

# An experimental pilot study of response to invalidation in young women with features of borderline personality disorder

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Received 7 November 2006; received in revised form 5 June 2007; accepted 8 June 2007

## Abstract

One of the leading biosocial theories of borderline personality disorder (BPD) suggests that individuals with BPD have biologically based abnormalities in emotion regulation contributing to more intense and rapid responses to emotional stimuli, in particular, invalidation [Linehan, M.M., 1993. *Cognitive–Behavioral Treatment of Borderline Personality Disorder*. Guilford, New York.]. This study used a 2 by 2 experimental design to test whether young women with features of BPD actually show increased physiological arousal in response to invalidation. Twenty-three women ages 18 to 29 who endorsed high levels of BPD symptoms and 18 healthy controls were randomly assigned to hear either a validating or invalidating comment during a frustrating task. Although we found preliminary support for differential response to these stimuli in self-report of valence, we found neither self-report nor physiological evidence of hyperarousal in the BPD features group, either at baseline or in response to invalidation. Interestingly, the BPD features group reported significantly lower comfort with emotion, and comfort was significantly associated with affective valence but not arousal. We discuss implications for understanding and responding to the affective intensity of this population.

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*Keywords:* Dialectical behavior therapy (DBT); Skin conductance; Interpersonal; Valence; Arousal; Validation

## 1. Introduction

Borderline personality disorder (BPD) is a clinically complicated disorder characterized by impulsivity and affective instability (Siever and Davis, 1991; APA, 1994). In spite of a high volume of literature on this disorder, major questions remain about its etiology and maintenance. Progress in treating BPD may offer new directions for this research. Of the treatments devel-

oped specifically for BPD, dialectical behavior therapy (DBT, Linehan, 1993) has received by far the most empirical support (Robbins and Chapman, 2004; Linehan et al., 2006). One surprising element of this widely disseminated treatment is that the underlying theory permeating both therapist training and patient education remains largely untested. The present study was designed as a preliminary test of one tenet of the underlying theory: that individuals with BPD have a heightened biologically based sensitivity to emotional invalidation.

We briefly review Linehan's theory of BPD and existing research relating to its key components: emotional vulnerability and invalidation. We then discuss our

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rationale for testing the interaction of these components, including a model for how invalidation might elicit hyperarousal in individuals with BPD. Finally, we introduce a new methodology for measuring multiple dimensions of emotional response to discrete validating and invalidating comments within a controlled laboratory setting.

### 1.1. Linehan's biosocial theory of BPD

Linehan (1993) cogently argues that the behavioral patterns characterizing BPD may develop out of a transactional process between an “emotionally vulnerable” individual and an “invalidating environment.” She characterizes an emotionally vulnerable individual as having a predisposition to react to emotional stimuli more quickly, at a lower threshold, with greater intensity, and with slower recovery than others. An invalidating environment is one that communicates to the individual that her private experience or expression of it is somehow wrong or inappropriate. BPD is believed to develop out of the reciprocal shaping of more extreme and coercive behaviors in both individual and environment. Unfortunately, there is very little research exploring whether and how individuals with BPD actually differ on dimensions of emotional vulnerability, and perhaps more importantly, whether individuals with BPD show a differential response to invalidation.<sup>1</sup>

### 1.2. Emotional vulnerability in BPD

Individuals with BPD consistently report elevated emotional intensity and affective lability (e.g., Koenigsberg et al., 2002; Stiglmayr et al., 2005). Yet, Linehan's “emotional vulnerability” is a broad construct, referring to multiple components of a person's emotional response tendency: time course (both onset and duration), sensitivity threshold, and intensity (Linehan, 1993). In the last 10 years, laboratory and ambulatory monitoring studies of individuals with BPD have identified abnormalities in facial affect recognition accuracy and speed (e.g., Wagner and Linehan, 1999), affective instability and “additional heart rate” (e.g., Ebner-Priemer et al., 2007a,b), and preliminary support

for slow return to baseline emotion (e.g., Stiglmayr et al., 2005). BPD samples have also demonstrated increased activation in limbic (Herpertz et al., 2001) and frontal (Schnell and Herpertz, 2007) brain regions in response to high arousal negative stimuli, and heightened startle as measured by electromyogram (EMG, Ebner-Priemer et al., 2005). However, they have failed to demonstrate direct physiological evidence of hyperarousal (e.g., elevated skin conductance response, Herpertz et al., 1999) typically associated with heightened affective intensity (Lang et al., 1998).

One possible explanation is that the stimuli used in existing laboratory studies of skin conductance response may be inadequate for eliciting the affective intensity characteristic of individuals with BPD. For instance, one study used standardized affective pictures (Herpertz et al., 1999). When potentially more salient stimuli, abandonment scripts, were used, participants diagnosed with BPD demonstrated a non-significant elevation in skin conductance (SC) fluctuations (Schmahl et al., 2004). Limited power and diagnostic overlap between groups may partly explain the statistical nonsignificance of this finding.

### 1.3. The role of invalidation

Linehan's biosocial theory (1993) suggests that emotional vulnerability alone does not lead to BPD. It is only when an emotionally vulnerable individual is invalidated and his responses elicit further invalidation that he fails to learn to accurately label or effectively manage his emotions, contributing to further vulnerability. There is preliminary evidence for the possible effects of invalidation. Parental criticism or invalidation of children's emotions has been associated with social and emotional problems in childhood (e.g., Eisenberg et al., 1996), self-injurious behavior in adolescence (Wedig and Nock, 2007), and psychological distress in adulthood (e.g., Krause et al., 2003). Unfortunately, reliance on retrospective self-report or cross-sectional designs limits the inferences that can be drawn. To determine if invalidation is a stimulus of sufficient salience to elicit hyperarousal in individuals with features of BPD, validation and invalidation must be directly manipulated while subjective and psychophysiological response are measured.

### 1.4. A model for the role of suppression in the effects of invalidation on arousal

Linehan's (1993) biosocial theory suggests that invalidation may be particularly salient for individuals

<sup>1</sup> Of note, Linehan's theory is of the etiology of BPD. It is primarily in the application of this theory within DBT that a current vulnerability to invalidation is implied. As this study was designed to measure current sensitivity to invalidation, it cannot speak directly to the etiology of BPD, per se.

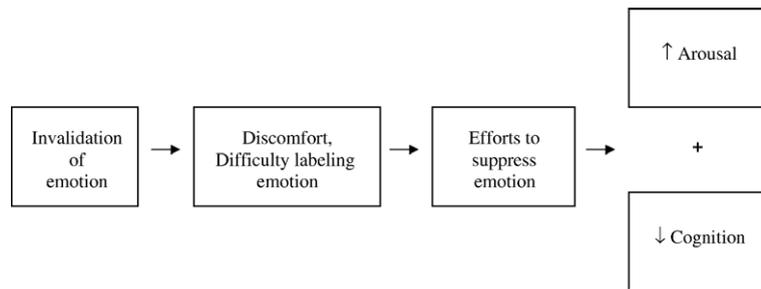


Fig. 1. Proposed mechanism and effects of invalidation in emotionally vulnerable individuals.

with BPD because they lack basic skills for managing their emotional vulnerability. One of the consequences of prior invalidation is that they have not learned to identify or regulate their very intense emotions. Invalidation not only exacerbates this dysregulation but prompts doubt regarding the very validity of their experience. Instead of focusing on understanding and managing the invalidated emotion, they are likely to become increasingly uncomfortable with it and make efforts to change or escape it (Linehan, 1993).

Preliminary support for suppression as a mechanism of invalidation comes from a recent study in which thought suppression partially mediated the relation between parental criticism and BPD features (Cheavens et al., 2005). The propensity for suppressing unwanted thoughts has been found to mediate the relationship between emotional reactivity and the frequency of self-injurious thoughts and behaviors as well (Najmi et al., 2006). Furthermore, efforts to suppress thoughts of affective material have been associated with increased arousal as measured by skin conductance level (SCL, e.g., Wegner et al., 1990). In as much as anxious arousal and emotion inhibition interfere with cognitive processes (e.g., Gellatly and Meyer, 1992; Linehan, 1993), invalidation may, by eliciting suppression or increasing arousal, also interfere with cognition. Fig. 1 illustrates the full model. The link between invalidation and efforts to suppress emotion is postulated to be discomfort or difficulty labeling emotion, consistent with Linehan's theory of the effects of invalidation, and assumptions about emotional suppression and inhibition as means for escaping aversive emotional experiences (e.g., Krause et al., 2003; Stiglmayr et al., 2005). Discomfort allows for milder forms of what in the extreme might be called distress (Linehan, 1993).

### 1.5. Purpose of the current study

The two goals of this study were to pilot a new methodology for measuring self-report and psycho-

physiological response to discrete interpersonal stimuli and to explore dimensions of emotional response to validation and invalidation in young women with features of BPD. We chose skin conductance as our preliminary psychophysiological measure due to its primary correspondence with the construct of arousal in Lang's foundational work on dimensions of emotional response to discrete stimuli (Lang et al., 1998). Our specific design was guided by four specific hypotheses. We expected that (1) individuals with BPD features would show significantly higher physiological and self-report of arousal response, increased discomfort with emotion, and decreased performance on solving anagrams in response to invalidation and compared to controls; (2) invalidation, relative to validation, would elicit increased physiological and self-report of arousal response and decreased performance on the anagram-solving task for all participants; (3) validation in contrast to invalidation would elicit increased comfort with emotion; and finally, since we expected that increased comfort with emotion might lead to more accurate labeling of actual experience, we hypothesized that (4) validation would predict increased consistency (higher correlation) between self-report and physiological measure of arousal.

## 2. Methods

### 2.1. Participants

Participants were recruited from an internet community bulletin board (Craigslist) with advertisements for healthy right-handed women for a study on emotional sensitivity. The ad for individuals with BPD features asked for "extremely sensitive" women who identified with a short list of BPD symptom descriptions. They were accepted into the study if they endorsed five or more symptoms of BPD on clinical phone interview with a licensed social worker with significant experience treating BPD. An analogue sample was chosen for

several reasons: (1) to explore underlying vulnerabilities in BPD (Cheavens et al., 2005) given evidence that BPD may be best understood from a dimensional rather than categorical perspective (Rothschild et al., 2003), (2) to facilitate recruitment and (3) to minimize complications in psychophysiological measures due to the polypharmacy associated with BPD.

Exclusion criteria for both groups included any evidence of seizure disorder, significant head injury, psychosis (other than transient symptoms), current substance abuse, past substance dependence, or any other medical condition or treatment that might add significant variance to the skin conductance measurements. Phone screenings were conducted with 67 of roughly 120 responses to ads for extremely sensitive females. Of these, 24 were subsequently excluded for not meeting diagnostic threshold, 13 were excluded on the basis of substance abuse or medical complications, and 30 were deemed eligible for the BPD feature group.

A total of 56 individuals, including 26 controls, were invited to participate. All 52 who came as scheduled consented to participate and completed the study. Of these, 11 subjects' data were removed from analyses due to technical difficulties, lapses in protocol, or behavioral interferences in measurements. Demographic data on the remaining 41 subjects are shown in Table 1.

## 2.2. Measures

### 2.2.1. BPD features

The OMNI-IV Personality Disorder Inventory (Loranger, 2001) is an abbreviated 210-item version of the OMNI, a self-report measure of abnormal personality traits based on Axis II categories of the Diagnostic and Statistical Manual of Mental Disorders (APA, 1994). It was used to measure the degree to which participants endorsed traits of BPD. Preliminary evidence supports its reliability and validity (Loranger, 2001). In a study of psychiatric inpatients and outpatients, the OMNI Borderline Disorder Scale (BOR) was highly correlated ( $r=0.81$ ) with the BPD dimensional score from interviews using the International Personality Disorder Examination (IPDE, Loranger, 1999, 2001). Software provided by the publisher generated  $T$  scores from test norms. Individuals with  $T$  scores  $>66$  on the BOR scale were included in the BPD features group, including one individual recruited as a control.

### 2.2.2. Intelligence quotient (IQ) subtests

The vocabulary and block design subtests of the Wechsler Adult Intelligence Scale-Third Edition

Table 1

Demographic and relevant baseline characteristics of groups

|                                            | BPD features<br>( $n=23$ )<br>Mean (S.D.) | Controls<br>( $n=18$ )<br>Mean (S.D.) | $t$ or $\chi^2$ <sup>a</sup> | Effect<br>size $d$ |
|--------------------------------------------|-------------------------------------------|---------------------------------------|------------------------------|--------------------|
| Age                                        | 22.9 (3.2)                                | 22.2 (2.2)                            | 0.84                         | 0.25               |
| Education level <sup>b</sup>               | 6.5 (1.2)                                 | 6.8 (0.6)                             | -0.82                        | -0.32              |
| Highest parental<br>education <sup>b</sup> | 7.2 (1.9)                                 | 7.4 (1.7)                             | -0.30                        | -0.11              |
| Highest parental<br>income <sup>c</sup>    | 7.52 (1.0)                                | 7.6 (1.0)                             | -0.11                        | -0.10              |
| Vocabulary <sup>d</sup>                    | 16.0 (2.5)                                | 15.3 (3.0)                            | 0.79                         | 0.25               |
| Block design <sup>d</sup>                  | 11.0 (2.6)                                | 13.3 (3.5)                            | -2.47*                       | -0.75              |
| Anagram 1 # correct                        | 5.7 (1.9)                                 | 6.4 (2.6)                             | -1.11                        | -0.31              |
| Anagram 2 # correct                        | 6.8 (1.9)                                 | 7.2 (1.9)                             | -0.63                        | -0.21              |
| BOR $T$ score <sup>e</sup>                 | 75.7 (1.4)                                | 45.2 (1.5)                            | 14.92***                     | 4.73               |
| SCL-90 score                               | 144.4 (47.5)                              | 32.3 (20.9)                           | 9.31***                      | 3.05               |
| Current distress                           | 65.8 (8.1)                                | 44.4 (5.3)                            | 9.67***                      | 3.13               |
| % ( $n$ ) on psychiatric<br>medication     | 21.7 (5)                                  | 5.6 (1)                               | 20.51***                     | N/A                |
| % ( $n$ ) on birth<br>control              | 43.5 (10)                                 | 50.0 (9)                              | 0.22                         | N/A                |
| % ( $n$ ) on any<br>medication             | 56.5 (13)                                 | 61.1 (11)                             | 1.20                         | N/A                |
| Mean 5 s baseline<br>SCL                   | 1.63 (0.61)                               | 1.74 (0.72)                           | -0.54                        | -0.16              |

\*  $P<0.05$ , \*\*  $P<0.01$ , \*\*\*  $P<0.001$ .

<sup>a</sup> Chi square test values given for medication variables.

<sup>b</sup> Education level 6 corresponds to "some college", 7 to *college graduate*, and 8 to *some graduate or professional school beyond college*.

<sup>c</sup> Income level was indicated by \$5000 salary increments until level 7 which corresponds to \$30,000–49,999 and 8 to \$50,000 or more.

<sup>d</sup> Scaled scores from subtests of WAIS-III.

<sup>e</sup> BOR=Borderline Personality Scale of the OMNI-IV. The BPD features group had a mean  $T$  score of 67.0 (S.D.=11.0) on the schizotypal subscale of the OMNI-IV but no other mean  $T$  score was  $>66$ . The mean number of  $T$  scores  $>66$  on personality disorder subscales (9) other than BPD was 3.4 (S.D.=1.9).

(WAIS-III, Wechsler, 1997) are highly correlated with Full Scale IQ and were used to ensure observed effects were not accounted for by pre-existing differences in IQ.

### 2.2.3. Skin conductance

Skin conductance level (SCL) was recorded by a pair of BIOPAC (BIOPAC Systems, Inc., Camino Goleta, CA) 6 mm Ag/AgCl electrodes filled with a chlorhexidine gluconate electrolyte gel. Electrode collars were attached to abrasion-free areas of the second phalanges of the second and third fingers of the left hand to assure standardized surface area for electrode gel application and conductivity. A BIOPAC GSR 100C amplifier maintained a constant voltage of 0.5 V across the electrodes. The signal was sampled at 50 Hz. The data

were acquired, reduced, and analyzed with AcqKnowledge v3.7.3 software. Movement artifacts were smoothed before measurements. SCL was quantified in the following manner:

- Baseline SCL*: mean SCL across the 5 s before the participant was told to start,
- SCL*: mean SCL during the following intervals: 2 s immediately preceding (SCL 2 s pre) and 2–17 s (SCL 15 s post) following each comment,
- SCL change*: SCL 15 s post minus SCL 2 s pre for each comment.

2.2.4. Brief self-report of emotion

Participants rated their current emotion on three dimensions. Valence and arousal were rated according to a 9-point scale using graphic figures from the Self-Assessment Manikin (SAM; Lang et al., 1993). Given that the proposed mechanism of invalidation was that it increased an individual’s discomfort and thus effort to change her emotion, participants rated comfort with their current emotion on a 5-point scale (1: *strongly want to get rid of the emotion* to 5: *it is completely acceptable*).

2.2.5. Response time to rate emotions

Anagram lists and emotion rating screens were presented via a program written in E-Prime Version 1.0 (Psychology Software Tools, Inc., Pittsburgh, PA). Response times from screen presentation to key press were available for each rating and used in post hoc analyses as a possible implicit measure of difficulty labeling emotion.

2.3. Procedures

This study was approved by the Harvard institutional review board. Participants were informed that this was a study of emotional sensitivity during a challenging cognitive task and provided written informed consent. They completed the OMNI-IV and were administered the two WAIS-III subtests. An undergraduate assistant (KG), blind to group, attached the electrodes, oriented them to tasks, and engaged in brief conversation about each participant’s area of study, employment, or experience living in the area until the electrodes had been attached for 10 min. This conversational time was included to facilitate a relationship with the assistant and increase the salience of later validation/invalidation. She then asked them to wait quietly until told through an intercom to begin.

Participants were given two lists of anagrams to solve (see Fig. 2). The first was designed as a pretest of initial anagram-solving ability and consisted of 14 easy to moderately difficult anagrams (e.g., rolgy, aordi) to be solved within 3 min. The second list of 18 included 10 unsolvable anagrams (e.g., oneci, rtean, partially taken from a list used by Aspinwall and Richter, 1999) to induce frustration, the emotional target for the validating and invalidating comments. Participants were told to take as much time as needed for this second set. They rated three dimensions (valence, arousal, comfort) of their emotional experience at 1.5-min intervals.

Piloting determined that participants were consistently frustrated by about 4 min into the second anagram set. Thus, at roughly 4.25 min into this set (exactly 45 s after the seventh emotion rating), each participant’s

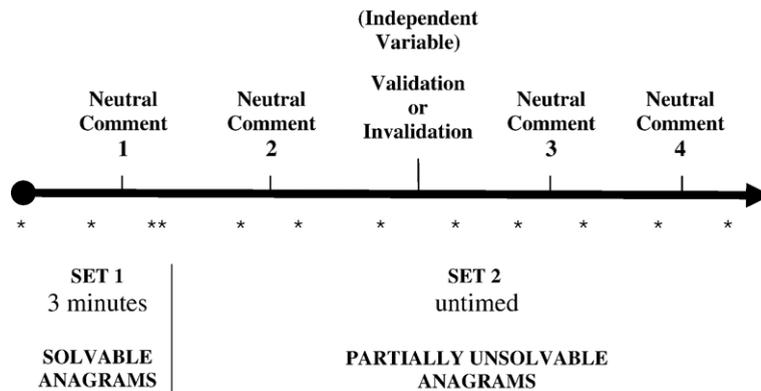


Fig. 2. Study procedures and time course. Note: The neutral comments were chosen as the most natural and neutral of a set piloted with psychology graduate students. Neutral comment 1 (N1) was spoken 45 s after the participant completed her 2nd emotion rating (ER): “If you have any trouble with the computer, let me know.” N2, 45 s after the 5th ER: “Just to remind you, you can go in any order on these.” N3, 45 s after the 9th ER: “Just to remind you, some of these will take longer than others.” N4, 45 s after the 11th ER: “Just checking in, work as long as you need to on this set.” \* ER: Self-report of arousal, valence, and comfort every 1.5 min.

random assignment was obtained and the assistant made either a validating (“Most people find this set of anagrams *really* frustrating” spoken in a warm tone) or invalidating comment (“There’s *no* need to get really frustrated. They’re *just* anagrams.” spoken in a puzzled, mildly critical tone) over the intercom. To control for orienting response and to measure relative responses to comments over time, all participants also heard four neutral comments of equal duration to the validating and invalidating comments. If participants had not stopped beforehand, they were told to stop 1 min and 35 s after the 16th emotion rating (roughly 25 min from the start of the task). They rated their emotions one final time before completing two follow-up questionnaires and being debriefed.

#### 2.4. Data analysis

Response times were log transformed to reduce outliers and improve normalcy. Although it is common practice to transform SC data, distributions of these data were relatively normal and not improved by transformation. Thus, for statistical reasons and ease of interpretation, we did not transform these data. Six outliers in our data were adjusted closer to the mean as recommended by [Tabachnick and Fidell \(2001\)](#). Groups were compared on demographics and baseline values using independent *t* tests and Chi-square tests. Analysis of the correlation matrix of demographic, pre-condition variables, and dependent variables revealed number correct on the first anagram set and baseline SCL as highly correlated with dependent variables but poorly correlated with each other. They were included as covariates in all analyses after the manipulation check. All tests were two-tailed.

Repeated measures MANCOVA of SCL 15 s post and emotion ratings served as a manipulation check of differential response to targeted comments. Repeated measures MANCOVA with group and condition as between-subjects variables were then used to test our first two hypotheses. We had four dependent variables. SCL change after validation or invalidation (V/I) minus change after the second neutral comment (N2)<sup>2</sup> served as our measure of relative change in physiological arousal. Relative changes in self-report of arousal and comfort were similarly calculated. The number of correct anagrams on set two was the fourth dependent variable

in this MANCOVA. To test our third hypothesis, we conducted a one-way ANCOVA of comfort at each of the latter three comments (V/I, N3, N4), controlling for SCL 15 s post and self-report of arousal after each comment. To test our fourth hypothesis, we calculated partial correlations between self-report of arousal and mean SCL 15 s post after each of the last three comments by condition.

We also conducted a number of exploratory analyses. Given that the salience of comments might register differently over time in different individuals, we conducted repeated measures MANCOVA of SCL change and change in all self-report dimensions over the course of the three post-condition comments (V/I, N3, N4) minus change on each at N2. To explore potential slowing of response recovery in this population, we also conducted analyses of half-recovery time for specific skin conductance responses and mean SCL beyond 15 s following each comment. We then examined SCL 15 s post and emotion ratings over time without subtracting prior responses. Finally, to conduct exploratory analyses of effects of validation and invalidation on response times (RT) to rate emotion, we conducted a repeated measures MANCOVA of the log RT to rate each of the three components of affect, controlling for the log of the mean RT after N2 in addition to the other covariates. For exploratory analyses we report on significant univariate effects not significant at the multivariate level unless specifically stated.

### 3. Results

#### 3.1. Group characteristics and emotional response

[Table 1](#) provides basic demographic and baseline data on both BPD feature and control groups. Groups did not differ on demographic variables but were significantly different on clinical measures as intended. The BPD features group also scored significantly lower on the WAIS-III block design subtest, which according to a recent meta-analysis, may be characteristic of this clinical group ([Ruocco, 2005](#)). Initial self-reports of emotion revealed no significant group differences for arousal ( $t_{39}=0.282$ ,  $d=0.09$ ,  $P=0.780$ ), but significant differences for both valence ( $t_{39}=-3.89$ ,  $d=1.26$ ,  $P<0.001$ ) and comfort with emotion ( $t_{39}=-3.15$ ,  $d=1.02$ ,  $P=0.003$ ). The BPD features group reported being less happy and less comfortable with their emotion than controls. Groups that were later validated vs. invalidated did not differ on initial demographic, self-report, or physiological measures, including SCL 15 s post N2 (controlling for standard covariates in all but the demographic comparisons).

<sup>2</sup> We subtracted change at N2 to control for general SC responsiveness to a comment while avoiding the confound of initial orienting response associated with N1 and possible condition effects at N3 and N4.

### 3.2. Test of new methodology

The initial goal of this study was to pilot a new methodology for measuring self-report and psychophysiological response to discrete interpersonal stimuli. As Fig. 3 illustrates, we found a large and significant multivariate effect for comment ( $F_{16, 22}=3.33$ ,  $\eta_p^2=0.71$ ,  $P=0.005$ ) which was explained primarily by a peak in SCL following the target validating/invalidating comments ( $F_{4, 148}=6.12$ ,  $\eta_p^2=0.14$ ,  $P=0.001$ , Greenhouse–Geisser) and a significant drop in valence ratings over the course of all comments ( $F_{4, 148}=4.79$ ,  $\eta_p^2=0.12$ ,  $P=0.004$ , Greenhouse Geisser). The former finding suggests that the target comments were more salient than the neutral comments;<sup>3</sup> the latter that the task was at least less pleasant over time. In a questionnaire at the end of the study, 95% of participants reported being at least mildly frustrated with the second anagram task with 68% reporting feeling more than mildly frustrated.

### 3.3. Findings for specific hypotheses

#### 3.3.1. Response to invalidation in BPD features group

We hypothesized that the BPD features group would demonstrate a significantly greater increase in arousal, decrease in comfort with emotion, and lower performance on solving anagrams in response to invalidation compared to controls. There was no evidence for a significant group by condition interaction on any of these dependent variables ( $P>0.3$ ,  $\eta_p^2<0.03$  for all group and interaction effects).

#### 3.3.2. Effects of invalidation

Our second hypothesis was that invalidation, relative to validation, would elicit increased self-report and SC arousal responses and decreased performance on the anagram-solving task for all participants. We found a medium and non-significant univariate trend for greater relative SCL change after invalidation compared to validation ( $F_{1, 35}=2.76$ ,  $\eta_p^2=0.07$ ,  $P=0.105$ ).

#### 3.3.3. Effects of validation

We also hypothesized that validation, relative to invalidation, would elicit increased comfort with present affect after controlling for both self-report and physio-

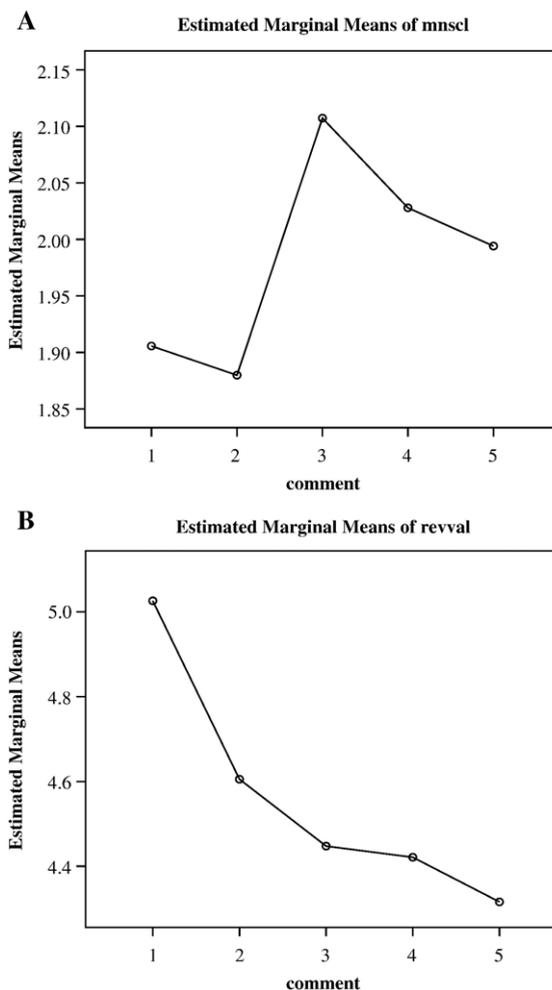


Fig. 3. Manipulation check. Note: The above graphs depict estimated marginal means for SCL (A) and self-report of valence (B), revised so that up is more positive. Comments are as follows: 1=Neutral 1, 2=Neutral 2, 3=Validation or Invalidation, 4=Neutral 3, 5=Neutral 4.

logical measurement of arousal. Increased comfort would lead to increased consistency between self-report and physiological measure of arousal. We did not find support for either of these hypotheses ( $P>0.4$  for condition effects on comfort,  $P>0.07$  for all partial correlations, mean  $r_p=0.04$  for validation, mean  $r_p=0.28$  for invalidation).

### 3.4. Exploring dimensions of emotional response over time

Given the number of variables considered in the following exploratory analyses, specific findings must be viewed with caution until replicated in a larger sample.

<sup>3</sup> Confirmation of the salience of the validating/invalidating comments was also obtained from open-ended debriefing questions. Participants recalled or commented much more readily on the validating/invalidating than the neutral comments.

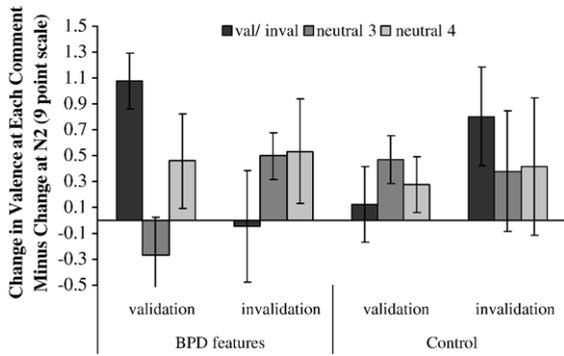


Fig. 4. Relative change in valence rating by group and condition. Note: Error bars represent standard error. There were no significant pairwise comparisons.

3.4.1. Relative change in response over the last three comments

We found no evidence that the BPD features group differed significantly in response to invalidation over time on either self-report or physiological measure of arousal. However, we did find a significant univariate condition effect for SCL change relative to change at N2 ( $F_{1, 32}=4.52, \eta_p^2=0.12, P=0.041$ ) suggesting higher SCL responsivity to invalidation than validation across groups. Interestingly, we found a significant univariate group by condition by comment effect for relative change in report of valence ( $F_{2, 64}=5.67, \eta_p^2=0.15, P=0.007$ , Greenhouse–Geisser). As can be seen in Fig. 4, the two groups reported almost opposite changes in valence in response to validation and invalidation relative to prior responses. Specifically, the BPD feature group showed the most positive initial response to validation while controls showed the most positive initial response to invalidation. Groups showed a different overall report of relative change in comfort over time as well ( $F_{2, 64}=3.61, \eta_p^2=0.10, P=0.051$ , Greenhouse–Geisser). Namely, the control group reported no overall relative change in comfort after the validating/invalidating comment and a relative increase in comfort over each of the last two comments. In

contrast, the BPD feature group showed the greatest relative increase in comfort immediately after the validating/invalidating comment, a relative drop after

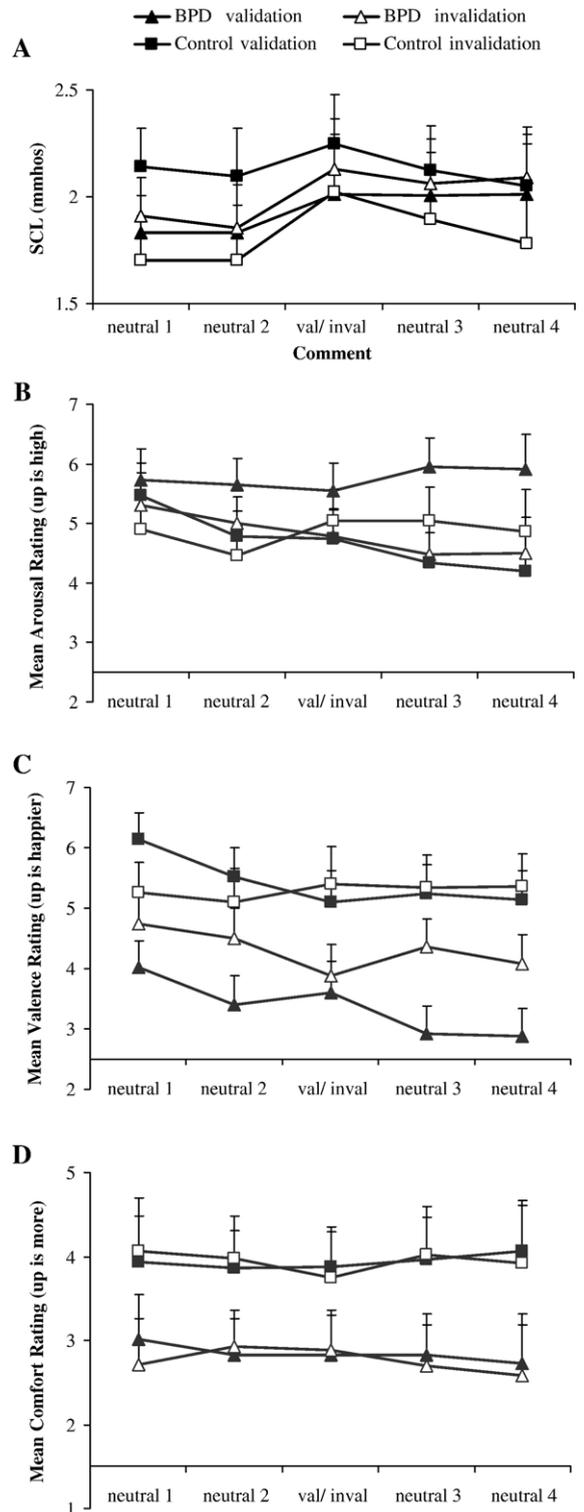


Fig. 5. Mean SCL and self-report of emotions following all five comments. Note: The graphs depict estimated marginal means for mean SCL (A), ratings of arousal (B) and valence (C) on the 9-point Self-Assessment Manikin (SAM) system, and comfort (D) on a 5-point scale. Number correct on anagram Set 1 and baseline SCL were included as covariates. Error bars represent standard error and are provided in one direction only for ease of distinguishing degree of error across groups and conditions.

the third neutral comment, and an increase again after the fourth neutral comment.

### 3.4.2. Skin conductance response recovery over time

We analyzed both half-recovery time and mean SCL beyond 15 s after each comment to explore evidence for slow return to baseline in the BPD features group. Our skin conductance data yielded no evidence to support this proposed component of emotional vulnerability ( $P > 0.05$  in all analyses).

### 3.4.3. Dimensions of self-report of emotion over time

As can be seen in Fig. 5, the BPD features group reported feeling significantly less positive and less comfortable with their emotions across comments in spite of no significant differences in self-report of arousal (significant multivariate group effect, univariate effects for valence:  $F_{1, 32} = 11.81$ ,  $\eta_p^2 = 0.27$ ,  $P = 0.002$ , comfort:  $F_{1, 32} = 12.19$ ,  $\eta_p^2 = 0.28$ ,  $P = 0.001$ , arousal:  $F_{1, 32} = 1.37$ ,  $\eta_p^2 = 0.04$ ,  $P = 0.250$ ). Interestingly, comfort and valence ratings were significantly correlated across all five comments ( $r = 0.53$  to  $0.62$ ,  $P < 0.001$ ) but neither was significantly correlated with self-report of arousal or SCL. In fact, the significant between-group differences in comfort at each comment remained significant after controlling for both self-report of arousal and mean SCL but not after controlling for valence.

### 3.4.4. Response time to rate emotions over the last three comments

To the extent that increased discomfort with emotion increases the time to rate it, we expected that participants who were invalidated would take longer to rate their emotion. We did find significant support for this potentially implicit response at the univariate level for immediate rating of valence ( $F_{1, 34} = 6.43$ ,  $\eta_p^2 = 0.16$ ,  $P = 0.016$ ). Response time for rating comfort was more complicated. As Fig. 6 illustrates, only controls took significantly longer to rate comfort with emotion immediately after being invalidated relative to being validated ( $F_{1, 13} = 5.14$ ,  $\eta_p^2 = 0.283$ ,  $P = 0.041$ ). Over time, groups demonstrated opposite patterns of response according to whether they were validated or invalidated ( $F_{2, 62} = 7.26$ ,  $\eta_p^2 = 0.190$ ,  $P = 0.001$ , also significant at the multivariate level and for each group separately). The invalidated controls and the validated BPD features group showed a relative decrease in time to rate comfort over time ( $F_{2, 8} = 2.63$ ,  $\eta_p^2 = 0.397$ ,  $P = 0.132$ ,  $F_{2, 12} = 8.21$ ,  $\eta_p^2 = 0.578$ ,  $P = 0.006$ , respectively), while the validated controls and invalidated BPD features group showed small, nonsignificant increases ( $F_{2, 12} = 0.13$ ,

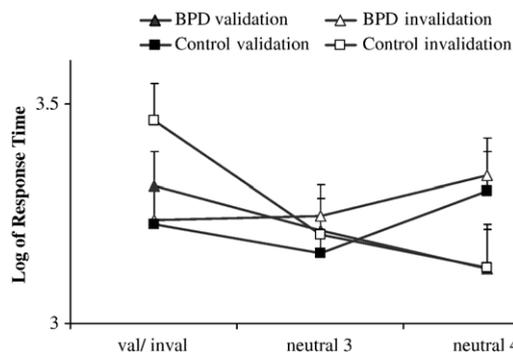


Fig. 6. Log of response time for rating comfort over the last three comments. Note: Error bars represent standard error for estimated marginal means, covarying log of mean response time (RT) after the second neutral comment. The only significant pairwise comparisons were between conditions for the control group immediately after the validating/invalidating comments and between responses after invalidation and neutral 4 for the invalidated BPD features group.

$\eta_p^2 = 0.022$ ,  $P = 0.877$ ,  $F_{2, 12} = 1.42$ ,  $\eta_p^2 = 0.191$ ,  $P = 0.280$ , respectively).

## 4. Discussion

The initial aim of this study was to pilot test a new experimental methodology for analyzing self-report and physiological response to discrete interpersonal stimuli. Target comments did elicit differential responses in participants suggesting this as a promising multimodal approach to measuring response to interpersonal stimuli within a well-controlled laboratory setting. The subsequent aim was to test whether individuals with features of BPD would show differential responsivity to invalidation relative to validation and relative to controls. Our analogue sample demonstrated no subjective or physiological evidence of hyperarousal in response to these particular stimuli as predicted. However, preliminary support for a basic sensitivity to invalidation in this population was evident in exploratory analyses. These suggested a relatively more negative initial response to invalidation when compared to validation and to controls. Somewhat surprisingly, controls responded relatively more positively to invalidation than validation immediately after these comments. While the size of our sample prohibited analyses based on interpretations, future research would do well to carefully assess the role of interpretations in responses to validating and invalidating comments.

The consistency of our lack of findings for heightened SC response with those of prior studies (e.g., [Herpertz et al., 1999](#)) might suggest that

hyperarousal, at least as measured by skin conductance and common self-report measures, is indeed not characteristic of individuals with features of BPD. More sensitive measures of activation, such as neuroimaging, may be necessary for understanding affective intensity and response to invalidation in this population. It is, of course, still possible that more salient interpersonal stimuli are needed to elicit hyperarousal. Invalidation did elicit a non-significant increase in physiological arousal over time; this effect was just not specific to individuals with features of BPD. The challenge in the laboratory is to increase salience while maintaining standardization.

However, the most striking finding in this study was that valence differentiated individuals with features of BPD from controls better than either psychophysiological measure or self-report of arousal. In spite of a lack of difference in arousal, the BPD features group reported being significantly less happy or emotionally comfortable across time and condition than controls. In fact, comfort with emotion appeared to be directly related to happiness and not arousal. The one prior study in which self-report ratings are discussed for both valence and arousal in a BPD sample also found a significant group effect for valence but not arousal (Herpertz et al., 1999). Not surprisingly, perhaps, the subjects with BPD rated both pleasant and neutral slides as less pleasant than comparison subjects did.

A recent discussion of the proposed mechanisms of DBT repeatedly identified the reduction of arousal not only as a goal but as a presumed mechanism of several strategies, in particular, validation (Lynch et al., 2006). In fact, while “negative emotional arousal” was identified as the target, change was proposed through reduction of arousal alone. While this may be a somewhat semantic issue, given that arousal is equated with intensity in both clinical and psychophysiological research (e.g., Lang et al., 1998; Schnell and Herpertz, 2007), it does highlight a potential discrepancy in clinician and client perceptions. Self-report measures of affective intensity typically do not distinguish between valence and arousal, the two commonly accepted dimensions of emotion. For instance, measures of “aversive tension,” incorporate both negative experience and arousal (e.g., Stiglmayr et al., 2005). To the extent that individuals with BPD or BPD features endorse more intensely negative but not more arousing affective experience, emphasis in clinical language may need to shift to reducing negativity and subjective intensity rather than arousal, *per se*.

It may also be helpful to consider negativity in the context of the behavioral patterns unique to BPD.

Biological and family studies suggest that the combination of impulsivity and affective instability may directly contribute to the development of BPD (e.g., Silverman et al., 1991; Koenigsberg et al., 2002). Behavioral dyscontrol (self-injury, suicide attempts, substance abuse), often considered a misguided attempt to reduce arousal (e.g., Haines et al., 1995), may in fact be the result of impulsive mismanagement of primarily *negative* affect, consistent with the self-reports of those engaging in such behaviors (Nock and Prinstein, 2004, 2005).

This might also shed light on the differential group by condition effects for a presumably implicit measure: response time for rating comfort. Contrary to expectations, the control group rather than the BPD features group took longer to rate comfort with emotion immediately after being invalidated relative to being validated. Although it is impossible to truly interpret this effect with such limited data, if the control response represents a more normative response to invalidation, it is possible that extra time reflects a comfort or willingness to clarify one’s actual emotion in the context of mildly critical outside feedback. The BPD feature group’s relatively faster rating of comfort after invalidation might then reflect impulsivity in this context, with the expected effects of validation and invalidation appearing only over time for this group.

A few limitations warrant noting in considering the implications of this study. First, this was a preliminary study to explore a new methodology. Results need to be tested with a larger sample. Second, participants were grouped by a self-report questionnaire and not a structured clinical interview. A sample meeting full criteria for BPD might demonstrate different response patterns. However, as BOR *T* scores were not significantly correlated with SCL or SC change variables, this seems unlikely. Third, our psychophysiological findings may have been influenced by psychiatric or other medications. We found no significant correlation between any medication variables and our primary dependent variables. The only significant pre-condition difference based on psychiatric medication status in the BPD feature group was for OMNI-IV BOR *T* score (medicated mean 81.4, S.D.=4.3, non-medicated mean 74.1, S.D.=6.5). Although all of the BPD feature group on psychiatric medications were invalidated, OMNI-IV BOR *T* scores did not differ significantly between subgroups later validated vs. invalidated. Considering these factors, we do not believe medication had a significant influence on our results. Finally, only one psychophysiological measure of emotion was used. With often poor characterization of intensity, activation, and arousal across psychopathology and psychophysiological

literatures, a more sophisticated combination of psychophysiological measures, including cardiac, electromyographic, EEG, and neuroimaging may be important in understanding the full physiological response to these stimuli and how this response corresponds to behavioral indicators of emotional intensity in this population.

Given the significance of interpersonal relationships in the experience and behavioral profile characteristic of BPD, this study suggests new methodological directions for understanding dimensions of affective instability in this complex disorder. With the right mood induction task, response to standardized (but apparently personalized) interpersonal comments could be measured using functional neuroimaging, similar to methodology used by Hooley et al. (2005) and affording a possibly more sensitive measure of activation or arousal. Finally, it will be important to consider the possibility that behavioral response learning within the context of impulsivity and intense negativity may explain the affective and interpersonal volatility characteristic of this population better than intrinsic differences in arousal response. Treatments of individuals with BPD and BPD traits may do well to increase emphasis on managing and altering extremely negative emotion. Validation may indeed be promising to this end.

## Acknowledgement

We would like to acknowledge the generous consultation and contributions of Wendy Berry Mendes, Avgusta Shestyuk, Pearl Chiu, Jill Hooley, Shelley Carson, Courtney Wiener, Beatriz MacDonald, Etienne Roesch, Christen Deveney, Andrea Miller, and Julie Edmunds. Financial support for this study was provided by the Sackler Scholar Programme in Psychobiology, a Karen Stone Fellowship, Harvard Restricted Funds, and the Ditmars Fund.

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