THE RELATIONSHIP BETWEEN EMOTIONS, SOCIAL PROBLEM SOLVING, AND BORDERLINE PERSONALITY FEATURES

by

Katherine Dixon-Gordon
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Name: Katherine Dixon-Gordon

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Examining Committee:

Chair: **Mark Blair, Ph.D.**
Assistant Professor

Alexander Chapman, Ph.D.
Senior Supervisor
Assistant Professor

Cathy McFarland, Ph.D.
Professor

Wolfgang Linden, Ph.D.
External Examiner
Professor
University of British Columbia

Date Defended/Approved: July 30, 2008

Abstract

People suffering from borderline personality disorder (BPD) demonstrate poor social problem-solving (SPS) performance. There is an absence of research, however, examining mechanisms driving SPS deficits among persons with BPD. In the present study, SPS performance of undergraduates with High (n = 26), Mid (n = 32), or Low (n = 29) levels of BPD features was assessed at baseline with the Social Problem Solving Inventory- Revised (SPSI-R), and using the means-ends problem-solving (MEPS) procedure before and after a negative emotion induction. The High-BPD group demonstrated SPS deficits at baseline on the SPSI-R, and a larger decrement in relevant means on the MEPS following the negative emotion induction, compared with the Low-BPD group. Increases in self-reported negative emotions during the emotion induction partially mediated the relationship between BPD features and change in SPS performance. These findings suggest that the SPS difficulties associated with BPD may be partly attributable to the intensity of negative emotions experienced by persons with heightened BPD features.

Keywords: Borderline Personality Disorder; Emotion Regulation; Social Problem Solving

Subject Terms: Borderline Personality Disorder; Emotions; Emotions Research

To my family.

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Introduction

Borderline personality disorder (BPD) is a serious health concern that heavily taxes the mental health system. Hallmark features of BPD include unstable affect, stormy interpersonal relationships, identity issues, impulsivity, and self-destructive behaviours (American Psychiatric Association, 2000). Individuals with BPD constitute up to 11% of psychiatric inpatients, and up to 20% of psychiatric outpatients (Widiger & Frances, 1989). The high prevalence of self-harm and suicide attempts among individuals with BPD (Fyer, Frances, Sullivan, Hurt, & Clarkin, 1988) accounts for much of this treatment utilization. Up to 38% of people who commit suicide meet criteria for BPD (Linehan, Rizvi, Shaw-Welch, & Page, 2000). Up to 81% of individuals diagnosed with BPD have attempted suicide at least once in their lifetime (Fyer et al., 1988). In addition to severe suicidality, BPD is characterized by high rates of non-suicidal self-injury (NSSI; 63%–80%; Shearer, 1994; Shearer, Peters, Quaytman, & Ogden, 1990; Soloff, Lis, Kelly, Cornelius, & Ulrich, 1994), defined as the deliberate, direct destruction or alteration of body tissue without conscious suicidal intent (Chapman, Gratz, & Brown, 2006; Gratz, 2003; Klonsky, Oltmanns, & Turkheimer, 2003).

Among persons with BPD, interpersonal difficulties frequently trigger suicide attempts and NSSI (Brodsky, Groves, Oquendo, Mann, & Stanley, 2006; Welch & Linehan, 2002). Furthermore, severity of BPD symptoms was positively associated with the presence of interpersonal problems (Lejuez et al., 2003). For example, persons with BPD reported significantly more impairment in interpersonal attachment, compared with a non-BPD control group (Minzenberg, Poole, & Vinogradov, 2006). One study of a sample of violent offenders demonstrated a correlation between scores on the Borderline Personality Inventory and scores on an inventory of interpersonal problems (Leichsenring, Kunst, & Hoyer, 2003). Individuals with BPD also report more interpersonal stressors (Tolpin, Gunthert, Cohen, & O'Neill, 2004; Zeigler-Hill & Abraham, 2006), compared to control groups. Given that interpersonal difficulties comprise an important criterion for BPD and precipitate self-destructive behaviours among individuals with BPD, it is crucial to examine the factors underlying interpersonal difficulties in BPD.

The numerous interpersonal problems experienced by individuals with BPD may be attributable to difficulties in resolving conflicts that arise in social contexts. This process of identifying solutions for problems which occur in the context of interpersonal situations, and choosing among these solutions is termed *social problem solving* (SPS; Platt & Spivack, 1975). Interpersonal difficulties such as dysfunctional relationships, low relationship satisfaction, and attachment insecurity are also associated with ineffective SPS (Davila, Hammen, Burge, Daley, & Paley, 1996; Metts & Cupach, 1990). Understanding the mechanisms underlying difficulties in SPS among persons who struggle with symptoms of BPD will facilitate the development of interventions to improve the social functioning and quality of life of such individuals.

Borderline Personality Disorder and Social Problem Solving

Individuals with BPD demonstrate a wide range of deficits in the area of SPS. For example, findings have indicated that individuals with BPD who have a history of NSSI generate more passive and fewer active solutions in response to social problem scenarios, compared with individuals with a history of suicidal ideation alone (Kehrer & Linehan, 1996; Linehan, Camper, Chiles, & Strosahl, 1987). Furthermore, within a sample of suicide attempters, individuals with BPD demonstrated more SPS deficits than suicide attempters without such a diagnosis (Berk, Jeglic, Brown, Henriques, & Beck, 2007). In particular, persons with BPD report fewer active or adaptive solutions to social problem scenarios when compared with controls (Zeigler-Hill & Abraham, 2006). Recent studies have further indicated that persons with BPD demonstrate a negative problem orientation impulsive or careless problem solving styles in social situations (McMurran, Duggan, Christopher, & Huband, 2007), even when compared to other clinical groups (Bray, Barrowclough, & Lobban, 2007).

The factors underlying SPS deficits in BPD, however, remain unclear. Studies in this area have generally measured SPS deficits with aggregated trait measures, such as the Social Problem Solving Inventory (D’Zurilla & Nezu, 1990; D’Zurilla, Nezu, &

Maydeu-Olivares, 2002) and have not examined the influence of context on SPS difficulties in BPD. Although persons with BPD may have a general, trait-like vulnerability to SPS deficits, research and theory suggest that many of the behavioral problems experienced by persons with BPD are context-dependent. Specifically, there has been the suggestion that problems with impulsivity (Domes, Winter, Schnell, Vohs, Fast, & Herpertz, 2006; Tice, Bratslavsky, & Baumeister, 2001) and NSSI occur primarily in response to emotional stressors (Chapman, Leung, & Lynch, 2008; Linehan, 1993). Similarly, as reviewed below, there is evidence that negative emotional states can hinder SPS performance in both clinical and non-clinical samples. Therefore, research is needed to examine the effects of emotional contexts on SPS among persons with BPD features.

Borderline Personality Disorder, Emotions and Emotion Regulation

The central difficulty underlying symptoms of BPD has been described as pervasive emotion dysregulation (Linehan, 1993; Lynch et al., 2006; Westen, 1991). *Emotion regulation* refers to the process by which individuals influence their emotional experiences. This may involve modulating timing of an emotion, which emotion is experienced, the subjective perception of the emotion, or expression of the emotion (Gross, 1998). According to Linehan's (1993) biosocial theory, BPD is characterized by a combination of a biologically-based tendency toward heightened emotional arousal with deficits in the skills necessary to regulate emotional experiences. This *emotional vulnerability* consists of emotional sensitivity (low-threshold for emotional activation), emotional reactivity (intense emotional responding), and a slow return to emotional baseline (i.e., delayed recovery from emotional stressors). Within this framework, many of the behavioral difficulties of persons with BPD (e.g., self-harm, impulsive behavior, substance abuse) are theorized to occur in response to emotional stressors. These behaviours may also function to regulate or reduce emotional arousal.

Existing research supports the notion of heightened emotional vulnerability among persons with BPD. For example, compared to non-psychiatric controls, individuals with BPD exhibit greater sensitivity to emotional cues (e.g., identification of the emotion salient in a facial expression, Lynch et al., 2006; or interference from identifying masked negative emotional words, Arntz, Appels, & Sieswerda, 2000) than non-BPD control groups. Features of BPD are also positively associated with self-reported negative emotions among clinical (Farmer & Nelson-Gray, 1995; Levine, Marziali, & Hood, 1997; Stiglmayr et al., 2005) and nonclinical (Cheavens et al., 2006; Rosenthal, Cheavens, Lejuez, & Lynch, 2005) samples. Preliminary research also demonstrates a tendency among individuals with BPD to exhibit greater sympathetic nervous system (SNS) arousal in response to startle (Ebner-Priemer et al., 2005) and emotional stimuli (Kuo, Rees, & Linehan, 2006), compared to persons without BPD. In contrast, other studies (Herpertz et al., 2000; Herpertz, Kunert, Schwenger, & Sass, 1999) did not find significant differences in SNS arousal between participants with and without BPD diagnoses. These studies, however, used different emotional stimuli, and did not control for dissociation during presentation of the stimuli. Dissociation (characterized by depersonalization and derealization; American Psychiatric Association, 2000), a frequent stress response among persons with BPD (Zanarini, Ruser, Frankenburg, Hennen, & Gunderson, 2000), has been associated with blunted physiological responses (Ebner-Priemer et al., 2005), and is therefore important to assess when measuring emotional responding. Taken together, existing research supports Linehan's (1993) conceptualization of heightened emotion vulnerability as a key feature of BPD. Further, evidence is suggestive of heightened physiological arousal in response to emotional stimuli among persons with BPD, compared to non-BPD controls, although more research is needed in this area.

In addition to experiencing frequent, intense negative emotions, individuals with BPD appear to have difficulties with the regulation of emotional arousal. Several tendencies may indicate difficulties with emotion regulation, such as limited access to strategies to up- or down-regulate emotions, lack of emotional awareness, and an inability to persist with goal-directed behaviour in the presence of negative emotional states (Gross, 1998; Gratz & Roemer, 2004). The severity and diagnosis of BPD have been associated with difficulties in the pursuit of goal-directed behaviour under negative emotional states (Gratz, Rosenthal, Tull, Lejuez, & Gunderson, 2006), self-reported difficulties with emotion regulation (Leible & Snell, 2004; Yen, Zlotnick & Costello, 2002), and the use of coping strategies geared toward escape or avoidance of emotions (Bijttebier & Vertommen, 1999; Chapman, Specht, & Cellucci, 2005; Kruedelbach, McCormick, Schulz, & Grueneich, 1993).

Pathways toward Poor SPS among Persons with BPD Features

Based on this research, BPD features are associated with intense negative emotions and difficulty regulating emotional arousal. As a result, one pathway toward poor SPS in BPD could be heightened negative emotional arousal. When persons with BPD are faced with stressors, they may have particular difficulty with problem solving generally, and social problem solving more specifically. Specifically, the research on emotions and BPD suggest that difficulties with social problem solving likely depend on the presence and severity of negative emotions and emotional stressors. Heightened negative emotional arousal may interfere with the cognitive processes involved in thinking through and solving social problems. In support of this notion, several studies have indicated that negative emotional states may hinder SPS. For example, among adolescent inpatients, scores on an inventory of SPS were inversely related to measures self-report measures of hopelessness and anxiety (Reinecke, DuBois, & Schultz, 2001). Along these lines, depressed females reported less planned SPS than women without depression (Kuyken & Brewin, 1994). In a laboratory study, negative emotion inductions were followed by less effective SPS (Mitchell & Madigan, 1984). A recent study examined SPS deficits among persons with BPD, compared with non-psychiatric and psychiatric controls (persons with an Axis I disorder, predominately dysphoric disorder) (Bray et al., 2007). Compared with the non-psychiatric controls, persons with BPD scored lower on all subscales of one measure of SPS; however, in comparison to psychiatric controls, persons with BPD only scored lower on the *specificity* subscale. These findings further suggest that negative emotional states may interfere with SPS among persons with BPD or BPD features.

Another pathway toward poor SPS in BPD could be the tendency of individuals with BPD features to use maladaptive strategies to regulate emotions. As mentioned, BPD features are associated with efforts to avoid or escape emotions, often called *experiential avoidance*. In laboratory studies, avoidant coping strategies (e.g., the suppression of thoughts and emotions) have been shown to increase the frequency of unwanted thoughts (Davies & Clark, 1998; Macrae, Bodenhausen, Milne, & Ford, 1997; Wegner & Erber, 1992) (also see Abramowitz, Tolin, & Street, 2001 for a meta-analytic review), and to be relatively ineffective at reducing negative emotional arousal (Butler, Wilhelm, & Gross, 2006). Further, avoidant emotion regulation strategies are effortful (e.g., Wegner, 1994) and use cognitive resources that could otherwise be used to solve social problems. Indeed, some research has suggested that, when emotionally distressed, individuals tend to give priority to the reduction of emotional distress, rather than to the inhibition of maladaptive behaviours (Tice, Bratslavsky, & Baumeister, 2001).

Some research has linked maladaptive emotion regulation with poor SPS performance. For instance, SPS performance was poorer among dysphoric undergraduates who were instructed to ruminate (with rumination being an example of a resource-intensive, maladaptive response to emotional stress) about negative personal attributes compared with dysphoric students assigned to use distraction (Lyubomirsky & Nolen-Hoeksema, 1995). In another study, higher levels of trait rumination among a sample of depressed participants predicted poorer SPS (Donaldson & Lam, 2004). Furthermore, a couple of studies have shown that higher scores on measures of avoidant coping and avoidant emotion regulation styles are associated with poorer problem solving performance generally (Carson & Runco, 1999) and SPS performance specifically (D'Zurilla & Chang, 1995).

Limitations of Existing Research

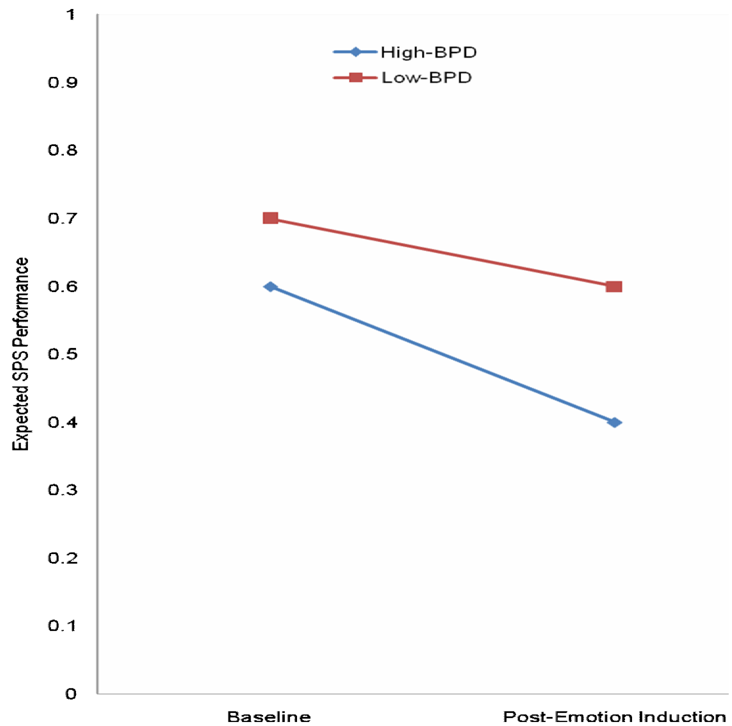
Despite suggestive evidence of the influence of emotional arousal and emotion regulation, alone or in combination, on SPS deficits in BPD, existing research has been characterized by noteworthy limitations. The extant research has relied primarily on broad, context-free self-report measures of SPS (e.g., Carson & Runco, 1999; Reinecke et al., 2001) and on cross-sectional designs. These methods are subject to response and recall biases and do not shed light on the specific contexts in which persons with BPD show SPS difficulties (e.g., when under emotional stress). The general approach in the research has been to conceptualize SPS problems as a trait-like deficit among persons with BPD features. On the contrary, for this research, I am proposing that SPS deficits in BPD are likely to be context-dependent and associated with emotional arousal and emotion regulation. In order to examine this proposal and surmount limitations in the research, I utilized both laboratory and self-report measures of SPS and examined SPS performance among persons with BPD in the presence and absence of emotional stressors.

Primary Aims and Hypotheses of this Research

The primary aim of this research was to examine the mechanisms underlying the relationship between SPS difficulties and features of BPD. I examined the effects of an emotional stressor, level of emotional arousal, and emotion regulation strategies on SPS performance among undergraduate participants who were high in BPD features, compared with controls who were low in BPD features. My hypotheses were as follows:

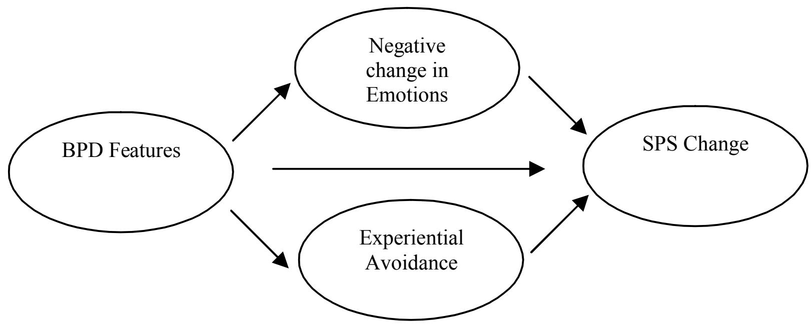
Hypothesis 1: *Emotion condition will moderate the association of BPD with SPS performance* (see Figure 1). I specifically hypothesized that (a) at emotional baseline, high-BPD individuals would demonstrate poorer SPS performance compared with low-BPD individuals, (b) high-BPD individuals will show worse SPS performance following an emotional stressor, compared with emotional baseline, and (c) the high-BPD group would show a greater decrease in SPS performance (relative to emotional baseline) following the emotional stressor, compared with the low-BPD group. No predictions were made regarding the low-BPD group.

Figure 1: ***The hypothesized significant Group x Emotion Condition interaction among individuals with high and low features of BPD***



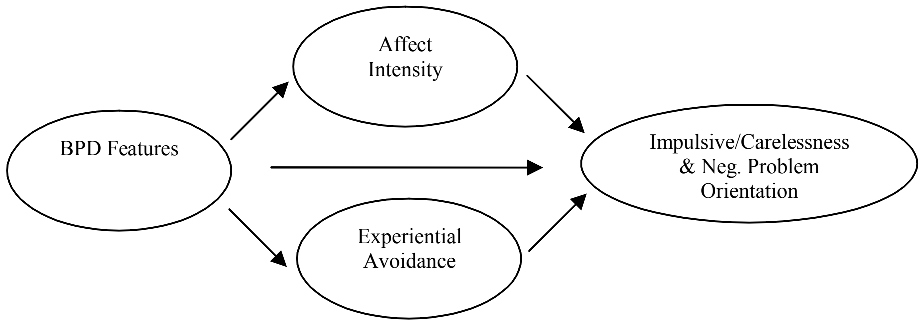
Hypothesis 2: Change in emotional state and experiential avoidance will mediate the association of BPD features with change in SPS performance (see Figure 2). In particular, I hypothesized that (a) BPD features will be positively associated with increases in negative emotional state (both self-report and psychophysiology measures) from baseline to post-stressor, (b) higher levels of BPD features will be associated with greater reductions in SPS performance, and (c) changes (i.e., increases) in negative emotional state will account for this association of BPD features with reductions in SPS performance. Given that difficulty regulating emotions might serve as an alternative explanation for the association of BPD features with reductions in SPS performance, I also examined the alternative hypothesis that experiential avoidance mediates the association of BPD features with reductions in SPS performance.

Figure 2: ***Model 1, in which the path between BPD features and change in SPS performance is expected to be mediated by negative change in emotions and experiential avoidance during the laboratory procedure***



Hypothesis 3: *Self-reported typical negative affect intensity will mediate the association of BPD features with trait measures of SPS* (see Figure 3). This expectation mirrors Hypothesis 2 on a trait-level by evaluated the relationships between self-report measures of the constructs of interest. I hypothesized that (a) BPD features will be positively associated with self-report of tendencies to experience intense negative emotions, (b) higher levels of BPD features will be associated with higher levels of negative problem orientation and more impulsive/careless styles of solving social problems on a trait-based measure of SPS, consistent with previous findings (McMurran et al., 2007), and (c) trait negative affect intensity will account for this positive association of BPD features with poor SPS. Given that difficulty regulating emotions might serve as an alternative explanation for the association of BPD features with poor SPS performance, I also examined the alternative hypothesis that maladaptive emotion regulation strategies, specifically experiential avoidance, mediate the association of BPD features with poor SPS performance.

Figure 3: ***Model 2, in which Model 1 is tested using cross-sectional self report, and the path between BPD features and SPS performance on the Impulsive/Careless Problem Solving Style and Negative Problem Orientation is expected to be mediated by negative affect intensity and experiential avoidance***



Methods

Participants & Recruitment

Undergraduates from Simon Fraser University were recruited to participate in initial mass-testing and smaller questionnaire sessions, for which they received $5 for their participation. Two-hundred-eighty seven (287) undergraduates participated in these sessions, including the Fall and Spring semesters. Participants were told that they may be contacted for further participation in a study on emotions.

Participants' gender, age, and scores on the Personality Assessment Inventory – Borderline Features Scale (PAI-BOR; Morey, 1991) determined eligibility for the subsequent laboratory sessions. In order to reduce variance in measures of physiology attributable to sex and age (De Meersman & Stein, 2007), only females under the age of 60 were eligible to participate in the laboratory sessions. Following Trull (1995; 2001) and Chapman et al. (in press), individuals who scored greater than or equal to 38 on the PAI-BOR were designated as the "High-BPD" group, and individuals who scored below 23 on the PAI-BOR were designated as the "Low-BPD" group. This lower-level cutoff on the PAI-BOR was chosen because this is the mean score reported for undergraduates (Morey, 1991). Individuals who scored between 23 and 38 on the PAI-BOR constituted the "Mid-BPD" group. Of the individuals eligible to participate, 29 High-BPD, 31 Mid-BPD and 30 Low-BPD individuals completed the study ($M_{age} = 21.59$, $SD = 5.57$). The participants' reported ethnicities were predominately Chinese or Chinese Canadian (42.40%) and White or Caucasian (37%; see Table 1).

Table 1: ***Demographics***

	n	%
Race/Ethnicity		
Chinese/Chinese Canadian	39	42.4
White/Caucasian	34	37.0
Black/African Canadian	2	2.2
Korean or Korean Canadian	2	2.2
Middle Eastern/Arab	2	2.2
Other Asian/Asian Canadian	1	1.1
East Indian/Indo-Canadian	1	1.1
Other	6	6.5
More than one racial group	3	3.3
Chose not to answer	2	2.2

The use of an undergraduate sample provided a feasible alternative to conducting this research using a clinical sample, because undergraduate participants are easily accessible and can be reimbursed for their time using non-monetary incentives, such as course credit. Practically, subclinical samples are also useful because they are less likely than clinical samples of persons with BPD to engage in behaviors that may influence measures of emotional arousal, such as severe drug use. In addition, as noted by Trull (2001), research on behavioral problems associated with BPD has focused primarily on individuals recruited from clinical settings (Trull, 2001), and as a result, findings may not generalize to persons who demonstrate significant but non-clinical levels of BPD features. Further, an examination of these factors among samples which exhibit a range of BPD features may be particularly informative, given that research suggests BPD can best be conceptualized as a dimensional disorder (Widiger, 1992). Given that findings have suggested significant impairments associated with BPD features among undergraduates in particular, research on SPS among undergraduates may help to identify factors related to such impairments.

Self-Report Questionnaires

Borderline Features.

The Personality Assessment Inventory – Borderline Features Scale (PAI-BOR; Morey, 1991) is a 24-item scale which was used to classify individuals as having high or low BPD features. Items are rated on a 4-point scale, where 0 is "completely false" and 3 is "very true." This measure assesses symptoms of BPD as defined in the DSM, and contains items related to affective instability, relationship instability, and impulsivity. The PAI-BOR has strong psychometric properties, and is commonly used to assess BPD features among undergraduates (Trull, 1995; 2001). In a recent study within the same population, the PAI-BOR demonstrated good test-retest reliability ($r = .89$) over approximately one month (Chapman et al., in press). In the present study, the PAI-BOR demonstrated high internal consistency, $\alpha = .89$.

Social Problem Solving.

The Social Problem-Solving Inventory-Revised (SPSI-R; D'Zurilla, Nezu, & Maydeu-Olivares, 2002) is a 52-item self-report measure designed to assess participants' abilities to identify the social problem, generate and compare solutions, make decisions, and implement solutions. Each item is rated from "not at all true of me" to "extremely true of me." The scores can be divided into five related subscales: (1) Positive Problem Orientation, which involves optimism regarding outcome and high self-efficacy; (2) Negative Problem Orientation, which is associated with low self-efficacy and low tolerance for frustration; (3) Problem Definition and Formulation, which involves ability to identify problems; (4) Generation of Alternative Solutions, which involves the ability to brainstorm potential solutions to problems; (5) Decision Making, which involves choosing among potential solutions based on strengths and weaknesses of solutions generated; (6) Impulsivity/Carelessness Style, which is typified by careless and incomplete attempts at SPS; (7) Avoidance Style, which is characterized by inaction or avoidance of SPS or responsibility for SPS; and (8) Rational Problem Solving, which is the deliberate and systematic application of effective strategies of SPS. Higher scores on the Positive Problem Orientation and Rational Problem Solving subscales are associated with adaptive styles of SPS, whereas higher scores on the other subscales are associated with dysfunctional styles of SPS (D'Zurilla et al., 2002). Among undergraduates, the subscales have good three-week test-retest reliability (ranging from $r = .72$ to $r = .88$), and high internal consistency, $\alpha = .72$ to $\alpha = .92$ (D'Zurilla et al., 2002). In the present sample, the internal consistency of the Positive Problem Orientation scale was low, $\alpha = .51$, and was not included in subsequent analyses. The internal consistencies for the remaining scales ranged from $\alpha = .75$ for Problem Definition and Formulation, to $\alpha = .91$ for Negative Problem Orientation.

Dissociation.

The Dissociative State Scale (DSS; Stiglmayr, Shapiro, Stieglitz, Limberger, & Bohus 2001) measured the severity of dissociative symptoms throughout the experimental procedures. This self-report measure consists of 19 items that relate to physiological (e.g. "hearing things as if from far away") and psychological dissociation (e.g., "feel as though I am standing beside myself"). Higher scores relate to more severe dissociative symptoms. This measure had high internal consistency in the present sample, $\alpha = .90$.

Current Affect.

The Positive And Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) was used to assess subjective emotional state. Participants were asked to rate how they feel "right now, (that is, at the present moment)" each of ten positive emotions (enthusiastic, interested, determined, excited, inspired, alert, active, strong, proud, attentive) and ten negative emotions (scared, afraid, upset, distressed, jittery, nervous, ashamed, guilty, irritable, hostile) on a Likert scale of 1 to 5. The PANAS has shown good test-retest reliability over eight weeks (r = .68 for Positive Affect, r = .71 for Negative Affect) among a sample of students (Watson et al., 1988). The PANAS has also demonstrated good validity (MacKinnon et al., 1999). In the present study, the PANAS demonstrated high internal consistency (α = .86-.91 for Positive Affect, α = .79-.81 for Negative Affect).

Affect Intensity.

The Affect Intensity Measure (AIM; Larsen & Diener, 1987) is a 40-item self-report questionnaire intended to measure the typical intensity with which individuals experience their emotions. The AIM has several scales, including positive affect, negative affect, affect intensity, and affect reactivity. For the present study, the negative affect intensity scale was used. The internal consistency of this scale was α = .76.

Psychopathology.

The Brief Symptom Inventory (BSI) is a 53-item self-report measure designed to assess various psychological symptoms and complaints (Derogatis, 1993). The BSI yields nine primary symptom dimensions and three global indices of psychopathology, including the Global Severity Index (GSI). The GSI is a weighted score that takes into account the number of symptoms reported and the intensity of distress assigned to each symptom by the respondent. The BSI has shown adequate psychometric properties, good sensitivity and moderate specificity, and high test-retest reliabilities for all the scales, r = .68 to r = .91 (Derogatis, 1993). For the present study, the GSI was used. The internal consistency of this scale was good, α = .76.

Experiential Avoidance.

The Acceptance and Action Questionnaire (AAQ; Hayes et al., 2004) is a 9-item self-report measure of experiential avoidance. Each item is rated on a 7-point Likert scale. These items tap into tendencies to make negative evaluation of internal experiences (e.g., “anxiety is bad”), as well as unwillingness to experience such aversive events. Scores on the AAQ have been associated with psychopathology in non-clinical samples (Chapman, Leung, Rosenthal, Walters, & Dixon-Gordon, in preparation), and typically have high internal consistency (e.g., α = .89, Kashdan, Barrios, Forsyth, & Steger, 2006). The internal consistency of the AAQ was adequate in the present study (α = .67). The AAQ was used as a trait-like measure experiential avoidance at baseline.

Participants’ responses to emotions experienced during the emotion induction were assessed with a modified version of Responses to Emotions Questionnaire (REQ; Campbell-Sills, Barlow, Brown, & Hofman, 2006).This questionnaire was modified to use the past tense to refer to the emotion induction. Each of the eight items is rated on a 9-point Likert scale. Four of these items assess various strategies of regulating emotions (suppression, distraction, reappraisal, attention redirection) and four items assess emotional acceptance (e.g., “I didn’t mind feeling uncomfortable during the tape”). The emotional acceptance scale will be reversed and used as one measure of experiential avoidance during the emotion induction. Internal consistency of the emotional acceptance scale was adequate, α = .67.

Participants’ emotion regulation strategies during the emotion induction were measured using a modified version of the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003). This self-report measure consists of 10 items which are rated on a Likert scale from 1 to 7, where 1 indicates “strongly disagree” and 7 indicates “strongly agree.” This measure has two factors: (1) reappraisal (e.g., “When I wanted to feel less *negative* emotion, I *changed the way I was thinking* about the situation”) and (2) suppression (e.g., “I controlled my emotions by *not expressing them*”). Among an undergraduate sample, this measure has adequate three-month test-retest reliability (r = .69) (Gross & John, 2003). For the present sample, internal consistency within each factor was good (α = .85 for reappraisal, and α = .80 for suppression). The suppression scale was used in the present study to evaluate emotion suppression during the emotion induction procedure.

Medical Health History Interview for Physiological Research.

This brief structured interview (MHHI; Beauchaine, 1993) was modified for use as a questionnaire, rather than as an interview, to identify medical factors that might interfere with accurate assessment of physiological variables. The MHHI assesses age, sex, height, weight, and any conditions that may involve cardiac health.

Skin Conductance Response

While completing the emotion induction procedure and the SPS task, participants were hooked up to equipment designed to measure skin conductance responses (SCRs). These data were acquired using Ag/AgCl electrodes, and through BIOPAC Systems amplifiers and scored using BIOPAC software (BIOPAC Systems, Inc., Santa Barbara, CA).

Skin conductance was recorded from two collars with electrodes attached to the second and third distal phalanges on the non-dominant hand. SCR is a commonly used measure of sympathetic activity. For the present study, I examined the SCRs associated with emotional arousal during the emotion induction procedure and the MEPS (described below). The SCR data was collected through an MP100WS system at the rate of 1000 samples per second. Mean skin conductance response (SCR) was calculated by averaging the number of SCRs (responses exceeding .05 microsiemens) per data collection period (5 minutes). If the SCRs were concurrent with physical movement by the participant, those SCRs were excluded from the calculation of mean SCRs.

Procedure

Laboratory Sessions.

The participant first completed several self-report questionnaires, including the AAQ, SPSI-R, and MHHI (see Table 2 for a description of the order of assessments and procedures). At this time, the experimenter and the participant completed the pre-experiment risk assessment (UWRAP; see below). The next step was the hook up to the physiological monitoring equipment. The participant completed the self-report measures of current affect and dissociation (PANAS, DSS), and then underwent the first vanilla baseline (see below for description), followed by another set of self-reports on current affect and dissociation. Next, the participant responded to three randomly selected MEPS scenarios. Self-reports on current emotional state and dissociation were collected a third time, followed by the second vanilla baseline, and a fourth set of self-reports of current affect and dissociation. At this time, the participant underwent the emotion induction procedure, and completed a fifth self-report of current affect and dissociation. The participant then responded to the other three randomly-ordered MEPS scenarios, followed by a sixth self-report of current affect. The participant was also asked how she dealt with her emotions during the emotion induction procedure using the modified ERQ and REQ. Finally, the UWRAP was completed to assess risk and improve mood, and the participant was debriefed to review the purpose of the study. The procedures involved in the data collection process ensured that experimenters check each questionnaire for missing data. If data were missing, the experimenter requested that the participant complete the missing item(s).

Table 2: ***Laboratory Procedures***

Order	**Task**	**Measures**
1	Self-Report	AAQ[a], BSI[b], MHHI[c], SPSI-R[d]
2	Risk Assessment	UWRAP[e], Part 1
3	Current Self-Report 1	DSS[f], PANAS[g]
4	Baseline 1	Vanilla Baseline
5	Current Self-Report 2	DSS, PANAS
6	SPS Measure 1	3 MEPS[h] scenarios
7	Current Self-Report 3	DSS, PANAS
8	Baseline 2	Vanilla Baseline
9	Current Self-Report 4	DSS, PANAS
10	Emotion Induction	Imaginal Social Rejection Scenario
11	Current Self-Report 5	DSS, PANAS
12	SPS Measure 2	3 MEPS scenarios
13	Current Self-Report 6	DSS, PANAS
14	Emotion Regulation	Modified ERQ[i] and REQ[j]
15	Risk Assessment	UWRAP, Part 2

[a] Acceptance and Action Questionnaire (Hayes et al., 1996)

[b] Brief Symptom Inventory (Derogatis et al., 1993)

[c] Medical Health History Interview (Beauchaine, 2003)

[d] Social Problem Solving Inventory – Revised (D'Zurilla, Nezu, & Maydeu-Olivares, 2002)
[e] University of Washington Risk Assessment Protocol (Linehan, 1998)
[f] Dissociative State Scale (Stiglmayr et al., 2001)
[g] Positive And Negative Affect Schedule (Watson et al., 1988)
[h] Means-Ends Problem Solving procedure (Platt et al., 1975)
[i] Emotion Regulation Questionnaire (Gross & John, 2003)
[j] Responses to Emotions Questionnaire (Campbell-Sills et al., 2006)

Risk Assessment.

Because the present study involved inducing negative emotions among a sample prone to negative affect and suicidal tendencies, it was imperative to assess distress, suicidal ideation and urges to engage in self-harm. I used a risk assessment protocol developed at the University of Washington (UWRAP; Linehan, 1998) for use with suicidal individuals who are diagnosed with BPD. The UWRAP involves the assessment of suicidal, self-harm, and drug-use urges at the beginning and end of the session, as well as brainstorming with the participant regarding ways to improve affect at the end of the session. Local resources for dealing with distress (such as crisis line telephone numbers) were provided at the end of each session.

Vanilla Baseline.

In order to obtain a physiological baseline, participants were seated in front of a screen that displays colours, one after another. Participants were asked to pick one colour and count how many times it appears on the screen. This baseline measurement lasted five minutes. The vanilla baseline has been found to cause less anxiety than a baseline obtained in the absence of activities (i.e., having the participant sit still and do nothing for five minutes; Jennings, Kamarck, Stewart, Eddy, & Johnson, 1992).

Means-Ends Problem-Solving (MEPS).

The MEPS (Platt, Spivack, & Bloom, 1975) was designed to assess ability to identify the sequence of steps necessary to reach a successful resolution of an interpersonal problem. This procedure involves giving participants the beginning and end of a social scenario, and asking the participant to brainstorm the middle of the story. For example, they may be asked how relationship difficulties with a boyfriend are resolved, how they went about making friends in a new neighbourhood, or what they did when their friends started to avoid them. These responses were recorded and transcribed prior to being rated.

The responses on the MEPS were scored using a method developed by Linehan and colleagues (Kehrer & Linehan, 1996), which has since been modified to allow finer distinctions between response categories. Each step is coded as relevant (a potentially effective response) or irrelevant (a response with no evident effectiveness); active (initiated by the storyteller), or passive ("out of the blue"), or inappropriate (dysfunctional responses, such as self-harm). Participants completed two sets of three MEPS scenarios. Responses on the MEPS were scored along three dimensions. *Relevancy* was calculated as the number of relevant means (compared with non-goal directed story responses) divided by the total number of relevant and irrelevant means (Howat & Davidson, 2002; Platt & Spivack, 1975). *Activity* was calculated as the number of means initiated by the first-person, divided by the total number of active, passive, and irrelevant means (Howat & Davidson, 2002; Linehan et al., 1987). *Inappropriateness* was calculated as the number of inappropriate means (involving maladaptive behaviours, including suicidal or violent thoughts or behaviours) divided by the total number of inappropriate and appropriate means (Howat & Davidson, 2002; Kehrer & Linehan, 1996). Each set contained three randomly selected MEPS scenarios (out of six), similar to the procedures implemented by Kremers and colleagues (Kremers, Spinhoven, Van der Does, & Van Dyck, 2006). Two graduate students (including the author) were trained to reliability in MEPS coding. Inter-rater reliability was assessed on ratings for a random sample of 10% of the cases. Intraclass correlation coefficients were .93, .91, and .72 for the *relevancy*, *activity*, and *inappropriateness* scales, respectively. Throughout the coding process, the coders completed consensus ratings each week for a total of 15% of the cases to reduce the possibility of rater drift. Consensus codes were not included in calculations of inter-rater reliability.

Imaginal emotion induction procedures.

The induction procedure required that participants listen to a five minute audiotape. Participants were instructed to close their eyes, listen carefully, and imagine that the events described were happening to them. They were asked to picture the events in their minds, and to allow themselves to feel how they would respond to these events in real life.

The tape portrays a social rejection scenario. The protagonist (referred to by the tape in the second-person) is described as a new student to the university. The tape describes the protagonist calling her boyfriend, and his telephone is answered by another female. Later, the protagonist overhears two of her friends criticizing her appearance, behaviour, and values. These friends also discuss the purported infidelity of the boyfriend.

This tape has been found to cause significant increase in negative affect in an undergraduate sample (Robins, 1988). This procedure was chosen to allow for psychophysiological data collection to occur throughout the activity, so an emotion induction procedure that required minimal movement was necessary.

Results

Preliminary Power Analyses and Sample Size Considerations

According to Cohen's (1992) recommendations, previous research has demonstrated a large effect of the relationship between negative emotionality and measures of SPS (e.g., Bray et al., 2007). Previous studies of the effects of suppression on mood have found effect sizes that range from small (Campbell-Sills et al., 2006), and medium (Salters-Pedneault, Gentes, & Roemer, 2007) to large (Kashdan et al., 2006). Given that the primary purpose of the proposed research was to clarify the relationship between negative emotionality and SPS, it was necessary to ensure that power is sufficient to detect at least a medium effect size. For analyses using ANOVA, ANCOVA, MANOVA and/or MANCOVA, with two groups, my power analysis indicated that a sample size of 30 participants per group will be sufficient to detect a small effect ($f = .10$) with power = .80. For multiple regression with three IVs, my power analysis indicated that a sample size of 90 would be sufficient to detect a moderate effect size ($f^2 = .15$) with power = .87.

Missing Data

Due to technical errors in the collection of physiological data, skin conductance for 25 participants could not be included in the analyses. Further, technical errors also led to the loss of 13 participants' MEPS data. Missing cases were excluded pairwise for each analysis.

Descriptive Statistics and Data Transformations

Visual inspection of the data indicated that the effect of the emotion induction did not appear to persist across all three of the second set of MEPS stories. To better evaluate the impact of the emotion induction, I chose to compare responses to one MEPS story before the emotion induction to the responses to the first MEPS story following the emotion induction. Further, practice effects across the first three MEPS stories were apparent. For instance, among the High-BPD and Low-BPD groups, relevancy increased significantly from the first to the third MEPS story, $t(52) = -2.10$, $p = .04$. To reduce the impact of practice effects, I chose to use the third MEPS story (immediately preceding the emotion induction) as the measure of baseline SPS.

Please see Table 3, 4, 5, 6, and 7 (respectively) for descriptive statistics for the primary MEPS DVs, the PANAS positive and negative affect scales, the skin conductance data, SPSI-R scale scores, and emotion regulation/experiential avoidance scores. The MEPS *Inappropriateness* scale exhibited leptokurtosis and positive skew (see Table 3). Logarithmic transformations resulted in more normal distribution properties for the *Inappropriateness* scores. Examination of the data revealed that the skew was largely attributable to the low frequency of inappropriate SPS means. Please see Table 4 for descriptive statistics on the PANAS positive and negative affect scales. The descriptive statistics were also calculated for mean SCRs at baseline (during the second vanilla baseline) and during the emotion induction for both Low- and High-BPD groups (see Table 5). These data were positively skewed, and demonstrated a large degree of leptokurtosis among the High-BPD group. Examination of box plots revealed multiple outliers. In instances where skin conductance data outliers are theoretically meaningful and of interest (such as the present study, in which we are comparing theoretically extreme groups), it has been suggested that outliers not be eliminated or recoded (Cacioppo, Tassinary, & Berntson, 2007). Therefore these outliers were retained for all subsequent analyses. The scales of the SPSI-R were calculated according to the manual (D'Zurilla, Nezu, & Maydeu-Olivares, 2002), and descriptive statistics suggested these scores were normally distributed (see Table 6). Finally, for measures of experiential avoidance during the emotion induction, given a high correlation of the ERQ suppression scale and the reversed REQ acceptance scale scores ($r = .34$), I created a composite score for experiential avoidance by summing the z-scores and dividing them by two (see Table 7 for descriptive statistics).

Table 3: ***Descriptive Statistics of Means-Ends Problem Solving Scores***

	Range	Mean (SD)	Skew (SE)	Kurtosis (SE)
		Baseline MEPS		
High-BPD				
Relevancy	.25-1.50	.84 (.26)	-.08 (.46)	.92 (.89)
Activity	.00-.67	.29 (.18)	-.06 (.46)	-.48 (.89)
Inappropriateness[a]	.00-.44	.04 (.11)	2.81 (.46)	7.92 (.89)
Low-BPD				
Relevancy	.33-1.27	.072 (.24)	.58 (.48)	.15 (.87)
Activity	.00-1.00	.23 (.21)	1.74 (.45)	5.60 (.87)
Inappropriateness[b]	.00-.54	.10-(.03)	1.4 (.45)	.96 (.87)
		Post-Induction MEPS		
High-BPD				
Relevancy	.00-1.33	.69 (.33)	-.37 (.46)	.26 (.89)
Activity	.00-.50	.21(.03)	.11 (.46)	-1.29 (.89)
Inappropriateness[c]	.00-.67	.10 (.03)	1.88 (.46)	3.54 (.89)
Low-BPD				
Relevancy	.50-1.33	.89 (.22)	.48 (.45)	-.47 (.87)
Activity	.00-.75	28 (.03)	.45 (.45)	.74 (.87)
Inappropriateness[d]	.00-.50	.03 (.02)	4.25 (.45)	19.51 (.87)

[a] After logarithmic transformations, at baseline for High-BPD: Range = (0-.16), *M* = .02 (.04), Skew = 2.64(.46), Kurtosis = 6.69(.89);

[b] For Low-BPD, Range = (0-.19), *M* = .04 (.06), Skew = 1.27(.45), Kurtosis = .33(.87);

[c] After logarithmic transformations, at post-emotion induction for High-BPD: Range = (0-.16), *M* = .04 (.01), Skew = 1.59(.46), Kurtosis = 2.03(.46)

[d] For Low-BPD: Range = (0-.18), *M* = .01 (.04), Skew = 4.01(.45), Kurtosis = 17.52(.87)

Table 4: ***Descriptive Statistics of Reported Emotions on the Positive And Negative Affect Schedule***

	Range	Mean (SD)	Skew (SE)	Kurtosis (SE)
		Baseline		
High-BPD				
Positive Affect	10.00-26.00	15.72 (5.65)	.65 (.43)	-1.09 (.85)
Negative Affect	10.00-24.00	14.79 (4.10)	.59 (.43)	-.58 (.85)
Low-BPD				
Positive Affect	11.00-41.00	24.83 (8.99)	.66 (.43)-.86 (.83)	.15 (.87)
Negative Affect	10.00-23.00	12.17 (2.82).23 (.21)	2.25 (.43)	6.68 (.83)
		Post-Emotion Induction		
High-BPD				
Positive Affect	10.00-34.00	16.34 (6.18)	1.20 (.43)	1.07 (.85)
Negative Affect	10.00-33.00	21.52 (6.84)	.06 (.43)	-1.25 (.85)
Low-BPD				
Positive Affect	10.00-39.00	22.07 (8.22)	.33 (.43)	-.97 (.83)

	Range	Mean (SD)	Skew (SE)	Kurtosis (SE)
Negative Affect	10.00-27.00	14.43 (4.54)	1.48 (.43)	1.88 (.83)

Table 5: ***Descriptive Statistics on Skin Conductance Responses***

	Range	Mean (SD)	Skew (SE)	Kurtosis (SE)
		Baseline		
High-BPD	0-.10	.02 (.04)	1.91 (.47)	1.79 (.92)
Low-BPD	0-.30	.03 (.07)	3.40 (.51)	12.34 (.99)
		Post-Emotion Induction		
High-BPD	.00-.60	.10 (.15)	2.41 (.51)	6.37 (.99)
Low-BPD	.00-.25	.02 (.07)	2.90 (.47)	7.59 (.92)

Table 6: ***Descriptive Statistics of Social Problem Solving Inventory-Revised (SPSI-R) Scales***

SPSI Scale	Range	Mean (SD)	Skew (SE)	Kurtosis (SE)
Positive Problem Orientation	58-127	95.44 (16.68)	.04 (.26)	-.91 (.51)
Negative Problem Orientation	77-134	100.78 (13.99)	.59 (.26)	-.41 (.51)
Problem Definition & Formulation	60-133	97.47 (15.18)	-.20 (.26)	-.24 (.51)
Generation of Alternative Solutions	59-136	97.35 (15.70)	.00 (.26)	-.67 (.51)
Decision Making	56-137	101.30 (6.55)	-.37 (.26)	-.36 (.51)
Solution Implementation & Verification	64-136	97/.74 (16.29)	.19 (.26)	-.35 (.52)
Rational Problem Solving	60-140	97.67 (16.02)	-.10 (.26)	-.01 (.51)
Impulsive/Careless Style	75-128	94.90 (13.34)	.88 (.26)	.23 (.51)
Avoidance Style	82-28	98.61 (11.86)	.68 (.26)	-.28 (.51)

Table 7: ***Descriptive Statistics of Experiential Avoidance (EA) Measures***

	Range	Mean (SD)	Skew (SE)	Kurtosis (SE)
AAQ[a]	1.78-6.00	3.86 (.83)	.0(.26)	-.15(.51)
EA Index[b]	-1.54-1.78	-.01(.83)	.37(.25)	-.11 (.50)

[a] Acceptance and Action Questionnaire.

[b] The mean of the *z* scores of the Responses to Emotions – Acceptance scale (reversed) and the Emotion Regulation Questionnaire- Suppression scale.

Identification of Potential Covariates

Potential covariates of skin conductance.

Physiological indices such as those that will be measured in this study have been found to covary with age (e.g., De Meersman & Stein, 2007; Scarpa, Raine, Venables, & Mednick, 1997). Also, some physiological indicators are inversely related to weight and height (e.g., Diggle, Liang & Zeger, 1996). To address whether age, weight or height might have confounded measures of skin conductance in the present study, I examined the effects of age, height, and weight as reported on the MHHI on mean SCR. To ensure age, weight, and height did not differ systematically across groups and confound group differences of SCRs, I conducted three independent samples *t* tests. There were no significant differences on these variables between the High-BPD and Low-BPD groups (*t*s = -.15 - .98 , *ps* = .34 - .88). There was also no significant association between age, height, or weight with change in skin conductance throughout the procedures (*r*s = -.02 - .24, *p*s = .08 - .83). Therefore these variables were not included as covariates in relevant analyses involving skin conductance.

I also evaluated whether there was a need to control for change in dissociation from baseline to post emotion induction in examining changes in skin conductance. There were no significant differences on change in dissociation between High-BPD and Low-BPD groups, $t(57) = .94$, $p = .35$. Further, the correlation between change in dissociation and change in skin conductance was non-significant ($r = -.23$, $p = .06$); thus, dissociation was not controlled for in subsequent analyses.

Potential covariates of MEPS.

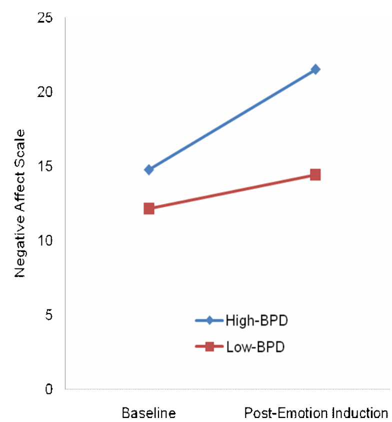
The High-BPD group had significantly higher scores on general psychopathology as measured by the GSI ($M = 1.67$, $SE = .55$), compared with the Low-BPD group ($M = .53$, $SE = .43$), $t\ (50.85) = -8.87$, $p < .01$, $d = 2.32$. Correlations between GSI and MEPS variables revealed no significant association of GSI with *inappropriateness* at baseline ($r = -.18$, $p = .12$) or post-emotion induction ($r =.09$, $p = .45$). There was, however, a significant association with *relevancy* ($r = .03$, $p = .03$) at baseline, but not following the emotion induction ($r = -.10$, $p = .41$). Similarly, the GSI was significantly correlated with *activity* post-emotion induction ($r = -.24$, $p = .04$), but not at baseline ($r = .18$, $p = .12$). Thus, GSI was not included as a covariate in subsequent analyses.

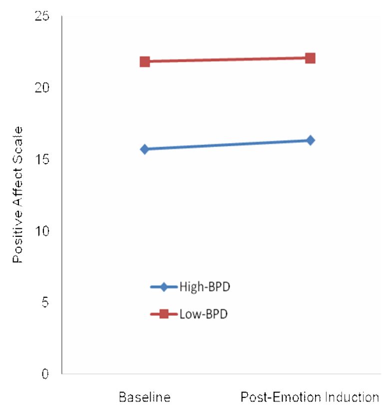
Manipulation Check Analyses

Self-Report Measures.

To assess whether the emotion induction elicited increased report of negative emotions, I conducted a 2 x 2 mixed-model multivariate analysis of variance (MANOVA), with Group (High-BPD: $n = 29$ vs. Low-BPD: $n = 30$) as the between-subjects factor, and Time (baseline vs. during the emotion induction) as the within-subjects factor. Scores on the PANAS Negative and Positive Affect scales were included as dependent variables. There was a significant effect of Group, $F(2, 56) = 19.01$, $p<.01$, $\eta^2 = .40$. Bonferroni-adjusted pairwise comparisons revealed that the High-BPD group exhibited higher negative emotion ($M = 18.16$, $SE = .69$) and lower positive emotion ($M = 16.03$, $SE = 1.30$) overall compared with the Low-BPD group (Positive Affect: $M = 13.30$, $SE = .68$; Negative Affect: $M = 21.95$, $SE = 1.25$). There was also a main effect of Time, $F(2, 56) = 16.13$, $p<.01$, $\eta^2 = .37$. There was an overall increase in report of negative emotions following the emotion induction, $F(1, 57) = 32.80$, $p<.01$, $\eta^2 = .37$ but no significant change over time in report of positive emotions, $F(1, 57) = .44$, $p = .51$, $\eta^2 =.01$, There was also a significant Group x Time interaction, $F(2, 56)= 3.96$, $p = .03$, $\eta^2 = .12$. Specifically, the High-BPD group reported significantly more negative emotions before the emotion induction ($M = 14.79$, $SD = 4.1$), compared with the Low-BPD group ($M = 12.17$, $SD = 2.82$), $t(57) = 2.88$, $p = .04$. Further, the High-BPD group also reported more negative emotions following the emotion induction ($M = 21.52$, $SD = 6.84$), compared with the Low-BPD group ($M = 14.43$, $SD = 4.54$), $t(57) = 4.70$, $p < .01$. In a follow-up ANOVA with Group as the between-subjects factor and difference from pre- to post-emotion induction on the PANAS negative affect scale as the DV, the High-BPD group demonstrated a significantly larger increase in reported negative emotions ($M = 6.72$, $SD = 7.06$), compared with the Low-BPD group ($M = 2.27$, $SD = 4.83$), $F(1, 57) = 8.06$, $p < .01$, $d = .67$. This increase in negative emotions from baseline to post-emotion induction was significant for both the Low-BPD group, $t(29) = 2.57$, $p = .016$, and the High-BPD group, $t(28) = 5.13$, $p < .01$. Please see Figure 4 for a diagram of change in negative emotions from baseline to post-emotion induction.

Figure 4: ***Scores on the Positive and Negative Affect Schedule at baseline and after the emotion induction for both High-BPD and Low-BPD groups***

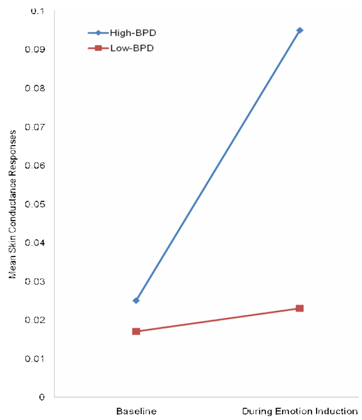




Skin conductance

Next, I examined the effect of the emotion induction on SCRs using a 2 x 2 mixed-model ANOVA, with Group (High-BPD: *n* = 20 vs. Low-BPD: *n* = 24) as the between-subjects factor, Time (vanilla baseline vs. emotion induction) as the within-subjects factor, and mean SCRs as the dependent variable. There was a significant effect of Group, $F(1, 42) = 4.31$, $p = .04$, $\eta^2 = .09$, such that the High-BPD group exhibited higher SCRs overall ($M = .06$, $SE = .01$) compared with the Low-BPD group ($M = .02$, $SE = .01$). There was also a significant effect of Time, $F(1, 42) = 4.13$, $p = .048$, $\eta^2 = .09$. Specifically, the pre-emotion induction SCR scores were lower ($M = .02$, $SE = .01$) compared with during the emotion induction ($M = .06$, $SE = .02$). The interaction of Group x Time was non-significant, $F(2, 42) = 2.89$, $p = .097$, $\eta^2 = .06$. A planned one-way ANOVA with Group as the IV and the difference between pre- and post-emotion induction SCRs as the DV revealed a non-significant effect of group, $F(1, 42) = 2.89$, $p = .097$, $d = .50$, with the High-BPD group demonstrating a larger, but non-significant, increase in SCRs from baseline ($M = .07$, SD = .17), compared with the Low-BPD group ($M = .01$, $SD = .07$).[1] Please see Figure 5 for a diagram of change in skin conductance from baseline to post-emotion induction.

Figure 5: ***Mean skin conductance responses at baseline and during the emotion induction for both High-BPD and Low-BPD groups***



Together, these results indicate that the emotion induction had the intended effect. Overall, participants reported an increase in negative emotions and exhibited an increase in SCRs during the emotion induction. Further, the High-BPD group demonstrated greater negative affect and SCRs overall, and there was a greater increase in self-reported negative affect and a greater (but non-significant) increase in SCRs among this group during the emotion induction, compared with the Low-BPD group.

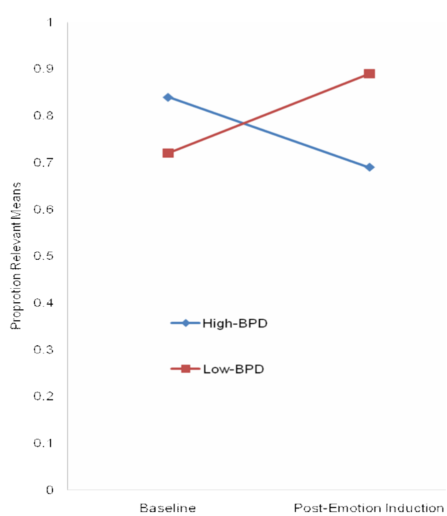
Social Problem Solving, Emotional State, and Borderline Personality Features

To test Hypothesis 1 and assess whether the emotion condition (baseline vs. post-emotion induction) moderated the association between level of BPD features and SPS performance, I conducted a series of three 2 x 2 mixed-model ANOVAs. For each analysis, Group (High-BPD: n = 26 vs. Low-BPD: n = 27) was the between subjects variable, and Time (baseline vs. post-emotion induction) was the within subjects variable. Within each ANOVA, a scale from the MEPS (*Relevancy, Activity*, or *Inappropriateness*) served as the DV. As noted above, it was expected that (a) the High-BPD group would demonstrate poorer SPS performance at baseline than the Low-BPD group, (b) that the High-BPD group would show worse SPS performance following an emotional stressor, compared with emotional baseline, and (c) the High-BPD group would show a greater decrease in SPS performance following the emotional stressor, relative to the Low-BPD group.

Relevancy.

As shown in Figure 6, there was a significant Group x Time interaction for *Relevancy*, $F(2, 51) = 16.50$, $p < .01$, $\eta^2 = .24$. At baseline, the difference between groups on *Relevancy* was non-significant, $t(51) = -1.87$, $p = .07$, although group differences emerged post-emotion induction, $t(51) = 2.56$, $p = .01$, at which point the High-BPD group used fewer relevant means ($M = .69$, $SD = .32$)_compared with the Low-BPD group ($M = .89$, $SD = .22$). A paired-samples *t* test demonstrated that the High-BPD group had significantly lower *Relevancy* post-emotion induction, $t(25) = 2.42$, $p = .02$. The Low-BPD group, however, demonstrated more *Relevancy* post-emotion induction, $t(26) = -3.44$, $p < .01$. A follow-up one-way ANOVA with Group as the IV and difference from baseline to post-emotion induction with *Relevancy* as the DV revealed that the High-BPD group had a significantly larger decrease in relevant means used ($M = -.15$, $SD = .32$) compared with the Low-BPD group ($M = .17$, $SD = .26$), $F(1, 51) = 16.50$, $p < .01$.

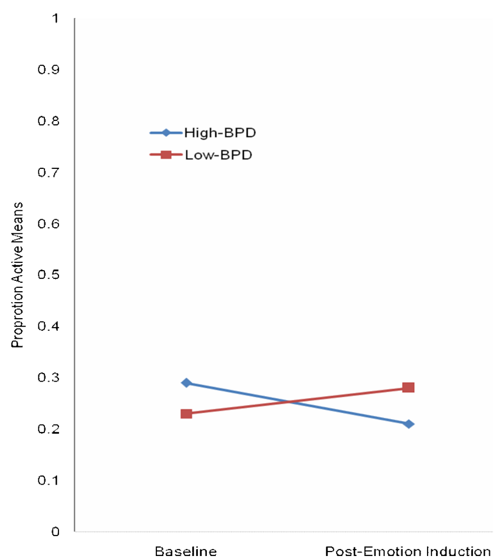
Figure 6: ***Scores on Relevancy at baseline and post-emotion induction for both High-BPD and Low-BPD groups***



Activity.

There also was an effect of a Group x Time interaction for *Activity*, $F(2, 51) = 4.82$, $p = .03$, $\eta^2 = .09$ (see Figure 7). There were no significant differences between groups at baseline, $t(51) = -1.31$, $p = .20$, or post-emotion induction, $t(51) = 1.61$, $p = .11$, on *Activity*. A paired-samples *t* test demonstrated that the High-BPD group had non-significantly lower *Activity* post-emotion induction, $t(25) = 1.81$, $p = .08$. The Low-BPD group demonstrated no significant differences between *Activity* at baseline and post-emotion induction, $t(26) = -1.30$, $p = .20$. A follow-up one-way ANOVA with Group as the IV and difference from baseline to post-emotion induction with *Activity* as the DV revealed that the High-BPD group had a significantly larger decrease in active means used ($M = -.09$, $SD = .24$) compared with the Low-BPD group ($M = .06$, $SD = .25$), $F(1, 51) = 4.82$, $p = .03$.

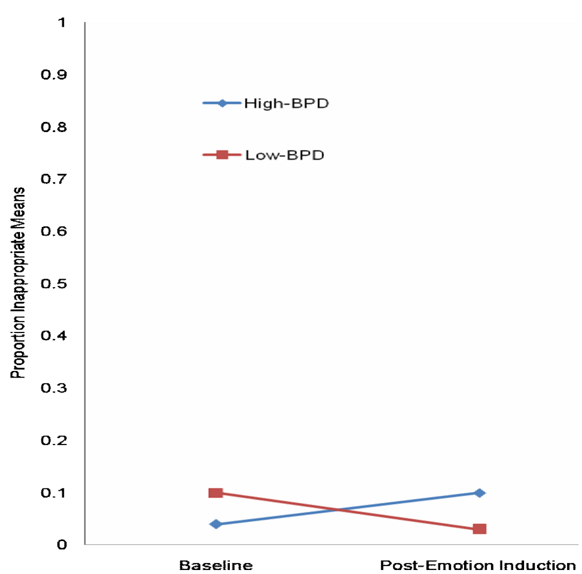
Figure 7: ***Scores on Activity at baseline and post-emotion induction for both High-BPD and Low-BPD groups***



Inappropriateness.

There also was a significant Group x Time interaction for *Inappropriateness*, $F(2, 51) = 7.75$, $p < .01$, $\eta^2 = .13$ (see Figure 8). There were no significant differences between groups at baseline, $t(45.54) = 1.63$, $p = .11$, or post-emotion induction, $t(40.28) = -1.91$, $p = .06$, on *Inappropriateness*. The High-BPD group did not use significantly more *Inappropriateness* post-emotion induction, compared with baseline, $t(25) = -1.58$, $p = .13$. Again, the Low-BPD group demonstrated less *Inappropriateness* post-emotion induction, $t(26) = 2.55$, $p = .02$. A follow-up one-way ANOVA with Group as the IV and difference from baseline to post-emotion induction with *Inappropriateness* as the DV revealed that the High-BPD group had a significantly larger increase in inappropriate means used ($M = .02$, $SD = -.05$) compared with the Low-BPD group ($M = -.03$, $SD = .07$), $F(1, 51) = 7.75$, $p < .01$.

Figure 8: ***Scores on Inappropriateness at baseline and post-emotion induction for both High-BPD and Low-BPD groups***



Social Problem Solving Inventory – Revised

I re-examined the hypothesis that High-BPD group would demonstrate poorer SPS performance at baseline compared with the Low-BPD group on the SPSI-R. A MANOVA was conducted, with Group (High-BPD: n = 26 vs. Low-BPD: n = 29) as the IV, and the scales of the SPSI-R as the DVs. The MANOVA revealed that the effect of Group was significant, F (9, 45) = 6.59, $p < .01$, $\eta^2 = .57$. As shown in Table 8, there was a significant effect of Group such that the High-BPD group demonstrated poorer SPS on all SPSI-R subscales except for the Solution Implementation scale, p = .18.

Overall, these findings suggest that although there were no group differences in SPS at baseline on the MEPS, the High-BPD group demonstrated a pattern of larger decrements in SPS following the emotion induction, compared with the Low-BPD group. This is consistent with the hypothesis that emotion condition acted as a moderator of the relationship between BPD Group and performance on the MEPS. Group differences did emerge at baseline on trait measures of SPS.

Table 8 ***Social Problem Solving Inventory-Revised Scales (SPSI-R) for both High-BPD and Low-BPD Groups***

SPSI Scale	High-BPD (n = 26) Mean (SD)	Low-BPD (n = *29*) Mean (SD)	F(1,53)	p	η^2
Positive Problem Orientation	87.23 (17.09)	104.24 (15.38)	15.10	<.01	.22
Negative Problem Orientation	112.42 (14.72	90.62 (7.28)	50.04	<.01	.49
Problem Definition & Formulation	93.77 (15.27)	101.66 (12.74)	4.36	.04	.08
Generation of Alternative Solutions	90.77 (14.67)	104.07 (13.28)	12.46	<.01	.19
Decision Making	96.69 (15.34)	106.38 (14.23)	5.90	<.01	.19
Solution Implementation & Verification	95.77 (15.83)	101.38 (14.85)	1.84	.18	.03
Rational Problem Solving	92.96 (14.70)	103.38 (12.66)	7.98	<.01	.13
Impulsive/Careless Style	102.50 (14.89)	87.66 (8.20)	21.56	<.01	.29
Avoidance Style	105.69 (12.79)	91.90 (6.46)	26.32	<.01	.33

Does Emotional State Mediate the Association of BPD with Social Problem Solving?

The following analyses were examined across the entire sample (the High-, Mid-, and Low-BPD groups). I examined Hypothesis 2, that changes in emotional state would mediate the association of BPD features with changes in SPS performance, by conducting a series of regression analyses, following recommendations by Baron and Kenny (1986). Prior to conducting these regressions, I examined zero-order correlations among these variables. Borderline personality features, as measured by the PAI-BOR, were significantly associated with the difference on the Negative Affect Scale on the PANAS from baseline to post-emotion induction, $r = .30$, $p < .01$. The difference in SCR from baseline was not significantly associated with BPD features, however, $r = .18$, $p = .14$. The difference between baseline and post-emotion induction scores on *Relevancy* was inversely related to BPD features, $r = -.42$, $p < .01$. The *Inappropriateness* difference score was positively associated with BPD features, $r = .26$, $p = .02$. The *Activity* difference score, however, was not significantly associated with BPD features, $r = -.07$, $p = .52$. In addition, SCR was not significantly associated with any of the difference scores on MEPS scales. Change in PANAS negative affect scale was significantly associated with change in *Relevancy*, $r = -.40$, $p < .01$, but not with change in *Activity* ($r = -.21$, $p = .06$) or *Inappropriateness* ($r = -.13$, $p = .25$). Therefore, based on these preliminary analyses, the regression analyses below focused on change in negative emotional state (measured by the PANAS) as a potential mediator of the association of BPD features with changes in *Relevancy* scores on the MEPS.

First, I regressed change in negative emotion scores on BPD features, finding that BPD features accounted for a significant proportion of the variance in change in negative emotions, $\beta = .30$, $p < .01$; $R^2 = .09$. Second, I regressed change in *Relevancy* on change in negative emotions, finding that negative emotions accounted for a significant proportion of the variance in change in *Relevancy,* $\beta = -.40$, $p < .01$; $R^2 = .16$. Third, I regressed change in *Relevancy* on BPD features, and found that BPD features accounted for a significant proportion of the variance in change in *Relevancy,* $\beta = -.42$, $p < .01$; $R^2 = .17$. Fourth, I conducted a simultaneous regression including negative emotion change scores and BPD features as the predictors and change in *Relevancy* as the DV. The overall model was significant, $R^2 = .28$, $p < .01$. The unique effect of negative emotion change scores was significant, $\beta = -.34$, $p < .01$. With change in negative emotions included in the model, BPD features remained significantly associated with negative change in *Relevancy*, $\beta = -.35$, $p < .01$. A Sobel (1982) test revealed that the mediation effect was significant, $z = 2.20$, $p = .027$. Because the effect of BPD features was still significant with negative emotions included in the regression, these findings indicate that change in negative emotions *partially* mediated the association of BPD features with change in *Relevancy*.

Next, I examined whether adding use of experiential avoidance during the emotion induction improved the prediction of decrement in SPS. To the model containing BPD features (as measured by score on the PAI-BOR) and PANAS negative affect scale as predictors of change in *Relevancy*, I added the experiential avoidance index. The addition of experiential avoidance as a predictor did not contribute significantly to the prediction of change in *Relevancy,* $\beta = .00$, $p = .98$, although the contributions of BPD features, $\beta = -.35$, $p < .01$, and change in negative emotions, $\beta = -.34$, $p < .01$, remained significant in the prediction of change in *Relevancy*.

Does Negative Affect Intensity Mediate the Association of BPD with Trait Measures of Social Problem Solving?

I also examined Hypothesis 3: whether trait levels of negative affect intensity accounted for the relationship between borderline personality features and SPS cross-sectionally. The following analyses were also examined across the entire sample (the High-, Mid-, and Low-BPD groups). Given the findings that persons with BPD specifically demonstrate difficulties with impulsive and careless problem solving, and a negative problem orientation (Bray et al., McMurran et al., 2007), both of these scales of the SPSI-R were used as outcome variables in these analyses. Consistent with this expectation, the Pearson correlation coefficients between the PAI-BOR and SPSI-R subscales were highest for the Negative Problem Orientation and Impulsive/Careless Problem Solving , $r = .62$ and $r = .41$, respectively, *p*s < .01.

Using the same steps for the regression analyses outlined above, BPD features were positively associated with negative affect intensity, $\beta = .62$, $p < .01$; $R^2 = .38$, and negative affect intensity was positively associated with Negative Problem Orientation, $\beta = .58$, $p < .01$; $R^2 = .34$. Further, BPD features were positively associated with Negative Problem Orientation, $\beta = .62$, $p < .01$; $R^2 = .39$. With both BPD features and negative affect intensity included in the model, negative affect intensity contributed significantly to the prediction of Negative Problem Orientation, β = .32, $p < .01$; $R^2 = .45$, and BPD features remained a significant predictor as well, β = .43, $p < .01$. A Sobel (1982) test revealed that the mediation effect for negative affect intensity was significant, $z = 2.74$, $p < .01$. Finally, after adding Experiential Avoidance (as measured by the AAQ) to the model, β =.30, $p < .01$; $R^2 = .50$ the contribution of BPD features (β = .29, $p = .014$) and negative affect intensity (β = .24, $p = .024$) remained significant. In addition, the mediation effect of Experiential Avoidance was also significant, $z = 2.37$, $p = .017$.

These steps were repeated with Impulsive/Careless Problem Solving from the SPSI-R as the outcome variable. Findings indicated the following: BPD features were positively associated with negative affect intensity, β = .62, $p < .01$; $R^2 = .38$; negative affect intensity was positively associated with Impulsive/Careless Problem Solving, β = .31 $p < .01$; $R^2 = .10$, and BPD features were positively associated with Impulsive/Careless Problem Solving, β = .41, $p < .01$; $R^2 = .17$. With both BPD features and negative affect intensity included in the regression model, negative affect intensity did not contribute significantly to the prediction of Impulsive/Careless Problem Solving, β = .08, $p = .54$; $R^2 = .18$, although BPD features remained a significant predictor, β = .37, $p < .01$. Therefore, negative affect intensity did not seem to account for the relationship between borderline personality features and an impulsive or careless problem solving style.

Supplemental Analysis

One possible explanation for the increases in SPS performance following the negative emotion induction among the Low-BPD group could be practice effects within the Low-BPD group, but not the High-BPD group. To examine this possibility, I conducted paired *t*-tests comparing the mean *Relevancy* score (the scale which demonstrated practice effects initially) for MEPS story 1 to MEPS story 3 (across the baseline set of stories), and MEPS story 4 to MEPS story 6 (across the post-emotion induction set of stories) separately for the Low-BPD group and the High-BPD group. Among the Low-BPD group, there was no difference between *Relevancy* in the first and third stories, $t(26) = .52$, $p = .61$, but there was a significant difference between the fourth and sixth stories $t(25) = 2.72$, $p = .01$. The High-BPD group, however, demonstrated a significant difference between *Relevancy* in the first and third stories, $t(25) = -3.10$, $p < .01$, but no difference between the fourth and sixth stories $t(23) = -1.17$, $p = .25$.This suggests that a practice effect occurred for the Low-BPD group only after the emotion induction, and for the High-BPD group only at baseline. This finding indicates that High- and Low-BPD groups demonstrated different patterns of practice effects across the MEPS procedures. Among the High-BPD group, the emotion induction appeared to interfere with learning on the MEPS tasks. Performance on the MEPS among the Low-BPD group, however, seemed to improve following the emotion induction, suggesting that the increase in negative emotions improved learning on the MEPS for this group.

Discussion

Extant research clearly demonstrates a link between features of BPD and difficulties with interpersonal relationships (e.g., Leichsenring et al., 2003, Tolpin et al., 2004) and social problem solving (e.g., Berk et al., 2007; Linehan et al., 1987). Identifying the mechanisms underlying the relationship between BPD and SPS difficulties is particularly important, given the likelihood of interpersonal stressors to precipitate many of the serious problem behaviours observed among persons with BPD (e.g., Brodsky et al., 2006; Welch & Linehan, 2002). The primary aim of the present study was to examine hypotheses regarding the role of emotional state and emotion regulation in the association of BPD features with SPS performance in the laboratory.

The findings of this study largely supported my primary hypotheses. For instance, negative emotional state moderated the association of BPD features with SPS performance, such that high-BPD participants performed more poorly than low-BPD participants only following an emotional stressor. Further, high-BPD participants showed a greater reduction in SPS performance from baseline to post-induction compared with low-BPD participants. Specifically, the negative emotion induction was associated with more passive, less relevant, and more inappropriate SPS among high-BPD participants. The findings provided partial support for my hypothesis that changes in negative emotional state would mediate the association of BPD features with changes in SPS performance, with findings indicating that negative emotional state partially mediated the association of BPD features with changes in the relevance of SPS solutions. Overall, the findings suggested that some of the SPS difficulties demonstrated by individuals with high levels of BPD features may be partially attributable to the comparatively higher levels of negative emotions experienced among this population, rather than by an independent skills deficit.

The hypothesis that persons with high levels of BPD features would exhibit poorer SPS at baseline was also partially supported by these findings. High-BPD individuals demonstrated poorer SPS at baseline on the SPSI-R compared with individuals with low levels of BPD features, whereas on the MEPS, there were no differences between groups at baseline. Unfortunately, measurement error and a smaller sample size for analyses involving the MEPS may have made such differences less likely to be detected. Another potential explanation for this apparent discrepancy is that the SPSI-R relies solely on self-report, and individuals with high levels of borderline personality features may have a more negative view of their SPS difficulties than they actually demonstrate. This is consistent with previous findings (e.g., Bray et al., 2007) that persons with BPD specifically achieve lower scores on the negative problem orientation scale, which assesses self-efficacy and pessimism regarding SPS skills. Additionally, the MEPS procedure may not have adequate verisimilitude to elicit SPS performance commensurate with that used in everyday life. Finally, these findings may simply underscore the emotion-dependent nature of SPS difficulties experienced by persons with high features of BPD; in the absence of emotional stressors, it may be that individuals with BPD do not exhibit SPS deficits. This discrepancy between SPS performance across measures highlights the need for further research on the factors underlying SPS difficulties, such as the effect of self-efficacy beliefs on SPS performance.

Although avoidant emotion regulation strategies did not account for SPS decrements beyond negative emotions during the laboratory session, cross-sectional analyses indicated that experiential avoidance did account for additional variance in SPS difficulties, above negative emotionality. Specifically, this seemed to be the case for negative problem orientation, rather than impulsivity in problem solving. This discrepancy between the findings found in the laboratory compared with questionnaire findings may be due to the increased ability to physically avoid situations evoking need for problem solving in the environment, but not in the laboratory. Another possibility is that the measures used to assess experiential avoidance at baseline may be superior to the measures used to assess experiential avoidance during the laboratory session. Finally, it may be that short-term use of experiential avoidance is effective for relief of negative emotions, whereas use of avoidant emotion regulation over time exhausts more resources and ultimately lead to a resurgence of negative emotions. Therefore it may be difficult to observe the negative effects of experiential avoidance in the laboratory. Clarification of the long-term versus short-term effects of experiential avoidance on SPS may be found through ecological momentary assessment.

The emotion induction procedure used in the present study had the intended effect. While listening to the audio recording, participants exhibited more SCRs. Following the emotion induction, participants reported more negative emotions. This emotion induction elicited greater increases in report of negative emotions among the High-BPD group, providing further support for a conceptualization of higher emotional reactivity among persons with BPD. The specific emotion induction used has the benefit of being particularly relevant to SPS, because it clearly outlined a distressing interpersonal scenario. It may be that persons with higher levels of BPD features might be particularly reactive to scenarios involving problematic interpersonal contexts, rather than more general emotion inductions.

Findings regarding SPS performance among the low-BPD group were unexpected. Overall, the low-BPD group seemed to improve performance following the emotion induction. Although this seems contradictory to the hypothesis that negative emotions negatively affect SPS, there may be some other factors influencing SPS performance among individuals with low levels of BPD features. One possibility is that practice effects continued for the Low-BPD group following the negative emotion induction, whereas the negative emotional intensity reduced practice effects among the high-BPD group. This is consistent with the higher levels of negative emotions among the high-BPD group, and also the impact of negative emotions on cognition and learning. Another explanation for this finding is that persons with high levels of BPD features have little experience with effective SPS, whereas individuals with low levels of BPD features may have more experience with effective SPS while in a negative emotional state. This may lead to mood-congruent recall (Eich & Forgas, 2003), wherein a negative emotional state may activate knowledge of previous SPS within similar states. Finally, findings that the low-BPD group reported lower negative emotions and exhibited fewer SCRs than the high-BPD group at baseline suggest an overall lower level of arousal. It is possible that the increase in general arousal following the emotion induction facilitated SPS among the low-BPD group by creating more “optimal” arousal levels for this task (Yerkes &

Dodson, 1908), whereas the emotion induction contributed to too much arousal for optimal SPS performance among the high-BPD group.

Several limitations of this research warrant consideration. First, the use of a non-clinical sample of females limits the extent to which findings of the present study generalize to individuals in clinical settings, and to males. Second, the presence of practice effects suggested that the MEPS may not be ideal for a repeated-measures design. It is quite possible that practice effects obscured differences between SPS performance at baseline and following the emotion induction. On the other hand, repeated administrations of the MEPS and comparisons between the third and fourth administrations of the MEPS allowed for some control over differences in practice effects between baseline and post-emotion induction MEPS performance. It is also possible that the length of time and active engagement requirement to complete the MEPS tasks may have distracted participants from the negative emotions generated by the emotion induction procedure. Third, despite efforts to standardize data collection, skin conductance data were lost for 25 of the 92 participants who completed the study. Also, 13 participants' MEPS data were not recorded correctly, resulting in further data loss. This reduced *N* resulted in lower power for analyses than expected, possibly contributing to some non-significant findings.

Despite these limitations, the present study yielded valuable information regarding the impact of emotional state and emotion regulation on SPS among undergraduates with high and low levels of BPD features. These findings provide support for considering social problem solving deficits as a natural consequence of negative emotional state, suggesting that SPS deficits do not necessarily represent a trait-like symptom of BPD. Rather, it is possible that heightened scores of persons with BPD features on trait measures of SPS are at least partly accounted for by their tendency to experience heightened negative emotional states and frequent emotional stressors. This study highlighted the specific impact of negative emotional state, rather than regulation of such emotions, as impacting SPS performance.

These findings may suggest refinements of existing interventions. For instance, the treatment for BPD with the greatest evidence for its efficacy, Dialectical Behaviour

Therapy (DBT; Linehan, 1993), teaches patients a variety of different behavioural skills (Mindfulness, Emotion Regulation, Interpersonal Effectiveness, and Distress Tolerance; Linehan, 1993). Given the findings of the present study, it is possible that future treatment refinements may result in a briefer treatment package. For instance, if negative emotional states are central to SPS deficits in BPD, training in strategies to regulate these emotions alone may be sufficient to improve SPS and reduce interpersonal problems in BPD. It is also possible that specific strategies for improving SPS skills may be valuable. For example, if negative emotional states specifically increase negative problem orientations, rather than be increasing impulsivity, changing attitudes towards problem solving may be the first step in increasing SPS among persons with BPD. Alternatively, improvements in emotion regulation may facilitate changes in cognition and attitudes. Finally, if emotional states and regulation strategies underlie the differences in SPS between individuals with low and high features of BPD, then these results may suggest ways to improve SPS among nonclinical populations as well.

Future studies may resolve some remaining questions raised by the present findings. For example, use of multiple measures of experiential avoidance in the laboratory may better capture the impact of experiential avoidance on SPS. Further, the mechanisms by which emotional state and experiential avoidance may negatively influence SPS performance have yet to be pinpointed. Existing research suggests that one possible pathway by which emotional state and regulation may impact SPS is by using more working memory resources, leaving less capacity to attend to the task of solving problems. Another possibility is that emotional state changes individuals' beliefs of self-efficacy of problem solving. Finally, it is possible that mood-congruent recall may bring to mind emotion-consistent behaviours, which may differ systematically between persons with high levels of borderline personality features, and individuals with low levels of such features. Further research in this area is needed to clarify the factors that influence interpersonal problems in BPD, and thereby contribute to meaningful improvements in the lives of individuals who suffer from BPD.

Notes

[1]Due to the non-normal distribution of the SCR data, these analyses were also run with non-parametric tests. Both the Mann-Whitney U and Wilcoxon signed ranks tests are less efficient and therefore are less likely to detect differences among non-normal distribution than t tests (Conover, 1998). With Group (High-BPD: $n = 20$ vs. Low-BPD: $n = 24$) as the IV and baseline SCR as the DV, the Mann-Whitney U test was non-significant, $z = -.074$, $p = .94$. A second Mann-Whitney U test with Group (High-BPD: $n = 20$, vs. Low-BPD: $n = 24$) as the IV and SCR during the emotion induction as the DV demonstrated a significant effect of Group, $z = -2.54$, $p = .01$. The High-BPD group also demonstrated a greater increase in SCRs from baseline to during the emotion induction, compared with the Low-BPD group, $z = 1.87$, $p = .06$. The difference in SCRs from baseline to during the emotion induction was in the same direction as previous analyses, although non-significant, for all participants, $z = 1.77$, $p = .077$.

References

Abramowitz, J. S., Tolin, D. F., & Street, G. P. (2001). Paradoxical effects of thought suppression: A meta-analysis of controlled studies, *Clinical Psychology Review, 21,* 683–703.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders*, *4th edition, text revision (DSM-IV-TR)*. Washington, DC: American Psychiatric Press, Inc.

Arntz, A., Appels, C., & Sieswerda, S. (2000). Hypervigilance in borderline disorder: A test with emotional stroop paradigm. *Journal of Personality Disorders, 14,* 366-373.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.

Beauchaine, T. (1993). *Medical health history interview for physiological research.* Unpublished measure, University of Washington.

Berk, M. S., Jeglic, E., Brown, G. K., Henriques, G. R., & Beck, A. T. (2007). Characteristics of recent suicide attempters with and without borderline personality disorder. *Archives of Suicide Research, 11,* 91-104.

Bijttebier, P., & Vertommen, H. (1999). Coping strategies in relation to personality disorders. *Personality and Individual Differences, 26,* 847-856.

Bray, S., Barrowclough, C., & Lobban, F. (2007). The social problem-solving abilities of people with borderline personality disorder. *Behaviour Research and therapy, 45,* 1409-1417.

Brodsky, B. S., Groves, S. A., Oquendo, M. A., Mann, J. J., & Stanley, B. (2006). Interpersonal precipitants and suicide attempts in borderline personality disorder. *Suicide and Life Threatening Behaviors, 36*, 313-322.

Butler, E.A., Wilhelm, F.H, & Gross, J. J. (2006). Respiratory sinus arrhythmia, emotion, and emotion regulation during social interaction. *Psychophysiology, 43*, 612-622.

Cacioppo, J. T., Tassinary, L. G., & Berntson, G. G. (2007). *Handbook of Psychophysiology, 3rd Edition.* Cambridge University Press: Cambridge.

Campbell-Sills, L., Barlow, D. H., Brown, T. A. & Hofman, S. G. (2006). Effects of suppression and acceptance on emotional responses of individuals with anxiety and mood disorders. *Behaviour Research and Therapy, 44,* 1251-1263.

Carson, D. K., & Runco, M. A. (1999). Creative problem solving and problem finding in young adults: Interconnections with stress, hassles, and coping abilities. *Journal of Creative Behavior, 33,* 167-190.

Chapman, A. L., Gratz, K. L., & Brown, M. (2006). Solving the puzzle of deliberate self-injury: The experiential avoidance model. *Behaviour Research and Therapy, 44*, 371-394.

Chapman, A. L., Leung, D., & Lynch, T. R. In press. Impulsivity and emotion dysregulation in borderline personality disorder. *Journal of Personality Disorders.*

Chapman, A. L., Leung, D., Rosenthal, M. Z., Walters, K. N., & Dixon-Gordon, K. L. Unraveling the connection between affect intensity and borderline personality disorder: The role of emotion dysregulation and experiential avoidance. Manuscript in preparation.

Chapman, A. L., Specht, M. W., & Cellucci, T. (2005). Borderline personality disorder and deliberate self-harm: Does experiential avoidance play a role? Suicide and Life-Threatening Behavior, 35, 388-399.

Davies, M. I., & Clark, D. M. (1998). Though suppression produces a rebound effect with analogue post-traumatic intrusions. Behaviour Research and Therapy, 36, 571-582.

Davila, J., Hammen, C., Burge, D., Daley, S. E., & Paley, B. (1996). Cognitive/interpersonal correlates of adult interpersonal problem-solving strategies. *Cognitive Therapy and Research, 20*, 465-480.

De Meersman, R.E., & Stein, P.K. (2007). Vagal modulation and aging. *Biological Psychology, 74*, 165–173.

Derogatis, L. R. (1993). *Symptom Checklist-90-R: Administration, scoring, and procedures manual* (3rd ed.). Minneapolis, MN: National Computer Systems.

Diggle, P. J., Liang, K., & Zeger, S. L. (1996). Analysis of longitudinal data. *Oxford University Press*.

Domes, G.,Winter, B., Schnell, K., Vohs, K., Fast, K., & Herpertz, S. C. (2006). The influence of emotions on inhibitory functioning in borderline personality disorder. *Psychological Medicine, 36,* 1163-1172.

Donaldson, C., & Lam, D. (2004). Rumination, mood and social problem-solving in major depression. *Psychological Medicine, 34,* 1309-1318.

D'Zurilla, T. J., & Chang, E. C. (1995). The relations between social problem solving and coping. *Cognitive Therapy and Research, 19*, 547-562.

D'Zurilla, T. J., & Nezu, A. M. (1990). Development and preliminary evaluation of the Social Problem-Solving Inventory (SPSI). *Psychological Assessment: A Journal of Consulting and Clinical Psychology, 2,* 156-163.

D'Zurilla, T. J., Nezu, A. M., & Maydeu-Olivares, A. (1995). *Manual for the Social Problem-Solving Inventory--Revised.* Unpublished manuscript, State University of New York at Stony Brook.

D'Zurilla, T.J., Nezu, A.M., & Maydeu-Olivares, A. (2002). Social Problem-Solving Inventory- Revised: Technical manual. North Tonawanda, N.Y.: Multi-Health Systems.

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

Eich, E., & Forgas, J. P. (2003). Mood, cognition, and memory (pp. 61-83). *In* A. F. Healy & R. W. Proctor (Eds.). *Handbook of Psychology: Experimental Psychology, Vol. 4.* Hoboken, New Jersey: John Wiley & Sons, Inc.

Fyer, M. R., Frances, A. J., Sullivan, T., Hurt, S. W. & Clarkin, J. (1988). Suicide attempts in patients with borderline personality disorder. *American Journal of Psychiatry, 145*, 737-739.

Gratz, K. L. (2003). Risk factors for and functions of deliberate self-harm: An empirical and conceptual review. *Clinical Psychology: Science and Practice, 10,* 192-205.

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.

Gratz, K. L., Rosenthal, M. Z., Tull, M. T., Lejuez, C. W., & Gunderson, J. G. (2006). An experimental investigation of emotion dysregulation in borderline personality disorder. *Journal of Abnormal Psychology, 115,* 850-855.

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

Gross, J. J. & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology, 85,* 348-362.

Hayes, S. C., Strosahl, K., Wilson, K. G., Bissett, R. T., Pistorello, J., Toarmino, D. et al. (2004). Measuring experiential avoidance: A preliminary test of a working model. *The Psychological Record, 54,* 553–578.

Hayes, S. C., Wilson, K. G., Gifford, E. V., Follette, V. M., & Strosahl, K. (1996). Experiential avoidance and behavioral disorders: A functional dimensional approach to diagnosis and treatment. *Journal of Consulting and Clinical Psychology, 64,* 1152-1168.

Herpertz, S. C., Dietrich, T. M., Wenning, B., Krings, T., Erberich, S.G., Willmes, K., Thron, A., & Sass, H. (2006). Evidence of abnormal amygdale functioning in borderline personality disorder: a functional MRI study. *Biological Psychiatry, 50*, 292–8.

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, 146,* 1550-1556.

Herpertz, S. C., Schwenger, U. B., Kunert, H. J., Lukas, G., Gretzer, U., Nutzmann, J. et al. (2000). Emotional responses in patients with borderline as compared with avoidant personality disorder. *Journal of Personality Disorders, 14*, 339-351.

Howat, S., & Davidson, K. (2002). Parasuicidal behaviour and interpersonal problem solving performance in older adults. *British Journal of Clinical Psychology, 41,* 375-386.

Jennings, J. R., Kamarck, T., Stewart, C., Eddy, M., Johnson, P. (1992). Alternate cardiovascular baseline assessment techniques: vanilla or resting baseline. *Psychophysiology, 29*, 742-750.

Kehrer, C. A., Linehan, M. M. (1996). Interpersonal and emotional problem solving skills and parasuicide among women with borderline personality disorder. *Journal of Personal Disorders, 10,* 153-163.

Klonsky, E. D., Oltmanns, T. F., & Turkheimer, E. (2003). Deliberate self-harm in a nonclinical population: Prevalence and psychological correlates. *American Journal of Psychiatry, 160,* 1501-1508.

Kremers, I. P., Spinhoven, P., Van der Does, A. J. W., & Van Dyck, R. (2006). Social problem solving, autobiographical memory and future specificity in outpatients with borderline personality disorder. *Clinical Psychology and Psychotherapy, 13,* 131-137.

Kruedelbach, N., McCormick, R. A., Schulz, S. C., & Grueneich, R. (1993). Impulsivity, coping styles, and triggers for craving in substance abusers with borderline personality disorder. *Journal of Personality Disorders, 7,* 214-222.

Kuo, J. R., Rees, M. & Linehan, M. M. (2006, November). *Psychophysiology of emotion dysregulation in BPD.* Poster session presented at a meeting of the Association of Behavioral and Cognitive Therapies, Chicago, Illinois, U.S.

Kuyken, W., & Brewin, C. R. (1994). Stress and coping in depressed women. *Cognitive Therapy and Research, 18,* 403-412.

Larsen, R. J., & Diener, E. (1987). Affect intensity as an individual difference characteristic: A review. *Journal of Research in Personality, 21,* 1-39.

Leible, T. L., & Snell, W. E., Jr. (2004). Borderline personality disorder and multiple aspects of emotional intelligence. *Personality and Individual Differences, 37,* 393-404.

Leichsenring, F., Kunst, H., & Hoyer, J. (2003). Borderline personality organization in violent offenders: Correlations of identity diffusion and primitive defense mechanisms with antisocial features, neuroticism, and interpersonal problems. *Bulletin of the Menninger Clinic, 67,* 314-327.

Lejuez, C. W., Daughters, S. B., Nowak, J. A., Lynch, T., Rosenthal, M. Z., & Kosson, D. (2003). Examining the inventory of interpersonal problems as a tool for conducting analogue studies of mechanisms underlying borderline personality disorder. *Journal of Behavior Therapy and Experimental Psychiatry, 34,* 313-324.

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

Linehan, M. M. (1998). *University of Washington Risk Assessment Protocol.* Unpublished protocol, University of Washington, Seattle.

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

Linehan, M. M., Camper, P., Chiles, J. A., & Strosahl, K. (1987). Interpersonal problem solving and parasuicide. *Cognitive Therapy and Research, 11*,1-12.

Linehan, M. M., Rizvi, S. L., Shaw-Welch, S. & Page, B. (2000). Psychiatric aspects of suicidal behaviour: personality disorders. In K. Hawton, K. van Heeringen (Eds.), *International handbook of suicide and attempted suicide*. Sussex, England, John Wiley & Sons.

Lyubomirsky, S. & Nolen-Hoeksema, S. (1995). Effects of self-focused rumination on negative thinking and interpersonal problem solving. Journal of Personality and Social Psychology 69, 176–190.

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

Macrae, C. N., Bodenhausen, G. V., Milne, A. B., & Ford, R. L. (1997). On the regulation of recollection: The intentional forgetting of stereotypical memories. *Journal of Personality and Social Psychology, 72,* 709-719.

MacKinnon, A., Jorm, A. F., Christensen, H., Korten, A. E., Jacomb, P. A., Rodgers, B. (1999). A short form of the positive and negative affect schedule: Evaluation of factorial validity and invariance across demographic variables in a community sample. *Personality and Individual Differences, 27*, 405-416.

Mandler, G. (1982). Stress and thought processes. In L. Goldberger & S. Breznitz (Eds.), *Handbook of stress: Theoretical and clinical aspects* (pp. 88-104). New York: Free Press.

McMurran, M., Druggan, C., Christopher, G., & Huband, N. (2007). The relationships between personality disorders and social problem solving in adults. *Personality and Individual Differences, 42*, 145-155.

Metts, S., & Cupach, W. R. (1990). The influence of relationship beliefs and problem-solving responses on satisfaction in romantic relationships. *Human Communication Research, 17*, 170-185.

Minzenberg, M. J., Poole, J. H., & Vinogradov, S. (2006). Adult social attachment disturbance is related to childhood maltreatment and current symptoms in borderline personality disorder. *Journal of Nervous & Mental Disease, 194,* 341-348.

Mitchell, J. E., & Madigan, R. J. (1984). The effects of induced elation and depression on interpersonal problem solving. *Cognitive Therapy and Research, 8,* 277-285.

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

Platt, J. J., & Spivack, G. (1975). Unidimensionality of the Means-Ends Problem-Solving (MEPS) procedure. *Journal of Clinical Psychology, 31*, 15-16.

Platt, J. J., Spivack, G., & Bloom, W. (1975). Manual for the means-end problem-solving procedure (MEPS): A measure of interpersonal problem-solving skill. Philadelphia, Hahnemann Medical College and Hospital; Department of Mental Health Sciences.

Reinecke, M. A., DuBois, D. L., & Schultz, T. M. (2001).Social problem solving, mood, and suicidality among inpatient adolescents. *Cognitive Therapy and Research, 25,* 743-756.

Robins, C. J. (1988). Development of experimental mood induction procedures for testing personality-event interaction models of depression. *Journal of Clinical Psychology, 44*, 958-963.

Rosenthal, M. Z., Cheavens, J. S., Lejuez, C. W., & Lynch, T. R. (2005). Thought suppression mediates the relationship between negative affect and borderline personality disorder symptoms. *Behaviour Research and Therapy, 43,* 1173-1185.

Salters-Pedneault, K., Gentes, E., & Roemer, L. (2007). The role of fear of emotional distress, arousal, and cognitive interference following an emotional stimulus. *Cognitive Behaviour Therapy, 36,* 12-22.

Scarpa, A., Raine, A., Venables, P. H., & Mednick, S. A. (1997). Heart rate and skin conductance in behaviorally inhibited Mauritian children. *Journal of Abnormal Psychology, 106,* 182-190.

Shearer, S. L. (1994). Phenomenology of self-injury among inpatient women with borderline personality disorders. *Journal of Nervous and Mental Disease, 182,* 524–526.

Shearer S. L., Peters C. P., Quaytman M. S., & Ogden R. L. (1990). Frequency and correlates of childhood sexual and physical abuse histories in adult female borderline inpatients. *American Journal of Psychiatry, 147*, 214–216.

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. In S. Leinhardt (Ed.), *Sociological Methodology 1982* (pp. 290-312). Washington DC: American Sociological Association.

Soloff, P. H., Lis, J. A., Kelly, T., Cornelius, J., & Ulrich, R. (1994). Risk factors for suicidal behavior in borderline personality disorder. *American Journal of Psychiatry, 151*, 1316– 1323.

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 Psychiatria Scandinavia,* 111, 372-379.

Stiglmayr, C. E., Shapiro, D. A., Stieglitz, R. D., Limberger, M. F., & Bohus, M. (2001). Experience of aversive tension and dissociation in female patients with borderline personality disorder – a controlled study. *Journal of Psychiatric Research, 35,* 111–118.

Tice, D. M., Bratslavsky, E., & Baumeister, R. F. (2001). Emotonal distress regulation takes precedence over impulse control: If you feel bad, do it! *Journal of Personality and Social Psychology, 80,* 53-67.

Tolpin, L., Gunthert, K., Cohen, L., & O'Neill, S., (2004). Borderline personality features and instability of daily negative aspect and self-esteem. *Journal of Personality, 72,* 111-137.

Trull, T. J. (1995). Borderline personality disorder features in nonclinical young adults: 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.

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 and Social Psychology, 54*, 1063-1070.

Wegner, D. M. (1994). Ironic processes of mental control. *Psychological Review, 101,* 34-52.

Wegner D. M., & Erber, R. (1992). The hyperaccessibility of suppressed thoughts. *Journal of Personality and Social Psychology, 63,* 903-912.

Wegner, D. M., & Zanakos, S. (1994). Chronic thought suppression. Journal of Personality, 62, 615–640.

Welch, S. S., & Linehan, M. M. (2002). High-Risk situations associated with parasuicide and drug use in borderline personality disorder. *Journal of Personality Disorders, 16,* 561-569.

Westen, D. (1991). Cognitive-behavioral interventions in the psychoanalytic psychotherapy of borderline personality disorders. *Clinical Psychology Review, 11*, 211-230.

Widiger, T. A. (1992). Categorical versus dimensional classification: Implications from and for research. *Journal of Personality Disorders, 6,* 287-300.

Widiger, T. A., & Frances, A. J. (1989). Epidemiology, diagnosis, and comorbidity of borderline personality disorder in American Psychiatric Press Review of Psychiatry, Vol. 8. In Tasman, Hales, & A. J. Frances (Eds.). American Psychiatric Press.

Yen, S., Zlotnick, C., & Costello, E. (2002). Affect regulation in women with borderline personality disorder traits. *Journal of Nervous and Mental Disease, 190,* 696-696.

Yerkes, R. M., & Dodson, J. D. (1908). The relation of strength of stimulus to rapidity of habit-formation. *Journal of Comparative Neurology and Psychology, 18*, 459-482.

Zanarini, M. C., Ruser, T. F., Frankenburg, F. R., Hennen, J., & Gunderson, J. G. (2000). Risk factors associated with the dissociative experiences of borderline patients. *Journal of Nervous and Mental Disease, 188*, 26–30.

Zeigler-Hill, V., & Abraham, J. (2006). Borderline personality features: Instability of self-esteem and affect. *Journal of Social & Clinical Psychology, 25*, 668-687.