that moment-to-moment variation in positive emotions buffer genetic risk for depression: A momentary assessment twin study. *Acta Psychiatr Scand*. 115:451–457.
- Widiger TA, Mullins-Sweatt SN (2009) Five-factor model of personality disorder: A proposal for DM-V. *Annu Rev Clin Psychol*. 5:197–220.
- Wittchen HU, Wunderlich U, Gruschwitz S, Zaudig M (1997) *SKID: Strukturiertes Klinisches Interview für DSM-IV Achse I*. Göttingen (Germany): Hogrefe.
- Zanarini MC, Frankenburg FR, Dubo ED, Sickel AE, Trikha A, Levin A, Reynolds V (1998) Axis I comorbidity of borderline personality disorder. *Am J Psychiatry*. 155:1733–1739.