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Evaluating the Effect of Interpersonal Responding on Emotional Sensitivity and Reactivity in Borderline Personality Disorder

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by

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Abstract

Major theoretical models of the development and maintenance of borderline personality disorder (BPD) contend that difficulties with affect regulation is the key features of BPD. These models suggest that chronic problems with affect regulation develop through a transaction between individual vulnerabilities, including emotional sensitivity and reactivity, and invalidating interpersonal environments. In addition, these models suggest the proximal interpersonal factors may influence emotional sensitivity and reactivity in BPD. However, the research on emotional responding in BPD has not directly examined the impact of interpersonal responses on emotional sensitivity or reactivity. The primary aim of the current study was to examine the effect of validating and invalidating experimental conditions on emotional sensitivity and emotional reactivity with a sample of individuals with a range of borderline personality disorder (BPD) features. A sample of 130 individuals with a range of BPD features were randomly assigned to receiving either validating or invalidating interpersonal feedback about their emotional experiences while completing a stressful mental arithmetic task. Participants reported their emotional arousal throughout the task, and then completed a morphing facial affect task, which provided a behavioral measure of emotional sensitivity. Results indicated that although BPD features did not predict emotional sensitivity within the validation condition, participants with greater BPD features had longer response latencies (slower responses) for identifying emotions within the invalidation condition. Individuals with greater BPD features also demonstrated greater emotional reactivity in both the validating and invalidation conditions. Overall, this study provides general support for Linehan's biopsychosocial theory of BPD. In

addition, emotional sensitivity in BPD does not appear to be a static feature of BPD, but rather appears to be context dependent, with invalidating (but not validating) interpersonal feedback resulting in delayed recognition of emotional stimuli.

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Introduction

Borderline Personality Disorder and Emotional Responding

Borderline personality disorder (BPD) is a disorder characterized by pervasive patterns of chaotic interpersonal relationships, an unstable sense of self, affective instability, and impulsive behaviors such as self-injury and suicidal behavior. Individuals diagnosed with BPD present a substantial public health problem, and individuals with BPD are among the largest consumers of mental health resources, constituting 20% of psychiatric inpatients and 10% of patients utilizing out-patient mental health clinics (APA, 1994). In addition, it is estimated that BPD has a lifetime mortality rate by suicide of 10%, which is 50 times higher than the suicide rate in the general population (Skodol, Gunderson, Pfohl, Widiger, Livesley, & Siever, 2002).

Virtually all major theories of BPD contend that failure of affect regulation is a core feature of BPD (Fonagy & Bateman, 2008). Varied approaches to the conceptualization of BPD such as Mentalization-Based Treatment (MBT; Fonagy & Bateman, 2006), Dialectical Behavior Therapy (DBT; Linehan, 1993), and Schema-Focused Therapy (SFT; Young, 1994) all contend that BPD is characterized by difficulties with emotion regulation. Emotion regulation can be defined as the process of influencing which emotions one experiences, when those emotions are experienced, and how emotions are experienced and expressed (Gross, 1998). In addition, most conceptualizations of emotion regulation include that self-management and goal directed behavior is maintained even in the presence of intense negative emotional arousal (Gratz & Roemer, 2004). In this respect emotion regulation is not simply the absence or reduction of negative emotion. Emotion regulation requires two paradoxical strategies:

(1) the ability to experience, identify, and label discrete emotions; and (2) the ability to modulation emotions (Linehan, 1993; McMain, Korman, & Dimeff, 2001).

Emotion dysregulation can be defined as a state of emotional arousal that is sufficiently high to disrupt cognitive and behavioral self-management (Fruzzetti, Shenk, & Hoffman, 2005). This is not the same as simply experiencing an intense emotion or being upset. Emotion dysregulation requires that some aspect of goal-directed behavior or self-control is inhibited, and typically includes intense negative emotional arousal, difficulty shifting attention away from negative emotional stimuli, cognitive distortions, inability to control impulsive or "escape" behaviors, and difficulty organizing behavior in a manner consistent with long-term goals (Fruzzetti et al., 2009). Emotion dysregulation is not considered a "symptom" of BPD, but rather is the core feature of BPD (Fruzzetti et al., 2005). The symptoms of BPD, then, are both maladaptive attempts to modulate emotional experiences, such as suicidal behavior, and the consequences of dysregulated behavior, such as chaotic interpersonal relationships.

Although most people will experience emotion dysregulation intermittently in their lives, BPD is characterized by *chronic and pervasive* emotion dysregulation (Linehan, 1993). Theories of the development of BPD features, including emotion dysregulation, contend that such difficulties develop through a combination of *both physiological and interpersonal factors*. For example, MBT contends that both constitutional vulnerabilities, such as a hard-to-manage temperaments, and environmental conditions, including parental invalidation, combine to create vulnerabilities to BPD (Fonagy & Bateman, 2008). In this theory, abilities to regulate emotion develop through accurate mirroring of emotion by an attachment figure. Parental neglect or emotional

under-involvement, both forms of invalidation, combined with genetic vulnerabilities, result in diminished abilities to regulate emotions.

Linehan and colleagues (Fruzzetti et al., 2005; Linehan, 1993;Linehan et al., 2007) have described a transactional theory for the development and maintenance of pervasive emotion dysregulation. BPD is proposed to develop as a result of the ongoing, mutually exacerbating transactions between emotional vulnerabilities and invalidating responses. Emotional vulnerabilities include: (1) heightened sensitivity to emotionally-relevant stimuli (a low threshold for the recognition or discrimination of emotional stimuli), (2) higher reactivity after emotional stimuli have been perceived (high intensity of emotional responses), and (3) a slow return to a baseline level of emotional arousal following activation (long duration of emotional responses; Linehan, 1993). Although emotional vulnerabilities may be partly biologically based, they are exacerbated through repeated exposure to an invalidating environment (Wagner & Linehan, 1999). An invalidating social "environment" is one in which the valid needs, experiences, and behaviors of an individual are not understood and are instead pervasively invalidated by criticism, inattention, punishment, dismissal, blaming, or unresponsiveness, or otherwise erratic, extreme, aversive, or socially and developmentally inappropriate responses (Fruzzetti et al., 2009). It is important to note that invalidation and validation are distinct from "negative" and "positive" responding. Invalidating responses can include a variety of behaviors, such as "fragilizing" (validating and supporting dysfunctional behaviors, which can be warm and have benign intent). Similarly, validating responses could include "invalidating the invalid," perhaps through withdrawing support for ineffective or

inappropriate behaviors or otherwise failing to support dysfunctional behaviors while supporting functional alternatives.

Figure 1 illustrates the transaction between emotional vulnerabilities and invalidation (Fruzzetti et al., 2005). Emotional vulnerabilities (sensitivity, reactivity, and slow return to baseline) lead to heightened emotional arousal (when prompted by some event). Heightened emotional arousal in turn leads to inaccurate expression, including mislabeling emotional experiences and other "out of control" behaviors (such as self-injury). Inaccurate expression is usually followed by an invalidating response ("You have nothing to be upset about," or "You're overreacting"), which in turn leads to increased emotional arousal. This cycle continues to perpetuate itself because chronic invalidating responses contribute to increased emotional sensitivity, emotional reactivity, and longer duration of emotional responses (high emotional vulnerability), and these vulnerabilities contribute to the increased likelihood of invalidation. The transactional nature of this model describes the development and maintenance of BPD. As a transaction, all components of this model reciprocally influence one another. In other words, vulnerable individuals become more vulnerable, and invalidating environments become more invalidating over time. Thus, pervasive emotion dysregulation develops through the transaction between emotional vulnerabilities and invalidating environments.

Research on Emotional Responding and Borderline Personality Disorder

Despite the agreement about the role of emotion dysregulation in BPD, research has not demonstrated this definitively. In addition, no research has examined the influence of initial emotional arousal or proximal interpersonal factors, including validating and invalidating feedback, on emotional responding in BPD, despite the

importance of such factors in major theories of BPD. For example, MBT contends that mentalizing (the capacity to make sense of the self and others) becomes unstable in the context of close relationships and during periods of emotional arousal (Fonagy & Bateman, 2008). Similarly, Wagner and Linehan (1999) suggest that emotional sensitivity in BPD may be influenced by current emotional state. Despite the importance of interpersonal factors in these theories, the current research has focused exclusively on one of the three emotional vulnerabilities believed to be present in BPD (emotional sensitivity, emotional reactivity, or long-duration of emotional responses) without attending to interpersonal factors or initial levels of emotional arousal. This research has produced varied results, which are summarized below.

Research on emotional sensitivity. Individuals who have enhanced emotional sensitivity have a lower threshold for detecting emotional stimuli, and should therefore demonstrate faster or more accurate to identification of emotional stimuli. The primary method for studying emotional sensitivity is to examine the ability to perceive emotions expressed by others, either through facial expression or prosody (vocal expression). To date six studies have examined abilities to recognize emotions expressed by others in individuals with BPD and have come to varied conclusions.

Levine, Marziali, and Hood (1997) examined accurate identification of emotions using "fully expressed" facial stimuli (pictures of faces showing a discrete, unambiguous emotion at 100% expression). They found that individuals with BPD were significantly less accurate at identifying facial expressions than individuals without BPD. Research by Bland, Williams, Scharer, & Manning (2004) also examined emotion identification using

fully-expressed facial stimuli and also found that individuals with BPD were less accurate at identifying facial expressions than individuals without this diagnosis.

In contrast, Wagner and Linehan (1999) found that individuals with BPD were actually more accurate at identifying facial expressions using fully expressed facial stimuli, as compared to individuals with a history of child sexual abuse (but no BPD diagnosis) and compared to individuals without child sexual abuse or a BPD diagnosis. Research by Lynch, Rosenthal, Kosson, Cheavens, Lejuez, & Blair (2006) also concluded that individuals with BPD have enhanced emotional sensitivity. Lynch et al. (2006) employed the use of morphing stimuli, which used facial expressions that gradually morphed from a neutral expression to a fully expressed face. This technique allows for the assessment of both accuracy of identification and speed of identification. This study found that individuals with BPD accurately identified facial expressions faster (at lower levels of expression) than individuals without BPD.

Minzenberg, Poole, and Vinogradov (2006) assessed emotional sensitivity using fully expressed facial stimuli, prosodic (vocal) expression, and a combination of the two in video vignettes. They concluded that although there were no differences between individuals with BPD and those without BPD for the fully expressed stimuli or prosodic expression, individuals with BPD were significantly less accurate at identifying emotions accurately in video vignettes. Domes, Czieschnek, Weidler, Berger, Fast, and Herpetz (2008) used both morphing facial stimuli and "ambiguous" or blended pictures of emotional expressions. They found no differences between individuals with BPD and those without BPD on identifying facial expressions using the morphing stimuli, and

concluded that individuals with BPD showed a bias toward anger when identifying ambiguous stimuli.

In sum, the research on emotional sensitivity in borderline personality disorder is varied. While some research indicates that individuals with BPD are actually more sensitive at identifying emotions, other studies conclude that they are less sensitive or that there are no differences between individuals with a diagnosis of BPD and those without this diagnosis. In addition, none of these research paradigms have examined the influence of emotional sensitivity with respect to initial levels of emotional arousal or interpersonal factors.

Research on emotional reactivity. Individuals who have enhanced emotional reactivity have greater intensity emotional responses. Emotional reactivity, or the intensity of emotional responses, has been studied through four primary methods: self-report measures, behavioral measures, physiological measures, and neuroimaging. Data from self-report studies indicates that individuals with BPD do experience greater affective instability and report enhanced affective intensity and reactivity (see Rosenthal, Gratz, Kosson, Cheavens, Lejuez, & Lynch, 2008 for a review). These data are consistent with expectations given the biosocial theory, which contends that individuals with BPD experience greater emotional reactivity, and which may in turn lead to greater affective instability.

Results from studies examining behavioral and physiological responding to emotional stimuli in individuals with BPD are less clear. Renneberg, Heyn, Gebhard, and Bachmann (2005) examined facial expressiveness in individuals with BPD compared to individuals with depression and individuals without either diagnosis. Individuals with

BPD showed reduced levels of facial expressiveness that were comparable to individuals with depression while watching positive and negative film segments. Both individuals with BPD and individuals with depression showed significantly less facial expressiveness than individuals without these diagnoses.

Herpertz, Kunert, Schwenger, and Sass (1999) conducted the first examination of physiological responses to emotional stimuli in individuals with BPD. This study compared 24 individuals with BPD to 27 healthy controls on self-report measures of arousal, skin conductance, heart rate, and startle response while viewing neutral, positive, and negative images. They found that individuals with BPD did not differ from the healthy controls on self-report measures, startle response, or heart rate. However, individuals with BPD did show lower levels of skin conductance, which could be indicative of less emotional arousal. In a second study, Herpertz et al. (2001a) compared physiological reactions of 25 individuals identified as psychopaths, 18 individuals with BPD and 24 control participants while viewing neutral, positive, and negative images. Results indicate that individuals with BPD did not differ significantly from the control participants, although individuals with BPD did show decreased levels of facial expression. Ebner-Preimer et al. (2005) examined physiological responses to a startling tone in 21 individuals with BPD compared to 21 healthy controls. Contrary to the findings of Herpertz et al. (1999, 2001a), this study found that the individuals with BPD had a greater startle response than individuals without this diagnosis.

Results from two neuroimaging studies are more consistent with the biosocial theory's contention that individuals with BPD have greater emotional reactivity. Herpertz et al. (2001b) examined fMRI results in response to neutral and aversive slides

for 6 individuals with BPD and 6 healthy controls. Results indicated that individuals with BPD showed greater amygdala activation in response. Similar results were found in a study conducted by Donegan et al. (2003) which compared fMRI results for 15 individuals with BPD to 15 healthy controls. Individuals with BPD evidenced heightened amygdala activity when viewing images of neutral, happy, sad, and fearful facial expressions, while control subjects did not show heightened amygdala activation in response to these images. Herpertz et al. (2001b) suggest that the enhanced amygdala activity provides evidence for enhanced emotional reactivity, as the amygdala is believed to play a role in mediating emotional responses.

Thus, the research on emotional reactivity in BPD is mixed. Self-report measures and neuroimaging results tend to support the notion that individuals with BPD experience greater emotional reactivity. However, physiological data indicates that individuals with BPD either have similar or decreased levels of emotional reactivity compared to individuals without this diagnosis.

Research on the duration of emotional responses. Individuals with long-duration emotional responses have a relatively slow return to baseline levels of emotional arousal. At this time there is little research examining this component of emotional responding within individuals with features of BPD. Research by Stiglmayr, Grathwol, Linehan, Ihorst, Fahrenberg, and Bohus (2005) compared levels of "aversive tension," or aversive emotional arousal, in 63 individuals with BPD to 40 healthy controls. Using a hand-held computer, participants were asked to track states of aversive tension every hour for two days. Not only did individuals with BPD report more frequent and more intense aversive

tension, individuals with BPD also reported that states of aversive tension had a longer duration.

Research on Proximal Interpersonal Factors and Emotional Responses

Shenk and Fruzzetti (in press) examined emotional responding following the receipt of validating and invalidating feedback within a heterogeneous college-student sample. Seventy participants were randomly assigned to either receive validating or invalidating feedback following engaging in a stressful mental arithmetic task. Physiological data including heart rate, respiration rate, and skin conductance level was collected throughout the task and participants were asked to provide a self-report of emotional arousal. Results indicated that validating feedback reliably led to decreased emotional arousal, as indicated by both reductions in physiological data and self-report of emotional arousal. In contrast, invalidating feedback resulted in participants maintaining high emotional arousal, indicated both by the physiological data and self-reports of emotional arousal. In summary, these data suggest that proximal interpersonal factors, in this case validating or invalidating feedback, have a significant impact on emotional reactivity in a heterogeneous population. This has not been demonstrated in individuals with features of BPD, nor has emotional sensitivity or duration of emotional responses been examined within the context of interpersonal factors.

Current Research: Emotional Responding in BPD within the Context of Interpersonal Factors

Although the current research on emotional responding in BPD has made important contributions to our understanding of the emotion process in BPD the results from these studies are limited. The significant limitation with the existing research is that

it has focused exclusively on emotional vulnerabilities (emotional sensitivity, emotional reactivity, and extended duration of emotional responses) as independent from one another and from interpersonal factors such as validating and invalidating responses from others. These designs fail to take into account the interrelated nature of emotional vulnerabilities and interpersonal factors emotional processing in BPD. Although more distal interpersonal factors have been studied (e.g., history of sexual abuse), more proximal interpersonal factors have not. Theories of emotional responding in BPD maintain that emotional processing in BPD includes both emotional vulnerabilities *and* interpersonal factors. Therefore, examining any piece of emotional responding in BPD (such as emotional sensitivity) without examining other components of emotional processing (such as interpersonal factors) is incomplete.

The current research examined experimentally the impact of BPD features and validating and invalidating social feedback on emotional sensitivity, emotional reactivity, and duration of emotional responses. Individuals were randomly assigned to receive either validating or invalidating feedback while engaging in a stressful task. All participants were assessed on measures of emotional sensitivity (using a behavioral measure assessing identification of emotional expression), emotional reactivity and duration of emotional responses (using a reliable self-report measure).

The utilization of BPD features as a continuous variable, as opposed to only including individuals with a formal diagnosis of BPD, has both pros and cons. It is possible that individuals with strong BPD features may differ in some ways from individuals who meet full diagnostic criteria for a formal BPD diagnoses on measures of emotional reactivity and sensitivity. However, treatment for BPD (including DBT) is

frequently warranted for individuals with strong BPD features, even if full diagnostic criteria are not met, and the measure employed in the current research is designed to identify individuals with clinically significant BPD features. Indeed, most current ways of understanding the phenomena related to BPD conceptualize this set of problems on a continuum, rather than diagnostically. In fact, the BPD diagnosis itself has rather low reliability. Therefore, the current research utilized a continuous measure of BPD features both because this is consistent with current paradigms and because this approach is likely to enhance the clinical utility of the results. In addition, the proposed research required a relatively large sample size and this method enhanced recruitment abilities by reducing participant burden (participants were not required to complete lengthy diagnostic interviews).

The primary hypotheses of the current study are: 1) BPD features will predict emotional sensitivity; 2) emotional sensitivity will differ between participants in the validating and invalidating conditions; 3) there will be an interaction effect on emotional sensitivity for BPD features and condition (validation or invalidation); 4) BPD features will predict emotional reactivity, with higher BPD features predicting greater emotional reactivity; 5) participants in the invalidating condition will demonstrate greater emotional reactivity compared to the participants in the validating condition; and 6) emotional arousal will mediate the relationship between condition (validation or invalidation) and emotional sensitivity.

Methods

Participants

Participants were 130 undergraduate students at a large university and a community college located in the Western United States. Recruitment was conducted through announcements in courses, through flyer postings, and through a web-based participant pool. Inclusion criteria included a minimum age of 18 years and fluency in written and spoken English; exclusion criteria included current psychosis (as determined by a *T* score $\geq$ 63 on the psychoticism subscale of the BSI) or a self-report from the participant that he or she was highly proficient in mathematics (as this may have influenced participants' responses to validating or invalidating feedback). If eligible, participants received course credit for completing the screening phase of the experiment. All participants received a $20.00 gift card to a location of their choice for participation in the laboratory phase.

A total of 773 participants were screened to form the final sample size of 130, with 65 participants in the validating condition and 65 participants in the invalidating condition. To ensure a representative distribution of BPD features, the final sample was distributed evenly (25% each) across "very low," "low," "medium," and "high" score groups on a well-established measure of BPD features (M = 26.35, SD = 13.48, range 6-60; quartile cut-offs were based on the natural distribution of scores and clinical cut-offs; cf. Trull, 1995; 2001). Participants had a mean age of 21 years (SD = 5.53; range 18-57 years). The final sample was 63% White/Caucasian, 12% Asian/Pacific Islander, 10% Hispanic/Latino, 4% Black/African American, 3% Native American, and 8% other ethnicity, roughly representing the local student population. There were 92 females and

36 males who completed the study. There were no significant differences on any demographic or baseline measures between experimental conditions. See Table 1 for a complete list of demographic and baseline variables by experimental condition.

Measures

Demographic Questionnaire. This measure was designed by the experimenters and has been used in several research protocols. It assesses general demographic information, including age, gender, race/ethnicity, and fluency in English. In addition, the demographics questionnaire contains a mathematics proficiency question. This is a self-report assessment of the participants' own perception of his or her proficiency in mathematics. Participants were asked to rate their proficiency in mathematics on a 7-point Likert-type scale. Participants who rated themselves a "7" in math proficiency were excluded from the study, as this may have impacted the experimental manipulation. The demographics questionnaire also assessed for psychotropic medication use. Participants were asked to list any psychotropic medications they taking at the time of screening. Although participants were not excluded based on medication use, medication use may have influenced emotional responding and therefore was examined in statistical analysis. The demographic questionnaire was administered during participant screening.

Personality Assessment Inventory – Borderline Features Scale. The Personality Assessment Inventory-Borderline (PAI-BOR; Morey, 1991) is an assessment of BPD features. The PAI-BOR has strong psychometric properties, including good test-retest reliability over one-month ($r = .90$) and high internal consistency ($\alpha = .92$; Chapman & Rosenthal, 2007). In addition, the PAI-BOR has been used in several studies of BPD features among undergraduates (Chapman & Rosenthal, 2007; Trull, 1995; 2001).

Although the PAI-BOR does not provide a clinical diagnosis of BPD, it has been shown to differentiate between individuals with and without diagnoses of BPD with 73-80% accuracy (Bell-Pringle, Prate, & Brown, 1997; Stein, Pinkser-Aspen, & Hilsenroth, 2007). In addition, Trull (1995) found that individuals scoring ≥38 had significantly higher rates of BPD symptom endorsement than individuals scoring below 38. To ensure that the final sample of participants covered the full spectrum of scores on the PAI-BOR, 25 % of participants had scores ≥38 ("high"), 25% had a score ≤37 and ≥24 ("medium"), 25% had a score ≤23 and ≥26 ("low"), and 25% had a score of ≤15 ("very low"). These quartiles were established based on the natural distribution of scores on the PAI-BOR and the clinically relevant cut-offs for "high" and "low" scores established by Chapman et al. (2007) and Trull (2001). The PAI-BOR was administered during participant screening.

Brief Symptom Inventory. The Brief Symptom Inventory (BSI; Derogatis, 1993) is an assessment of general psychiatric symptoms. The BSI has strong psychometric properties, including strong internal consistency (α = .71-.85) and good test-retest reliability (r = .80-.90; Derogatis, 1993). Participants who score above the clinical cut-off on the "psychoticism" subscale ($T \geq 63$) were excluded from this study, as psychosis has been demonstrated to impact abilities to recognize facial expressions (cut-off from Derogatis, 1993). The BSI was administered during participant screening.

Positive and Negative Affect Schedule. The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellgen, 1988) is a twenty-item measure which assesses an individual's perception of which emotions he or she is currently experiencing as well as how intensely these emotions are experienced. The PANAS takes

approximately 1 minute to complete and is used as a repeated measure of changes in emotional experiencing. Reliability of the PANAS in a large non-clinical sample indicates strong internal consistency in both the positive affect scale (Cronbach's $\alpha = .89$) as well as for the negative affect scale (Cronbach's $\alpha = .85$). In addition, the PANAS has good concurrent validity with measures of depression and anxiety (Crawford & Henry, 2004). The PANAS was administered five separate times: 1) "baseline" assessment; 2-4) following the receipt of validating and invalidating feedback; and 5) immediately following the morphing facial affect task.

Morphing Facial Affect Task. Emotional sensitivity was assessed using a behavioral challenge-task designed to assess abilities to identify facial expressions modeled after that used by Blair et al. (2001) and Lynch et al. (2006). This methodology was selected as it allows an assessment of abilities to detect facial expressions at varying levels of expression. "Sensitivity," then, can be accurately measured as the threshold at which emotional stimuli can be accurately detected (latency), as well as accuracy of emotion identification at 100% expression.

The morphing facial stimuli consist of facial expressions that are gradually morphed over 39 stages from neutral faces to faces at 100% expression (one of six emotions: sadness, fear, anger, surprise, disgust, and happiness). The morphing stimuli used in this study was developed using the Pictures of Facial Affect (Ekman & Friesen, 1976). Participants viewed 36 trials (6 for each emotion), with each trial presented for 17.55 seconds. Participants were asked to identify the emotion as soon as they were able by clicking the mouse on a box with the emotion name. Participants were allowed to "change their mind" as often as they liked, and were asked to give a "final answer" when

the face was at 100% expression. The morphing facial affect recognition task was administered immediately following the experimental manipulation.

Validating and Invalidating Behavior Coding Scale. The experimental conditions (validating and invalidating feedback) were rated through the use of the Validating and Invalidating Behavior Coding Scale (VIBCS; Fruzzetti & Shenk, 2009). This manipulation check ensured that participants assigned to the validating condition received consistently validating feedback and participants assigned to the invalidating condition receive consistently invalidating feedback. All validating and invalidating feedback was video-recorded (part of subject consent). The experimenter (delivering the feedback) was rated by trained coders using the VIBCS. All coders were blind to the participant's assignment to experimental condition. Previous use of this coding system (Shenk & Fruzzetti, in press) indicates good inter-rater reliability (intraclass correlation coefficient $r = .74$).

Procedures

Overview of procedures. The procedures are presented in Table 2. These steps are described in further detail below.

Invitation for continued participation. Upon completion of the screening measures through a web-based recruitment site participants were asked if they were willing to be contacted to participate in a second part of the study. Participants who met the inclusion/exclusion criteria (described above) and who indicated willingness to participate were contacted and invited to participate in the remainder of the study in the laboratory, which examined emotional responses and facial recognition abilities following a stressful math task. Because awareness of the validating and invalidating

experimental conditions could interfere with natural responses in these conditions, the study design necessitated incomplete disclosure. Appropriate measures were taken to minimize any discomfort that may have resulted, and all participants were fully debriefed after they completed the study.

Randomization procedure. All participants in the second part of the study were randomly assigned to either a validating or invalidating experimental condition immediately prior to their scheduled participation time. Randomization was conducted by a research coordinator and the experimenters (those delivering the validating and invalidating feedback) were blind to the participant's score on the PAI-BOR. Both sex (male or female) and BPD features ("very low," "low," "medium," and "high") were included as blocking factors in the randomization. Sex was included as a blocking factors because sex differences have been observed in experiments using mental arithmetic (e.g., Keltikangas-Jaorvinen & Heponiemi, 2004).

Random assignment with a yoked design was used to ensure equal numbers of males and females and equal numbers of individuals "very low," "low," "medium" and "high" on BPD features in each condition. For example, a computer-generated random number (even or odd) was used to assign the first female participant who was "high" on BPD features to experimental condition. The next female participant "high" on BPD features was automatically assigned to the other experimental condition. A subsequent random number determined the assignment of the third female participant "high" on BPD features, and the fourth was automatically assigned to the other experimental condition, etc. This same procedure was used for females who were "very low," "low," and "medium" on BPD features, and for males who were "very low," "low," "medium" and

'high" on BPD features. This ensured that the final experimental conditions contained equal numbers of males and females and equal numbers of participants across the distribution of BPD features, therefore reducing bias.

Exposure to validating and invalidating feedback. All participants were asked to complete nine mental arithmetic tasks designed to mildly increase baseline levels of physiological arousal. The use of mental arithmetic is a commonly used procedure to activate sympathetic responding in research examining physiological arousal (Keysor, Mazzocco, McLeod, & Hoehn-Saric, 2002; Mathias, Stanford, & Houston, 2004; McDonagh-Coyle et al., 2001, Shenk & Fruzzetti, in press), without any significant harm to participants. Each participant, regardless of experimental condition, was administered the same exact mental arithmetic problems in the same order. Each participant had forty seconds to complete each arithmetic problem.

Following the third, sixth, and ninth mental arithmetic tasks, participants were exposed to either validating or invalidating responses from the experimenter depending on the experimental condition to which they had been randomly assigned. After the third, sixth, and ninth arithmetic tasks, participants were asked to describe to the experimenter their current emotional experience. Once the participant described his or her emotional experience, he or she was exposed to either validating or invalidating responses, depending on the experimental condition. Female experimenters delivered all validating and invalidating feedback to control for sex of the experimenter.

The length of exposure to validating or invalidating behaviors was approximately two minutes at each of the three intervals (e.g., following the third, sixth, and ninth mental arithmetic tasks). For example, a participant may have described his or her

emotional experience stating, “I feel frustrated. I think I should be getting more answers.” Examples of validating comments in response to this are, “Completing math mentally is a frustrating task,” “Most other participants have expressed the exact same feeling,” “Of course, it was designed to be frustrating,” and “I also would feel frustrated if I were the one completing the task.” Examples of invalidating comments are, “I don’t understand why you would feel frustrated,” “There’s no need to get upset,” and “Other people were frustrated, but not as much as you seem to be.” Facial expressions, voice tone, and body language of the experimenter were consistent with these verbal validating or invalidating responses.

Collection of self-report of emotional reactivity. Following the validating or invalidating responses, participants were asked to complete the short version of the PANAS in order to collect self-report data on changes in emotional responding following exposure to one of the experimental conditions. The PANAS was administered five separate times throughout these procedures. The first administration was a “baseline” assessment and was conducted prior to completing any mental arithmetic problems. The second, third, and fourth administrations followed receipt of validating and invalidating feedback. The fifth and final administration followed completion of the morphing facial affect recognition task.

Completion of morphing facial affect task. Immediately following the completion of the ninth mental arithmetic task and the fourth PANAS, participants completed the morphing facial affect task. As described above, this task consists of viewing facial expressions that are gradually morphed across 39 stages from neutral faces to faces at 100% expression (one of six emotions: sadness, fear, anger, surprise, disgust, and

happiness). Participants viewed 36 trials (6 for each emotion), with each trial presented for 17.55 seconds (each stage was shown for 45 milliseconds). Following the completion of this task all participants completed the fifth and final PANAS. The following instructions (based on those used by Lynch et al., 2006) were given to all participants:

> You will be presented a series of faces. These faces are initially neutral, that is, they have a blank expression. However, the faces will slowly change over many stages to reveal one of the six target emotions listed on the screen. For each face you will have to determine which expression is displayed as quickly as possible without merely guessing. So remember, as soon as you think you know which expression is displayed, click the button with the appropriate emotion: fear, sadness, disgust, surprise, happiness, or anger. Once you have given your answer, you can change your mind when you want to, and as often as you want, by clicking a different button. For example, if you think the face is expressing "fear" and click the "fear" button, and later decide the face is actually expressing "disgust," you may then press the "disgust" button. Finally, for each face, you will be asked to give a final answer.

The morphing facial affect task allows for several possible methods of examining emotional sensitivity. The primary measure of performance was the average latency to the first "correct" response. Secondary measures included average latency to the first incorrect response and accuracy of response for faces at 100% expression. The latency to the first incorrect response was used to distinguish sensitivity from impulsivity or response bias, which may have led some individuals to respond correctly at a faster rate

without actually being able to correctly identify the expression. This method has been used previously by Lynch et al. (2006) and Blair et al. (2001).

Debriefing and believability check. The experimental manipulation (validating versus invalidating responses) necessarily involved incomplete disclosure. If participants were aware that they had been assigned to receive invalidating feedback, it is reasonable to assume that this would have impacted their emotional responding. Therefore, following the completion of the facial affect recognition task, all participants were fully debriefed. Participants were informed that the purpose of the experiment was to investigate how emotional arousal is affected by social validating and invalidating responses during an interpersonal interaction. The concepts of validation and invalidation were briefly explained and a description of their use in the study was given. Participants were also informed of the difficulty of the arithmetic problems and the unlikelihood that anyone could solve the tasks without paper and pencil and in the time allotted. In addition, participants were asked if they were aware of the use of validating and invalidating feedback prior to participating in this study, or if they suspected that the experimenter was intentionally delivering validating or invalidating feedback. The purpose of this was to check "believability" of experimental conditions. Participants were given ample time to ask any questions about the study or to make any comments about the study to the experimenter.

Results

Baseline Group Differences

Differences between experimental conditions (validation and invalidation) were examined in terms of self-reported demographic information and baseline measures on the PAI-BOR and PANAS. No significant differences between groups were observed at baseline on any of these measures. In addition, BPD features were not a significant predictor of participant age. Overall, it appeared that the yoked random assignment was effective in producing similar numbers of men and women in each experimental condition as well as yielding comparable groups on all relevant baseline measures. See Table 1 for descriptive statistics on PANAS and PAI-BOR scores at baseline.

Adherence Check and Experimenter Differences

An adherence check was performed to ensure that participants assigned to the validating condition received validating behaviors and participants assigned to the invalidating condition received invalidating behaviors. This adherence check was first assessed using the Validating and Invalidating Behavior Coding Scale (Fruzzetti & Shenk, 2009). The experimenters were rated using the VIBCS in order to obtain reliable and accurate measurements of observed validating and invalidating behaviors. A total of three coders were used to perform the manipulation check. All coders were blind to participant's assignment to experimental condition. Forty percent of the entire sample was coded by every member of the coding team in order to establish interrater reliability. Because the VIBCS is an ordinal rating scale, an intraclass correlation coefficient (ICC) was calculated in order to determine interrater reliability. A two-way, mixed effects model with absolute agreement among coders was used to calculate an average measure

ICC of .95, indicating excellent interrater reliability (Shrout & Fleiss, 1979). Once measures of reliability were obtained, a between-group multivariate analysis of variance (MANOVA) was performed to assess whether there were significant group differences in codes for validating and invalidating behaviors. Results of the MANOVA indicated significant differences between experimental conditions, $\Lambda = .03$, $F(2, 52) = 955.88$, $p < .001$, on ratings of validating and invalidating behaviors. Overall, the adherence check suggested that validating and invalidating behaviors were reliably observed by raters and that codes for validating and invalidating behaviors differed significantly between groups. Thus, participants assigned to the validating condition received validating behaviors and participants assigned to the invalidating condition received invalidating behaviors.

An ANOVA was then conducted to assess for differences among experimenters on emotional reactivity for participants within each condition (as measured by PANAS scores after receiving the final round of feedback). Results indicated a significant difference in level of negative affect reported by participants in the validating condition, $F(2,62) = 5.04$, $p < .01$. A post-hoc comparison indicated a significant difference in participant reports of negative affect between experimenter 1 ($M = 16.1$, $SD = 5.62$) and experimenter 3 [$M = 11.29$, $SD = 1.9$; $t(54) = 3.13$, $p < .01$]. All other results were non-significant. To examine the impact of the experimenter difference found for negative affect in the validating condition, all analyses (presented below) were conducted twice: once including all participants, and once excluding participants run by experimenter 3 (as experimenter 3 ran fewer participants than experimenter 1). There were no differences in

findings when participants run by experimenter 3 were excluded, and therefore data analysis includes all participants.

Believability Check

After completing the study, a total of 5 participants in the validation condition (n=65) and 18 participants in the invalidation condition (n=65) reported that they had "suspected" that experimenter feedback was related to the study objective. No participants reported that they were aware of the use of deception prior to participating in the study. Differences in positive and negative affect (as measured by PANAS scores after receiving the final round of feedback) between participants who reported "suspecting" and those who did not were assessed using MANOVAs. Results indicated no significant differences in positive affect or negative affect within the validation condition between participants who stated they suspected deception (positive affect: M = 24.2, SD = 4.87; negative affect: M = 12.6, SD = 2.79) and those who did not have this suspicion [positive affect: M = 27.35, SD = 9.48; negative affect: M = 14.93, SD = 5.42; Λ = .97, $F(2,62)$ = .86, *ns*], and no significant differences in positive affect or negative affect within the invalidation condition between participants who stated they suspected deception (positive affect: M = 25.67, SD = 9.86; negative affect: M = 17.83, SD = 6.45) and those who did not have this suspicion [positive affect: M = 21.72, SD = 21.72, SD = 8.98; negative affect: M = 20.38, SD = 8.88; Λ = .95, $F(2,62)$ = 1.62, *ns*]. Given that the presence of "suspicion" did not appear to impact the experimental manipulation, all participants were included in data analyses.

Hypotheses 1, 2, and 3: BPD features will predict emotional sensitivity, emotional sensitivity will differ between participants in the validating and invalidating conditions,

and there will be an interaction effect of BPD features and condition on emotional sensitivity.

Before conducting data analyses, all variables were examined for skewness and kurtosis and were found to be normally distributed. Means, standard deviations, and ranges of latency to the first correct response (in ms) for each emotion by experimental condition are presented in Table 3. Multiple linear regression analyses were conducted to examine the main effect of BPD features, the main effect of condition, and the interaction effect of BPD features and condition on emotional sensitivity (N=130). BPD features (participant score on the PAI-BOR), condition (validating or invalidating responses), and the interaction term of BPD features by condition were entered as predictor variables, and average latency to the first correct response (for each emotion analyzed separately) on the morphing facial affect task was entered as the outcome variable. BPD features were a significant predictor of emotional sensitivity for happy, sad, and surprise, with greater BPD features predicting longer response latency (slower response time). All emotions, except disgust, showed similar patterns of response for BPD features within the validation and invalidation conditions. As can be seen in Figure 2, across emotions the difference between participants with high and low levels of BPD features is greater in the invalidation condition than in the validation condition. Despite this, there was only a significant interaction effect for BPD features by condition for happy, and a trend toward an interaction effect for surprise, with participants with greater BPD features in the invalidation condition having the longest response latency (slowest response). There were no other significant main effects for BPD features or conditions or significant

interaction effects. The results from the multiple regression analyses for happy, sad, and surprise are presented in Table 4.

To further examine the impact of BPD features on response latency, regression analyses were conducted with BPD features as the predictor variable and average latency to the first correct response (for each emotion) as the outcome variable within each condition (validation and invalidation). Within the validation condition, BPD features were not a significant predictor of latency to response for any emotions. However, within the invalidation condition, greater BPD features significantly predicted a longer response latency (slower response time) for happy, sad, and surprise expressions, and there was a trend toward significance for anger and fear. These data are presented in Table 5.

Lastly, planned secondary analyses were conducted. The first analysis examined whether differences in emotional sensitivity could be attributed to early responding with more errors (impulsive responding). Regression analyses were conducted with BPD features as the predictor variable and average latency to the first *incorrect* response as the outcome variables (for each emotion). BPD features were a significant predictor of average latency to the first incorrect response for anger (β=.22, R^2=*.048,* F= 4.11, $p <$ .05) and for fear (β=.22, R^2=*.047,* F= 5.77, $p <$ .01). In both cases, BPD features were predictive of a longer latency to the first incorrect response. BPD features were not a significant predictor of average latency to first incorrect response for any other emotions (disgust β = -.022, R^2 = .000, F = .057, *ns*; happy β = -.073, R^2 = .005, F = .074, *ns*; sad β = .099, R^2 = .010, F = .755, *ns*; surprise β = .080, R^2 = .006, F = .625, *ns*). Regression analyses were then conducted within each condition (validation and invalidation) with BPD features as the predictor variable and average latency to the first incorrect response

as the outcome variable. Within the validation condition, BPD features were not a significant predictor of latency to first incorrect response for any emotion (anger β = .146, R^2 = .021, F = .852, *ns*; disgust β = -.126, R^2 = .016, F = .923, *ns*; fear β = .146, R^2 = .021, F = 1.265, *ns*; happy β = -.282, R^2 = .080, F = .260, *ns*; sad β = .053, R^2 = .003, F = .093, *ns*; surprise β = .084, R^2 = .007, F = .343, *ns*). Within the invalidation condition, greater BPD features significantly predicted a longer response latency (slower response) to the first incorrect response for anger (β=.29, R^2=.086, F= 3.97, $p < .05$) and for fear (β=.29, R^2=.085, F= 5.33, $p < .05$). There were no significant differences in latency to the first incorrect response for any other emotions (disgust β = .078, R^2 = .078, F = .349, *ns*; happy β = -.046, R^2 = .002, F = .019, *ns*; sad β = .118, R^2 = .014, F = .595, *ns*; surprise β = .072, R^2 = .005, F = .242, *ns*). As the only main effects for BPD features for latency to the first *correct* response were for happy, sad, and surprise, and BPD features did not predict differences in latency to the first *incorrect* response for these emotions, it can be concluded that "impulsive responding" does not account for the relationship between lower BPD features and faster response latency.

Analyses were then conducted to examine whether differences in sensitivity could be attributed to greater overall accuracy in abilities to identify facial expressions when fully expressed. Regression analyses were conducted with BPD features as the predictor variable and number of correct responses for fully expressed faces for each emotion as the outcome variable. BPD features were not a significant predictor of number of correct responses for any emotion, indicating that there were not overall differences in abilities to identify fully expressed emotions (anger β = .000, R^2 = .000, F = .000, *ns*; disgust β = .029, R^2 = .001, F = .106, *ns*; fear β = -.137, R^2 = .019, F = 2.432, *ns*; happy β = .031, R^2

= .001, F = .121, *ns*; sad β = .033, R^2 = .001, F = .136, *ns*; surprise β = .042, R^2 = .002, F = .223, *ns*).

Finally, analyses were conducted to examine whether psychotropic medication use might have been a confounding factor (affecting latency to the first correct response). ANOVAs were conducted with medication use as the independent variable (10 participants reported taking psychotropic medications) and latency to the first correct response as the dependent variables. There were no significant differences for medication use on latency to first correct response for any emotions [anger: *F(1,129)* = .856, *ns*; disgust: *F(1,129)* = .020, *ns*; fear: *F(1,129)* = .278, *ns;* happy *F(1,129)* = .819, *ns*; sad *F(1,129)* = 1.043, *ns*; and surprise *F(1,129)* = .108, *ns*].

Hypotheses 4: BPD features will predict emotional reactivity, with higher BPD features predicting greater emotional reactivity.

Differences in positive and negative emotional intensity (overall level of affect) and reactivity (changes in affect) as predicted by BPD features were examined using regression analyses within each condition. This data is illustrated in Figure 3.

First, intensity and reactivity of positive affect within the validation condition was examined. Regression analyses were conducted with BPD features as the predictor variable and positive affect (as measured by the PANAS) as the outcome variables at time 1 (baseline), time 2 (immediately following the first round math problems of validating feedback), time 3 (following the second round), and time 4 (following the third round). At baseline, BPD features were not a significant predictor of positive affect (β = -.09, R^2 = .008, F = .505, *ns*) . At time 2, BPD features did significantly predict positive affect, with greater BPD features predicting less positive affect (β = -.30, R^2=.093, F=

6.43, $p < .01$). At times 3 and 4, BPD features remained a significant predictor of positive affect, with greater BPD features predicting less positive affect (time 3: $\beta = -.29$, $R^2 = .085$, $F = 5.86$, $p < .01$; time 4: $\beta = -.35$, $R^2 = .12$, $F = 8.71$, $p < .01$).

Because BPD features were not predictive of positive affect at baseline but were significant at time 2, this suggests that higher BPD features may be associated with greater affective reactivity. To test this, change in positive affect from baseline to time 2 was examined using a regression analysis with BPD features as the predictor variable and change from baseline to time 2 (raw change score) as the outcome variable. BPD features were a significant predictor of change in positive affect from baseline to time 2 ($\beta = -.31$, $R^2 = .095$, $F = 6.59$, $p < .01$), with individuals with higher BPD features having greater reductions in positive affect, and individuals lower in BPD features actually more likely to have increases in positive affect. However, BPD features were not a significant predictor of change in positive affect from time 2 to time 3 ($\beta = -.02$, $R^2 = .001$, $F = .037$, *ns*), or from time 3 to time 4 ($\beta = -.18$, $R^2 = .033$, $F = 2.13$, *ns*), indicating that the increase in reactivity was an initial response that then stabled off following subsequent interactions.

Next, intensity and reactivity of negative affect was examined within the validation condition. Regression analyses were conducted with BPD features as the predictor variable and negative affect (as measured by the PANAS) as the outcome variable at time 1 (baseline), time 2 (immediately following the first round math problems of validating feedback), time 3 (following the second round), and time 4 (following the third round). At baseline, BPD features were a significant predictor of negative affect ($\beta = .35$, $R^2 = .12$, $F = 8.76$, $p < .01$), with greater BPD features predicting

higher levels of negative affect. At times 2, 3, and 4, BPD features remained a significant predictor of negative affect, with greater BPD features indicating higher levels of negative affect (Time 2: β = .38, R^2=.15, F= 10.68, p < .001; Time 3: β = .41, R^2=.16, F= 12.4, p < .001; Time 4: β = .37, R^2=.14, F= 10.19, p < .001).

To examine whether these differences were the result of greater negative emotional intensity overall or greater affective reactivity, change in negative affect from baseline to time 2, from time 2 to time 3, and from time 3 to time 4 was examined using a regression analyses with BPD features as the predictor variable and change in negative affect (raw change score) as the outcome variables within the validation condition. BPD features were a significant predictor of changes in negative affect from baseline to time 2 (β = .22, R^2=.05, F= 3.16, p < .05), with individuals with higher BPD features having greater increases in negative affect. However, BPD features were not a significant predictor of change in negative affect from time 2 to time 3 (β = .01, R^2 = .000, F = .009, *ns*), or from time 3 to time 4 (β = -.12, R^2 = .014, F = .911, *ns*), indicating that the increase in reactivity was an initial response that then stabled off following subsequent interactions.

The same analyses were then conducted within the invalidating condition. Regression analyses were conducted with BPD features as the predictor variable and positive affect (as measured by the PANAS) as the outcome variable at time 1 (baseline), time 2 (immediately following the first round math problems of invalidating feedback), time 3 (following the second round), and time 4 (following the third round). At baseline, BPD features were not a significant predictor of positive affect (β = -.13, R^2 = .017, F = 1.081, *ns*). At time 2, BPD features did significantly predict positive affect, with greater

BPD features predicting less positive affect (β = -.22, R^2=.05, F= 3.16, p < .05), although this was not significant for time 3 (β = -.15, R^2 = .023, F = 1.51, *ns*) or time 4 (β = -.09, R^2 = .009, F = .544, *ns*). BPD features were not a significant predictor of change in positive affect from baseline to time 2 (β = -.14, R^2 = .021, F = 1.338, *ns*).

Next, intensity and reactivity of negative affect was examined within the invalidation condition. Regression analyses were conducted with BPD features as the predictor variable and negative affect (as measured by the PANAS) as the outcome variable at time 1 (baseline), time 2 (immediately following the first round math problems of invalidating feedback), time 3 (following the second round), and time 4 (following the third round). At baseline, BPD features were a significant predictor of negative affect (β = .53, R^2=.28, F= 24.65, p < .001) with greater BPD features predicting higher levels of negative affect. At times 2, 3, and 4, BPD features remained a significant predictor of negative affect, with greater BPD features indicating higher levels of negative affect (Time 2: β = .48, R^2=.23, F= 18.66, p < .001; Time 3: β = .53, R^2=.28, F= 24.26, p < .001; Time 4: β = .47, R^2=.22, F= 18.14, p < .001).

Changes in negative affect within the invalidation condition from baseline to time 2, from time 2 to time 3, and from time 3 to time 4 were examined using regression analyses with BPD features as the predictor variable and change in negative affect (raw change score) as the outcome variables. BPD features were a significant predictor of change in negative affect from baseline to time 2 (β = .23, R^2=.05, F= 3.58, p < .05), with individuals with higher BPD features having greater increases in negative affect. However, BPD features were not a significant predictor of change in negative affect from time 2 to time 3 (β = .10, R^2 = .011, F = .679, *ns*), or from time 3 to time 4 (β = -.12, R^2 =

.014, $F = .882$, *ns*), indicating that the increase in reactivity was an initial response that then stabilized in subsequent interactions.

Hypotheses 5: Participants in the invalidating condition will demonstrate greater emotional reactivity than participants in the validating condition.

To examine the impact of validating and invalidating feedback on emotional reactivity, changes in positive and negative affect were first examined within each condition (validation and invalidation), and then differences in levels of affect were compared between conditions. Means and standard deviations are presented in Table 6. Data are illustrated in Figure 4.

A repeated measures ANOVA was conducted examining changes in positive affect across baseline, time 2 , time 3, and time 4 within the validation condition. Results indicated a significant change in positive affect across time for participants in the validation condition, $F(2.11,134.75) = 4.15$, $p < .05$. Contrasts indicated a significant decrease in positive affect between baseline and time 2, $F(1,64) = 10.98$, $p < .01$. There were no significant differences between groups on changes in positive affect between time 2 and time 3 [$F(1,64) = .607$, *ns*], or between time 3 and time 4 [$F(1,64) = .152$, *ns*]. In addition, positive affect at time 4 was not significantly different from positive affect at baseline, $F(1,64) = 3.63$, *ns*. A repeated measures ANOVA was then conducted examining changes in negative affect across time within the validation condition. Results indicated a significant change in negative affect across time for participants in the validation condition $F(2.48,158.39) = 13.58$, $p < .001$. Contrasts indicated a significant increase in negative affect from baseline to time 2, $F(1,64) = 31.75$, $p < .01$, and a significant *decrease* in negative affect from time 2 to time 3, $F(1,64) = 9.74$, $p < .01$, and

further decrease from time 3 to time 4, $F(1,64) = 8.41$, $p < .01$. There were no significant differences in negative affect between baseline and time 4, $F(1,64) = .77$, *ns*.

A repeated measures ANOVA was then conducted examining changes in positive affect across time, within the invalidation condition. There was a significant change in positive affect across time for participants within the invalidation condition, $F(1.85,118.33) = 17.84$, $p < .001$. Contrasts indicated a significant decrease in positive affect from baseline to time 2, $F(1,64) = 28.89$, $p < .001$, and from time 3 to time 4 $F(1,64) = 14.75$, $p < .001$. Change from time 2 to time 3 was not significant, $F(1,64) = .281$, *ns*. Positive affect a time 4 was significantly lower than positive affect at baseline, $F(1,64) = 29.55$, $p < .001$. A repeated measures ANOVA was then conducted examining changes in negative affect across time within the invalidation condition, and there was significant difference in negative affect across time, $F(2.19,140.49) = 39.34$, $p < .001$. Contrasts indicated a significant increase in negative affect from baseline to time 2, $F(1,64) = 91.25$, $p < .001$, and a decrease from time 2 to time 3, $F(1,64) = 6.03$, $p < .05$. There was no significant change from time 3 to time 4, $F(1,64) = .352$, *ns*. Negative affect at time 4 was significantly higher than negative affect at baseline, $F(1,64) = 37.45$, $p < .001$.

Finally, analyses were conducted to examine differences in positive and negative affect between the validation and invalidation conditions. Repeated measures ANOVAs indicated significant differences in positive affect, $F(1.97, 252.09) = 19.21$, $p < .001$, and in negative affect, $F(2.45, 313.47) = 44.09$, $p < .001$, between the validation and invalidation condition. Independent samples t-tests were then conducted to examine specific differences in positive and negative affect between conditions at baseline, time 2,

time 3, and time 4. Results indicate a significant difference between the validation and invalidation condition in positive affect at time 4, $t(128) = 2.64$, $p < .01$, with participants in the validation condition reporting significantly higher levels of positive affect than participants in the invalidation condition. There were no significant differences in positive affect between conditions at baseline [$t(128) = .407$, *ns*], time 2 [$t(128) = 1.64$, *ns*] , or time 3 [$t(128) = 1.49$, *ns*]. There were significant differences between the validation and invalidation conditions in negative affect at time 2, $t(128) = 2.58$, $p < .01$, time 3, $t(128) = -2.93$, $p < .01$, and time 4, $t(128) = -4.029$, $p < .001$, with participants in the invalidation condition reporting significantly higher levels of negative affect compared to participants in the validation condition . There were no significant differences in baseline negative affect between the validation and invalidation condition, $t(128) = -1.36$, *ns*.

Hypothesis 6: Emotional arousal will mediate the relationship between condition (validation or invalidation) and emotional sensitivity.

Condition was not a significant predictor of average latency to the first correct response for any emotion (see results for Hypotheses 1, 2, and 3). As this initial hypothesis was not supported, analyses to establish the mediating role of emotional arousal between condition and emotional sensitivity were not conducted.

Return to Baseline

Finally, although not a primary hypothesis, analyses were conducted to examine the impact of BPD features on return to affective baseline for positive and negative affect. Multiple regression analyses were conducted with BPD features, condition (validation and invalidation), and the interaction of BPD features by condition as

predictor variables, and the difference in positive and negative affect between baseline and time 5 (raw change score) as outcome variables. Results indicated no significant main effects for BPD features, condition, or the interaction of BPD features by condition on return to baseline for positive affect or negative affect [positive affect: $R^2 = .046$, $F(3,129) = 2.03$, *ns*; negative affect: $R^2 = .041$, $F(3,129) = 1.82$, *ns*].

Discussion

Major theoretical models for understanding the development and maintenance of BPD features suggest that BPD develops through a transaction between individual vulnerabilities (enhanced emotional sensitivity, increased emotional reactivity, and a slower return to baseline levels of emotional arousal) and an invalidating interpersonal environment (Fruzzetti et al., 2005; Linehan, 1993; Linehan et al., 2007). Despite the importance of both individual vulnerabilities *and* interpersonal factors in these theories, research on emotional processing in BPD has focused exclusively on individual vulnerabilities without taking interpersonal context into consideration. Findings from these studies are mixed, with some research suggesting that individuals with BPD are more accurate at detecting emotional stimuli (Wagner & Linehan, 1999; Lynch et al., 2006), and other studies concluding that individuals with BPD are actually less accurate at identifying emotional stimuli (Levine et al., 1997; Bland et al., 2004). Differences in findings across these studies may be accounted for by assessing the impact of proximal interpersonal factors on emotional sensitivity in individuals with features of BPD, as this is central to theoretical understandings of emotional processing in BPD.

Therefore, the current research examined the impact of BPD features on emotional sensitivity and reactivity within the context of either validating or invalidating interpersonal feedback. It was hypothesized that: 1) BPD features would predict differences in emotional sensitivity; 2) emotional sensitivity would differ between validating and invalidating condition; 3) there would be an interaction effect for BPD features and condition on emotional sensitivity; 4) higher BPD features would predict greater emotional reactivity; 5) participants in the invalidating condition would

demonstrate greater emotional reactivity than participants in the validating condition; and 6) emotional arousal would mediate the relationship between condition and emotional sensitivity.

Hypotheses 1, 2 and 3

Overall, the current research provides mixed support for Hypotheses 1, 2 and 3. BPD features did predict emotional sensitivity for happy, sad, and surprised expressions. Specifically, higher BPD features predicted longer response latencies (slower response) for these emotions. However, BPD features were not predictive of emotional sensitivity for faces expressing anger, fear, or disgust. There was no main effect for condition, indicating that there was no difference in emotional sensitivity overall for participants varying by validating and invalidating conditions. Thus, Hypothesis 2 was not supported.

There was a significant interaction effect for BPD features and condition for happy, and a trend toward a significant interaction effect for surprise. Further analyses of this interaction indicated that although BPD features were not a significant predictor of emotional sensitivity for any emotions within the validation condition, they were a significant predictor of emotional sensitivity to happy, sad, and surprised faces within the invalidation condition. In addition, there was a trend toward significance for identification of angry and fearful faces. This suggests that validating and invalidating feedback did have a differential effect on emotional sensitivity. BPD features did not appear to impact emotional sensitivity within the context of validating interpersonal interactions. Yet, within the context of invalidating interpersonal contexts, BPD features did predict emotional sensitivity, with individuals with higher BPD features having longer response latencies (slower responses).

Taken together, this data suggests that the nature of interpersonal feedback impacts abilities to detect facial expressions in individuals with features of BPD. Specifically, individuals with features of BPD have greater difficulty identifying facial expressions within the context of receiving invalidating interpersonal feedback. However, within the context of validating interpersonal feedback, BPD features do not predict abilities to detect any emotions. This pattern was seen across all emotions, with the exception of disgust. These results may help to explain the disparate findings in previous research. All previous research on emotional sensitivity in BPD has examined sensitivity as a construct independent from contextual factors. The current research suggests that emotional sensitivity is *not* a static feature of BPD, but changes depending on the context in which it is assessed. Within the context of validating interpersonal interactions, emotional sensitivity in individuals with BPD may be no different than that of individuals without this diagnosis. Within the context of invalidating interpersonal feedback, individuals with BPD may demonstrate a slower response in identifying facial expressions. Although this study examined invalidating interpersonal feedback specifically, these findings may generalize to other "high stress" contexts. As noted above, this pattern of responding was seen in all emotions except disgust. Previous research suggests that individuals with BPD may have greater overall difficulties indentifying facial expressions of disgust (Bland et al., 2004; Levine et al., 1997), indicating that the lack of findings for this particular emotion may be the result of a "ceiling" effect in abilities to detect disgust.

These findings lend general support to the biopsychosocial theory of BPD (Linehan, 1993). Emotional sensitivity does appear to be the result of a *transaction*

between individual vulnerabilities and interpersonal context, rather than a static factor. However, while the biopsychosocial theory contends that individuals with BPD should demonstrate enhanced sensitivity to emotional stimuli, these findings actually suggest that individuals with BPD are slower at identifying facial expressions within the context of invalidating interactions. This highlights the importance of including interpersonal contexts when studying emotional processing in BPD.

Hypothesis 4

The current findings do support Hypothesis 4. BPD features predicted emotional reactivity for both positive and negative affect, with higher BPD features predicting greater emotional reactivity. BPD features did not predict baseline levels of positive affect for participants in either condition, suggesting that there are not overall differences in baseline levels of positive affect for individuals with BPD features. Within the validation condition, BPD features predicted greater changes in positive affect, with higher BPD features predicting a greater decrease in positive affect from baseline to time 2 (immediately following the first round of math problems and validating feedback). Although BPD features did not predict change in positive affect from baseline to time 2 within the invalidation condition, BPD features did predict less positive affect overall after receiving feedback in both conditions.

BPD features were a significant predictor of negative affect at baseline, time 2, time 3, and time 4 in both conditions, with people who had higher BPD features reporting greater negative affect. This is consistent with research suggesting that individuals with BPD experience greater levels of negative affect overall (greater intensity of negative emotion). There was also evidence for greater reactivity, as BPD features predicted

greater change in negative affect from baseline to time 2 in both conditions. Increased emotional reactivity did appear to be limited to the initial response, with levels of negative affect appearing to plateau after time 2. These findings are consistent with the biopsychosocial theory and suggest that higher BPD features predict greater levels of negative affect regardless of interpersonal context, and that higher BPD features predict greater initial emotional reactivity to emotional stimuli.

This study did not support the part of the model that predicts that individuals with greater BPD features will have a slower return to baseline levels of emotional arousal. Differences between affect at time 5 and baseline affect were not predicted by BPD features. All participants, regardless of BPD features, showed reductions in both positive and negative affect following completion of the morphing facial affect task. It is possible that the repetitive nature of the morphing facial affect task obscured abilities to detect return to baseline. This could be because the emotion recognition task itself served an emotion regulation function, perhaps by distracting attention away from the stressful math task.

Hypothesis 5

Hypothesis 5 was supported, with participants in the invalidation condition demonstrating greater emotional reactivity compared to participants in the validation condition. Within the validation condition, participants showed an initial decrease in positive affect and an increase in negative affect following the first round of math problems and validating feedback. This suggests an initial response to the stressful task. However, following the second round of validating feedback, participants showed significant decreases in negative affect and remained stable in the experience of positive

affect. By time 4, participants in the validation condition had returned to their baseline levels of both positive and negative affect, despite continued exposure to the stressful math task.

Within the invalidation condition, participants also had an initial decrease in positive affect and an increase in negative affect following the first round of math problems and receipt of invalidating feedback. However, unlike participants in the validation condition, participants in the invalidation condition remained at elevated levels of negative affect and continued to have reductions in positive affect following subsequent rounds of feedback. In addition, participants in the invalidation condition reported significantly higher negative affect and significantly less positive affect at time 4 as compared to baseline arousal.

These findings provide support for the importance of the social environment in the regulation of emotions, and replicate the findings of Shenk and Fruzzetti (in press). Although participants in both conditions have continued exposure to the same stressful math task, participants who receive validating feedback show significant improvements in overall mood, while participants receiving invalidating feedback maintain high levels of overall negative affect and further reductions in positive affect. Thus, while invalidation serves to perpetuate negative emotional arousal, validation can actually serve to help individuals to regulation their own emotional experience, despite continued exposure to stressors.

Implications and Limitations

Emotional sensitivity does not appear to be a "static" feature of borderline personality disorder. Rather, emotional sensitivity may be dependent on interpersonal context and current levels of emotional arousal. Moreover, individuals with features of borderline personality disorder appear to be "less" emotionally sensitive (have greater difficulty identifying emotional stimuli) in the context of invalidating interpersonal interactions and/or during periods of high negative emotional arousal. These results also suggest that proximal interpersonal factors, such as validating and invalidating feedback, have a significant impact on individual emotional arousal and provide support for the "co-regulation" of emotions.

Of course, there are limitations to this study design and therefore to the conclusions that can be drawn. First, any attempt to measure emotional sensitivity with high internal validity will be flawed to some degree. The method used to assess emotional sensitivity in this study may be limited in its external validity. When assessing the emotions of others in the natural environment, of course, we do not rely solely upon facial expressions. However, it can be argued that facial expressions do serve as one of the primary channels for communicating information about emotional states, and therefore, while abilities to identify facial expressions accurately may not be the only relevant component of emotional sensitivity, it is certainly a necessary component. It is also important to note the distinction between emotional sensitivity and emotional reactivity. Sensitivity, as it is defined and measured in the current design, is a measure of our abilities to *detect* emotional stimuli, and this does not necessarily translate to how individuals react to those stimuli. Yet, it is impossible to evaluate emotional sensitivity

without the presence of emotional reactivity, and it is reasonable to assume that one may influence the other. In addition, the impact of invalidating feedback may vary depending on the context of the relationship in which it occurs. While the current experimental procedures were effective at raising the level of negative affect experienced by participants, the relationship between the experimenter and participant is essentially non-personal. The impact of validating and invalidating feedback may be different within the context of close interpersonal relationships. Future research could use more externally valid methods of assessment of emotional of emotional sensitivity and of assessing the impact of validating and invalidating feedback. For example, future research could examine the impact of validating and invalidating feedback on emotional sensitivity when the feedback is delivered by an individual close to the participant. Abilities to detect emotions could be examined within the contexts of conversations with others, comparing emotions detected by one individual to those reported to have been experienced by the other, or by looking at abilities to detect emotions that morph from one emotion to another without passing through a "neutral" phase (perhaps a more realistic depiction of actual changes in emotional expression).

It is also possible that the longer response latency (slower response) found in individuals with greater BPD features exposed to invalidating feedback may be indicative of slower information processing overall, rather than a specific deficit in abilities to recognize emotions. This may be further supported by the results demonstrating that individuals with greater BPD features also had longer response latencies to the first *incorrect* response for some emotions in the invalidating condition. Taken together, this may suggest that invalidating interpersonal contexts may result in slower information

processing overall. However, even if this is the case, this does not discredit the findings that individuals with higher BPD features had longer response latencies (slower responses) in detecting some emotions. It simply suggests that this may be a part of a larger process, and the results would still be relevant to understanding emotional processing in BPD. Future research could test this hypothesis by examining response latencies to a variety of tasks, including tasks that are "non emotional" in nature.

Second, it could be argued that although the differences in response latency are statistically significant, they may have limited clinical utility. After all, does a difference in seconds actually have an impact on emotional responding? This may be especially relevant given that there were no significant differences in overall abilities to detect emotions when fully expressed. Although this is a valid concern, given the clarity of results (differences in significant findings between the validating and invalidating conditions), it can be concluded that interpersonal context does impact emotional sensitivity. When this is combined with the evidence for increased reactivity to emotional stimuli, this certainly suggests that difficulties in identifying emotions may contribute to the problems with interpersonal relationships often found in BPD. This could be further clarified through research examining how detection of emotional stimuli actually impacts interpersonal behaviors. For example, do individuals with BPD features wait until they "know" which emotion is being expressed prior to acting? If so, they are more likely to respond to accurate information about the emotional state of the other person, and the differences in latencies may be relatively unimportant. However, if they tend to respond at the same time as those lower in BPD features (in which case, they may respond before they have accurately identified the expressed emotion), this may have a

detrimental impact on interpersonal functioning. This very issue is central to empirically supported treatments for BPD. For example, DBT emphasizes the importance of relationship mindfulness as a skill for improving abilities to be aware of and accurately respond to the emotions of others (Linehan, 1993). MBT refers to the similar process as mentalizing, and improvements in mentalization is a central goal of MBT (Fonagy & Bateman, 2006).

Finally, this study design does not allow us to draw conclusions about individuals with features of BPD compared with other psychological disorders, and this study assessed features of BPD within a largely non-clinical sample. Future research employing the use of clinical comparison groups will add to the clinical specificity of these results. However, even if these results are not unique to BPD and are actually characteristic of a broader range of psychological disorders, the findings are still relevant to the treatment of borderline personality disorder.

In fact, these results have several implications for the treatment of BPD. First, these results suggest that effective treatment include a focus on improving abilities to identify emotional stimuli, especially under conditions of high emotional arousal. These findings indicate that when individuals with significant features of BPD are experiencing high levels of negative emotional arousal they may have a reduced ability to identify the emotions of others, which may in turn lead to the exacerbation of conflict in interpersonal relationships. For example, during an argument it is normative for individuals to experience heightened negative affect. If an individual has features of BPD, this negative affect may impair his or her abilities to detect the emotional response of the other individual accurately, which may in turn lead to an increased likelihood of receiving an

invalidating response. The invalidating feedback, then, may result in maintaining high levels of negative affect (as suggested by this study's results). Treatment targeting enhancing abilities to identify emotions of others accurately may lead to increased accurate responding to emotional expressions, which may lead to a greater likelihood of receiving validating feedback, which in turn may lead to reductions in negative affect. This is presently a component of both DBT and MBT (Linehan, 1993; Fonagy & Bateman, 2006), and these results help to verify the importance of such targeting in effective treatments.

Second, these results suggest that effective treatment of BPD cannot focus solely on treating "individual" components of the disorder. Rather, this study highlights the importance of proximal interpersonal factors in understanding emotional processing in BPD, and therefore suggests that effective treatment should include direct targeting of interpersonal relationships. This data provides support for the importance of interpersonal feedback in either maintaining negative emotional arousal (when feedback is invalidating) or actually reducing negative arousal (when feedback is validating). Including partners, family members, and other significant individuals in the treatment of BPD (perhaps through direct validation training) may help to create interpersonal environments in which individuals with BPD are more likely to receive validating responses, which may in turn result in decreased experiencing of negative affect and improved interpersonal relationships. Indeed, recent research by Fruzzetti and colleagues (Fruzzetti & Fantozzi, 2008; Hoffman et al., 2005; Fruzzetti & Mosco, 2010) suggests that couple- and family-based treatments may be effective at addressing individual psychopathology.

In conclusion, this study provides support for the importance of proximal interpersonal factors in understanding emotional processing in BPD. First, it appears that emotional sensitivity in BPD is not a static trait, but may be dependent on proximal interpersonal factors and current levels of emotional arousal. Second, it suggests that the nature of those interpersonal responses (specifically, validation or invalidation) has differing impacts on emotional responding and the regulation of emotional responses. Overall, the results suggest that individuals with greater features of BPD are slower to identify facial expressions across emotions when exposed to invalidating feedback, although their response times are comparable to those without BPD features when exposed to validating feedback. Third, individuals with BPD experience greater overall negative affect, and are also more reactive to at least some key interpersonally relevant emotional stimuli (facial expression of emotion). Taken together these results suggest effective treatment for BPD may benefit from a focus on improving abilities to detect emotional stimuli, especially when negative emotional arousal is high, and that the treatment of symptoms of BPD must go beyond addressing individual factors and incorporate improving "co-regulation" in interpersonal relationships.

References

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders (4th ed., text version)*. Washington, DC: Author.

Bell-Pringle, V.J., Prate, J.L., & Brown, R.C. (1997). Assessment of borderline personality disorder using the MMPI-2 and the Personality Assessment Inventory. *Assessment, 4,* 131-139.

Bland, A.R., Wiliams, C.A., Scharer, K., & Manning, S. (2004). Emotion processing in borderline personality disorders. *Issues in Mental Health Nursing, 25,* 655-672.

Chapman, A.L., Rosenthal, M.Z., Leung, D.W. (2007). *Emotion suppression in borderline personality disorder: An experience sampling study.* Manuscript submitted for publication.

Coray, M. (2006). *Annual diversity and enrollment report: Regular (degree seeking) students.* University of Nevada, Reno.

Derogatis, L. R. (1993). BSI brief symptom inventory. Administration, scoring, and procedures manual (4th Ed.). Minneapolis, MN: National Computer Systems.

Domes, G., Czieschnek, D., Weidler, F., Berger, C., Fast, K., & Herpertz, S. (2008). Recognition of facial affect in borderline personality disorder. *Journal of Personality Disorders, 22,* 135-147.

Donegan, N.H., Sanislow, C.A., Blumberg, H.P., Fulbright, R.K., Lacadie, C., Skudlarski, P., et al. (2003). Amygdala hyperactivity in borderline personality disorder: Implications for emotional dysregulation. *Society of Biological Psychiatry, 54,* 1284-1293.

Ebner-Priemer, U.W., Badeck, S., Beckmann, C., Wagner, A., Feige, B., Weiss, I., et al. (2005). Affective dysregulation and dissociative experience in female patients with borderline personality disorder: A startle response study. *Journal of Psychiatric Research, 39,* 85-92.

Ekman, P., & Friesen, W. V. (1976). *Pictures of facial affect.* Available from http://www.paulekman.com/research_cds.php

Ekman, P., & Matsumoto, D. (1992). *Japanese and Caucasian facial expressions of emotion and neutral faces.* Authors: San Francisco, CA.

Fonagy, P., & Bateman, A.W. (2006). Mechanisms of change in mentalization-based treatment of BPD. *Journal of Clinical Psychology, 62,* 411-430.

Fonagy, P., & Bateman, A.W. (2008). The development of borderline personality disorder – A mentalizing model. *Journal of Personality Disorders, 22,* 4-21.

Fruzzetti, A. E., & Fantozzi, B. (2008). Couple therapy and the treatment of borderline personality and related disorders. In A. Gurman (Ed.), *Clinical Handbook of Couple Therapy* (4th Edition) (pp. 567-590). New York: Guilford Press.

Fruzzetti, A. E. & Mosco, E. A. (2010). *Dialectical behavior therapy adapted for couples: A pilot group intervention for couples*. Manuscript under review.

Fruzzetti, A. E., & Shenk, C. E. (2009). *Defining and measuring validating and invalidating behaviors: Reliability and validity of an observational rating scale*. Unpublished manuscript, University of Nevada, Reno.

Fruzzetti, A.E., & Crook, W. (2008).*Components of emotion regulation: Understanding the differential contributions of emotion regulation and distress tolerance to individual psychopathology.* Unpublished manuscript, University of Nevada, Reno.

Fruzzetti, A.E., Crook, W., Erikson, K.M., Lee, J.E., & Worrall, J.M. (2009). Emotion regulation. In W. O'Donohue, J. Fisher, & S. Hayes (Eds.), *Cognitive Behavior Therapy, Applying Empirically Supported Techniques in Your Practice, Second Edition.* Wiley.

Fruzzetti, A. E., Shenk, C., & Hoffman, P.D. (2005). Family interaction and the development of borderline personality disorder: A transactional model. *Development and Psychopathology, 17,* 1007-1030.

Gratz, K.L., Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the difficulties in emotion regulation scale. *Journal of Psychopathology and Behavioral Assessment, 26,* 41-54.

Gross, J.J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2,* 271-299.

Herpertz, S.C., Dietrich, T.M., Wenning, B., Krings, T., Erberich, S.G., Willmes, K. et al. (2001b). Evidence of abnormal amygdala functioning in borderline personality disorder: A functional fMRI study. *Society of Biological Psychiatry, 50,* 292-298.

Herpertz, S., Gretzer, A., Steinmeyer, E.M., Muehlbauer, V., Schuerkens, A., & Sass, H. (1997). Affective instability and impulsivity in personality disorder. Results of an experimental study. *Journal of Affective Disorders, 44,* 31-37.

Herpertz, S.C., Kunert, H.J., Schwenger, U.B., & Sass, H. (1999). Affective responsiveness in borderline personality disorder: A psychophysiological approach. *American Journal of Psychiatry, 156,* 1550-1556.

Herpertz, S.C., Werth, U., Lukas, G., Qunaibi, M., Schuerkens, A., Kunert, H.J. et al. (2001a). Emotion in criminal offenders with psychopathy and borderline personality disorder. *Archives of General Psychiatry, 58,* 737-745.

Hoffman, P., Fruzzetti, A., Buteau, E., Neiditch, E., Penney, D., Bruce, M., Hellman, F., Struening, E. (2005). Family connections: A program for relatives of persons with borderline personality disorder. *Family Process, 44,* 217-225.

Keltikangas-Jaorvinen, L., & Heponiemi, T. (2004). Vital exhaustion, temperament, and cardiac reactivity in task-induced stress. *Biological Psychology, 65*, 121-135.

Keysor, C. S., Mazzocco, M., McLeod, D. R., & Hoehn-Saric, R. (2002). Physiological arousal in females with fragile X or Turner syndrome. *Developmental Psychobiology, 41*(2), 133-146.

Levine, D., Marziali, E., & Hood, J. (1997). Emotion processing in borderline personality disorders. *The Journal of Nervous and Mental Disease, 185,* 240-246.

Linehan, M. (1993). *Cognitive-behavioral treatment of borderline personality disorder*. New York: Guilford Press.

Linehan, M., Bohus, M., & Lynch, T. (2007). Dialectical behavior therapy for pervasive emotion dysregulation: Theoretical and practical underpinnings. In J. Gross (Ed.), *Handbook of Emotion Regulation.* New York: Guilford Press.

Lynch, T.R., Rosenthal, M.Z., Kosson, D.S., Cheavens, J.S., Lejuez, C.W., & Blair, R.J.R. (2006). Heightened sensitivity to facial expressions in borderline personality disorder. *Emotion, 6,* 647-655.

Mathias, C. W., Stanford, M. S., & Houston, R. J. (2004). The Physiological Experience of the Paced Auditory Serial Addition Task. *Archives of Clinical Neuropsychology, 19*(4), 543-554.

McDonagh-Coyle, A., McHugo, G. J., Friedman, M. J., Schnurr, P. P., Zayfert, C., & Descamps, M. (2001). Psychophysiological reactivity in female sexual abuse survivors. *Journal of Traumatic Stress, 14*(4), 667-683.

McMain, S., Korman, L.M., & Dimeff, L. (2001). Dialectical behavior therapy and the treatment of emotion dysregulation. *Journal of Clinical Psychology, 57,* 183-196

Minzenberg, M.J., Poole, J.H., & Vinogradov, S. (2006). Social-emotion recognition in borderline personality disorder. *Comprehensive Psychiatry, 47,* 468-474.

Morey, L. C. (1991). *Personality Assessment Inventory: Professional manual.* Odessa, FL: Psychological Assessment Resources.

Renneberg, B., Heyn, K., Gebhard, R., & Bachmann, S. (2005). Facial expression of emotions in borderline personality disorder and depression. *Journal of Behavior Therapy and Experimental Psychiatry, 36,* 183-196.

Rosenthal, M.Z., Gratz, K.L., Kosson, D.L., Cheavens, J.S., Lejuez, C.W., & Lynch, T.R. (2008). Borderline personality disorder and emotional responding: A review of the research literature. *Clinical Psychology Review, 28,* 75-91.

Sayrs, J. H. R., & Fruzzetti, A. E. (2009). *Partner invalidating responses in couples: Impact on affect and expression.* Unpublished manuscript, University of Nevada, Reno.

Schmahl, C.G., Elzinga, B.M., Ebner, U.W., Simms, T., Sanislow, C., Vermetten, E., et al. (2004). Psychophysiological reactivity to traumatic and abandonment scripts in borderline personality disorder and posttraumatic stress disorders: A preliminary report. *Psychiatry Research, 126,* 33-42.

Shenk, C. E., & Fruzzetti, A. E. (in press). The impact of validating and invalidating responses on emotional arousal. *Journal of Social and Clinical Psychology*.

Skodol, A.E., Gunderson, J.G., Pfohl, B., Widiger, T.A., Livesley, W.J., & Siever, L.J. (2002). The borderline diagnosis I: Psychopathology, comorbidity, and personality structure. *Society of Biological Psychiatry, 51,* 936-950.

Stein, M.B., Pinkser-Aspen, J.H., Hilsenroth, M.J. (2005). Borderline pathology and the personality assessment inventory (PAI): An evaluation of criterion and concurrent validity. *Journal of Personality Assessment, 88,* 81-89.

Stiglmayr, C.E., Grathwol, T., Linehan, M.M., Ihorst, G., Fahrenberg, J., & Bohus, M. (2005). Aversive tension in patients with borderline personality disorder: A computer-based controlled field study. *Acta Psychiatrica Scandinavica, 111,* 372-379.

Trull, T.J. (1995). Borderline personality disorder features in nonclinical young adults: 1. Identification and validation. *Psychological Assessment, 7,* 33-41.

Trull, T.J. (2001). Structural relations between borderline personality disorder features and putative etiological correlates. *Journal of Abnormal Psychology, 110,* 471-481.

Wagner, A.W., & Linehan, M.M. (1999). Facial expression recognition ability among women with borderline personality disorder: Implications for emotion regulation? *Journal of Personality Disorders, 13,* 329-344.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality & Social Psychology, 54*(6), 1063-1070.

Young, J.E. (1994). *Cognitive therapy for personality disorders: A schema-focused approach (Revised ed.)* Sarasota, Fl: Professional Resources.

Table 1

Descriptive Data on Demographic and Baseline Variables in Each Condition

		Condition	
		Validation (n=65)	Invalidation (n=65)
		M or n	*M* or n
		(SD or %)	(SD or %)
Demographics			
Sex			
	Male	18 (28%)	20 (31%)
	Female	47 (72%)	45 (69%)
Age		21.06 (6.28)	21.23 (4.71)
Ethnicity			
	White/Caucasian	37 (57%)	45 (69%)
	Asian/Pacific Islander	10 (15%)	6 (9%)
	Hispanic/Latino	8 (12%)	5 (8%)
	Black/African American	2 (3%)	3 (5%)
	Native American	3 (5%)	1 (1%)
	Other Ethnicity	5 (8%)	5 (8%)
Measures			
PANAS-P		28.8 (7.87)	28.26 (7.18)
PANAS-N		14.22 (3.91)	15.34 (5.39)
PAI-BOR		25.52 (12.69)	27.18 (14.26)

Note. PANAS-P = Positive and Negative Affect Schedule-Positive Affect Subscale; PANAS-N = Positive and Negative Affect Schedule-Negative Affect Subscale.

Table 2

Overview of Procedures

Step	Procedure	Approximate Time per Step
1	Participants completed screening measures	N/A
2	Participants were invited to participate in the second portion of the study	N/A
3	Random assignment to experimental condition (validation or invalidation)	N/A
4	First administration of the PANAS	1 Minute
5	Completion of the first, second, and third mental arithmetic task	2 Minutes
6	Participant was asked to describe their current emotional experience	1-2 Minutes
7	Validating or invalidating feedback was delivered (based on condition)	2 Minutes
8	Second administration of the PANAS	1 Minute
9	Completion of the fourth, fifth, and sixth mental arithmetic tasks	2 Minutes
10	Participant was asked to describe their current emotional experience	1-2 Minutes
11	Validating or invalidating feedback was delivered (based on condition)	2 Minutes
12	Third administration of the PANAS	1 Minute
13	Completion of the seventh, eighth, and ninth mental arithmetic tasks	2 Minutes
14	Participant was asked to describe their current emotional experience	1-2 Minutes
15	Validating or invalidating feedback was delivered (based on condition)	2 Minutes
16	Fourth administration of the PANAS	1 Minute
17	Completion of facial-affect recognition task	11 Minutes
18	Fifth administration of the PANAS	1 Minute
19	Participant was fully debriefed and “believability” of experimental condition was assessed	5-10 Minutes

Table 3

Mean, Standard Deviation, and Range of Latency to the First Correct Response (in ms) for Each Emotion Within the Validation and Invalidation Conditions.

Outcome Variable	*M (SD)*	Range
Validation		
Anger	13,103.89 (3,305.72)	6,940.17 – 25,523.50
Fear	13,634.02 (3,030.43)	9,243.80 – 23,739.67
Disgust	13,358.32 (2,978.72)	8,040.80 – 20,593.60
Happy	8,161.63 (3,883.79)	3,393.17 – 19,448.00
Sad	12,686.51 (3,261.12)	7,351.17 – 21,927.00
Surprise	11,012.56 (3,767.49)	5,109.50 – 21,202.75
Invalidation		
Anger	13,863.55 (3,588.38)	6,596.80 – 22,016.00
Fear	13,408.19 (3,186.17)	7,726.50 – 21,344.00
Disgust	13,552.74 (2,894.91)	9,148.33 – 20,062.00
Happy	8,840.05 (4,651.71)	2,797.00 – 20,307.50
Sad	13,276.34 (3,241.94)	7,637.83 – 23,211.00
Surprise	11,737.76 (4,155.72)	5,606.50 – 22,025.20

Table 4

Summary of Multiple Regression Analyses as a Predictor to Average Latency to First Correct Response for Anger, Fear, Disgust, Happy, Sad, and Surprise (N=130)

Outcome Variable		B	SE(B)	β	R^2	Δ R^2
Anger						
	Step 1				.024	.024
	Constant	12388.16	716.35			
	BPD Features	28.04	22.54	.109		
	Condition	713.05	605.03	.104		
	Step 2				.036	.012
	Constant	13200.27	962.27			
	BPD Features	-3.78	33.81	-.015		
	Condition	-785.15	1333.17	-.114		
	BPD Features*Condition	57.06	45.27	.280		
Disgust						
	Step 1				.019	.019
	Constant	12736.07	638.17			
	BPD Features	31.43	20.08	.138		
	Condition	-182.35	538.96	-.030		
	Step 2				.021	.001
	Constant	12986.81	861.99			
	BPD Features	21.61	30.28	.095		
	Condition	-644.92	1194.24	-.105		
	BPD Features*Condition	17.62	40.55	.097		
Fear						
	Step 1				.014	.014
	Constant	12986.46	614.92			
	BPD Features	25.37	19.35	.116		
	Condition	-123.44	519.36	-.021		
	Step 2				.022	.008
	Constant	13550.06	827.83			
	BPD Features	3.29	29.08	.015		

	Condition	-1163.17	1146.90	-.198		
	BPD Features*Condition	39.59	38.95	.227		
Happy						
	Step 1				.080	.080**
	Constant	5960.15	861.45			
	BPD Features	86.26	27.10	.271**		
	Condition	535.11	727.58	.063		
	Step 2				.127	.047**
	Constant	7948.51	1134.01			
	BPD Features	8.35	39.84	.026		
	Condition	-3133.05	1571.09	- .367*		
	BPD Features*Condition	139.69	53.35	.553**		
Sad						
	Step 1				.051	.051*
	Constant	11403.58	664.25			
	BPD Features	50.27	20.89	.208*		
	Condition	506.31	561.06	.078		
	Step 2				.059	.007
	Constant	11985.41	894.61			
	BPD Features	27.47	31.43	.114		
	Condition	-567.05	1239.43	-.088		
	BPD Features*Condition	40.88	42.09	.213		
Surprise						
	Step 1				.039	.039
	Constant	9696.53	815.72			
	BPD Features	51.56	25.66	.175*		
	Condition	639.52	688.96	.081		
	Step 2				.063	.024
	Constant	11017.68	1088.54			
	BPD Features	-.20	38.24	-.001		
	Condition	-1797.75	1508.11	-.227		
	BPD Features*Condition	98.82	51.21	.396		

Note. * $p < .05$, ** $p < .01$.

Table 5

Summary of Regression Analyses with BPD Features as a Predictor to Average Latency to First Correct Response within Validation Condition (n=65) and Invalidation Condition (n=65)

Outcome Variable	B	SE(B)	β	R^2	*F*	*p*
Validation						
Anger	-3.78	32.79	-.015	.000	.013	.909
Disgust	21.61	29.43	.092	.008	.539	.465
Fear	3.289	30.06	.014	.000	.012	.913
Happy	8.35	38.52	.027	.001	.047	.829
Sad	27.47	32.17	.107	.011	.729	.396
Surprise	-.200	37.38	-.001	.000	.000	.996
Invalidation						
Anger	53.28	30.99	.212	.045	2.957	.090
Disgust	39.23	27.71	.176	.015	2.003	.162
Fear	42.89	25	.211	.045	2.943	.091
Happy	148.05	36.62	.454	.206	16.342	.000
Sad	68.35	27.32	.301	.076	6.259	.015
Surprise	92.62	34.81	.318	.087	7.078	.010

Table 6

Mean and Standard Deviation of Positive Affect and Negative Affect within the Validation and Invalidation Condition

	Positive Affect		Negative Affect	
	M	*SD*	*M*	*SD*
Validation				
Baseline	28.80	7.87	14.22	3.91
Time 2	26.51	7.95	17.58	6.35
Time 3	26.92	8.65	16.22	6.07
Time 4	27.11	9.22	14.75	5.29
Invalidation				
Baseline	28.26	7.18	15.34	5.39
Time 2	24.17	8.32	20.92	8.27
Time 3	24.51	9.79	19.91	8.15
Time 4	22.82	9.32	19.68	8.31

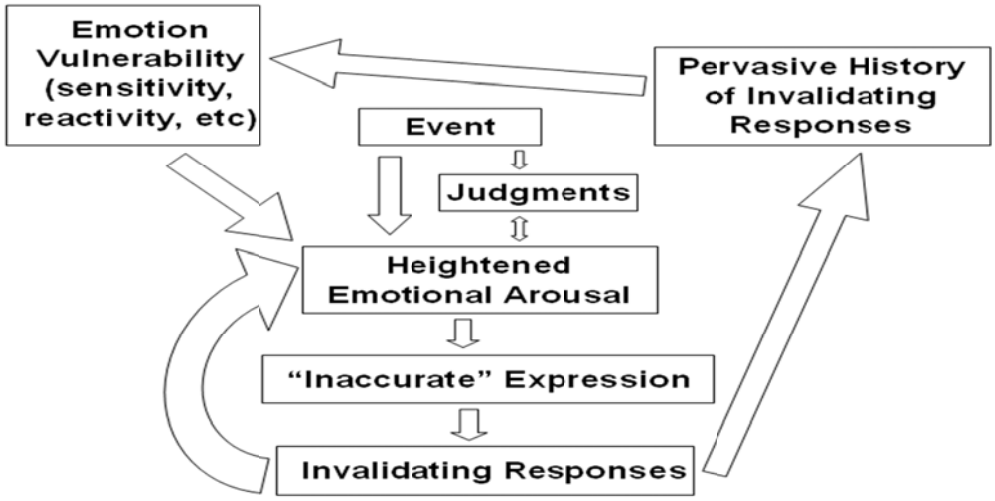

Figure 1. The transactional model: Emotional vulnerabilities lead to invalidating responses, which in turn lead to increased emotional vulnerabilities (Fruzzetti et al., 2005).

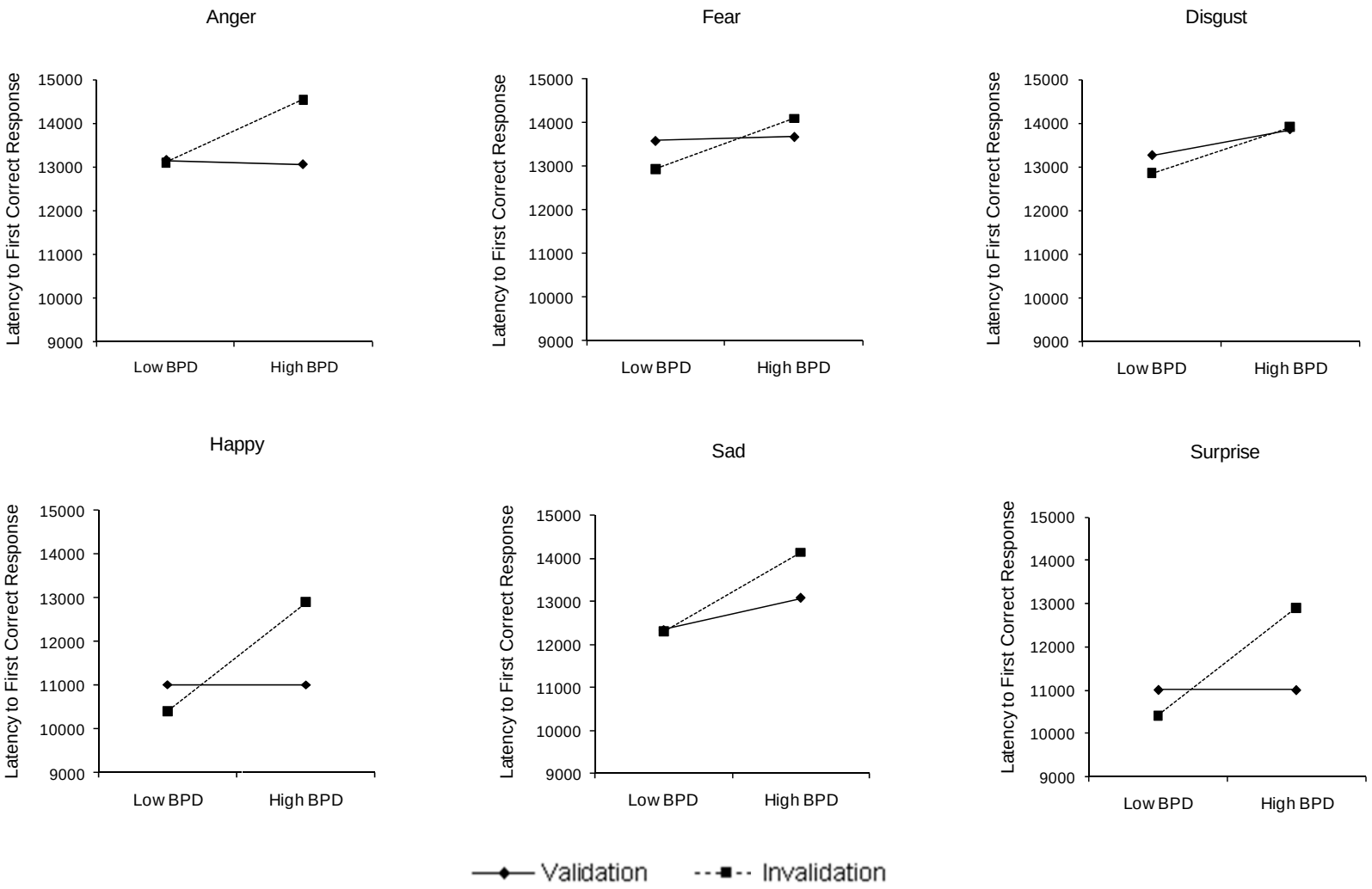

Figure 2. Average latency to first correct response (ms) for each emotion within the validation condition (n=65) and invalidation condition (n=65) by level of BPD features.

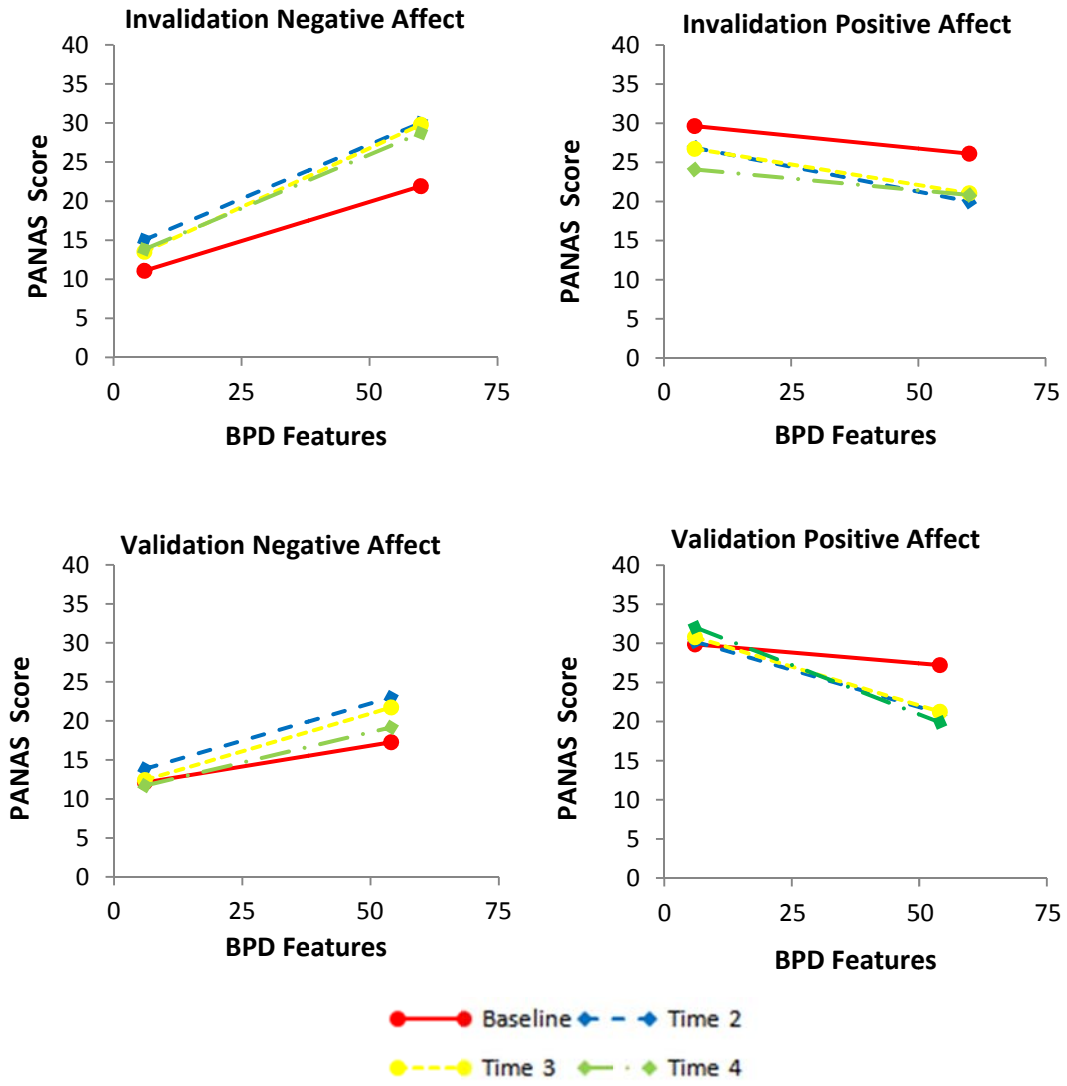

Figure 3. BPD Features, as measured by the PAI-BOR, by PANAS Score on the negative affect scale and positive affect scale at Baseline, Time 2, Time 3, and Time 4 for the invalidation condition (n=65) and validation condition (n=65).

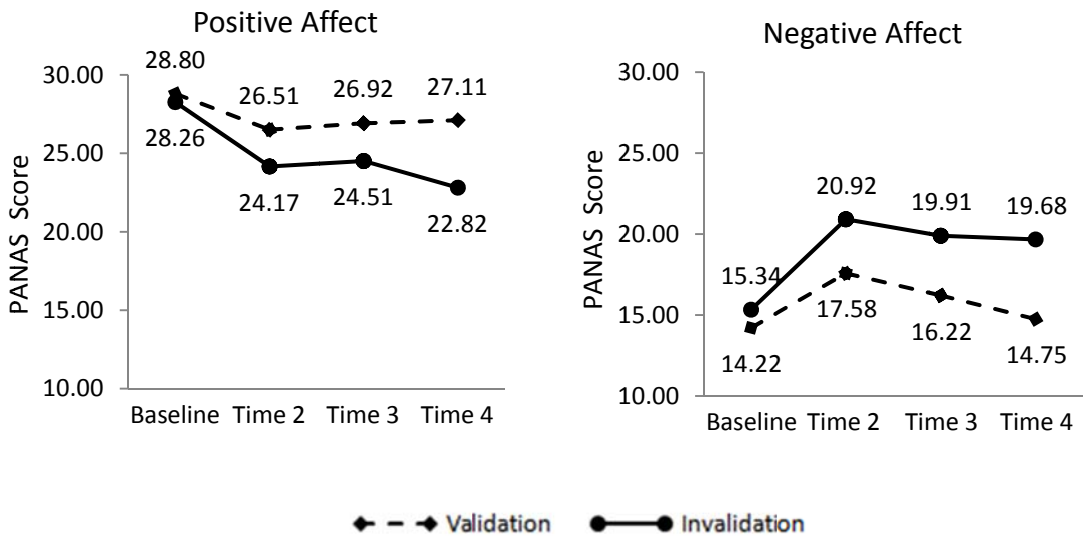

Figure 4. Changes in positive affect and negative effect for the validation and invalidation conditions from baseline to time 2, time 3, and time 4, labeled with means.