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Rumination in Borderline Personality Disorder: An examination of interpersonal contexts in experimental and daily life settings

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RUMINATION IN BORDERLINE PERSONALITY DISORDER: AN EXAMINATION OF INTERPERSONAL CONTEXTS IN EXPERIMENTAL AND DAILY LIFE SETTINGS

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ABSTRACT

This study examined whether Borderline Personality Disorder (BPD) features predict increased rumination in response to interpersonal contexts, leading to increased negative affect (NA) outcomes across self-report, experimental, and daily life settings. As BPD is characterized by sustained NA, emotion dysregulation, and pervasive difficulties in interpersonal relationships, interpersonal contexts may present a specific liability for individuals with BPD to ruminate, and subsequently, experience enduring NA. Undergraduate participants (*N*=119) completed measures of BPD features, dispositional rumination, emotion dysregulation, and both 1) a laboratory protocol that measured spontaneous rumination and affective reactivity to non-interpersonal (sad film clip) and interpersonal (Cyberball) stimuli and 2) a 7-day Ecological Momentary Assessment (EMA) that measured hourly peak NA, deployment of rumination at time of peak NA, interpersonal context at peak NA, and immediate NA relative to the EMA prompt. Multiple mediation models and general linear models were fit to examine study hypotheses. Results suggest differences in the relationships at trait level compared to state and momentary levels, wherein BPD predicts trait rumination and emotion dysregulation only. However, findings support that interpersonal contexts produce increased rumination that, in turn, may sustain negative affective states. Results suggest the need to include interpersonal considerations as a context for understanding ruminative cycles and affective outcomes.

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CHAPTER I

INTRODUCTION

Borderline Personality Disorder (BPD) is characterized by a chronic, pervasive pattern of instability in interpersonal relationships and dysregulated affects (American Psychiatric Association (APA), 2013; Salsman & Linehan, 2012). These patterns may emerge from the frantic efforts to avoid abandonment, unstable self-image, impulsivity, suicidal ideation and behavior, affective instability, inappropriate anger, and dissociative symptoms that are often experienced by those with BPD (APA, 2013). Not surprisingly, BPD is highly functionally impairing, as evidenced by the relatively high prevalence rates in outpatient and inpatient settings, estimated to be 10% and 20%, respectively (ten Have, et al., 2016; Tolpin, Gunthert, Cohen, & O'Neill, 2004). These high rates are in part explained by the strong tendencies for those with BPD to engage in suicidal behaviors and deliberate self-harm (DSH) (Kleiman, Ammerman, Look, Berman, & McCloskey, 2014). Indeed, approximately 75% of individuals with BPD attempt suicide at one point in their lives, and 10% complete their suicide attempt (Black, Blum, Pfohl, & Hale, 2004). These estimates may also speak to the high rates of DSH behaviors that

increase the risk for suicide completion (Selby, Bender, Gordon, Nock, & Joiner, 2012) and lead to further functional impairment.

Functional impairment among those with BPD is further increased by co-occurring psychiatric disorders that are associated with BPD at high rates. A nationwide epidemiological study examining prevalence of co-occurring psychiatric disorders demonstrated 12-month comorbidity estimates of BPD and anxiety disorders and BPD and depressive disorders range from 21% to 59% and 29%-50%, respectively. Specifically, occurrence of Major Depressive Disorder comorbid with BPD, within a 12-month window, hovers around 19% (Grant et al., 2008). Further, BPD appears to have a chronic course, with subthreshold symptoms evident even among those who no longer meet full diagnostic criteria (APA, 2013; Gunderson, et al., 2011), and continued psychosocial impairment among those in remission from the disorder (Zanarini, Frankenburg, Hennen, Reich, & Silk, 2005).

The cost of functional declines in BPD are far reaching, adversely impacting not only the individuals with the disorder and their interpersonal relationships, but society as well. This is due to frequent behavioral health service utilization, in the form of inpatient hospitalizations and community mental health treatment services, which is estimated to cost between $3,000 and $44,000 annually, per individual (Meuldijk, McCarthy, Bourke & Grenyer, 2017). Notably, as those with BPD are often under-employed and of lower financial means (Wehbe-Alamah & Wolgamott, 2014), these costs are often absorbed by society. Given the high rates of personal and societal costs, the literature continues to search for key processes and mechanisms that may guide prevention and treatment efforts.

1.1 BPD and Emotion Dysregulation

A large body of work points to emotion dysregulation (ED), or the tendency to experience intense, enduring emotional states, as a core deficit in BPD (Carpenter & Trull, 2013; Glenn & Klonsky, 2009; Salsman & Linehan, 2012). For example, Glenn and Klonsky (2009) showed that elevated BPD symptoms were associated with ED, independent of co-occurring negative affect (NA), anxiety, and depression symptoms. Relatedly, Dixon-Gordon and colleagues (2015) found greater levels of ED among those with BPD features relative to those with elevated depression symptoms, on self-report measures and during an experimental stressor task. Specifically, those with elevated BPD features reported heightened levels of distress shortly after engaging in a stressful paced auditory serial addition task, with these levels evidencing a more enduring course relative to those with elevated depression symptoms (Dixon-Gordon et al., 2015). Further, ED has been shown to predict the stability of BPD symptoms over a 12-month period, independent of other known risk factors (Stepp et al., 2014).

In addition to maintaining BPD symptoms, functional consequences of dysregulated emotional states include inhibited goal-directed activity and increased likelihood of behavioral dysregulation in the form interpersonal strife, self-injurious behavior (Gratz & Roemer, 2008), and substance use (Trull, Sher, Minks-Brown, Durbin, & Burr, 2000). For example, Miano, Groselli, Roepke, and Dziobek (2017) examined the effect of ED on communication behavior and feelings in romantic relationships in a sample of individuals with BPD and healthy controls. Their results showed that ED, indexed by heightened behavioral indices of stress, led those in the BPD group to engage in more hostile interpersonal communications than women in the control group (Miano et

al., 2017). In a similar vein, Herr, Rosenthal, Geiger, and Erikson (2013) examined the links between ED, BPD features, and interpersonal problems in an adult community sample. Their results showed that the effects BPD features on interpersonal problems were mediated by ED (Herr et al., 2013).

Others have shown that high levels of ED are associated with deliberate self-harm behaviors among student (Gratz & Roemer, 2008), community-dwelling adult (Klonsky, 2011; Klonsky, Oltmanns, & Turkheimer, 2003), and clinical populations (Zanarini et al., 2008). For instance, Gratz and Roemer (2008) examined the link between ED and deliberate self-harm behaviors. The authors found that ED accounted for differences between frequent self-harmers versus those without a history of self-harm and variability of frequency within the self-harmer group, above and beyond other risk factors (Gratz and Roemer, 2008). Bradley and colleagues (2011) also examined the relationship between ED and behavioral dysregulation. Their findings demonstrated that ED predicted unique variance in behavioral dysregulation outcomes, marked by suicidality and alcohol and drug use, independent of dispositional NA (Bradley, et al., 2011). In a similar vein, Dixon-Gordon, Chapman, Weiss, and Rosenthal (2014) observed elevated levels of ED among students with high BPD features that, in turn, robustly correlated with behavioral dysregulation in daily life.

1.2 Maladaptive Emotion Regulation

Emotion dysregulation may arise from ineffective emotion regulation (ER) strategies. Emotion regulation refers to automatic and volitional processes that alter the timing, chronicity, and topographical elements of a given emotion (English, Lee, John, & Gross, 2017; Thompson, 1994). Emotion regulation deficits leading to ED may reflect the

use of ineffective (maladaptive) ER responses. Maladaptive ER responses span interpersonal, behavioral, and cognitive domains (Wenzlaff & Luxton, 2003; Chapman, Dixon-Gordon, & Walters, 2011) and are a transdiagnotic risk factor for psychopathology (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Naragon-Gainey, McMahon, & Chacko, 2017). While maladaptive ER responses are aimed at reducing distress, and may work in the short-term, they paradoxically exacerbate its intensity and duration over the long-term (Kovacs, Rottenberg, & George, 2009; Yaroslavsky, Pettit, Lewinsohn, Seeley, & Roberts, 2013).

For example, thought suppression, a maladaptive cognitive ER response marked by efforts to not think about distressing stimuli, is linked to the long-term maintenance of dysphoria in undergraduate students (Wenzlaff & Luxton, 2003). Relatedly, Rosenthal and colleagues (2005) noted robust links between dysphoria and thought suppression among those with elevated BPD symptoms. Specifically, over-reliance on thought suppression to reduce distress mediated the relationship between NA and BPD symptoms in a sample of community-dwelling adults (Rosenthal, Cheavens, Lejuez, & Lynch, 2005). Others have also noted strong relationships between BPD symptoms and the use of other maladaptive ER responses (Dixon-Gordon et al., 2014).

1.3 Rumination

Rumination is one maladaptive ER response that has received increased attention as one mechanism for emotional and behavioral dysregulation that is experienced by those with BPD (Selby, Anestis, & Joiner, 2008). Rumination represents moody pondering about one's emotional state and its causes (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Joormann & Stanton, 2016), that while implemented in an effort to

understand the antecedents to feeling distressed, maintains negative information in conscious awareness and exacerbates NA (Joormann & Stanton, 2016). While linked to psychopathology in general (Aldao et al., 2010), contemporary models posit rumination as the mechanism by which those with BPD experience dysregulated affects and behaviors (Selby, Anestis, Bender, and Joiner, 2009). In particular, the Emotional Cascade model posits that when someone with BPD becomes upset in response to a triggering event (e.g., interpersonal rejection) or experiences a diffuse negative mood state, he or she begins to ruminate, which maintains and exacerbates their negative mood. In turn, worsened negative mood has a reciprocal relationship with rumination that culminates in emotional and behavioral dysregulation and other maladaptive ER responses (Selby et al., 2008). To illustrate this process, suppose an individual gets into a heated argument with a close friend and becomes upset. She may begin to dwell on the argument, on how her friend hurt her, and on how poorly she is currently feeling. In turn, this ruminative process will prolong her distress and lead to further moody ponderings. As her distress escalates, she may seek relief that, for someone with BPD, often involves such maladaptive responses as self-injury (Andrewes, Hulbert, Cotton, Betts, & Chanen, 2017), substance use (Trull et al., 2000), and further interpersonal conflict (Herr et al., 2013).

Empirical works show that experimentally-induced rumination is linked to increased NA (Rood, Roelofs, Bögels, & Arntz, 2012) and that induced NA is linked to ruminative thinking (Feldner, Leen-Feldner, Zvolensky, & Lejuez, 2006). For instance, experimentally-induced rumination has been shown to induce (Rood et al., 2012) and maintain high levels of NA among adolescent (Park, Goodyer, & Teasdale, 2004; Rood et

al., 2012) and adult populations (Nolen-Hoeksema & Morrow, 1993; Nolen-Hoeksema et al., 2008; Park et al., 2004). Moreover, others have shown that adults with higher dispositional tendencies to ruminate experienced greater levels of distress after negative mood induction as compared to their low-ruminating peers (Feldner et al., 2006).

With respect to BPD, a growing body of literature shows that individuals with the disorder are more likely to choose maladaptive ER strategies, specifically rumination (Selby et al., 2009; Trull & Carpenter, 2013), when experiencing negative affective states in experimental conditions (Baer et al., 2011) and as assessed via self-report (Peters et al., 2017). For example, Gardner, Dodsworth, and Selby (2014) examined links between BPD traits, rumination, and non-suicidal self-injury (NSSI)/suicidality in a forensic male sample. Their findings indicated robust associations between BPD, rumination, and NSSI, wherein rumination mediated the effects of BPD on NSSI and suicidality (Gardner, et al., 2014). Additionally, Sauer et al. (2016) investigated habitual ER choice in patients with BPD as compared to patients with depression and healthy controls. Their results showed that, relative to the other two groups, patients with BPD engaged in greater ruminative thinking in everyday life (Sauer et al., 2016). Next, Selby and Joiner (2013) examined the relationship between BPD, rumination, NA, and behavioral dysregulation (e.g., NSSI, substance use, physical fights) in the daily lives of community-dwelling adults. Their results showed robust links between distress, ruminative thinking, BPD, and behavioral dysregulation, wherein those with BPD who engaged in ruminative thinking during periods of distress were found to be at a marked risk to engage in dysregulated behaviors (Selby & Joiner, 2013).

While growing evidence links rumination to BPD, there is a surprising dearth of studies that examine the relationship between BPD, rumination, and distress experimentally. Therefore, evidence for the Emotional Cascade model remains largely correlational and based on cross-sectional findings from self-report measures. Further, the circumstances under which ruminative responses are a particular risk for those with BPD remain unclear. Given that ER use is largely influenced by context, clarifying under which circumstances those with BPD are especially prone to ruminate may shed light on novel points of entry for intervention efforts.

1.4 Interpersonal Contexts and Rumination in BPD

While rumination is broadly linked to negative emotional states (Nolen-Hoeksema, 2000), perceived interpersonal slights and rejection may be particular triggers for those with BPD to ruminate. Though largely unexplored by the empirical literature, several lines of evidence support this possibility. First, BPD is marked by sensitivity to interpersonal contexts, and peers of individuals with BPD report more perceived sensitivity to interpersonal interactions and rejection with those individuals (Klonsky et al., 2003). For example, those with BPD have been shown to over-evaluate others' emotional states and intentions, which is a known risk factor for interpersonal conflict and distress (Sharp, et al., 2011). Second, interpersonal stressors evoke greater distress among those with BPD relative to others (Russell, Moskowitz, Zuroff, Sookman, & Paris, 2007). For instance, Stepp, Pilkonis, Yaggi, Morse, and Feske (2009) examined the interpersonal experience of patients with BPD over a seven-day period using digital diary entry. The authors found that, compared to healthy controls, individuals with BPD experienced more disagreement and ambivalence in social interactions, which evoked

higher levels of negative emotions (Stepp et al., 2009). Researchers have also found evidence of greater distress among those with BPD, relative to controls, during social situations (e.g., Russell et al., 2007). Lastly, BPD appears to be linked to ruminative responses when recalling social interactions. For example, Peters and colleagues (2017) examined writing samples of those with low and elevated BPD symptoms in a free-recall writing task. Participants were asked to write about a topic that has recently been on their minds, along with contextual information surrounding their thinking. Their results showed that those in the elevated BPD symptoms group engaged in more ruminative thinking, and wrote about situations in which others upset them more frequently than those in the low-BPD symptoms group. Further, ruminative thinking was robustly linked to distress reported after the writing task (Peters et al., 2017).

CHAPTER II

CURRENT STUDY AIMS

The present study aimed to test key facets of the Emotional Cascade model across experimental and naturalistic conditions. First, whether rumination--and more specifically, brooding--mediates the often-noted relationship between BPD symptoms and ED, as measured via self-report and affective states experienced in daily life, was examined. The second idea tested was whether interpersonal contexts pose a particular liability for those with elevated BPD symptoms to ruminate across experimental and daily life settings; explicating the relationship between contexts and the Emotional Cascade model would shed new light on treatment and intervention efforts. Currently, the main line of treatment for BPD is Dialectical Behavior Therapy (DBT), which promotes acceptance of "what is" combined with promoting healthy change, specifically in interpersonal interactions (Koerner & Linehan, 2000). Testing whether ruminative tendencies are preferentially deployed in interpersonal contexts may be helpful in isolating the specific interactions that elicit dysregulated behaviors and maladaptive ER responses to fold into our prediction and treatment models. Such insight may help clinicians to winnow down ER skills-building to strategies that robustly target

rumination, rather than those that target the myriad other maladaptive ER responses that are deployed by those with BPD. Individuals who are better prepared to identify their triggers for ED may be better able to modify their environment and reduce their use of maladaptive ER responses, providing better outcomes for all.

2.1 Hypotheses

Hypothesis 1a. Trait rumination and brooding will mediate the relationship between BPD and trait emotion dysregulation (see Appendix, Figures 1 and 1a).

Hypothesis 1b. EMA-based rumination will mediate the relationship between BPD and NA in daily life (see Appendix, Figure 2).

Hypothesis 2a. BPD symptoms will predict greater spontaneous rumination following interpersonally-based negative induction relative to non-interpersonal negative mood induction, which in turn will predict higher levels of NA following the interpersonal mood induction procedure (see Appendix, Figure 3).

Hypothesis 2b. BPD symptoms will predict higher ruminative tendencies in response to interpersonal contexts in daily life, which, in turn, will predict a more enduring course of NA (see Appendix, Figure 4).

CHAPTER III

METHOD

3.1 Participants

One hundred and nineteen undergraduate participants constituted the final sample recruited from the Undergraduate Psychology Research Pool at Cleveland State University. Participants received course credit for their time. Eligible participants were those who completed a pre-screen survey online as part of another study, followed instructions on nine items that measured their adherence to directions on study measures, expressed an interest in completing a second phase of the online study, and provided their contact information. The age of participants ranged from 18-44 (M = 20.40, sd = 4.75) and 72.3% of the sample was female (n = 86). Fifteen participants (12.6%) endorsed clinical levels of BPD symptoms (scores of 38 or higher on the PAI-BOR) and 2.8% of the sample met clinical criteria for a personality disorder (n = 3). Fifty-nine participants (49.6%) met clinical criteria for current or history of psychiatric disorders (e.g., Major Depressive Disorder, Social Anxiety Disorder, Specific Phobia). Of all participants, 7.6% (n = 9) endorsed current Major Depressive Disorder and 31.9% (n = 38) reported a history of Major Depressive Disorder. Participants with depression histories and those

who were currently depressed were not excluded due to high comorbidity of the disorder with BPD (Grant et al., 2008). For implications of this inclusion, please refer to limitations.

3.2 Measures

3.2.1 General measures.

Demographic questionnaire. A nine-item measure that gathers participants' age, sex, race, current year in school, household income level, country of origin, number of years/generations family has been in the U.S., their relationship status, sexual orientation, and the gender of their current/last romantic partners.

Personality assessment inventory-borderline scale (PAI-BOR). The PAI-BOR is a 24-item subscale of the Personality Assessment Inventory that is commonly used to assess BPD features in nonclinical samples (Trull, Useda, Conforti, & Doan, 1997). The PAI-BOR measures affective instability, identity problems, negative relationships, and self-harm by seeking responses to items such as, "My mood shifts quite suddenly," and "Sometimes I feel terribly empty inside" via a 4-point Likert scale, from 0 (*false*) to 3 (*very true*) (Morey, 1991). Scores on the measure range from 0 to 72, with scores above 38 indicating elevated BPD features and scores of 60 or more indicating clinical-level BPD features (De Moor, Distel, Trull, & Boomsma, 2009). The PAI-BOR shows high internal consistency (α = .84, Trull et al., 1997) and predictive validity (De Moor et al., 2009). In this sample, the PAI-BOR (α = 0.88) evidenced acceptable reliability.

Difficulties in emotion regulation scale (DERS). The DERS is a 36-item measure assessing individuals' typical levels of ED across six domains that include nonacceptance of negative emotions, lack of emotional awareness, and lack of emotional

clarity. Participants rated how alike they are to such statements as, “I experience my emotions as overwhelming and out of control” via a 5-point Likert scale that ranges from 1 (*almost never*) to 5 (*almost always*). Scores on the DERS range from 36 to 180, with higher scores indicating greater levels of ED. The DERS has been shown to demonstrate good psychometric properties in the form of high internal consistency ($\alpha = 0.93$) and adequate construct and predictive validity (Gratz and Roemer, 2004). In this sample, the DERS ($\alpha = 0.94$) evidenced good reliability as well.

Ruminative response scale (RRS) and RRS brooding subscale. The RRS is a 22-item measure that assesses responses to dysphoric mood that are focused on the self, symptoms, and cause/consequences of one’s mood (Nolen-Hoeksema & Morrow, 1991). The RRS is part of a larger measure, the Response Styles Questionnaire (RSQ; Nolen-Hoeksema & Morrow, 1991) but only the RRS subscale was used in this study. Participants rated how alike they are to statements like “When I feel sad, down, or depressed, I generally think, “What am I doing to deserve this?”” via a 4-point Likert scale that ranges from 1 (*almost never*) to 4 (*almost always*). Scores on the RRS range from 22 to 88, with higher scores indicating greater levels of ruminative response. The Brooding subscale of this measure was also used in hypothesis testing to determine if brooding items specifically shared a stronger relationship with trait-level BPD features and predicted trait ED (Treynor, Gonzalez, & Nolen-Hoeksema, 2003). The RRS has been shown to demonstrate good psychometric properties in the form of high internal consistency ($\alpha = 0.90$) and adequate test-retest reliability (Treynor et al., 2003). In this sample, the RRS ($\alpha = 0.94$) and its brooding subscale ($\alpha = 0.80$) evidenced good reliability.

3.2.2 Laboratory experiment measures.

State negative affect ratings. State NA was measured via items drawn from the Positive and Negative Affect Schedule (e.g., sad, nervous, joyful; Watson, Clark, & Tellegen, 1988). Participants used a 10-point Likert scale to respond to prompts like "How sad do you feel right now?" before and after negative mood induction procedures (see *Procedures*). State NA reflects the aggregate of the NA items (i.e., sad and angry). Number of descriptive NA items were limited to reduce participant burden in-lab.

State rumination. State rumination was measured via a single item following the two negative mood induction procedures. Respondents used a 10-point Likert scale when responding to "I found it hard to not think about the way the movie made me feel," and "I found it hard to not think about the way the game made me feel," respectively.

3.2.3 Ecological momentary assessment measures.

Immediate & peak negative affect. Negative affect was measured via items drawn from the Positive and Negative Affect Schedule (i.e., sad, upset, angry, frustrated, and stressed; Watson et al., 1988). Participants were asked to endorse these items using a 5-point Likert scale at the time when they received the EMA prompt (Immediate NA) and while reflecting on the most negative that they felt during the past hour (Peak NA). Immediate and Peak NA were aggregated into their respective index scores.

Rumination. Rumination in daily life was measured via an EMA prompt that asked participants to identify which ER response they deployed once they experienced peak distress during the prior hour. Rumination was provided as one response option, ("Feel unable to stop thinking about how you were feeling") and it was measured dichotomously (utilized vs. not-utilized).

Interpersonal context. The interpersonal context of negative events associated with peak NA were measured via two EMA items referencing that time, asking "Were you alone?" and "What were you doing?". Contextual information that was collected determined whether peak NA was interpersonally-linked. For example, if individuals reported that they were "not alone" and that they were having a specific experience/interaction with someone else, then it was coded interpersonally. Similarly, an event was coded as interpersonal if individuals reported that they were physically "alone", but that they just ended, or were currently having, a negative interaction on the phone. Notable exceptions were if individuals were around others generally (e.g., at work, at home), and therefore "not alone", but they had not specifically interacted with anyone; these events did not qualify as interpersonal for study purposes. Events were coded by two independent raters, $\kappa = .667$. Additionally, data from these questions have previously been shown to reliably identify stressful interpersonal contexts (Napolitano et al., *manuscript in preparation*).

3.3 Procedure

3.3.1 Experimental protocol.

Data used from this study were drawn from a larger project on the links between internalizing disorders, ER, and psychophysiological processes. This larger project was carried out in two phases: Phase 1 involved an online data gathering on personality dimensions, ER, and contextual factors, and Phase 2 involved data collection in the laboratory and in participants' daily lives via EMA. Phase 1 and phase 2 data was used in this study, wherein RRS and DERS scores were obtained during Phase 1 and PAI-BOR

scores were obtained during Phase 2. Additionally, all laboratory and EMA data came from Phase 2.

Before participants began the experimental protocol, they privately completed self-report surveys that assessed their levels of BPD features (PAI-BOR); dispositional rumination (RRS) and levels of emotion dysregulation (DERS) were collected online, during Phase 1. Next, participants completed semi-structured clinical interviews to assess histories of psychiatric disorders, the information from which was not used in the present study. Then, participants engaged in an experimental protocol that included, among other tasks, watching a 2.5-minute sad film clip ("The Champ"; Gross and Levenson, 2005) and completing a 5-minute interpersonal exclusion task (Cyberball) to engender negative mood states (Williams & Jarvis, 2006). Cyberball is an interactive ball-tossing game in which the participant passes the ball to two other "players" (computer-generated confederates) by clicking on one of the two pictures on the screen. The ball is tossed equally among the players initially, but throughout the game, the percentage of tosses to the participant is systematically lowered. During the final third of the game, the participant is completely excluded in order to engender feelings of rejection. Differences between pre- and post-task NA ratings for the Sad Film and Cyberball tasks served as manipulation checks for the two mood induction procedures.

3.3.2 Ecological momentary assessment.

EMA sampling generally occurred five times between 9:00 a.m. and 9:00 p.m. during the seven contiguous days following the laboratory procedure via fixed prompts in SurveySignal (Hofmann & Patel, 2015) to enable sampling of participants' affective states evenly across the morning, afternoon, and evening hours. This sampling scheme

was sometimes adjusted to accommodate times during which participants were unable to use their cell phones (e.g. no signals sent during class or a signal sent after 9 p.m. if participant requested it). Following best practices (Shiffman, Stone, & Hufford, 2008), participants were sent a reminder prompt 15 minutes after receiving the initial text message within a given sampling period, and were allowed a 30-minute window to complete a given EMA survey before the survey deactivated. Each EMA survey assessed both immediate affective states and those that occurred during peak times of distress during the prior hour. Contextual information about activities in which participants engaged, along with their interpersonal contexts at the time of immediate and peak NA was ascertained, along with ER response deployed during times of peak distress. Overall response rate to EMA prompts was 73% and 44% of those observations evidenced moderate peak NA levels (peak NA ≥3).

3.4 General Analysis

Descriptive statistics and bivariate associations among study variables were examined using SPSS v. 21. SPSS was also used to examine assumptions that underlie analytic approaches to test the study hypotheses, as well as Hypotheses H1a. and H2a. Mediation analyses and path models were fit using the PROCESS Macro, model 4 (Hayes, 2013) for SPSS 21. Bias-corrected 95% confidence intervals and bootstrap estimates were calculated with 5,000 samples. All other study hypotheses were tested using HLM software v. 7.01 (Raudenbush, Bryk, Cheong, & Congdon Jr., n.d.). Participants' sex was examined as a covariate in all models as BPD symptoms, rumination, emotional reactivity, and ED are known to be elevated among females, relative to males (Johnson et al., 2003; Charbonneau, Mezulis, & 2009; Thayer, Rossy,

Ruiz-Padial, & Johnsen, 2003). For hypotheses H1a. and H2a., assumptions of linearity, homoscedasticity, normality, and multicollinearity were met. Next, an evaluation of the assumptions of regression revealed violations of homoscedasticity specifically for EMA data and, consequently, heteroscedasticity-robust standard errors were used to correct this violation. Per a priori power analyses, all analyses were sufficiently powered to test study hypotheses.

CHAPTER IV

RESULTS

4.1 Manipulation Check

Two dependent-samples t-tests were performed to determine if mood induction procedures were successful in inducing negative affect (i.e., elevated "sad" and "angry" ratings from immediately pre-task to immediately post-task). Means, standard deviations, and significance values are presented in Table 1. Significant change in negative affect scores indicate that the manipulation was successful in inducing negative mood.

4.2 Descriptive Analyses

Pearson correlations were performed to examine correlations between all variables in models (see Table 2). Age was correlated only with lower dispositional rumination, lower ED, lower rumination after sad film, and lower negative affect after sad film and Cyberball; thus, age was included in all final analyses as a covariate. Contrary to hypothesis, sex was unrelated to all self-report and experimental variables; however, sex was retained as a covariate in all analyses to ensure that it was not predictive by itself or in any interactions. Elevated BPD features were strongly correlated with higher general and brooding trait-level rumination and trait-level ED (rs= .63-.66, $ps \leq .001$). Elevated BPD features were also correlated with rumination after sad film and Cyberball, and heightened negative affect after Cyberball to a lesser extent (rs= .19-.23,

ps= .01-.04). General trait-level rumination and its brooding subscale were strongly correlated with trait emotion dysregulation (*rs*= .75-.79, *ps*≤ .001.) and rumination after Cyberball and negative affect after Cyberball were moderately correlated (*rs*= .31-.42, *ps* = <.001-.003). General trait rumination and its brooding subscale were correlated with negative affect after sad film (*rs*=.23-.27, *ps*=.003-.01). Trait-level ED was moderately correlated with rumination and worsened negative affect after sad film and Cyberball (*rs*=.21-.39, *ps*= <.001-.03). Lastly, rumination after sad film was moderately correlated with negative affect after sad film and Cyberball and negative affect after sad film was strongly correlated with negative affect after Cyberball (*rs*=.19-.59, *ps*= <.001-.04).

4.3 Hypothesis Testing

4.3.1 H1a. Do trait rumination and brooding mediate the relationship between BPD features and trait emotion dysregulation?

In order to test this question, two path models were run to examine whether 1) BPD features predict increased trait-level rumination (RRS total score) and 2) whether BPD features predict increased brooding (RRS Brooding subscale), and in turn, if types of rumination predicted trait-level ED (DERS total score). Brooding was examined alongside rumination as brooding constitutes and captures the more stereotypically "moody" components of rumination, apart from the more reflective rumination captured by the RRS (Treynor et al., 2003). Following best practices (MacKinnon, Fairchild, & Fritz, 2007), mediation analyses were conducted in a single step, and boot strapping approaches were used to derive confidence intervals around the indirect effect (Preacher & Selig, 2012).

In the first model, dispositional rumination (RRS total score) was regressed on BPD symptoms (path a), and ED was regressed on BPD symptoms (path c) and dispositional rumination (path b). In the second model, dispositional brooding (RRS Brooding subscale) was regressed on BPD symptoms (path a), and ED was regressed on BPD symptoms (path c) and dispositional brooding (path b).

Independent of the effects of demographic characteristics, BPD features significantly predicted greater levels of rumination (b =.81, p< .001). Next, rumination significantly predicted ED (b =1.02, p< .001), independent of the effects of BPD features (b =.47, p < .003). Test of indirect effects revealed that the effects of BPD features on ED were partially mediated via general rumination (indirect effect = .83, 95% CI .58-1.11).

Independent of the effects of demographic characteristics, results of the second model showed support for the indirect effect of BPD features on ED via brooding. Specifically, this model indicated that BPD features significantly predicted greater levels of brooding (b =.21, p< .001). Next, brooding significantly predicted ED (b =3.40, p< .001), independent of BPD features (b =.61, p< .001). Mediation analyses revealed that the effects of BPD features on ED were partially mediated via general rumination (indirect effect = .70, 95% CI .45-.97).

4.3.2 H1b. Does EMA-based rumination mediate the relationship between BPD and NA in daily life?

In order to examine this hypothesis, a 2-1-1 multilevel mediation model was conducted to test whether rumination mediates the effects of BPD on distress in participants' daily lives (Preacher & Hayes, 2004). This model was examined piecewise, given that the mediator (rumination) was time-varying. In the first the model,

spontaneous rumination, ascertained via EMA during times of peak distress (level 1 mediator) was regressed on BPD symptoms (path a). In the second part of the model, immediate NA (level 1 outcome) was regressed on BPD symptoms (level 2 predictor) (path c) and EMA-based rumination (path b). Following best practices (see Enders & Tofighi, 2007), EMA-based rumination was disaggregated into its time-invariant component (average probability of a given participant's tendency to ruminate, PM-RUM, a Level 2 predictor) and time-varying component (momentary deviation in the probability of a given participant's tendency to ruminate relative to his or her respective average tendency to ruminate, PD-RUM, a Level 1 predictor) in the second part of the model. The interaction between time-invariant and time-varying component of rumination was included in the model as the effect of deviation from one's usual ruminative tendencies may be influenced by the level at which one typically ruminates.

Demographic characteristics were regressed on outcomes in all models, and the timing between immediate and peak NA and peak NA levels (level 1 covariates) in the second part of the model. Random effects were fit to all level 1 variables, as level 1 outcomes, predictors, and covariates may vary across observations.

Contrary to expectation, BPD features did not significantly predict EMA-based rumination (OR_{pai} = 1.02, p = .08), thereby precluding rumination serving as mediator between BPD features and immediate NA. Contrary to expectation, neither BPD features nor the time-invariant component of EMA-based rumination significantly predicted immediate NA. However, consistent with expectation, the effect of time-varying component of EMA-based rumination on immediate NA was significant (b= 1.29, p <.001), which suggests that ruminating more, relative to one's average level, is associated

with prolonged NA. This effect was qualified by a trend-level interaction with the time-invariant component of EMA-based rumination (p = .06) whereby the effects of momentary ruminative responses during peak times of distress were less deleterious for those with greater average tendencies to ruminate across the measurement period (see Figure 5).

4.3.3 H2a. Do BPD symptoms predict greater spontaneous rumination following interpersonally-based negative induction relative to non-interpersonal negative mood induction, and in turn, do higher levels of NA follow the interpersonal mood induction procedure?

To examine the first part of this hypothesis, a repeated measures ANCOVA was performed where rumination was the outcome, task (sad film vs. Cyberball) was the within-subjects factor, and BPD features was a between-subjects predictor. The effects of age and sex were covaried. Results from the repeated measures ANCOVA indicated that there was no main effect of task, $F(1, 114) = 1.72$, p =.19, partial η^2=.02, which suggests that rumination levels did not significantly differ across the sad film and Cyberball tasks (see 3). Independent of between subjects effect of age, which was associated with reduced state rumination levels, $F(1, 114) = 4.46$, p =.04, partial η^2=.04, BPD features predicted elevated state rumination across both tasks, $F(1, 114) = 5.92$, p =.02, partial η^2=.05. In contrast to expectation, BPD features did not significantly moderate the effect of task, which suggests that rumination across tasks did not significantly differ as a function of BPD symptoms, $F(1, 114) = .00$, p = 1.00, partial η^2=.00.

To test whether elevated BPD features predicted greater NA reactivity in response to an interpersonal context, two additional repeated measures ANCOVAs were

performed where change in NA levels (pre- and post- task NA scores) were the dependent variables, task (sad film vs. Cyberball) was the within-subjects factor, and BPD features was a between-subjects predictor. The effects of age and sex were covaried. Independent of the effects of age and sex, results from the repeated measures ANCOVA measuring change in NA from pre- to post-sad film indicated that there was a main effect of time, $F(1, 115) = 22.55$, $p<.001$, partial $\eta^2=.17$, which suggests that NA levels significantly increased across the sad film task. Borderline Personality Disorder features evidenced a significant between-subjects effect, but did not significantly interact with the within-subjects effect of time $F(1, 115) =1.88$, $p =.17$, partial $\eta^2=.02$, which suggests that elevated features were associated with high levels of NA across pre- and post-task observations, $F(1, 115) =4.11$, $p =.05$, partial $\eta^2=.03$.

Another repeated measures ANCOVA was fit to test whether BPD features predicted increased NA levels across Cyberball Task. Independent of the effects of sex and age, results from the repeated measures ANCOVA revealed non-significant effect of time, which suggests that NA levels did not change across the Cyberball Task $F(1, 114) = 3.47$, $p=.07$, partial $\eta^2=.03$. Further, while BPD features evidenced significant between-subjects effects, they failed to display the expected interaction with time $F(1, 114) = .83$, $p=.36$, partial $\eta^2=.01$. As with the Sad Film, this finding suggests that those with elevated BPD features reported higher NA levels at pre- and post-task observations, $F(1, 114) = 6.23$, $p=.01$, partial $\eta^2=.05$.

Finally, mediation models were fit to examine whether change in NA following the Sad Film was influenced by BPD features via spontaneous rumination. This series of models regressed (1) spontaneous rumination following the sad film and Cyberball,

respectively, onto BPD features (paths a1-a2), and (2) each mood induction procedure's post-task NA on its respective task-specific spontaneous rumination levels (paths b1-b2), and BPD features (path c). The effects of age, sex, and pre-task levels of NA were covaried.

In contrast to expectation, BPD features did not significantly predict rumination following the sad film clip (b=.05, p = .07) or the Cyberball task (b= .04, p = .053). However, in partial support with expectation, elevated rumination levels following the sad film predicted elevated post-task levels of NA ($b_{\text{rum-sad film}}$ = .34, p <.001), but failed to emerge as a significant predictor for distress following the Cyberball task ($b_{\text{rum-cyberball}}$= .11, p =.18).

4.3.4 H2b. Do BPD symptoms predict higher ruminative tendencies in response to interpersonal contexts in daily life, and in turn, do those contexts predict a more enduring course of NA?

A 2-1-1 mediated-moderation model was tested in to examine whether BPD features predict higher ruminative tendencies in response to interpersonal contexts in daily life which, in turn, predict an enduring course of NA (i.e. a lower change from peak NA to current NA levels). The full mediated-moderation model was examined in two phases: the first regressed predictors and covariates on spontaneous rumination (a dichotomous mediator), and the second regressed current NA levels on spontaneous rumination, predictors, and covariates. As with the multilevel model that examined H1b, EMA-based rumination was disaggregated into its time-invariant component (average probability of a given participant's tendency to ruminate, PM-RUM, a Level 2 predictor) and time-varying component (momentary deviation in the probability of a given

participant's tendency to ruminate relative to his or her respective average tendency to ruminate, PD-RUM, a Level 1 predictor) in the second part of the model, as was the occurrence of interpersonal context (PM-INT and PD-INT). The interaction between time-invariant and time-varying components of rumination and interpersonal context were included, as appropriate, given that the effect of deviation from one's usual levels of each construct may be influenced by their respective average levels of occurrence.

In the first model, rumination was the level 1 dependent variable, BPD features served as the level 2 moderator, interpersonal context of peak distress as the level 1 predictor, and demographic characteristics served as level 2 covariates. All level 1 variables were allowed to vary within participants across observations.

In terms of fixed effects, and independent of demographic characteristics, individual's average tendency to experience distress in an interpersonal context predicted a greater likelihood to ruminate ($OR_{\text{PM-INT}}$=8.01, p=.01), as did deviation from this average level ($OR_{\text{PD-INT}}$= 2.58, p<.001). These main effects were qualified by a significant interaction between time-varying and invariant components of interpersonal context. Specifically, the effect of experiencing distress in an interpersonal context on probability to ruminate was reduced among those whose peak distress usually occurred in such a context ($OR_{\text{PD-INT X PM-INT}}$= .02, p=.01; see figure 6), In contrast to the hypothesis, BPD features were unrelated to EMA-based rumination, and it did not moderate the effect of time-variant and invariant effects of interpersonal context.

With respect to immediate NA levels, findings reported for H1b were maintained when time-varying and invariant component of interpersonal context of distress were added to the model (see Table 4). Interestingly, greater tendencies to experience distress

and interpersonal context predicted faster declines in NA across peak and immediate levels (b = -1.78, p = .03).

CHAPTER V

DISCUSSION

The present study aimed to test key facets of the Emotional Cascade model across experimental and naturalistic conditions. There is evidence that individuals with BPD and elevated BPD features may ruminate when distressed and this rumination can trap them in a cycle wherein rumination leads to profound negative mood states and further rumination or terminate in behavioral dysregulation (Selby et al., 2009). Further, the literature on rumination in BPD suggests that interpersonally-relevant contexts may contribute to increased rumination and ruminative cycles (Peters et al., 2017). Testing whether ruminative tendencies are preferentially deployed in interpersonal contexts may help isolate specific interactions that pose a unique threat to individuals with BPD and elevated BPD features. Two sets of hypotheses were examined to test whether rumination mediated the relationship between BPD symptoms and ED, via self-report and affective states in daily life, and whether interpersonal contexts present a specific liability for individuals with elevated BPD symptoms to ruminate across experimental and daily life settings.

The first hypothesis was that rumination and brooding will mediate the relationship between BPD and trait ED. Results indicated that BPD features significantly predict greater levels of rumination, and that in turn, rumination predicts increased ED. This relationship illustrates the importance that dispositional rumination plays in linking elements of personality pathology and stable difficulty in regulating emotion—and it may help explain why individuals with elevated BPD features experience ED. Since this relationship was established, the less effective component of rumination—brooding—was tested next. Indeed, BPD features predicted increased brooding and in turn, brooding predicted higher ED. These findings are consistent with those of others that show robust association across self-report (Peters et al., 2017; Meaney, Hasking, & Reupert, 2016) and experimental (Sauer & Baer, 2012) studies that link BPD to rumination, as well as BPD features with ED (Chapman, Leung, & Lynch, 2008; Peters, Smart, & Baer, 2015). Interestingly, there are a lack of empirical studies that examine whether rumination is a mechanism between BPD features and ED. The results of this study help to bridge this gap, and suggest that it is important to consider emotion regulation responses, rather than outcomes of emotion regulation failures solely, when considering the link between BPD and dysregulated affects.

The second hypothesis was that rumination would mediate the relationship between BPD and NA in daily life, serving as a comparison point for dispositional relationships and extending the outcome to one facet of ED, heightened NA (Carpenter & Trull, 2013). In contrast to the findings on self-report measures, elevated BPD features were unrelated to rumination in response to peak periods of distress. To the author's knowledge, this study is one of the first to examine the relationship between BPD

features and rumination outside of the laboratory setting. Consequently, no clear basis of comparison is currently available. However, there is a large body of work to suggest discordant findings between construct levels when they are measured via self-report versus experience sampling (Shiffmann et al., 2008). Therefore, it is feasible that ruminative tendencies measured via self-report may not align with actual behavior that is measured through EMA. To test this, an exploratory analysis that regressed EMA-based rumination on demographic characteristics and trait rumination was performed; results failed to show a significant relationship between trait and EMA-based rumination (*OR* = 1.01, $p = .10$), confirming a possible discrepancy. That is not to say, however, that EMA-based rumination shows poor construct validity, as the tendencies to ruminate in daily life did predict enduring levels of NA. Another potential explanation for the null effect of BPD features on rumination is that at the time of distress, those with elevated BPD features may engage in an alternate maladaptive ER response. This may be the case as rumination usually is a protracted experience that is believed to cycle upwards in intensity over time. Therefore, its effects may not be immediately perceived, especially when alternate immediate responses such as tobacco, alcohol, substance use, and maladaptive interpersonal responses like yelling, arguing, and fighting are more immediate and salient. The possibility that those with elevated BPD features engage in non-ruminative maladaptive responses first, and ruminate later once the intensity of peak distress somewhat abates should be examined in future studies.

The third hypothesis tested whether BPD symptoms predicted greater rumination following an interpersonally-based negative mood induction procedure relative to a non-interpersonal negative mood induction, and whether spontaneous rumination mediated

the effects of BPD on NA reactivity in response to the mood induction procedures. Unexpectedly, while BPD features predicted elevated tendencies to ruminate spontaneously, such tendencies did not differ across the two tasks.

This finding may be understood in one of several ways: first, the relatively low levels of BPD features in this sample may be insufficient to elicit strong ruminative responses following interpersonal rejection, relative to sad mood induction. Second, many participants evidenced a history of depression (32%) and a small subset were in the midst of a depressive episode (~8%). As depression is closely tied to rumination, and depressive episodes leave residual impairment in the form of elevated depression symptoms, it possible that those in remission or in the midst of a depressive episode fail to differentiate interpersonal context, which would reduce the effect of interpersonal rejection. Indeed, the relationship between depression and poor context differentiation has been described with respect to affective states (e.g., Emotion Context Insensitivity; Rottenberg, Gross, & Gotlib, 2005). Moreover, exploratory analyses that examined the relationship between depression status and BPD features showed robust elevation in features for those with depression histories (b=6.60, $t(116) = 3.00$, $p = .003$) and current depression (b=6.60, $t(116) = 3.58$, $p < .001$; $R^2 = .18$). As depression was closely tied to BPD features, depression status may have confounded the relationship between BPD features and rumination across interpersonal and non-interpersonal contexts. Finally, as the Cyberball task relied on successfully deceiving participants into believing that they were playing the game with real peers, it is feasible that the effectiveness of the task was reduced by poor participant buy-in. However, irrespective of the effectiveness of deception, there is evidence to suggest that while Cyberball is highly effective in eliciting

feelings of exclusion (Williams & Jarvis, 2006), it does not always elicit change in mood, specifically negative mood (Zadro, Williams, & Richardson, 2004). Whether it was a lack of effective deception or that rejection failed to equate with an increase in NA are possibilities that should be examined in future studies.

The discrepant findings in the form of significant bivariate and between-subjects association between BPD features and state rumination, but no association in mediation models between constructs, is curious. However, this apparent discrepancy may reflect methodological differences between the three analytic approaches. For instance, the above noted bivariate associations were small in magnitude, and did not covary for demographic characteristics. While the ANCOVA statistically covaried the effects of demographic characteristics, as did the mediation model, the between-subjects effect in the ANCOVA reflects the relationship between a predictor and an average of the dependent variables. Therefore, such an aggregate may prove a more reliable index of the construct, especially when the levels of that construct do not change across the repeated measures.

In a similar vein, it is interesting that spontaneous rumination predicted greater NA reactivity following the sad film, but was unrelated to NA change following the Cyberball task. This discrepancy may be understood by the relatively poor efficacy of the Cyberball manipulation. This conclusion is supported by the non-significant within-subjects effect of time within the repeated measures ANCOVA and, given the previously discussed limitation of mood induction through the Cyberball task, may not be expected to be linked to spontaneous rumination. In contrast, rumination in response to sadness has been well-documented to induce and prolong distress (e.g., Kirkegaard Thomsen, 2006).

Another curious finding was that BPD features predicted greater NA reactivity to the sad film clip, but not the Cyberball task. This finding stands in contrast to research that shows robust mood induction effects for those with BPD when the mood induction procedure is interpersonal in nature (Renneberg, Herm, Hahn, Staebler, Lammers, & Roepke, 2012; Lawrence, Chanen, & Allen, 2011). However, the high rate of depression in this sample may account for this unexpected finding. Indeed, those with elevated depression levels have been shown to respond more strongly to negative mood elicitors relative to non-depressed peers (Gemar, Segal, Sagrati, & Kennedy, 2001). As the majority of the sample fell well-below the clinical range of BPD features (median = 24), the strong reactivity to the sad film may have been driven by elevated depression levels.

The fourth and final hypothesis was that BPD features will predict higher ruminative tendencies in response to interpersonal contexts in daily life, which, in turn, will predict a more enduring course of NA. The results failed to support this hypothesis. While interpersonal context predicted a greater likelihood to deploy rumination as the primary ER response during times of distress, BPD levels were unrelated to this association. The observed effect of interpersonal context on rumination is consistent with a body of work that demonstrates the strong, evocative nature of interpersonal environments (Hepp et al., 2017; 2018). Further, as in the model testing Hypothesis 1b, rumination as a response had the most iatrogenic effect when it occurred among those who do not typically ruminate. That is, while interpersonal context predicted a higher likelihood to ruminate, the consequence of such responses do not uniformly predict enduring distress. The conditional effect of rumination on enduring NA may be understood in several ways. It is feasible that those who typically ruminate tend to

experience elevated levels of NA at times of peak distress, whereby the effect of rumination on NA change over time would be obscured by peak NA levels. However, exploratory analyses that tested this possibility showed that the invariant component of rumination did not predict elevated peak NA levels (p= .37), while person-deviations in rumination predicted elevated peak NA levels (b= 2.12, p< .001). It is also feasible that feeling "unable to stop thinking about how you are feeling" may reflect a tendency for self-reflection among those who generally respond to distress in this way. It is also possible that such high ruminators are more motivated to change their emotions through other means. That is, a high tendency to feel one's emotions may be adaptive in that it signals a potential need to respond to said emotions.

It is also noteworthy that while interpersonal context predicts greater ruminative tendencies, experiencing peak distress within an interpersonal context is associated with less enduring NA. Perhaps interpersonal context in these situations reflects access to social support, rather than interpersonal altercations. Specifically, interpersonal contexts were coded as present if the participant reported being in the presence of social interaction. Therefore, such interaction may reflect opportunities to instrumentally use others to problem solve or reduce distress. Conversely, if the individual with whom the participant interacted elicited the reported distress, remaining with that peer provides more opportunity to resolve the conflict, as compared to leaving the situation. Finally, the index of interpersonal context did not differentiate whether the interaction the participant experienced was the cause of affective change or the ER attempt. Therefore, the data likely reflect a mixture of those possibilities. Future work that more clearly measures

interpersonal context and its role in peak distress levels would do much to clarify the relationship between BPD, rumination, and distress.

5.1 Limitations

Findings of this study should be interpreted alongside several limitations. Initially, there appears to be an issue regarding the Cyberball task wherein participants may or may not believe that the individuals they were playing against are real. This is a limitation because individuals who are not deceived and do not believe that the outcome of the game is real are unlikely to become upset, understandably. This difference is also notable when compared with the sad film, which proved to be an effective mood induction, suggesting that when participants were fully engaged with the stimuli that it was effective.

Next are specific sample considerations. First, this was a student sample and the effects that were being tested may have been too small to find in a sample relatively devoid of elevated personality pathology, especially considering the relative contribution of depression symptoms and histories in the sample. Specifically, the robust effects of negative mood induction post-sad film may be viewed through the lens of current depressive symptomology present within the sample—approximately 8% of the sample met criteria for a current depressive episode and 32% of the sample evidenced a history of MDD. Though highly comorbid with BPD, depression's relationship with rumination and brooding may cloud the clinical picture and predict outcomes differently than BPD features (Kirkegaard Thomsen, 2006).

Next, aggregating "angry" and "sad" may be a more faithful interpretation of heightened negative affect, per study hypotheses, but a more specific testing of anger

versus sadness may be warranted when these are the only two discrete emotions tested experimentally. For example, Renneberg and colleagues (2012) found that anger may be more robustly related to interpersonal rejection in Cyberball and Peters and colleagues (2015) established evidence that anger rumination, compared to rumination generally, may be particularly relevant to elevated BPD features and emotional outcomes.

Lastly, very few individuals identified that they used rumination as an ER response in daily life (approximately 9% of approx. 1000 observations) and evidenced relatively high levels of traditionally "effective" ER responses, primarily problem-solving (approx. 24%). This could contribute to the overall lack of higher immediate NA evidenced in the daily life sample by way of effective ER. While individuals were more likely to ruminate in interpersonal contexts, this was the exception rather than the rule.

5.2 Future Directions

Future research in this area could capitalize on data collected by examining discrete affective states rather than aggregate NA scores, as anger may be tied to interpersonal rejection specifically for individuals with elevated BPD features (Renneberg et al., 2012) and anger rumination may play a significant role in reactivity to interpersonally relevant stimuli (Peters et al., 2015). Next, future research would do well to include higher concentrations of individuals with BPD features in order to examine these relationships more faithfully. Specifically, examining these relationships with balanced groups of individuals reflecting low and high concentrations of BPD features would help clarify the roles of interpersonal context and rumination across the range of BPD pathology. Third, due to the high comorbidity of depression symptoms with BPD features, future investigations into these relationships could exclude individuals with

elevated depression symptoms to obtain a clearer picture of these relationships. Alternatively, individuals with elevated depression symptoms and/or histories without elevated BPD features could be compared to individuals with elevated BPD features, and even healthy controls, to help test the model presented and more thoroughly conclude whether interpersonal contexts present a specific sensitization for those with elevated BPD features to ruminate and, in turn, experience worsened affective outcomes. Lastly, other elicitors to engender interpersonal distress—particularly anger—should be considered as an alternative or supplement to procedures like the Cyberball task. More specific elicitors may provide clarification for the relationship between personally relevant distress, rumination, and BPD features.

5.3 Strengths and Clinical Implications

The strengths of the present study are reflected in its design. First, the mood induction procedures employed mirror those commonly encountered in daily life, thereby increasing the ability to generalize findings. Second, these relationships were examined comprehensively across multiple domains, from self-report to daily life, which provided novel information on these relationships and may help inform future research. Third, this study utilized a direct comparison of interpersonal rejection to a relatively non-interpersonal elicitor, enabling the comparison of interpersonal contexts across experimental and daily life indices. The richness of information provided by results may help inform future research examining which contexts present a unique liability for individuals with elevated BPD to engage in maladaptive ER. While the relationships were not related as hypothesized in experimental and daily life settings, these findings are clinically relevant because they illustrate the important link between unique increases in

rumination and how they can lead to poor affective outcomes and further, illustrate that even for individuals with low personality pathology, increased interpersonal context during times of peak distress presents a specific liability for increased maladaptive ER repertoires.

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APPENDIX A: Tables

Table 1. *Dependent samples t-tests manipulation check of mood induction procedures*

	Negative Affect Pre-Task		Negative Affect Post-Task			
	M	SD	M	SD	t-test	*df*
Sad Film	3.27	2.41	6.93	3.61	12.24***	118
Cyberball	3.10	1.85	4.14	2.94	4.61***	117

***$p \leq .001$

Table 2. *Descriptive statistics and correlations among demographic, BPD, rumination, and affect measures*

			1.	2.	3.	4.	5.	6.	7.	8.
1.	Age	20.40 (4.75)	---	.04	-.15	-.19*	-.17	-.29**	-.19*	-.15
2.	Sex	---		---	-.17	-.05	-.07	-.11	-.14	.02
3.	PAI-BOR	24.42 (12.10)			---	.64***	.63***	.66***	.21*	.19*
4.	RRS_{TOT}	49.87 (15.09)				---	.92***	.79***	.18	.31***
5.	RRS_{BROO}	12.02 (3.90)					---	.75***	.17	.28**
6.	DERS	87.52 (25.31)						---	.21*	.25**
7.	Rum_{SF}	5.63 (3.29)							---	.17
8.	Rum_{CB}	4.29 (2.82)								---

***$p \leq .001$, **$p \leq .01$, *$p \leq .05$

Note. PAI-BOR= Personality Assessment Inventory Borderline Subscale total score; RRStot= Ruminative Response Scale total score; RRSbroo=Ruminative Response Scale Brooding Subscale total score; DERS= Difficulties in Emotion Regulation total score; Rumsf= Rumination level after Sad Film clip; Rumcb= Rumination level after Cyberball task

Table 3. *Means of affect ratings across baseline and mood induction procedures*

Variable	Pre-task *M* (SD)	Post-task *M* (SD)	*test statistic*
Negative Affect			
Baseline	3.30 (2.17)		
Sad Film	3.27 (2.41)	6.93 (3.61)	$t(118) = 12.24$, $p < .001$, $d = 1.19$
Cyberball	3.11 (1.84)	4.14 (2.94)	$t(117) = 4.61$, $p < .001$, $d = .42$

Note. d=Cohen's d.

Table 4. *Results of one-way repeated measures ANCOVA predicting negative affect for sad film*

Predictor	*F*	*df*	*p-value*	η_p^2
Between-Subjects				
BPD	4.11	1, 115	.045	.03
Age	5.67	1, 115	.019	.05
Within-Subjects				
Time (pre, post)	22.55	1, 115	<.001	.17
BPD X Time	1.88	1, 115	.173	.02
Sex X Time	3.95	1, 115	.049	.03

Note. BPD = Personality Assessment Inventory-Borderline Subscale, pre = pre-Sad Film, post = post-Sad Film.

Table 5. *Results of one-way repeated measures ANCOVA predicting negative affect for Cyberball*

Predictor	*F*	*df*	*p-value*	η_p^2
Between-Subjects				
BPD	6.23	1, 114	.014	.05
Within-Subjects				
Time (pre, post)	3.47	1, 114	.065	.03
BPD X Time	.83	1, 114	.364	.01

Note. The effects of age, sex, and their interaction with within-subject factors were non-significant in model and are not presented to improve clarity. BPD = Personality Assessment Inventory-Borderline Subscale, pre = pre-Cyberball, post = post-Cyberball.

Table 6. *Borderline Personality Disorder (IV) effects on negative affect reactivity following the sad film (DV_1) and Cyberball (DV_2) task via spontaneous rumination (Med.)*

	DV_1: Negative Affect following the Sad Film					
	Step 1: IV→ Med			Step 2: IV/MED→ DV_1		
Variable	*B*	*SE(B)*	β	*B*	*SE(B)*	β
Covariates						
Age	-.10	.06	-.14	-.10	.06	-.13
Sex	-.82	.67	-.25	-.95	.62	-.26
NA_{PreSF}	.13	.13	.09	.64***	.12	.43
IV						
PAI-BOR	.04	.03	.15	-.03	.02	-.10
Med						
Rum_{SF}	---	---	---	.34***	.09	.31
	DV_2: Negative Affect following the Cyberball Task					
Covariates						
Age	-.07	.05	-.12	-.06	.05	-.10
Sex	.23	.59	.08	-.66	.51	-.22
NA_{PreCB}	.22	.14	.14	.84***	.13	.53
IV						
PAI-BOR	.04	.02	.17	.02	.02	.08
Med						
Rum_{CB}	---	---	---	.11	.08	.11

Note. Sex= 0 = female, 1= male, PAI-BOR = Personality Assessment Inventory-Borderline Scale, Rum_{SF} = spontaneous rumination level post- Sad Film, Rum_{CB}= spontaneous rumination level post-Cyberball, NA_{PreSF}= Negative affect prior to the Sad Film, NA_{PreCB}= Negative affect prior to the Cyberball task.
***$p \leq .001$

Table 7. *Fixed effects estimates and variance-covariance estimates for 2-1-1 mediation model of rumination (Med.) on BPD features and negative affect (DV)*

Step 1: IV→Med						
Parameters	*B*	*SE*(B)	*t*-ratio	*df*	*OR*	*95% CI*
Intercept	-2.45***	.16	15.72	68	.09	(.06 -.12)
Level 2						
Age	-.01	.02	-0.39	68	.99	(.94 -1.04)
Sex	-.11	.32	-0.36	68	.89	(.47 -1.69)
PAIBOR	.02	.01	1.80	68	1.02	(.99 -1.04)

Step 2: IV/Med→DV				
Parameters	*B*	*SE*(B)	*t*-ratio	*df*
Intercept	10.56***	.28	37.88	67
Level 2				
Age	.004	.03	.15	67
Sex	-.11	.35	-.29	67
PMRUM	2.00	1.41	1.4	67
PAIBOR	.01	.01	1.4	67
Level 1				
when	-.49	.06	-8.11	71
wNA	.55***	.04	14.39	71
PDRUM	1.29***	.35	3.67	70
PDRUMxPMRUM	-3.03	1.59	-1.91	70

Random Parameters			
	SD	Variance Component	χ^2 (*df*)
Intercept	1.67	2.79	100.65 (32)
when	.23	.05	49.87 (36)
wNA	.24	.06	87.06 (36)
PDRUM	.51	.26	45.51 (35)
Residual (*e*)	2.15	4.64	

Note. Sex= 0 = female, 1= male, PAI-BOR = Grand mean centered Personality Assessment Inventory-Borderline Scale score, PMRUM = time invariant average EMA-based rumination; when= timing between peak negative affect and EMA prompt; wNA= peak negative affect within hour preceding EMA prompt; PDRUM= time varying component of EMA-based rumination.
$^{***}p \leq .001$

Table 8. *Fixed effects and variance-covariance estimates for moderated mediation model of BPD (Mod.) on interpersonal context's effect on rumination (Med.) and negative affect (DV)*

Step 1: IV→Med

Parameters	*B*	*SE*(B)	*t*-ratio	*df*	*OR*	*95% CI*
Intercept	-2.13***	.26	-8.13	66	.12	(.07 -.20)
Level 2						
Age	-.03	.04	-.68	66	0.97	(.90 -1.05)
Sex	-.04	.35	-.12	66	0.96	(.48 -1.92)
PAIBOR	.01	.01	.76	66	1.01	(.99 -1.03)
PMINT	2.08*	.86	2.42	66	8.01	(1.44 -44.53)
PMINTxPAIBOR	.03	.08	.31	66	1.03	(.87 -1.22)
Level 1						
	B	*SE*(B)	*t*-ratio	*df*	*OR*	*95% CI*
when	-.12	.07	-1.58	71	.89	(.77 -1.03)
PDINT	.95***	.28	3.44	66	2.58	(1.49 -4.48)
PMINTxPDINT	-4.17*	1.77	-2.35	66	.02	(.00 -.54)
PAIBORxPDINT	.01	.02	.39	66	1.01	(.97 -1.05)
PMINTxPDINTx PAIBOR	.07	.17	.40	66	1.07	(.76 -1.50)

Step 2: IV/Med→DV

Parameters	*B*	*SE*(B)	*t*-ratio	*df*
Intercept	10.59***	.28	37.57	65
Level 2				
Age	.002	.02	.11	65
Sex	-.06	.35	-.19	65
PMRUM	2.77	1.50	1.85	65
PAIBOR	.01	.01	1.82	65
PMINT	-1.78*	.77	-2.30	65
PMINTxPAIBOR (Mod.)	.01	.06	.11	65
Level 1				
when	-.50***	.06	-8.03	71
wNA	.56***	.04	14.41	71
PDRUM	1.27***	.37	3.51	70

Table 8. *continued*

	B	*SE*(B)	*t*-ratio	*df*
PDRUMxPMRUM	-3.54	1.87	-1.89	70
PDINT	-.22	.24	-.93	66
PDINTxPAIBOR	.01	.01	.51	66
PDINTxPMINT	-.91	1.39	-.65	66
PDINTxPMINTxPAIBOR	.09	.12	.74	66

Random Parameters

	SD	Variance Component	χ^2 (*df*)
Intercept	1.70	2.89	92.05 (24)
when	.25	.06	52.87 (30)
wNA	.24	.06	61.66 (30)
PDRUM	.74	.54	36.96 (29)
PDINT	.52	.27	28.27 (25)
Residual (*e*)	2.14	4.57	

Note. Age and sex were non-significant covariates at Level 1 and were not included for Level 1 interactions for the sake of clarity. Sex= 0 = female, 1= male, PAI-BOR = Grand mean centered Personality Assessment Inventory-Borderline Scale score, PMINT= time invariant average level of peak negative affect experienced in an interpersonal context; PDINT= time varying component of peak negative affect experienced in an interpersonal context relative to one's average experience; PMRUM = time invariant average EMA-based rumination; when= timing between peak negative affect and EMA prompt; wNA= peak negative affect within hour preceding EMA prompt; PDRUM= time varying component of EMA-based rumination;
***$p \leq .001$, *$p \leq .05$

APPENDIX B: Figures

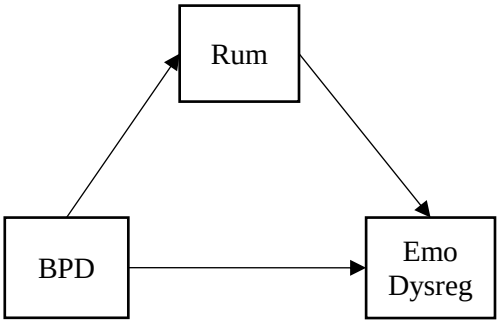

Figure 1. BPD= PAI-BOR total score; Rum= RRS total score; Emo Dysreg = DERS total score

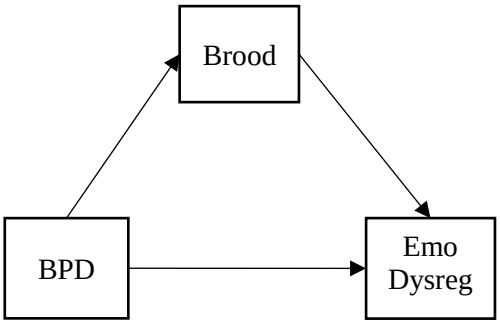

Figure 1a. BPD= PAI-BOR total score; Brood= RRS brooding subscale; Emo Dysreg = DERS total score

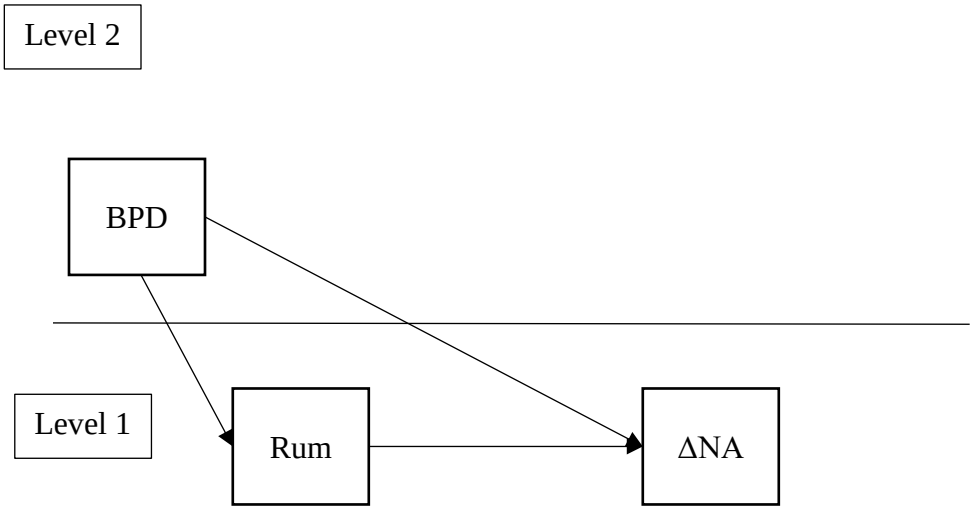

Figure 2. BPD= PAI-BOR total score; Rum= Rumination (yes/no); ΔNA = Change in negative affect (NA) (i.e., sad, upset, angry, frustrated, and stressed) from peak NA to current NA.

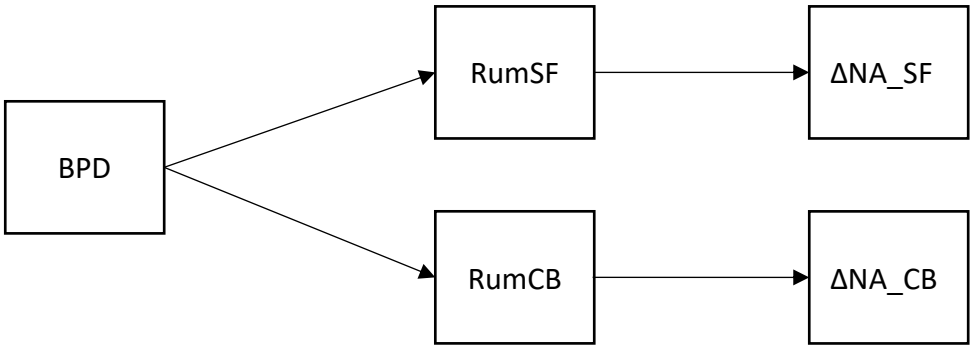

Figure 3. BPD = PAI-BOR total score; RumSF= Engagement (10-pt. Likert scale) in state rumination post sad film clip; RumCB = Engagement (10-pt. Likert scale) in state rumination post Cyberball; ΔNA_SF = Change in negative affect (NA) (i.e., sad, upset, angry, frustrated, and stressed) from pre-sad film clip to post-sad film clip; ΔNA_CB = Change in negative affect (NA) (i.e., sad, upset, angry, frustrated, and stressed) from pre-sad Cyberball to post-Cyberball

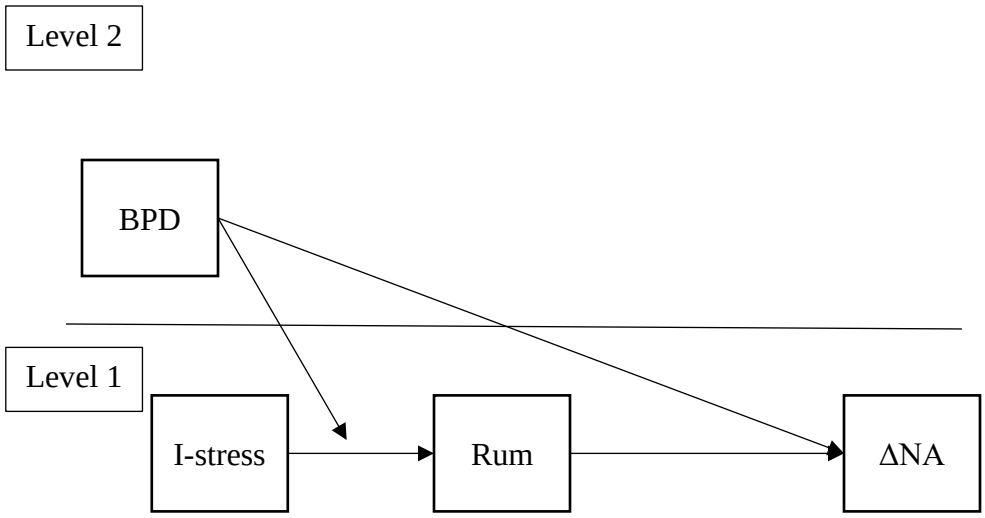

Figure 4. I-Stress = Interpersonal context (yes/no); BPD = PAI-BOR total score; Rum= Rumination (yes/no); ΔNA = Change in negative affect (NA) (i.e., sad, upset, angry, frustrated, and stressed) from peak NA to current NA.

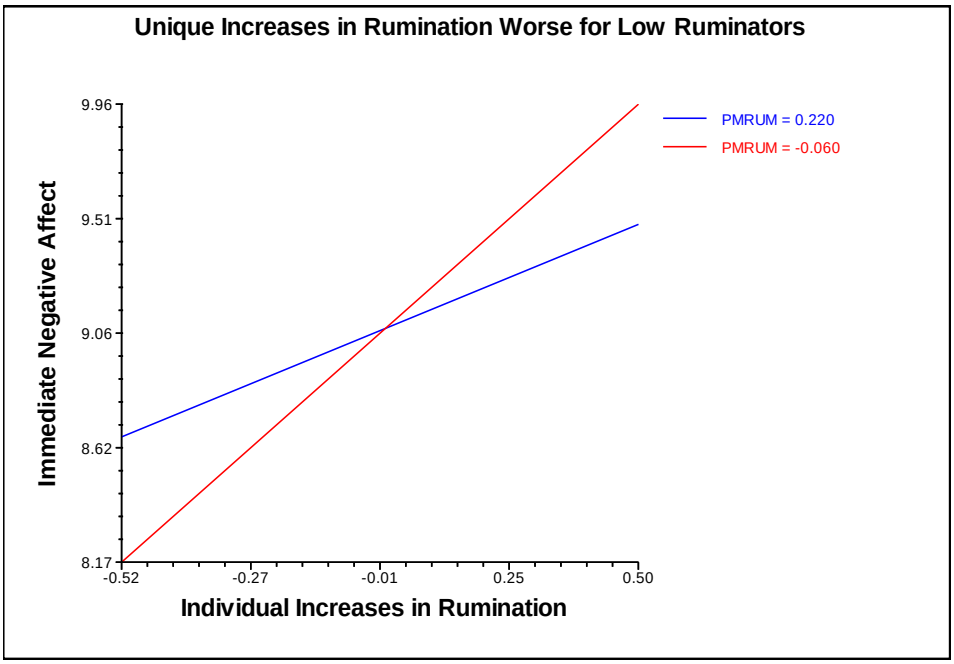

Figure 5. Time varying increases in rumination relative to time-invariant rumination levels predict increased immediate negative affect across observations. This effect is more robust in individuals who are less likely to ruminate on average (red). PMRUM= Average level of rumination deployed across measurement period.

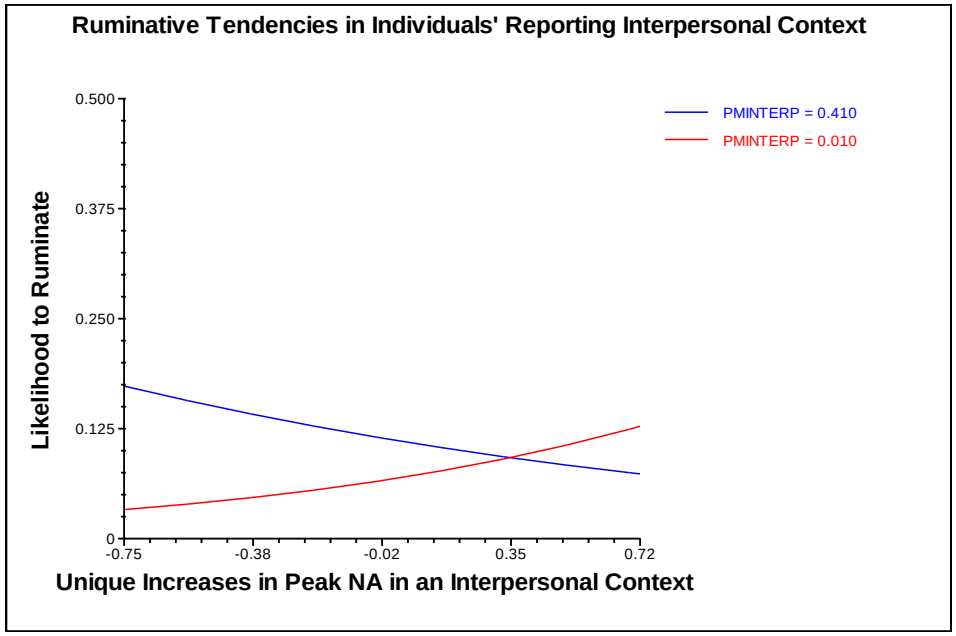

Figure 6. Time varying increases in experiencing peak NA in an interpersonal context relative to time-invariant levels of interpersonal context during peak NA evidence reduced likelihood to ruminate when individuals report higher levels of experiencing interpersonal context on average across measurement period (blue). PMINTERP= Average level of peak negative affect experienced in an interpersonal context; NA= negative affect.