

# Florida State University Libraries

---

Electronic Theses, Treatises and Dissertations

The Graduate School

---

2011

## A Real-Time Evaluation of Emotional Cascades in Borderline Personality Disorder

Edward Andrew Selby



THE FLORIDA STATE UNIVERSITY  
COLLEGE OF ARTS AND SCIENCES

A REAL-TIME EVALUATION OF EMOTIONAL CASCADES IN  
BORDERLINE PERSONALITY DISORDER

By

EDWARD ANDREW SELBY

A Dissertation submitted to the  
Department of Psychology  
in partial fulfillment of the  
requirements for the degree of  
Doctor of Philosophy

Degree Awarded:  
Summer Semester, 2011

The members of the committee approve the dissertation of Edward A. Selby defended on September 23, 2010.

---

Thomas E. Joiner  
Professor Directing Dissertation

---

Mark Winegardner  
University Representative

---

N. Bradley Schmidt  
Committee Member

---

Natalie Sachs-Ericsson  
Committee Member

---

Christopher Schatschneider  
Committee Member

Approved:

---

Janet Kistner, Chair, Psychology Department

---

Joseph Travis, Dean, College of Arts and Sciences

The Graduate School has verified and approved the above-named committee members.

I dedicate this dissertation to my late father, Joseph D. Selby, for always pushing me to seek out the most difficult challenges and pursue my dreams.

## ACKNOWLEDGEMENTS

I would like to acknowledge the mentorship and support of my major professor, Thomas Joiner, as well as the many individuals who assisted me in successfully carrying out this work: Stephen Wonderlich, Scott Engel, Ross Crosby, and Matthew Nock and his lab members for providing me with training on how to conduct experience sampling methodology, Jessica Ribeiro for her help with recruiting community participants for this study, Calista Selby for her thoughtful feedback throughout the project and faith in me and my ideas, and Kate Selby, Emily Selby, Leah Selby, Anna Selby, and William Selby for their support and love. Finally, I would like to thank the National Institute of Mental Health and the Association of Behavioral and Cognitive Therapies – Neil S. Jacobson Foundation for funding they provided, without which this study would not have been possible.

## TABLE OF CONTENTS

List of Tables.....	vii
List of Figures .....	viii
Abstract .....	ix
1. INTRODUCTION.....	1
2. METHODS.....	11
2.1 Participants.....	11
2.2 Screening and Recruitment Procedures.....	12
2.3 Procedure.....	13
2.4 Equipment .....	13
2.5 Measures.....	13
2.6 Data Analytic Strategy .....	16
3. RESULTS.....	17
3.1 Baseline Preliminary Analyses .....	17
3.2 Experience Sampling Preliminary Analyses .....	19
3.3 Constructing a Real-World Emotional Cascade Model .....	21
3.4 Future Prediction of Dysregulated Behaviors .....	27
3.5 Event Contingent Ratings .....	35
3.6 Supplemental Analyses .....	38
4. DISCUSSION .....	42
APPENDICES.....	46

A	Demographics Form.....	46
B	Baseline Dysregulated Behaviors Assessment.....	47
C	Beck Suicide Scale.....	48
D	Cognitive Emotion Regulation Questionnaire .....	52
E	PDA Questionnaire Variables.....	53
F	Human Subjects Approval Notification.....	55
G	Informed Consent Form .....	57
H	Debriefing Form.....	60
	REFERENCES .....	62
	BIOGRAPHICAL SKETCH .....	67

## LIST OF TABLES

3.1 Participant Characteristics.....	18
3.2 Dysregulated Behaviors and Interpersonal Events.....	20
3.3 Predictors of Future Behavior .....	32
3.4 Event-Contingent Reports.....	36
3.5 Positive Behavior Characteristics .....	38



## LIST OF FIGURES

3.1 Hypothesized Real-World Model.....	22
3.2 Original Real-World Model .....	24
3.3 Revised Real-World Model.....	27
3.4 Probability Graph of Rumination Function.....	34

## ABSTRACT

Borderline personality disorder (BPD) is characterized by intensity and sensitivity of negative emotion (emotion dysregulation) as well as various dysregulated behaviors, including self-injury, suicide attempts, binge eating, and substance use. The emotional cascade model of BPD (Selby & Joiner, 2009) suggests that the turbulent emotional experience of those with BPD is the result of emotional cascades, vicious cycles of increasing rumination and negative emotion.

Dysregulated behaviors, then, may serve as potent methods of distraction from rumination due to the salient physical sensations these behaviors provide (e.g., pain from self-injury). Although this model has received correlational and experimental support (Selby et al., 2009), additional research on the real-time processes of rumination and emotion, and how they relate to dysregulated behaviors, is needed. The following study used experience sampling methodology wherein individuals endorsing recent behavioral dysregulation (some with diagnoses of BPD) were signaled randomly 5 times each day for two weeks using palm pilots, at which times they recorded their thought processes, emotional experience, recent interpersonal events and dysregulated behaviors. Participants completed a total of 3,118 scheduled random assessments over monitoring. Using various forms of hierarchical linear modeling, the results of the study supported the Emotional Cascade Model using real-world data. Importantly, the data indicated that high levels of rumination have an exponential effect on predicting future engagement in dysregulated behaviors, especially for those with BPD. The results of this study provide important support for the emotional cascade model and suggest that it is a theory with important clinical implications.

## CHAPTER 1

### INTRODUCTION

Borderline personality disorder (BPD) is a chronic and severe disorder characterized by chaotic interpersonal relationships, affective instability, anger control problems, identity diffusion, various forms of impulsive behaviors, chronic feelings of emptiness, and self-injurious and suicidal behavior (DSM-IV, 1994). This disorder appears to affect as much as 6% of the population (NESARC Wave 2), and is the most commonly diagnosed personality disorder in both inpatient and outpatient settings (Widiger & Trull, 1993). Individuals with BPD have significant functional impairments and have an extremely high rate (between 5-7%) of death by suicide (Duberstein & Conwell, 1997). These individuals are among the most frequent users of the health care system among mentally disordered individuals, with regards to physician visits, emergency room visits, and hospitalization (Hueston, Mainous, & Schilling, 1996). Thus, BPD poses a significant public health concern that warrants further empirical investigation of underlying psychopathological traits and processes.

#### *Emotion Dysregulation in BPD*

When examining the diagnostic criteria for BPD, one thread among many of the symptoms is difficulty with negative emotion. Individuals with BPD often experience difficulties with affective lability, where the valence and magnitude of emotion fluctuate frequently throughout the day (Trull et al., 2008). They are also prone to experiencing intense fears of abandonment, anger control difficulties, and feelings of emptiness (APA, 1994). This overall experience of difficulties with negative emotion is often referred to as *emotion dysregulation*.

One of the classic theories of BPD, referred to as the biopsychosocial model of BPD (Linehan, 1993), has attempted to explain the nature of emotion dysregulation in BPD. In this theory there are three processes that contribute to emotional vulnerability in BPD: 1) individuals with BPD experience negative emotion as much more intense than do most people, 2) individuals with BPD are more sensitive than others to emotional stimuli that contribute to emotion dysregulation, and 3) individuals with BPD, as compared to others, have a slower return

to emotional baseline when upset. Thus, the emotion dysregulation of BPD may consist of extreme experience of negative emotion; emotion dysregulation is easily triggered; and episodes of emotion dysregulation last for extended periods of time.

There is some support for Linehan's model of emotion dysregulation in BPD. Cowdry et al. (1991) conducted a study in which patients with BPD rated their general mood two times each day, and they found that patients with BPD had greater morning-to-evening mood variability and a more random distribution of morning moods than did depressed patients and controls.

Koenigsberg et al. (2002) found that patients with BPD experienced greater emotional lability with regard to anger, anxiety, and oscillation between depression and anxiety than patients with depression, cyclothymia, or bipolar II disorder. In a 24-hour experience sampling study with BPD and healthy control participants, Ebner-Priemer and colleagues (2007) found heightened affective instability for both emotional valence and distress in the BPD group. In another experience sampling study taking place over the duration of a month, Trull et al. (2008) found that BPD patients regularly experienced more extreme changes in hostile, fearful, and sad affect than did depressed patients. Finally, Yen, Zlotnick, and Costello (2002) found that affect intensity was associated with number of BPD symptoms in patients diagnosed with BPD.

Evidence thus appears to support the emotion dysfunction component of Linehan's biopsychosocial model of BPD. Although current research provides preliminary evidence for this model of emotion dysregulation, the specific mechanisms that cause emotion dysregulation in BPD are still unclear. Furthermore, exactly how emotion dysregulation incites behavioral dysregulation remains unclear. This may be where the Emotional Cascade Model of BPD provides incremental understanding of BPD, especially with regard to the relationship between emotional and behavioral dysregulation. But first, to understand the Emotional Cascade Model, an understanding of rumination and behavioral dysregulation is essential.

### *Rumination and Negative Emotion*

Ruminative processes may serve as a common underlying cause of behavioral dysregulation in BPD, as will shortly be seen in the description of the Emotional Cascade model. Rumination (Nolen-Hoeksema, 1991) is the tendency to repetitively think about the causes, situational factors, and consequences of one's negative emotional experience – in other words continuously thinking about and focusing attention on emotionally relevant stimuli. Rumination

tends to be an unhelpful, if not pernicious, cognitive approach to emotion regulation. Why do people do it then? Many people ruminate because they believe (incorrectly) that doing so will increase their understanding of the situation and aid in problem-solving (Papageorgiou & Wells, 2001).

The use of rumination has generally been found to magnify negative emotion as well as increase its duration (see Thomsen, 2006 for a review). Furthermore, as negative emotion increases, so does the attention paid to emotion (Fredrickson & Branigan, 2005; Salovey, 1992). For example, Moberly and Watkins (2008) found evidence for a bidirectional relationship between rumination and negative emotion using an experience sampling design (in non-BPD subjects). Additional evidence for the amplification properties of rumination on negative emotion was provided by an experimental rumination induction study by Donaldson and Lam (2004), who found that depressed individuals in a rumination condition showed a significant deterioration in mood; however, control participants in a rumination condition did not show deterioration in mood. These findings were replicated in a study by Lavender and Watkins (2004), who found that a rumination induction increased both negative emotion and negative future thinking in depressed individuals compared to controls. Rumination also appears to influence various affective states in the same manner. For example, Rusting and Nolen-Hoeksema (1998) demonstrated that rumination on anger increased feelings of anger following an experimental angry mood induction, whereas participants who were distracted following the angry mood induction showed significantly lower levels of anger.

Rumination has also been connected to borderline personality disorder in three studies. In one study examining rumination in the context of BPD, Abela et al. (2003) found that participants diagnosed with BPD had significantly higher levels of rumination than did individuals diagnosed with major depressive disorder. This finding was unexpected given that research has established a strong connection between rumination and depression (Just & Alloy, 1997). A second study linking rumination to BPD was conducted by Smith et al. (2006), who examined rumination among all Axis II personality disorders. They found that of all the Axis II disorders, rumination was uniquely related to dimensions of BPD in college students, even after controlling for depression. The third study used structural equation modeling to link BPD to rumination and found that BPD symptoms (as assessed by a structured clinical interview) predicted high levels of anger rumination, catastrophizing, and brooding (intense rumination on

depressed affect) even after controlling for current symptoms of depression (Selby, Anestis, Bender, & Joiner, 2009). In summary, rumination appears to magnify negative emotion and has been associated with BPD, but additional work is needed to solidify and clarify this relationship.

### *Behavioral Dysregulation in BPD*

Some diagnostic criteria for BPD can be satisfied by a variety of dysregulated behaviors, which we define here as behaviors that are difficult to control and result in harm to the patient or impairment in daily and interpersonal functioning. Many of these behaviors have been found to have affect-regulating properties and some have been linked to rumination as well. One of the most intriguing BPD behaviors that has well established emotion regulation functions and is associated with rumination is non-suicidal self-injury (NSSI; Arney & Crowther, 2008; Briere & Gil, 1998; Brown, Comtois, & Linehan, 2002; Hilt et al., 2008; Selby, Anestis, Bender, & Joiner, 2009). Rumination and emotion regulation have also been associated with bulimic behaviors (Nolen-Hoeksema et al., 2007; Selby, Anestis, & Joiner, 2008; Steiger et al., 2005; Smyth et al. 2007), suicide attempts (Selby, Anestis, & Joiner, 2008), and alcohol use (Cooper et al., 1995; Nolen-Hoeksema & Harrell, 2002; Nolen-Hoeksema et al., 2007; Selby, Anestis, & Joiner, 2008). The role of substance use as a form of coping behavior in BPD is also supported by findings that individuals comorbid with BPD and a substance use disorder report substance craving and use in response to negative emotional states, social rejection, and tension more than do substance using individuals without a diagnosis of BPD (Kruegelbach et al., 1993). Other behaviors that may be dysregulated and may potentially have emotion-regulating properties in BPD (but have yet to be associated with rumination and emotion regulation) include reckless driving, impulsive spending, shoplifting, and pathological gambling.

Individuals with BPD have also been shown to have dysregulated interpersonal behaviors, such as quarrelsome behavior toward others (Russell et al., 2007). These behaviors may also have emotion-regulating properties. For example, excessive reassurance seeking has been associated with both BPD and rumination (Selby, Anestis, & Joiner, 2008). Aggressive behaviors commonly found in BPD, such as throwing objects or hitting someone, have also been linked to rumination (Bushman et al., 2001; Bushman et al., 2005, Anestis et al., in press). Other interpersonal behaviors that may be dysregulated and potentially regulate negative emotion include begging, threatening, or pleading with someone, verbal fights, threatening suicide or self-

injury, repeated phone calls, and risky sexual behaviors. More research is needed to determine if these interpersonal behaviors are also related to rumination and emotion regulation.

### *The Emotional Cascade Model*

The Emotional Cascade Model (Selby & Joiner, in press) attempts to provide a direct link between emotion dysregulation and behavioral dysregulation in BPD through a process called an “emotional cascade.” In an emotional cascade, BPD individuals may experience a positive feedback loop in which the tendency to ruminate on negative emotional thoughts and feelings increases levels of negative emotion, and the increase in negative emotion, in turn, increases levels of attention to emotional stimuli, thus resulting in more rumination. In essence, this cycle causes a flood of racing negative emotional thoughts, which in turn increase levels of negative emotion in a vicious, repetitive cycle. This phenomenon may account for the extreme emotional experience observed in BPD, as well as why dysregulated behaviors are so central to BPD.

The emotional cascade process is helpful for understanding the wide array of emotional disturbances in BPD because rumination can magnify negative emotion of different valences (i.e., sadness, anger, fear). It also helps explain why minor negative emotional stimuli may be followed by emotional experience that spirals out of control. Furthermore, rumination is a process that has been shown to extend the length of negative emotional experiences. Rumination would thus appear to account for the emotional intensity seen in BPD, as well as the heightened sensitivity to emotional stimuli and slow return to emotional baseline proposed by Linehan. Consequently, what may seem like a trivial event (such as a simple remark by a friend or family member) may cause an individual with BPD to intensely ruminate on the negative emotions induced by the remark. This may then create an extremely intense negative mood state, one that it is impervious to mild distractions in daily life, due to the intensity of the rumination process. The self-perpetuating effects of rumination may then account for the slow return to emotional baseline that Linehan has described. It is the intensity of emotional cascades that may instigate dysregulated behaviors.

Behavioral dysregulation in BPD, in the perspective of the Emotional Cascade Model, would serve as a suite of methods of “distraction” that break-up the emotional cascade process. Due to such an intense ruminative process, normally effective strategies such as cognitive reappraisal (changing how one thinks about a situation) or normal methods of distraction such as

talking to a friend, or going for a walk, may not be distracting enough to dampen the emotional cascade process and stop the cycle of increasing negative emotion. BPD individuals may instead focus their attention on the physical sensations associated with a dysregulated behavior, such as the pain or the sight of blood associated with non-suicidal self-injury (NSSI), or the influence of a drug, in order to distract themselves from ruminative thoughts. This distraction “short-circuits” the emotional cascade, halting the build up and intensity of negative emotions and allowing these emotions to subside because attention is no longer on emotion. In this sense, a dysregulated behavior provides negative feedback to the emotional cascade, interfering with the ruminative processes. This interference then shifts the system of emotion dysregulation into a more stable state of lower negative emotion. This same pattern of behavioral distraction may extend to various forms of behavioral dysregulation in BPD, including aggressive and other interpersonal behaviors.

If distraction is helpful at regulating emotion, then why is it that other forms of distraction such as taking a cold shower are not as effective as extreme forms of behavioral dysregulation such as NSSI or substance abuse? Rumination has been linked to many psychological disorders, and not all individuals who ruminate engage in behavioral dysregulation. This may be because individuals with other disorders, such as depression, experience smaller emotional cascades; these individuals, however, may experience less intense rumination than individuals with BPD. This may be why taking a cold shower or talking to a friend may help someone feeling depressed or anxious, but these behaviors may not divert enough attention away from emotional experience to distract an individual with BPD. Also, behaviors such as taking a cold shower may not provide enough distraction to occupy most of an individual’s mind. For example, it may be easier to ruminate in the shower than while experiencing physical pain or gorging on food. Thus, semi-distracting behaviors may not absorb enough attention to fully distract from rumination and emotion.

Using dysregulated behaviors to distract from rumination may have neurobiological foundations as well. For example, Ray and colleagues (2005) found that increases in rumination on negative emotion (in non-BPD subjects) correlated with increased activation of the left ventrolateral prefrontal cortex and left amygdala during an induced rumination procedure; both neural structures have been shown to activate during the experience of negative emotion (Phan et al., 2003). Interestingly, Schmahl et al. (2006) found that increases in pain (through a self-harm



proxy) decreased activity in the amygdala of patients with BPD. Based on the findings of these studies, emotional cascades may increase activity in the amygdala, while dysregulated behaviors may then decrease activity in this same area.

### *Support for the Emotional Cascade Model*

Although some supporting evidence has been presented throughout the description of the emotional cascade model, it is important to reiterate some supporting information as well as direct explorations of the emotional cascade model. Various studies have linked rumination to various dysregulated behaviors, and to BPD as well (Abela et al., 2003; Smith et al., 2006; Selby, Anestis, Bender, & Joiner, 2009). These studies also suggest that rumination is associated with BPD in a way that is unique from depression (although additional studies are needed to provide further support for this hypothesis). Additional evidence of the connection between heightened emotion and behavioral dysregulation comes from studies using daily monitoring, which have demonstrated increasing negative emotion prior to dysregulated behavior (binging and purging in particular; Smyth et al., 2007; Wegner et al., 2005) and decreased levels of negative emotion following these behaviors (Smyth et al., 2007). These studies need to be replicated in individuals with BPD, however. Daily monitoring studies with individuals with BPD have also demonstrated increases in negative emotion following stressful daily events (Glaser et al., 2008), and this daily affective instability is often associated with daily behavioral and interpersonal problems (Russell et al., 2007).

In a recent study, the emotional cascade model was examined in a sample of undergraduates diagnosed with BPD and control subjects. In this study, Selby, Anestis, Bender, & Joiner (2009) used structural equation modeling and found that rumination fully mediated the relationship between symptoms of BPD (as assessed by a structured clinical interview) and a behavioral dysregulation latent variable (comprised of excessive reassurance seeking, bulimic behaviors, drinking to cope, NSSI, and suicidal symptoms), even after controlling for symptoms of depression and symptoms of other Cluster B personality disorders. The model also provided a good fit to the data. In this same study they also conducted a rumination induction where all subjects were instructed to ruminate for five minutes about something in their life that was upsetting to them. They found that the individuals diagnosed with BPD not only had higher self-reported baseline negative emotion, but they also demonstrated greater reactivity and intensity of

negative emotion following the rumination induction than control subjects. These findings remained significant even after controlling for current symptoms of depression and symptoms of other Cluster B personality disorders. The results of this study provide additional evidence for the role of rumination in BPD and dysregulated behaviors, and this study also provided some evidence to support the notion that individuals with BPD may ruminate at higher levels than individuals experiencing depressive symptoms.

Thus, there is some evidence that supports the Emotional Cascade Model. The current state of research suggests that there are numerous behaviors that appear to have emotion-regulating properties in general, and furthermore that many of these behaviors are present in individuals with BPD. Moreover, one common link between many of these dysregulated behaviors, as well as BPD, appears to be rumination. Yet, despite this evidence, further research is needed to test the Emotional Cascade Model of BPD, especially in individuals with BPD from a clinical setting, and in comparison to other individuals from clinical settings. Additional evidence is also needed to corroborate that individuals with BPD ruminate more intensely and frequently than individuals with other disorders such as depression, alcohol use disorders, and bulimia nervosa.

### *Experience Sampling Methodology*

The use of experience sampling methodology may be a way to provide incremental, rigorous testing of the emotional cascade model of BPD. Experience sampling involves daily monitoring of participants with palm pilots (PDAs). Participants are prompted to record their thoughts, feelings, and behaviors throughout the course of multiple days, and using statistical modeling methods the relationships between these variables can be tested. Experience sampling removes a good portion of the retrospective recall involved in standard self-report measures of emotion and behavior, and it also serves to provide stronger evidence of temporal precedence for some variables. Cross-lagged analyses can also be used to determine if a variable at one signal predicts another variable at the next signal, providing some evidence for temporal precedence.

Data recording can be arranged into various schedules, depending on the goals of the research. Event-contingent recording involves the participants completing the questionnaires on the palm-pilot at times when they are doing or experiencing something. An example in smoking research might involve having participants complete the forms when they are experiencing

cravings, or after they have smoked a cigarette. Event-contingent recordings are useful for capturing specific events, but they are problematic in that they are dependent on those events taking place and the participant recalling to complete the forms at those times. A second form of data recording involves time-contingent signaling. In this form of data collection the palm-pilots are scheduled to signal the participant at pre-specified times throughout the day, at which time the participant completes the forms. This method is useful for capturing emotional data, as the signal may come during emotional experience. These signals can also be scheduled to occur randomly, so that the participant does not know exactly when the signal will come. It is also possible to combine the two forms of data collection so that participants are randomly signaled throughout the day, and they are also instructed to complete the forms for certain events as well.

Experience sampling is an ideal method for providing further analysis and testing of the emotional cascade model. Importantly, experience sampling is feasible with individuals diagnosed with BPD (Trull et al., 2008), despite the thought that individuals with BPD might be uncooperative with this methodology. Previous experience sampling studies on BPD found that BPD subjects vacillate between interpersonal aggressiveness and submissiveness (Russell et al., 2007), and that they experience greater variability and intensity of negative emotion (affective lability) than do individuals diagnosed with major depressive disorder (Trull et al., 2008). Other studies have found individuals with BPD respond to daily stressors with increased negative emotion and decreased positive emotion (Glaser, Van Os, Mengelers, & Myin-Germeys, 2008), and another study found that inability to identify emotions was related to fluctuations in distress in participants diagnosed with BPD, as were elevations in heart rate (Ebner-Priemer, et al., 2008). An experience sampling study of the emotional cascade model would add to these findings, as well as provide more understanding regarding the nature of emotional and behavioral dysregulation in BPD. Experience sampling would also allow for a more direct examination of real-time rumination and negative emotion in predicting dysregulated behaviors.

### *Emotional Cascades and Experience Sampling: The Current Study*

The purpose of the current study was to use experience sampling methodology to further explore the emotional cascade model in borderline personality disorder. Through this methodology real-time rumination may be associated with negative emotion and behavioral dysregulation, providing stronger evidence for emotional cascades in the real world. By having

participants exhibiting current behavioral dysregulation, including participants with BPD diagnoses, complete these experience sampling protocols, differences in rumination and behavioral dysregulation can also be assessed. The first part of the study will use information gathered during experience sampling to create a hierarchical (multilevel) structural equation model of instability of emotion and rumination and the relationships of these variables with frequency of interpersonal problems and behavioral dysregulation. The second part will use generalized hierarchical linear modeling with cross-lagged analyses to determine if high levels of rumination and negative emotion at one signal predict behavioral dysregulation at the next signal.

The hypotheses of the following study are four fold. First, it was expected that the multilevel structural equation model will provide significantly good fit for the data that are collected. Second, it was hypothesized that there would be significant BPD group effects on paths between latent variables in the structural equation model, such that, as compared to other participants, the BPD group would have stronger relationships between the rumination, affective, interpersonal, and behavioral variables. This is because the BPD group may experience more frequent and intense emotional cascades as compared to those who engage in some dysregulated behaviors, but do not meet criteria for a diagnosis of BPD. Third, it was predicted that generalized hierarchical linear models would provide evidence indicating that rumination and negative emotion at one signal will predict an increased probability of behavioral dysregulation at the next signal. We also expected that there would be significant quadratic effects for rumination and negative emotion such that higher rumination and negative emotion values will yield much higher predictive probabilities of behavioral dysregulation at the next signal than moderate or lower levels of these variables. The final hypothesis for this study was that BPD diagnosis would significantly predict behavioral dysregulation at any given signal. This is because those who engage in dysregulated behaviors, but do not have BPD, may be likely to engage in fewer dysregulated behaviors, while those with BPD may have a more broad spectrum and frequency of dysregulated behaviors.

## CHAPTER 2

### METHODS

#### 2.1 Participants

Participants were 47 people (66% female), all of whom had endorsed at least four instances of behavioral dysregulation within the last two weeks. All subjects were drawn from both the FSU introduction to psychology student subject pool and the Tallahassee community-at-large. Criteria for inclusion to participate in the current included: 1) Report of at least four dysregulated behaviors over the last two weeks (NSSI, arguments, physical fights, binge-eating/vomiting, drug use, alcohol binges, or a combination of these behaviors), and 2) No imminent risk of suicide as indicated by absence of suicidal intent and a suicide plan.

Participants were not required to have a diagnosis of BPD to participate in this study, although recruiting efforts were made to increase the number of participants with this diagnosis. The racial and ethnic make-up of the participants was diverse, with 8.5% reporting Hispanic ethnicity, and racial composition of 68.1% white/European, 19.1% black/African American, 6.4% Asian, 2.1% Native American, and 4.3% multiracial. This study was approved by the university institutional review board and all participants provided informed consent.

#### 2.2 Screening and Recruitment Procedures

*Student Participants.* Over 2,500 FSU students were first screened for participation at the beginning of the fall and spring semesters through the general psychology mass screening process, which most introductory psychology students participate in. This mass screening procedure has successfully been used to recruit an adequate sample of subjects with BPD in a previous study at Florida State University (Selby et al., 2009). Symptoms of BPD were screened using modified items from the SCID-II screening questionnaire (see below). These items were modified to be forced yes/no questions describing symptoms of BPD. Only those students

reporting at least four dysregulated behaviors in the last two weeks and endorsing at least 5 BPD symptoms were invited to participate in the study. Those meeting screening criteria were invited by email to participate in the study, and they were informed that they were eligible for the study because of their report of “unique emotional experiences” on the mass screening questions. Overall 20 (23%) student participants, out of 87 who were invited, participated in the study. There were no significant differences on number of dysregulated behaviors or number of BPD symptoms reported between those who participated and those who did not respond. Student participants were offered course credit for their participation in the study. In order to enhance compliance with the daily monitoring, students were offered the opportunity to receive additional course credit for completing at least 80% of the random daily assessments.

*Community Participants.* Community participants were recruited through local and online advertisements and flyers in community mental health centers. Flyers listed symptoms of BPD and examples of dysregulated behaviors, indicating that anyone who experiences difficulties with any of these problems was eligible to participate in the study. All community participants who came to the lab for participation in the study met criteria for entry into the study. Community participants were compensated \$50 for completing the study. In order to enhance compliance with the daily monitoring, however, participants were offered an additional \$50 if they completed at least 80% of the random daily assessments.

### 2.3 Procedure

All participants were first brought in for an initial screening session, where they were assessed for dysregulated behaviors engaged in over the last two weeks and current level of suicidality. Level of suicidality was assessed with the Beck Suicide Scale (see below) and a clinical interview, and any participants indicating elevated levels of suicidality by endorsing suicidal intent or plans were provided with mental health referrals in the case of intense suicidal desire. Appropriate procedures were in place if participants indicated imminent suicide risk by endorsing suicidal intent or plans, but no participants in this study met criteria for imminent risk. If participants met criteria for inclusion into the study they then completed structured clinical interviews for Axis I diagnoses and BPD and they were also trained on using the PDA. Those who did not meet criteria for the study were thanked for their time and debriefed. No participants reported imminent suicidal intent or suicide plans. All participants who participated

in the experience sampling portion of the study carried the palm-pilot for two practice days, followed by two consecutive weeks of actual monitoring.

## 2.4 Equipment

The experience sampling portion of the study was completed through the use of Palm Zire 31 PDAs. The devices were programmed in a way that allowed participants to complete a brief questionnaire each time the PDA randomly beeped them. Only one PDA malfunctioned during the course of monitoring, but that participant's data was recovered without issue, and a new PDA was provided to the participant. No PDAs were stolen or destroyed.

## 2.5 Measures

*Demographics Form:* All participants completed a form used to collect demographic information such as age, gender, Hispanic ethnicity, race, socioeconomic background, etc. Information was also collected regarding whether the participant was currently treatment seeking or being prescribed any psychotropic medications.

*Assessment of Axis I Diagnoses: Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998).* All participants were assessed with the MINI to diagnose potential Axis I psychopathology. Axis I diagnoses were used as covariates in many of the analyses if there were significant differences in rates of Axis I diagnoses for those with BPD compared to those without BPD. All clinical assessments were completed by the primary investigator of the study, who was a masters level trained clinician at the time of data collection. A second masters level graduate student in clinical psychology conducted a chart review of all participant diagnostic interviews and established his own Axis I and BPD diagnoses (assessment for which is described below) for each participant. Inter-rater reliability indices indicated that all Axis I diagnoses had adequate inter-rater reliability, with the lowest estimate being  $\kappa = .73$  for past hypomanic episodes. However, most were above  $\kappa = .80$  for other Axis I diagnoses.

*Assessment of Borderline Personality Disorder:* All participants were administered the *Structured Clinical Interview for DSM-IV Axis II personality disorders* (SCID-II; First, Spitzer, Gibbon, Williams, & Benjamin, 1997) module for BPD. For a diagnosis of BPD a participant had to have endorsed least five out of nine diagnostic criteria. The inter-rater reliability estimate for BPD diagnosis was  $\kappa = .81$ , which indicates adequate diagnostic consensus. In the current

study, 16 participants met criteria for BPD (34%); there were a number of participants with subthreshold symptoms of BPD, however.

*Beck Scale for Suicide Ideation* (BSS; Beck & Steer, 1993). All participants completed the BSS prior to evaluation with the diagnostic interviews. This measure is a self-report measure of suicidal ideation and intent over the past week. Risk was assessed according to recommended guidelines (Joiner et al., 1999), and the appropriate referrals were provided for those endorsing suicidal ideation (i.e. referral for therapy, hospitalization). No participants in this study met criteria for imminent risk or needed hospitalization.

*Cognitive Emotion Regulation Questionnaire* (CERQ; Garnefski et al., 2001). This measure was used as a state measure of rumination for developing convergent validity of the experience sampling rumination questions (see PDA assessment below). For all analyses both the rumination and catastrophizing subscales were combined into one index of rumination, consistent with previous studies (Selby et al., 2009; Selby et al., 2008).

PDA Questionnaire: The PDAs were programmed to “beep” or alert the participant five times at random between 9am and 10pm every day. At each beep the participant was requested to complete the PDA questionnaire, which generally took under three minutes to complete. The participants had the opportunity to “snooze” the PDA if they were in a situation where completing the form is problematic (e.g., driving); doing so silenced the beeping for 5 minutes. Participants were informed that they needed to respond to the beep within 1-hour for the beep to count toward the compliance incentive described earlier. Participants also had the option to manually input event-contingent recordings into the PDA if they had engaged in a dysregulated behavior and wanted to record their experience. In the case that a random signal came within the next hour of the event-contingent recording, participants were instructed to complete the random-signal recording as if they had never done the event-contingent recording.

When completing the signal and event recordings, the PDA questionnaire asked each participant whether he or she was completing the form in response to a random signal, or if they were responding as a result of a dysregulated behavior. Participants were then asked questions about their current emotional state, current levels of thoughts they may be experiencing, recent dysregulated behaviors they may have engaged in, and recent problematic interpersonal interactions or personal events that they may have had. The questions on the PDA form were arranged such that questions about mood and emotion were always filled out, and then checklists



of behaviors were presented and the participant recorded all recent dysregulated behaviors. If the participant had not engaged in any dysregulated behaviors, he or she still needed to complete the other information on the form. A list of recent interpersonal problems was also presented, asking the participant to record any he or she might have experienced. Upon completion of the questionnaire, the participant pressed a “finish” button, which returned the form to the first questions for when the next assessment arrived.

*Affect Assessment:* All participants were asked to rate their current emotional state, including both positive and negative emotion (i.e. anger, fear, ashamed, excited, proud, etc.). The questions asked participants to rate each emotion on a visual-analog scale from 1(low)-10(high). For the current study only negative emotion variables were used including: angry, sad, worried, ashamed and numb. The Cronbach’s alpha for the indices of negative emotion across monitoring for all participants was .73, indicating good internal consistency.

*Rumination Assessment:* At each signal questions were asked about what the participant was thinking. Each question was prefaced, “Please rate how much you are currently thinking about the following from 1(not at all) to 10(very much so).” The rumination specific questions were: “a currently upsetting problem,” “upsetting memories,” “the emotions that I am feeling,” “negative future situations,” and “how to solve a problem.” These questions were combined into an overall scale of rumination. An initial consistency analysis indicated somewhat low internal consistency ( $\alpha = .63$ ), which may have been due to the fact that problem solving is an impure measure of rumination (Treyner et al., 2003). After removing problem solving, the remaining questions had strong internal consistency across all recordings for all participants ( $\alpha = .79$ ). Thus, for the analyses in the results section the rumination composite variable did not include problem solving.

*Dysregulated Behaviors Assessment:* Participants were asked to indicate if they have engaged in any of the following behaviors since the previous signal: NSSI, substance use, physical fights, reckless driving, threats, impulsive shopping and over-eating. Participants were asked about their current level of desire to engage in any of these behaviors.

*Interpersonal Problems Assessment:* Participants were also asked if they experienced any recent interpersonal experiences such as criticism, insults, arguments, or rejection.

Participants were also be asked to indicate who the problem was with if they report an interpersonal problem; this list included common relationships such as romantic partner, friend, parent, sibling, boss, employee, or other person.

*Personal Events Assessment:* Participants were asked if they had experienced any events where they felt like they had failed or disappointed themselves in some way.

## 2.6 Data Analytic Strategy

Because experience sampling data can be complex and require extensive details regarding data analyses the results section has been structured into multiple sections of analyses and results. Each of these sections discusses the main analytic approach to testing the main hypotheses as well as the outcomes of those specific analyses. In total there are six analytic sections. The first section discusses the baseline information on participants and uses standard analyses such as chi-square and ANOVA analyses. The second section discusses the characteristics of reports during monitoring such as types and frequency of behaviors and this section uses primarily descriptive statistics. The third section focuses on the construction of an overall real-world emotional cascade model and uses hierarchical structural equation modeling. The fourth section focuses on the use of previous recordings in the prediction of future behaviors and uses generalized hierarchical linear modeling with curvilinear components. The fifth section involves the investigation of event contingent reports of behaviors and uses repeated measures mixed models to examine before and after effects of behaviors on emotions. The sixth section details supplemental analyses and explores the report of positive behaviors during monitoring and the influence of monitoring on levels of negative emotion, dysregulated behaviors, and rumination. All analyses were either conducted with either SPSS or MPlus version 5.3 (Muthén & Muthén, 2004), which is an appropriate statistical program for handling complex and multilevel analyses.

## CHAPTER 3

### RESULTS

#### 3.1 Baseline Preliminary Analyses

Table 1 displays the basic demographic and diagnostic information between the two groups, those with BPD and those with dysregulated behaviors and no BPD diagnosis. Also included in this table are baseline measures of rumination (CERQ), suicidality (BSS), and initial report of dysregulated behaviors over the previous two weeks. As seen in Table 1, there were significant group differences such that the BPD group was older, was composed of more women, had more people in treatment, and had more people on psychotropic medication. There were no significant group differences on Hispanic ethnicity, race, socioeconomic status, or percentage of participants from the community. Importantly, the only significant difference on demographic variables between the student and community samples was that the student group was younger ( $F_{1,46}=10.6, p<.05$ ); this indicated that combining both groups was appropriate.

Regarding diagnostic differences (also displayed in Table 1), the BPD group had more people meeting criteria for current major depressive disorder (MDD), dysthymia, post-traumatic stress disorder (PTSD), generalized anxiety disorder (GAD), and social anxiety disorder (SAD). There were no other significant diagnostic differences between the two groups. On measures of baseline psychopathology, the BPD group reported higher levels of baseline trait rumination, higher levels of suicidality, and a greater number of dysregulated behaviors over the previous two weeks. A brief follow-up ANCOVA analysis was conducted on baseline trait rumination to determine how robust the relationship between BPD and this measure of rumination was. This analysis controlled for current MDD, dysthymia, GAD, PTSD, and SAD. The results indicated that even when controlling for these alternative Axis I diagnoses, the BPD group still reported higher levels of baseline trait rumination ( $F_{1,40}=9.96, p<.01, d=1.86$ ). This was also a large effect (Cohen, 1988). Importantly, this finding is consistent with the findings of Selby et al. (2009), who found that a group of BPD participants reported higher levels of trait rumination than did a control group even when accounting for depressive symptoms.

Table 3.1: Participant Characteristics.

Variable	COMPARISON	BPD	$F   \chi^2(df)$	d   $\phi$
	( $N=31$ )	( $N=16$ )		
	$N(\%)   M(SD)$	$N(\%)   M(SD)$		
Age	22.0(8.1)	28.7(11.4)	5.48*(45)	.68
Female	17 (55)	14 (88)	5.01*(1)	.33
Hispanic Ethnicity	2 (6)	2 (12)	.50(1)	--
Race			3.52(4)	--
White/European	22 (71)	10 (63)		
Black/African-American	5 (16)	4 (25)		
Asian	1 (3)	2 (13)		
American Indian	1 (3)	0 (0)		
Multiracial	2 (6)	0 (0)		
Community Participant	15 (48)	12 (75)	3.06(1)	--
Seeking Treatment	2 (6)	9 (56)	11.95*(1)	.50
Psychotropic Medication	2 (6)	6 (38)	7.20*(1)	.39
Low Socioeconomic Status	9 (29)	4 (25)	.09(1)	--
Psychiatric Diagnoses				
Major Depression Current	3 (10)	11 (69)	17.61*(1)	.61
Dysthymia Current	2 (6)	6 (38)	7.20*(1)	.39
Past Manic Episode	3 (10)	5 (31)	4.48(1)	--
Past Hypomanic Episode	5 (16)	6 (38)	2.69(1)	--
Panic Disorder Lifetime	5 (16)	3 (19)	.82(1)	--
Panic Disorder Current	2 (6)	4 (25)	1.52(1)	--
PTSD Current	1 (3)	7 (44)	12.27*(1)	.51
GAD Current	5 (16)	12 (75)	15.84*(1)	.58
OCD Current	1 (3)	1 (6)	.24(1)	--
Bulimia Current	2 (6)	1 (6)	.01(1)	--
SAD Current	1 (3)	4 (25)	5.26*(1)	.33
AUD Current	12 (39)	4 (25)	.88(1)	--

Table 3.1 - continued.

	COMPARISON	BPD		
SUD Current	13 (42)	6 (38)	.09(1)	--
ASPD	2 (6)	2 (13)	.50(1)	--
Indices of Psychopathology				
Baseline Behaviors	9.81 (5.22)	19.19 (10.24)	17.49*(45)	1.15
Baseline Rumination	18.64(5.34)	29.31(6.10)	38.20*(45)	1.86
Baseline BSS	.65(1.84)	7.31(7.85)	20.61*(45)	1.17

\* = Significant a  $p < .05$

### 3.2 Experience Sampling Preliminary Analyses

Participants completed a total of 3,118 scheduled random assessments over monitoring. The average participant completed 65 signals during monitoring, indicating that the compliance rewards for participants were very effective. Participants also recorded 81 event-contingent signals, in which they completed a modified PDA questionnaire in response to having just engaged in a dysregulated behavior. Compliance indices indicated that the student participants completed approximately 93% of the scheduled random recordings and community participants completed approximately 96%. All students successfully completed the study and all received additional course credit for adequate compliance. There were no community participants who dropped out of the study, and all received the full compensation amount.

Table 2 shows the reporting summary of all random-signal reports of dysregulated behaviors, interpersonal interactions, and personal events that took place across participants for the duration of the study. The most commonly reported dysregulated behaviors were illicit drug use, crying, and yelling, while the least common were hanging up on someone, reckless driving, and physical fights. The most common interpersonal interactions were being ignored or disappointed by someone. Disappointing one's self was one of the most common personal event reported during monitoring, with over 60% of the sample reporting this type of personal event. From the characteristics reported in Table 2, it is apparent that numerous instances of severe

behavioral dysregulation were captured across the sample. This finding further validates the use of PDAs in researching dysregulated behaviors.

One important preliminary analysis was to examine the validity of PDA rumination assessment because this was a measure created specifically for this study and has not previously been validated. As a reminder, the rumination score at each PDA signal was a composite of thoughts about a current upsetting situation, past upsetting memories, thoughts about emotions, and thoughts about future concerns. Problem solving was not included due to decreased internal consistency when it was included (see Rumination Assessment in the Methods section).

Correlation analyses indicated that baseline levels of trait rumination had a significant, positive correlation with reports of rumination at any given signal ( $r = .24, p < .001$ ), and with average daily rumination ( $r = .29, p < .001$ ). Furthermore, baseline rumination also had a significant positive correlation with average level of rumination across the duration of monitoring ( $r = .42, p < .001$ ). These correlations provide evidence for the validity of the momentary assessment of rumination used in this study.

Table 3.2: Dysregulated Behaviors and Interpersonal Events

Dysregulated Behavior	Total Reported	Percent Reporting	Individual Range	MEAN	SD
Alcohol Binge	50	45.3%	0-5	1.01	1.39
Reckless Driving	14	20.3%	0-3	.31	.69
NSSI	25	13.8%	0-12	.56	1.98
Impulsive Shopping	21	25.6%	0-6	.47	1.12
Illicit Drug Use	116	34.2%	0-19	2.56	5.20
Binge Episode	62	36.8%	0-15	1.36	2.71
Physical Fight	9	4.4%	0-8	.18	.04
Threw Object	20	29.0%	0-4	.42	.81
Slammed Door	22	29.8%	0-5	.49	1.04
Cried	101	48.7%	0-24	2.23	4.39
Yelled	77	60.3%	0-10	1.68	2.27
Hung Up on Someone	17	23.9%	0-4	.37	.81
Insulted Someone	28	28.2%	0-6	.28	.45

Table 3.2 – continued.

Dysregulated Behavior	Total Reported	Percent Reporting	Individual Range	MEAN	SD
Begged Someone	27	29.1%	0-7	.60	1.30
Accused Someone	30	31.8%	0-5	.68	1.26
Dissociation	70	41.6%	0-13	1.36	2.86
Identity Disturbance	66	48.3%	0-9	1.40	2.19
<u>Interpersonal/ Intrapersonal Events</u>					
Someone Insulted	32	32.7%	1-5	.70	1.26
Someone Rejected	29	33.3%	1-8	.65	1.38
Someone Criticized	49	51.5%	1-8	1.08	1.54
Someone Ignored	75	51.7%	1-12	1.62	2.86
Someone Ordered	37	43.5%	1-4	.82	1.11
Given Dirty Look	49	33.4%	1-15	1.14	2.76
Someone Disappointed	89	55.2%	1-9	1.94	2.61
You Failed	68	54.7%	1-9	1.46	2.12
You Disappointed Self	161	62.6%	1-24	3.44	4.93

### 3.3 Constructing a Real-World Emotional Cascade Model

This section of data analysis involved hierarchical (multilevel) structural equation modeling (SEM) using MPlus. A SEM model was constructed using measures of variability and instability for the emotion, rumination, behavioral, and interpersonal variables obtained from the PDA questionnaires. Total frequency of interpersonal problems, personal events and dysregulated behaviors were generated for all reports occurring during monitoring. On the other hand, *Instability Indices* of rumination and negative affect were used because instability takes into account temporally chained observations and accounts for the magnitude of the variable at each recording (Ebner-Priemer et al., 2009), and emotion/rumination at one signal is highly correlated with the next signal. *Instability* is best calculated using the *Mean Squared Successive Difference (MSSD)* equation:

$$MSSD(X) = \frac{\sum_{i=2}^n (x_i - x_{i-1})^2}{n - 1}$$

This equation takes into account both the amplitude and frequency of the variable ( $x$ ), which in these analyses will be levels of anger, sadness, anxiety, and rumination. The  $i$  in this equation refers to each observation within each participant and  $n$  refers to the total number of observations for that participant during the course of monitoring.

A multilevel SEM model (Figure 1) was constructed which predicted that frequency of interpersonal problems and personal events (Triggers) would result in instability of rumination, which would then lead to emotional cascades, which in turn would then influence emotional instability and finally the total report of dysregulated behaviors.

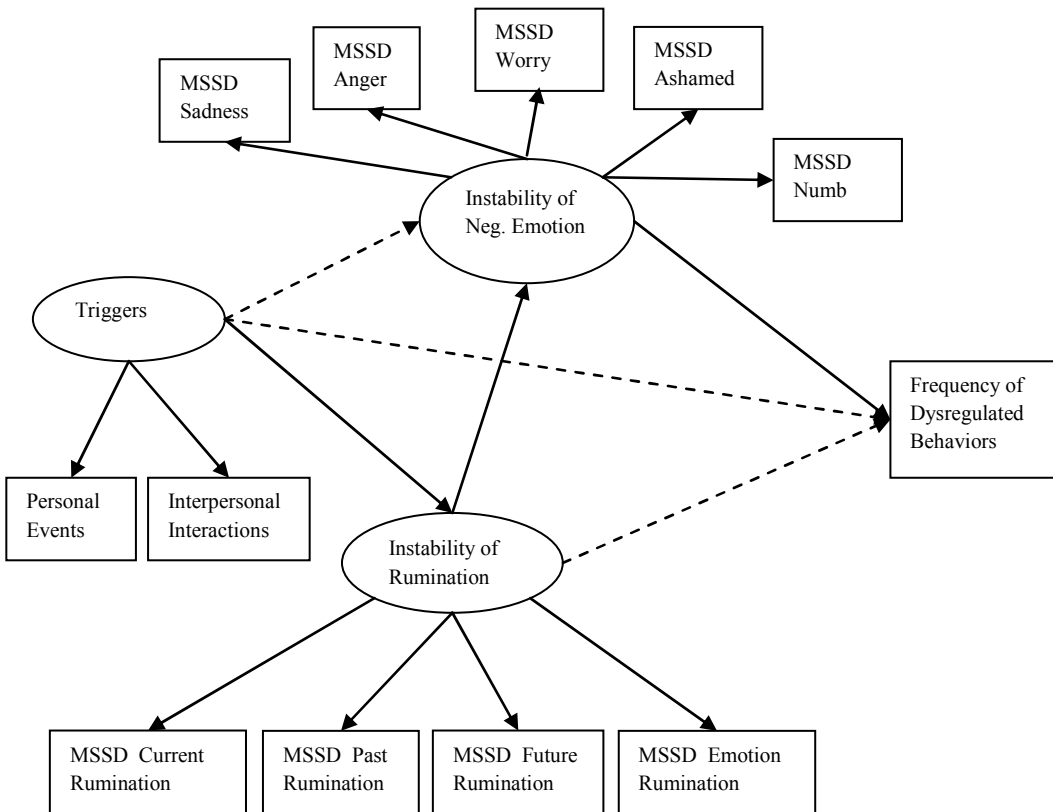


Figure 3.1: Hypothesized Real-World Model



Standard criteria for fit were used to indicate good fit with the model including: a non-significant  $\chi^2$  value,  $CFI > .95$ , and  $RMSEA < .06$  (Hu & Bentler, 1999). Fit of alternative models were compared using the AIC index, as these alternative models were not nested. AIC model values lower by 10 units as compared to another model are considered to have significantly better fit (Burnham & Anderson, 2004). The effects of BPD versus no-BPD diagnosis on the relationships between latent variables in the model were also estimated using random slopes analyses in MPlus. There were no missing data. In Figure 1, solid lines indicate hypothesized flow of effects, dashed lines indicate indirect effects, and latent residuals are not displayed.

#### Results: Original Real-World Model

When this model was generated in MPlus, many of the hypotheses were supported. As can be seen in Figure 2, all of the indicators for each latent variable loaded well onto their respective latent variables. There were also significant paths from Triggers leading to Rumination, Rumination had a significant path to Negative Emotion, and Negative Emotion had a significant path to Dysregulated Behaviors. Contrary to the original hypotheses, however, significant paths remained from Triggers to Negative Emotion and Dysregulated Behaviors, and from Rumination to Dysregulated Behaviors.

There was one major problem with this model, however. Despite numerous attempts at constraining various paths and correlations to zero, the overall model fit was poor ( $\chi^2=187.02$ ,  $df=75$ ,  $p < .001$ ,  $CFI = .68$ ,  $TLI = .62$ ,  $RMSEA = .18$ ). Because the fit of the model was so poor, the estimates generated within the model are not trustworthy. Unfortunately there was no obvious reason for such poor model fit, especially given the significant loadings of paths and indicators. The poor fit may have been due to the use of the MSSD indices and/or the low number of participants. Because the hypotheses were generally supported, but model fit was poor, development of an alternative, similar model without MSSD indices was warranted.

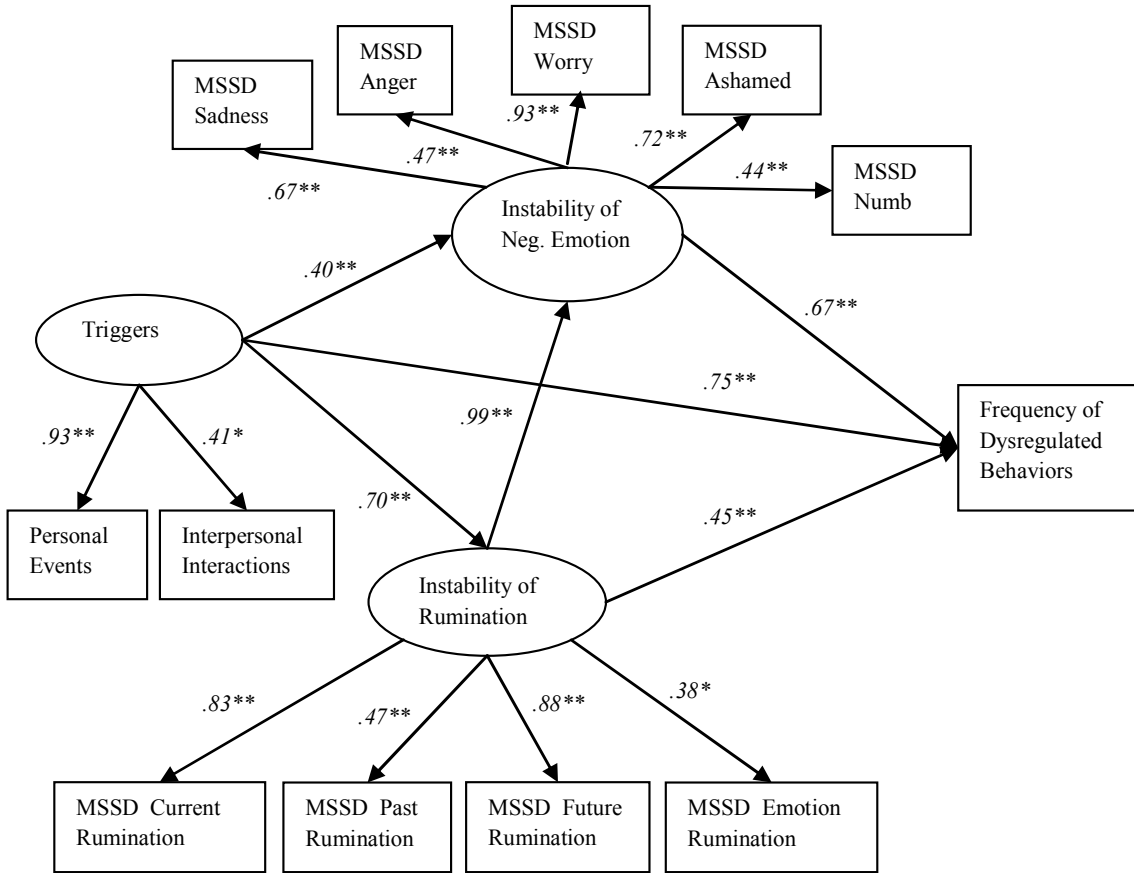


Figure 3.2: Original Real-World Model

### Revised Model

In the approach to the revised model a similar overall structure remained. The biggest difference with the new model was the use of actual momentary data on triggers, emotion, and rumination, as opposed to collapsing these observations into single indices (i.e., MSSD or total frequency indices). Thus, as an example, rather than using an MSSD index for anger as an indicator for the Negative Emotion latent variable, every given observation of anger during monitoring for each participant was used as an indicator for that latent variable. The same applies to the rumination, interpersonal and personal variables, and behavioral dysregulation variables. A couple of additional changes were also made: 1) Because the total count of dysregulated behaviors for each observation was used for the behavioral dysregulation variable, this variable had to be treated as a count variable (due to non-normal distribution) and use of a

loglinear link function with a Poisson distribution was required. This change required the use of the MLR estimator in MPlus, which does not generate traditional fit indices with this kind of data (CFI, RMSEA, etc.). Instead, model comparison with the use of log-likelihood ( $H_0$ ),  $AIC$ , and  $BIC$  values was the only approach available. 2) Because this model required the use of all 1300+ observations, including the analyses of BPD predicting random slopes between the latent variables would have generated a model with too many dimensions for MPlus to generate model parameters. To remedy this situation the analyses were conducted in two parts. First, the overall model was generated in a similar manner to the one above, except that BPD was included as a between level predictor of dysregulated behaviors only. Then a second model was run exploring the effect of BPD diagnosis only on the slopes of the paths between latent variables (i.e., rumination on negative emotion). It should also be noted that this second kind of analysis in MPlus does not generate standardized path estimates, so standard errors are also displayed. Between these two analyses, all of the desired information could be generated.

#### Results: Revised Real-World Model

The best fitting revised model is displayed in Figure 3, along with all of the parameter estimates that were generated in the two analyses. First, the fit indices for the original model hypothesized (with triggers leading to rumination, which in turn lead to increased negative emotion, which in turn predicted number of dysregulated behaviors) were compared to an alternative model in which rumination and negative emotion were switched. Contrary to original hypotheses, the second model (with rumination being the most proximal predictor of dysregulated behaviors) provided a better fit to the data ( $H_0 = -56,155.71$ ,  $AIC = 112,391.42$ ,  $BIC = 112,633.22$ ) than the second model did ( $H_0 = -56166.05$ ,  $AIC = 112,412.10$ ,  $BIC = 112,653.90$ ,  $AIC_A = 20.68$ ). Because this second model provided a better fit to the data, this is the model that will be discussed.

Within the structural component of this model all factor loadings for each indicator of each latent variable significantly loaded onto their respective latent variables. Among the latent variables, Negative Emotion fully mediated the relation between Triggers and Rumination (unfortunately the estimate of the indirect effect cannot currently be generated with this kind of analysis). Similarly, Rumination fully mediated the relationship between Negative Emotion and Dysregulated Behaviors. One important final note with this model was that BPD was a

significant predictor of Dysregulated Behaviors, even when accounting for rumination, negative emotion, and triggers.

The second part of analyzing this model involved using BPD diagnosis as a predictor of random slopes of the paths between the latent variables displayed in Figure 3. This allowed for the testing of significant BPD effects on the relationships between the latent variables. A significant effect for BPD on each random slope was expected. Two out of three of these hypotheses were supported. There was a significant BPD effect on the relation between Negative Emotion and Rumination, indicating that those with BPD have a stronger tendency to respond to negative emotion with rumination. There was also a significant effect between BPD on the slope of Rumination leading to Dysregulated Behaviors. This finding supported the hypothesis that those with BPD have an even stronger tendency to respond to rumination with a dysregulated behavior than others who have difficulties with rumination and dysregulated behaviors. There was not a significant effect, however, of BPD on the slope between Triggers and the experience of Negative Emotion. This suggests that perhaps people with BPD do not initially respond more negatively to upsetting interpersonal interactions or personal disappointments than others with dysregulated behaviors.

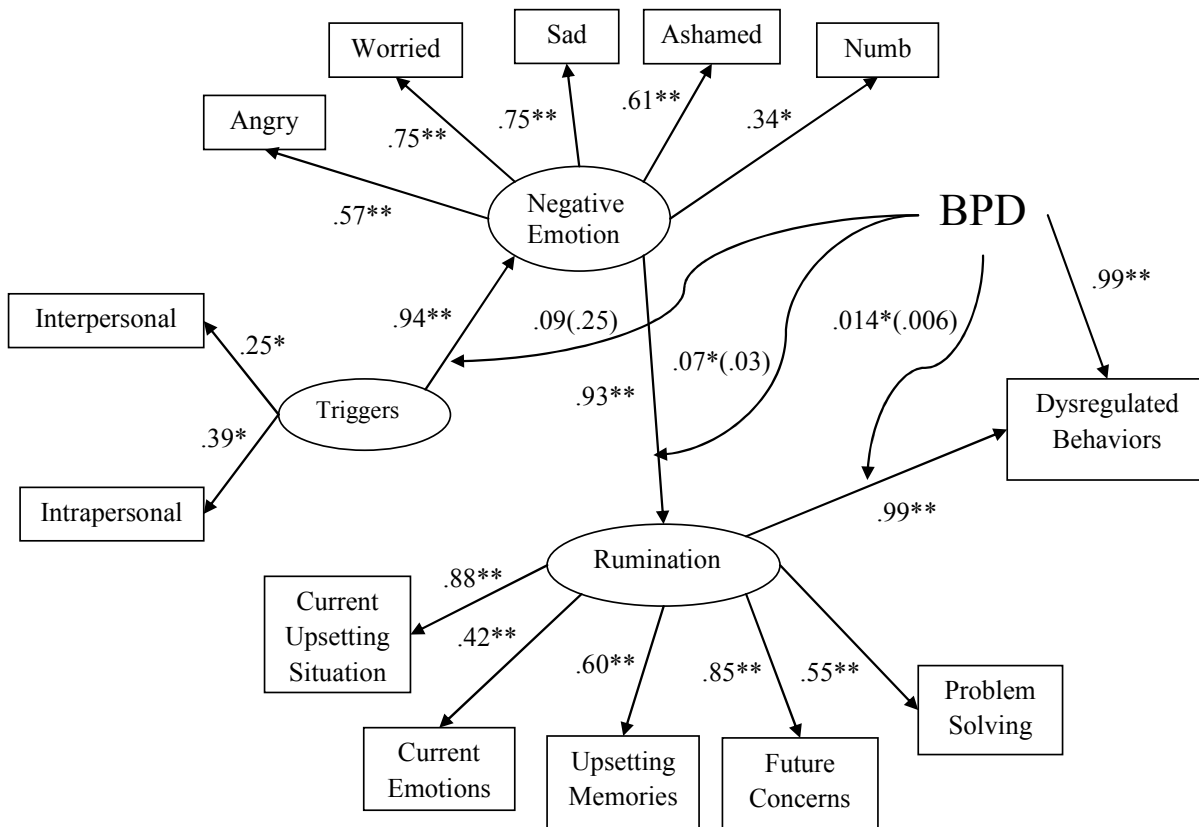


Figure 3.3: Revised Real-World Model

Caption. A Real-World Model of Emotional Cascades in BPD. Straight lines indicate direct paths, while curved lines indicate random slope effects.

### 3.4 Future Prediction of Dysregulated Behaviors

#### *Base Model*

The purpose of this next set of analyses was to establish the predictive value of high levels of rumination and negative emotion (as measures of emotional cascades) at one signal in predicting the occurrence of dysregulated behavior by the next signal. Hierarchical generalized linear modeling (HGLM) was used to test these hypotheses. HGLM is an extension of standard hierarchical linear modeling, except that it is used in situations where the distribution of the

outcome variable is non-normal, and in this case the outcome (occurrence of a dysregulated behavior) was binary.

First, each signal recording was coded such that the presence of any dysregulated behavior was coded (1) or no dysregulated behaviors were reported (0). This variable was collapsed across all of the various behaviors such that the occurrence of any dysregulated behavior counted. Next, cross-lagged variables for rumination (a composite of all types of rumination from the PDA questionnaire) and negative emotion (the sum of sadness, anxiety, anger, and numb and ashamed feelings) were computed such that the previous scores at any given recording were dropped down to the subsequent row (each row in univariate data format represents one recording for each participant). Doing so allowed for the data from the previous recording to be used in prediction of behavioral dysregulation at the subsequent recording.

The HGLM analyses consisted of three levels: within-individual observations each day (Level 1), day of signaling within each participant (Level 2), and between each individual (Level 3). First the base model will be discussed, and then within-level predictors will be added to the GHLM equation.

The base three-level model is displayed below:

$$\text{Response Distribution: } BxDys_{ijk} \mid \mu_{ijk} \sim \text{BER}(\mu_{ijk})$$

$$\text{Link Function: } \eta_{ijk} = \log(\mu_{ijk})$$

Linear Predictor:

$$\text{Level 1 (observation): } \eta_{ijk} = \beta_{0jk}$$

$$\text{Level 2 (day): } \beta_{0jk} = \beta_{00k} + u_{0jk}$$

$$\text{Level 3 (individual): } \beta_{00k} = \gamma_{000} + u_{00k}$$

$$\begin{matrix} u_{0jk} \\ u_{00k} \end{matrix} \sim N \left[ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \tau_{00}^{(2)} & 0 \\ 0 & \tau_{00}^{(3)} \end{pmatrix} \right]$$

In this model, the response distribution for engaging in a dysregulated behavior ( $BxDys_{ik}$ ) at any given signal will be Bernoulli, which refers to a binary outcome for an individual case ( $N=1$ ). In all equations  $i$  refers to the observation,  $j$  denotes the day, and  $k$  denotes each individual, while  $\mu_{ijk}$  pertains to the expected value of  $BxDys$ . In hierarchical generalized linear modeling a link function is used to transform analyses for continuous outcomes to non-normal outcome distributions. For these analyses a log link function was used to ensure that the

expected value of BxDys ( $\mu_{ijk}$ ) does not fall outside the binomial range of 0-1. In the link function,  $\eta_{ijk}$  refers to the log transformed expected value of BxDys.

The Level 1 linear outcome predictor actually consists of three levels of equations. The Level 1 equation refers to the prediction of logit transformed expectation of BxDys ( $\eta_{ijk}$ ) at each observation, with  $\beta_{0jk}$  serving as the intercept coefficient. The Level 2 equation determining  $\beta_{0jk}$  consists of  $\beta_{00k}$ , the daily mean, with variance  $\tau_{00}^{(2)}$ , and the day-level deviations from the mean,  $u_{0jk}$ . The daily mean  $\beta_{00k}$  is determined from the Level 3 equation, with individual-level mean  $\gamma_{000}$  and variance  $\tau_{00}^{(3)}$ , and the individual-level deviation from the mean,  $u_{00k}$ . It can be helpful to think of the three level equations as collapsed down to one equation:  $\eta_{ijk} = \gamma_{000} + u_{0jk} + u_{00k}$ . The model components will be tested for significance at  $\alpha = .05$ .

A preliminary analysis with the baseline model was run to assess whether a three-level structure was appropriate (as indicated by a significant effect for Day). Furthermore, hierarchical analyses have to account for autocorrelation within a model. Autocorrelation refers to the often high correlation between variables that are measured closely in time. In these data autocorrelation is important to account for because all observations are relatively close in time (most around 2 hours apart) and other issues arise such as the time between observations not being equal across participants and observations. To account for the potential concerns regarding autocorrelation, the following predictors were included in Level 1 of the model: lag-time (to account for time between observations), lag-behavior (to account for behavioral influences on future recordings), and the interaction between lag-time and lag-behavior to account for autocorrelation.

The results of this preliminary model indicated that, as expected, Day of monitoring was a significant predictor of the occurrence of a dysregulated behavior ( $\gamma = -.14$ ,  $SE = .04$ ,  $p < .05$ ). Interestingly, this relation was negative, which means that as days of recording progressed, the probability of a dysregulated behavior at any given signal decreased. This suggests that the assessment was therapeutic. Regarding the autocorrelation terms, none was a significant predictor of dysregulated behavior (lag-time  $\gamma = -.004$ ,  $SE = .004$ ,  $p = .37$ ; lag-behavior  $\gamma = -.42$ ,  $SE = .49$ ,  $p = .39$ ; lag-time\*lag-behavior  $\gamma = -.053$ ,  $SE = .089$ ,  $p = .55$ ). This analysis indicated that nesting observations within days, and days within individuals was an appropriate structure for modeling with these data. This analysis also indicated that autocorrelation was not a major concern in these analyses.

### *Model with Predictors*

This model was used to predict the outcome, engagement in behavioral dysregulation (BxDys), from the hypothesized causal variables. This model had the same response distribution and link function described above. In this model, however, cross-lagged rumination and cross-lagged negative emotion were used to predict future behavioral dysregulation, and in doing so levels of rumination and negative emotion at one signal were used to predict behavioral dysregulation reported at the next signal. This model was important for identifying if there is temporal precedence in rumination and negative emotion prior to the onset of a dysregulated behavior. Furthermore, quadratic terms for cross-lagged rumination and negative emotion variables were included in the model to determine if the relationships between rumination and negative emotion with behavioral dysregulation are stronger at higher levels of the predictors than lower and moderate levels. Other Level-1 predictors included the experience a problematic interpersonal interaction or personal event with-in that signal period.

Also at Level 1 of the analyses the occurrence of an interpersonal interaction or personal event was included in prediction with the expectation that these occurrences would be significant predictors of behavioral dysregulation. Finally, BPD diagnosis and other Axis I diagnoses and demographic variables that were significantly different between groups were entered as covariates on Level 3 to determine if BPD diagnosis increases the predicted probability of behavioral dysregulation at each signal, beyond these covariates. The model equations are as follows:

$$\text{Level 1 (observation): } \eta_{ijk} = \beta_{0jk} + \beta_{1jk}(\text{lag-rumination})_{i-1jk} + \beta_{2jk}(\text{lag-negemotion})_{i-1jk} + \beta_{3jk}(\text{lag-rumination}^2)_{i-1jk} + \beta_{4jk}(\text{lag-negemotion}^2)_{i-1jk} + \beta_{5jk}(\text{INT})_{ijk} + \beta_{6jk}(\text{PER})_{ijk}$$

$$\text{Level 2 (within-day): } \beta_{0jk} = \beta_{00k} + \beta_{001}(\text{Day})_k + \beta_{002}(\text{Week})_k$$

$$\beta_{1jk} = \beta_{01k}$$

$$\beta_{2jk} = \beta_{02k}$$

$$\beta_{3jk} = \beta_{03k}$$

$$\beta_{4jk} = \beta_{04k}$$

$$\beta_{5jk} = \beta_{05k}$$

$$\beta_{6jk} = \beta_{06k}$$



Level 3 (individual):  $\beta_{00k} = \gamma_{00} + \gamma_{01}(\text{BPDdx})_k + \gamma_{02}(\text{age})_k + \gamma_{03}(\text{sex})_k + \gamma_{04}(\text{community})_k$   
 $+ \gamma_{05}(\text{treatment})_k + \gamma_{06}(\text{medication})_k + \gamma_{08}(\text{MDD})_k + \gamma_{08}(\text{dysthymia})_k + \gamma_{010}(\text{SAD})_k + \gamma_{011}(\text{PTSD})_k$   
 $+ \gamma_{012}(\text{GAD})_k + \gamma_{013}(\text{BSS})_k + u_{00k}$

$$\beta_{001} = \gamma_{11}$$

$$\beta_{002} = \gamma_{12}$$

$$\beta_{01k} = \gamma_{10}$$

$$\beta_{02k} = \gamma_{20}$$

$$\beta_{03k} = \gamma_{30}$$

$$\beta_{04k} = \gamma_{40}$$

$$\beta_{05k} = \gamma_{50}$$

$$\beta_{06k} = \gamma_{60}$$

Reduced Form:  $\eta_{ijk} = \text{logit}(\mu_{ijk}) = \gamma_{00} + \gamma_{11}(\text{Day})_k + \gamma_{12}(\text{Week})_k + \gamma_{01}(\text{BPDdx})_k + \gamma_{02}(\text{MDD})_k + \gamma_{03}(\text{PTSD})_k + \gamma_{04}(\text{SAD})_k + \gamma_{05}(\text{GAD})_k + \gamma_{06}(\text{sex})_k + \gamma_{07}(\text{age})_k + \gamma_{10}(\text{lag-rumination})_{i-1jk} + \gamma_{20}(\text{lag-negemotion})_{i-1jk} + \gamma_{30}(\text{lag-rumination}^2)_{i-1jk} + \gamma_{40}(\text{lag-negemotion}^2)_{i-1jk} + \gamma_{50}(\text{INT})_{ijk} + \gamma_{60}(\text{PER})_{ijk} + u_{00k}$

The reduced form of the above equation was such that  $\eta_{ijk}$  refers to the probability that a dysregulated behavior was reported based on the predictors at each signal during each day for each participant, with  $\gamma_{00}$  being the observation intercept (average probability of behavioral dysregulation) with error terms:  $u_{0jk}$  (day level), and  $u_{00k}$  (individual level). Including these error terms allows the intercept to vary randomly for the day and individual level. Each of the subsequent gamma ( $\gamma$ ) values that have not already discussed refers to the odds-slope of each predictor variable on the probability that a dysregulated behavior occurred.

The results of the prediction analyses using the experience sampling data collected for this study can be found in Table 3. First the within subjects predictor variables (Level 1 and Level 2) will be discussed. Again, as expected, day of monitoring was a significant predictor of the occurrence of behavioral dysregulation. Week of monitoring, however, was not. The occurrences of a recent interpersonal interaction or personal event were also significant, positive predictors of the occurrence of behavioral dysregulation.

Table 3.3: Predictors of Future Behavior

Variable	Categorical Behavior		Count Behaviors	
	$\gamma$	$SE(\gamma)$	$\gamma$	$SE(\gamma)$
<u>WITHIN LEVEL</u>				
	$R^2=.17^{**}(SE=.02)$			
Day	-.13*	.06	-.33*	.17
Week	.05	.06	.23	.20
Lag-Rumination	-.19	.10	-.52	.28
Lag-Negative Emotion	-.05	.08	-.23	.12
Lag-Rumination <sup>2</sup>	.34**	.08	.97**	.15
Lag-Negative Emotion <sup>2</sup>	.12	.11	.51†	.26
Interpersonal Events	.15**	.04	.36**	.06
Personal Events	.12**	.03	.24**	.04
<u>BETWEEN LEVEL</u>				
	$R^2=.50^{**}(SE=.13)$			
Borderline Personality Disorder	.41**	.12	.50*	.21
Age	.30	.23	.29	.31
Sex	.13	.20	.21	.25
Community	.35	.20	.51*	.24
Treatment Seeking	.31	.18	.51	.27
On Medication	.25	.17	.19	.21
Major Depressive Disorder	-.73*	.24	-.83*	.31
Dysthymia	.51*	.20	.68*	.28
Social Anxiety Disorder	-.26*	.13	-.36*	.16
Post-traumatic Stress Disorder	.26	.15	.36*	.18
Generalized Anxiety Disorder	1.05**	.21	1.42**	.23
Beck Suicide Scale	-.44*	.21	-.65*	.26
<u>INTERACTION</u>				
BPD*Lag-Rumination	.23*	.11	.66*	.27
BPD*Lag-Rumination2	-.10	.09	-.45	.17
BPD*Lag-Negative Emotion	-.20	.14	-.30	.40
BPD*Lag-Negative Emotion2	.11	.14	.01	.33

Table 3.3: Predictors of Future Behavior

Variable	Categorical Behavior		Count Behaviors	
	$\gamma$	$SE(\gamma)$	$\gamma$	$SE(\gamma)$
Model Variance Component	.50**	.13	---	---
Model $H0$	-1217.76		-1665.96	
Model $AIC$	2487.53		3381.92	
Model $BIC$	2562.09		3533.04	

†= $p<.06$ , \* =  $p<.05$ , \*\* =  $p<.001$

Regarding the primary hypotheses of these analyses, the only significant predictor of future dysregulated behavior was the quadratic lag-rumination term. The linear effects for lag-rumination and negative emotion and the quadratic term for lag-negative emotion were not significant. Importantly, when the quadratic function of lag-rumination<sup>2</sup> was graphed (see Figure 4), the hypothesis that higher levels of rumination at any given signal would result in an exponentially increased probability of a dysregulated behavior occurring by the time of the next signal was supported. As seen in Figure 4, as participants' recorded rumination levels reached just 20 units or more (out of a maximum of 40), the probability of a dysregulated behavior occurring within the next 2-3 hours approached 100%.

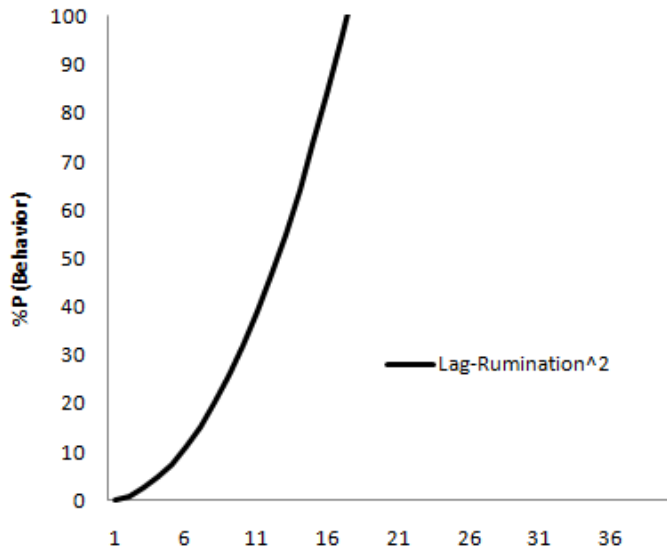


Figure 3.4: Probability Graph of Rumination Function

Caption: Lag-Rumination<sup>2</sup> Function in Predicting the Probability a Future Dysregulated Behavior Occurring

Because the lag-negative emotion terms were non-significant, and thus inconsistent with the original hypotheses, the model was re-run without including the lag-rumination terms. In this model both negative emotion terms were significant predictors, with the linear lag-negative emotion effect being negative ( $\gamma = -.65, SE = .051, p < .001$ ), and the quadratic effect being positive ( $\gamma = .73, SE = .033, p < .001$ ). When graphed the quadratic function of lag-negative emotion was similar to the lag-rumination function graphed in Figure 4. This finding suggests that although negative emotion may be a strong predictor of future dysregulated behavior, rumination may be the stronger and more fundamental predictor, because it may be the active driving force of emotional cascades and the component that dysregulated behaviors are used specifically to stop.

In this model there were also a number of significant Level 3 predictors (between subjects). Importantly, BPD remained a positive, significant predictor of dysregulated behavior. MDD and SAD were significant, negative predictors meaning that a diagnosis of either depression or social anxiety disorder decreased the probability of a dysregulated behavior occurring at any given signal. Dysthymia and GAD were significant, positive predictors. This suggests that these disorders may also be characterized, at least in part, by behavioral

dysregulation. Finally, BSS score was a significant negative predictor, suggesting that those with higher levels of suicidal ideation were less likely to engage in various dysregulated behaviors.

Some additional follow-up analyses on these models were also conducted. The interaction terms between BPD and lag-rumination and lag-negative emotion, and their quadratic terms, were also included in the model with the expectation that these interactions would all be significant predictors of dysregulated behaviors. The interaction terms indicated, however, that only the interaction between BPD and the lag-rumination linear effect was significant. Graphing out this interaction indicated that it was in the hypothesized direction, such that those with BPD and high levels of rumination predicted even higher probability of a dysregulated behavior at the subsequent signal.

Finally, these same analyses were re-run using a count variable of dysregulated behavior recorded at each signal, as opposed to a dichotomous variable. Using a count variable, as opposed to a binary outcome, captures occasions where multiple dysregulated behaviors occurred, situations which may be somewhat different in nature than instances of single behaviors. In order to run these analyses the link function and outcome distribution for the previous model needed to be switched from the logit function with a Bernoulli distribution to a loglinear link function with a Poisson distribution. These analyses (see Table 3) were essentially the same as the results from the binary analyses with a couple of interesting differences. First, whether the participant was a student or from the community became a significant predictor, with those from the community having more likelihood of reporting instances of multiple dysregulated behaviors. Second, in these analyses PTSD became a significant, positive predictor. This suggests that those with PTSD may experience occasions where they have multiple dysregulated behaviors, perhaps due to trauma symptoms and/or emotional cascades.

### 3.5 Event-Contingent Ratings

Although the primary focus of this study was on the random signals completed during monitoring, all participants also had the option to input event-contingent recordings into the program. Event-contingent recordings occurred when a participant engaged in one of the listed dysregulated behaviors and desired to input a recording soon afterward. These recordings were slightly different than the random-signal recordings in that the participants were asked not only

about the behavior they engaged in, but also their levels of negative emotion and rumination both before and after the behavior. Participants were not required to complete these recordings.

Overall, 81 event-contingent recordings were obtained for all subjects over monitoring. Variables were created for pre- and post- levels of both negative emotion and rumination. The data were analyzed in SPSS using the mixed module so that the before and after effects of each behavior within each individual could be reported. The analyses were split into two sets, one about negative emotion and the other about rumination. BPD and an interaction term between BPD and pre- levels of negative emotion and rumination were also included in these models. There were no random effects applied to these models.

The results of the analyses can be seen in Table 4. The first analysis indicated that there was a significant change in negative emotion from before and after the behavior ( $F_{1,82}=107.27$ ,  $p<.001$ ). Yet, contrary to predictions, the change was an increase in negative emotion from before the behavior took place. Although the overall fixed BPD effect on pre- and post-negative emotion was not significant ( $F_{1,82}=1.95$ ,  $p=.09$ ), there was a significant interaction between BPD and pre-negative emotion ( $F_{1,82}=4.51$ ,  $p=.037$ ). This interaction was graphed and revealed that those with BPD and higher levels of pre-negative emotion also reported a greater increase in negative emotion following the behavior.

Table 3.4: Event-Contingent Reports

Variable	BPD		Comparison		<i>F(df)</i>
	Before	After	Before	After	
	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>	
Negative Emotion	11.72(5.72)	12.22(5.31)	8.57(4.9)	10.14(5.38)	107.27**(1,82)
Negative Emotion – No Ashamed	10.19(5.12)	8.77(4.02)	7.28(4.22)	7.21(3.77)	66.74**(1,82)
Rumination	21.43(12.47)	23.19(12.11)	15.00(10.56)	15.89(10.31)	61.88**(1,82)

Caption: Before and After Behavior Levels of Rumination and Negative Emotion

Because the results of this analysis were contrary to predictions, we considered alternative explanations for the results. In previous work on the emotional cascade model it has been suggested that many people may experience increased feelings of shame following a dysregulated behavior and that those feelings of shame may initiate a subsequent emotional cascade and dysregulated behavior (i.e., as in the case of bingeing and purging). To test this hypothesis the same analysis was run except that both pre- and post-negative emotion were calculated without including feelings of being ashamed. The results of this analysis were in line with the original predictions, as there was a significant change from pre-negative emotion to post-negative emotion ( $F_{1,82}=66.74, p<.001$ ), and as was expected there was a significant decrease in negative emotion after the behavior. As in the analysis before, there was not a significant BPD effect in change between pre- and post-negative emotion ( $F_{1,82}=1.57, p=.21$ ). In this analysis, however, there was not a significant interaction between BPD and pre-negative emotion ( $F_{1,82}=2.22, p=.14$ ).

The next change variable analyzed was pre- and post-rumination. This analysis indicated that levels of pre-rumination were significantly different than post-rumination ( $F_{1,82} = 61.88, p<.001$ ), but contrary to expectations there was an increase in rumination following the behavior. There was no main effect for BPD ( $F_{1,82}=1.71, p=.20$ ), and there was not a significant pre-rumination and BPD interaction ( $F_{1,82}=.33, p=.56$ ). These findings suggest that following a dysregulated behavior rumination increased. The results of this analysis may have been influenced by two factors: 1) the event rumination and negative emotion questions were worded slightly differently from each other. The negative emotion questions were phrased: “How did you feel before?” and “How did you feel after?” On the other hand, the rumination questions were phrased: “How much was this on your mind before?” and “How much is this on your mind now?” Because the rumination question did not specifically ask how the participants felt immediately after the behavior, it is possible that the immediate effects of the behavior on rumination were not captured with these questions. 2) The second possibility for the unexpected rumination findings is that the effects of the behavior on the emotional cascade are very brief, and very shortly after the behavior, rumination and another emotional cascade may again start. This second explanation is supported by the finding that, when the emotion “ashamed” was included in the overall negative emotion, there was a significant increase in negative emotion

following the behavior. But, when “ashamed” was removed from the negative emotion composite variable, the analyses came out as originally expected. This may indicate that the dysregulated behaviors used by these participants were effective at reducing negative emotion only very briefly, and afterwards they may actually feel and ruminate worse. Finally, it is also interesting to note that the BPD group experienced significantly more shame following their dysregulated behaviors than did the comparison group. This increased experience of shame may further aggravate dysregulated behaviors in those with BPD.

### 3.6 Supplemental Analyses

#### Positive Behaviors

As a part of assessment with the PDA questionnaire all participants had the opportunity to rate “positive” behaviors that they had engaged in since the previous signal. Common examples of behaviors included: talking to a friend, watching a movie, taking a walk, writing in a diary, talking to a relative, playing on the internet, doing something creative, listening to music, and reading a book or magazine. Part of the goal with assessing positive behaviors was to determine if participants were making efforts to positively regulate negative emotion or examine if those in therapy were using more positive behaviors than those not in therapy.

Regarding the characteristics of positive behaviors, a total of 1547 positive behaviors were recorded during monitoring. On average, each participant rated 1.54 positive behaviors per recording ( $SD = 1.80$ ). The characteristics of positive behaviors are reported in Table 5. The most common positive behaviors reported were talking to a friend, listening to music, and reading something. The least commonly reported positive behavior was writing in a diary.

Table 3.5: Positive Behavior Characteristics

Positive Behavior	Total Reported	Percent Reporting	Individual Range	<i>MEAN</i>	<i>SD</i>
Talking to a Friend	910	91.4	0-65	19.76	18.71
Watched a Movie	265	75.6	0-42	5.90	7.60
Took a Walk	339	75.0	0-40	7.28	8.86



Table 3.5 – continued.

Wrote in a Diary	13	13.9	0-5	.26	.86
Talked to a Relative	279	74.0	0-51	6.06	9.38
Played on the Internet	414	74.9	0-42	9.22	11.47
Did Something Creative	234	71.4	0-31	4.83	7.18
Listened to Music	604	87.0	0-59	12.89	15.49
Read Something	247	85.7	0-27	5.33	6.16

To analyze the effects of BPD diagnosis and other predictors of positive behaviors, generalized estimating equations in SPSS were used to account for the nested structure of observations within individuals. Number of different positive behaviors reported at any given recording was used as the outcome variable, and a loglinear link with Poisson distribution was used to account for positive behaviors being a count variable. BPD and current treatment seeking status were the first predictors explored with positive behaviors. Only fixed slopes were estimated.

BPD was not a significant predictor of using less positive behaviors at any given signal ( $B=.17, SE=.32, p=.33$ ), and current treatment seeking status did not have an effect on using more positive behaviors at any given signal ( $B=.15, SE=.37, p=.68$ ). There was not a significant interaction between BPD and treatment seeking status ( $B=.34, SE=.71, p=.63$ ). Additional predictors were also entered into the generalized estimating equations to examine whether they were significant predictors of using positive behaviors at any given signal. Lag-rumination, lag-negative emotion, and the quadratic terms for both, and interpersonal interactions were all not significant predictors of positive behaviors. Personal Events at any given signal, however, were significant negative predictors of using a positive behavior ( $B = -.52, SE = .19, p<.01$ ). This means that the experience of personal feelings of failure or disappointment decreased the likelihood of participants engaging in positive behaviors. Use of positive behaviors did not increase or decrease during the course of monitoring.

## Changes in Rumination, Negative Emotion, and Behavior during Monitoring

Because the very act of monitoring with PDAs may have influence the experience of rumination, negative emotion, and dysregulated behaviors, the levels of these variables were modeled over the monitoring period. To do this a hierarchical model was constructed in SPSS in which momentary observations of rumination, negative emotion, and dysregulated behaviors were nested within days and weeks. By regressing day and week onto each of the outcome variables (rumination, negative emotion, and dysregulated behaviors) estimates would be generated determining if the levels of these variables changed on a weekly or daily basis. A second analysis was also conducted using BPD as a predictor of random slopes for the effect of day and week on the outcome variables. It was predicted that levels of rumination, negative emotion, and dysregulated behaviors would decrease over the course of monitoring because using the PDA would help participants understand their thought and behavior patterns, and thus become better at regulating emotion and controlling behaviors appropriately.

The results of the first analysis indicated that week was not a significant predictor of change in momentary levels of negative emotion, rumination, or dysregulated behaviors. Similarly, there was not a significant effect of day on momentary negative emotion or rumination. However, there was a significant effect of day on dysregulated behaviors ( $\gamma = -1.31$ ,  $p < .001$ ). This effect indicated that number of dysregulated behaviors reported at any given signal decreased over the course of monitoring.

The second analysis, which used BPD as a predictor of random slopes for the effect of day and week on rumination, negative emotion, and dysregulated behavior, resulted in only one significant finding. BPD was a significant predictor of a random slope for the relation of day and number of dysregulated behaviors reported at any given moment ( $\gamma = .083$ ,  $SE = .034$ ,  $p = .014$ ). This finding indicated that those with BPD reported a greater decrease in the report of dysregulated behaviors at any given recording as the monitoring progressed.

The findings of these analyses indicate that there may be positive treatment implications for using PDAs to monitoring thought, emotion, and behavior patterns. Although levels of rumination and negative emotion did not decrease over the period of monitoring, the number of dysregulated behaviors engaged in did. This finding suggests that perhaps many participants learned, as a byproduct of the study, more effective ways to cope with their negative emotion in

an alternative way and control dysregulated behaviors. In fact, the BPD group showed an even stronger decrease in dysregulated behaviors over monitoring. These positive findings are in line with individual reports from numerous participants who indicated that the monitoring had been a positive experience for them and that they had found it to be very helpful. This is particularly interesting because all participants were told that this study was not about treatment of any problems they might have and that the only purpose of it was to gain a better understanding of thoughts, emotions, and behaviors and how they interact in the real world. Thus, using PDAs in treatment may have important positive implications for the future.

## CHAPTER 4

### DISCUSSION

The purpose of this study was to explore the Emotional Cascade Model of BPD in the real world, where, rather than using self-report indices of rumination to predict self-report indices of behavioral dysregulation, actual momentary assessments of rumination and emotion could be used to test a number of predictions that arise from the emotional cascade model. In order to obtain these data, 47 participants coming from both the community at-large as well as a student population carried PDA devices for over two weeks. During this period of monitoring subjects responded to five random signals throughout each day. Participants were also assessed for various Axis I diagnoses as well as for BPD diagnoses.

The overall results of the study indicate that many of the hypothesized predictions of the emotional cascade model were supported by the data. First, a real-world model of emotional cascades in BPD was created using hierarchical structural equation modeling. This model indicated that across numerous reports for all participants, triggering episodes such as negative interpersonal interactions or personal experiences of failure significantly predicted the experience of negative emotion. This negative emotion, then, was a significant predictor of increased experience of rumination. Increased rumination, in turn, was a significant predictor of dysregulated behaviors. This model was also a better fit to the data than a model in which rumination preceded negative emotion. Finally, BPD diagnosis had important effects on the strength of the relation between negative emotion and rumination such that those with BPD experienced a stronger link between the two. Furthermore, BPD diagnosis was also associated with a stronger relation between rumination and dysregulated behaviors. All of these findings indicated that the emotional cascade model may be accurately describing phenomena that happen in the real world and that although emotional cascades may not be unique to those with BPD, those with BPD appear to have stronger emotional cascades and thus more trouble with dysregulated behaviors.

A second major finding of this study was that rumination was a significant predictor of future dysregulated behavior. That is, a high level of rumination at any given signal was a strong robust predictor of engaging in a dysregulated behavior within the next 2-3 hours. In fact, level

of rumination was a stronger predictor than negative emotion, and it had an exponential effect so that even moderate levels of rumination strongly predicted a future behavior. These analyses also indicated that other important predictors of dysregulated behavior were negative interpersonal interactions and personal feelings of failure or disappointment with one's self. On a diagnostic level, BPD was a positive predictor of dysregulated behavior at any given signal, while MDD was a negative predictor. This is an interesting contrast given that both disorders have been found to have problems with rumination. One final finding of note with these analyses was that there was also a significant interaction between BPD and rumination such that the combination of both increased the probability of a dysregulated behavior at any given signal. Thus, when those with BPD ruminate there is a high probability that a dysregulated behavior will take place.

The current study has numerous implications for the understanding and treatment of BPD. Given the results of this study and previous studies (Selby et al., 2008; Selby et al., 2009), a strong list of evidence has been generated for the emotional cascade model. The support the model also has strong external validity for use in the real-world. Having a model of psychopathology that has solid empirical support is important, because from that model better evidence-based treatments can be developed.

### *Strengths and Limitations*

One of the major strengths of this study was that it included participants from the community; many of those participants also had BPD diagnoses. This is important because previous work on emotional cascades has been limited to exploration in student populations. Replicating effects with individuals from the community increases the generalizability of research on emotional cascades. A second strength of this study was that in the main analyses a variety of Axis I diagnoses were controlled for, and even when controlling for these alternative diagnoses the hypothesized effects remained robust. This included controlling for diagnostic levels of depression, a disorder that is important to control for when exploring rumination in BPD given the high correlation between depression and rumination as well as depression and BPD. One final strength of this study was that it used real-world data as opposed to single-measure self-report questionnaires. Because these data were collected over time, predictions of future behavior could be made, providing important predictive validity for the emotional cascade model.

There are also some limitations to consider with the following study. Despite the robust findings of the current study, these data are only able to address temporal precedence and cannot be used to test the causal effects of emotional cascades on dysregulated behavior. Similarly, these data are still self-report in nature meaning that they are subject to the biases and perceptions of the participants. For example, one of the behaviors that could be reported was “driving recklessly.” The way that this question is worded leaves the meaning of the behavior open to interpretation. For example, one participant could consider speeding alone to meet threshold for this behavior, while another may be weaving in and out of traffic and feel that they are not driving recklessly. One final limitation to this study was the somewhat low number of BPD participants in the study. With 16 participants meeting criteria for BPD, there was potential for low power. Yet, despite this limitation, the main hypotheses of this study were mostly supported. This suggests that the effects of emotional cascades in those with BPD are large, so much so that they were detectable with a sample size like that in the present study.

#### *Treatment implications*

One of the major strengths of the emotional cascade model is that it has numerous, practical implications for real-world clinical work. The findings of this study further suggest that clinical approaches that are successful in treating BPD may have the common mechanism of decreasing rumination. In clinical settings, rumination patterns could be assessed and the therapist could help the patient understand that when he or she is ruminating behavioral dysregulation is more likely. The current study could also have important clinical implications for the direct use of experience sampling in the treatment of BPD. Patients could be assigned palm-pilots which would randomly signal them throughout the day to help them gain awareness of when they are ruminating and upset, as well as learn what situations might have the highest likelihood of causing them to engage in a dysregulated behavior. If the emotional cascade model is accurate, then helping the patient monitor and understand his or her thought/rumination patterns may help him or her cope better with emotional distress. By identifying what initiates rumination, and how one responds to rumination (i.e. with behavioral dysregulation), then a patient may recognize when an emotional cascade is starting and then have an opportunity to implement distraction techniques early. This early intervention may then dampen or circumvent a full-blown emotional cascade.

### *Future Directions*

The findings of this study support continuing research on the Emotional Cascade Model. Future studies that should include additional experimental studies. Currently, all of the data for the model is primarily correlational. To further support the model, evidence is needed that emotional cascades are causing dysregulated behaviors. Possible studies could include pairing a rumination induction with a pain tolerance proxy to determine if those who receive the pain tolerance measure instead of a control condition experience greater reduction in negative emotion afterward. This study would also benefit from the use of psychophysiological data, as most of the research on emotional cascades has been self-report. Future research should also explore the use of smart-phone applications for DBT skills coaching and monitoring of rumination and negative emotion. By helping patients pay more attention to their emotional cascades and corresponding behaviors in their daily lives they may improve faster. Finally, future studies should examine more details of the Emotional Cascade Model such as whether different emotions lead to different behaviors, as well as how emotional cascades are different among those with and without BPD.

APPENDIX A

DEMOGRAPHICS FORM

**Background Information**

Participant ID#: \_\_\_\_\_

Current Age: \_\_\_\_\_

Gender:      Male              Female

Do you identify your ethnicity as Hispanic? Yes    No    Unknown

Please identify your race:

- \_\_\_\_\_ European/ Caucasian/ White
- \_\_\_\_\_ African American/Black/Caribbean
- \_\_\_\_\_ Asian
- \_\_\_\_\_ Hispanic/Latino
- \_\_\_\_\_ Native Hawaiian/Other Pacific Islander
- \_\_\_\_\_ Native American/Native Alaskan
- \_\_\_\_\_ More than One Race
- \_\_\_\_\_ Unknown/Do not wish to report

Are you currently a student of Florida State University?              Yes              No

Are you currently in therapy for mental health/counseling?              Yes              No

Are you currently taking any psychotropic medications              Yes              No

If yes, please report which one(s) to the best of your knowledge:

\_\_\_\_\_

\_\_\_\_\_

Do you work at a job during the day?              Yes    No

Please rate your family's financial background:

            Low Income              Moderate Income              High Income

What time do you usually get up in the morning? \_\_\_\_\_

What time do you usually go to bed at night? \_\_\_\_\_



## APPENDIX B

### BASELINE DYSREGULATED BEHAVIORS ASSESSMENT

Please rate, to the best of your knowledge, how often you have engaged in the following behaviors over the LAST TWO WEEKS:

Hung up phone on someone:	0	1	2	3	4+
Slammed a door:	0	1	2	3	4+
Binged on food:	0	1	2	3	4+
Used an illicit drug:	0	1	2	3	4+
Binged on alcohol:	0	1	2	3	4+
Purposely injured yourself					
without suicidal intent:	0	1	2	3	4+
Shopped impulsively:	0	1	2	3	4+
Insulted someone:	0	1	2	3	4+
Got into a physical fight:	0	1	2	3	4+
Threw something:	0	1	2	3	4+
Drove Recklessly:	0	1	2	3	4+
Cried:	0	1	2	3	4+
Accused Someone:	0	1	2	3	4+
Lost track of time and place:	0	1	2	3	4+
Your view of yourself changed:	0	1	2	3	4+

## APPENDIX C

### BECK SUICIDE SCALE (BSS)

Directions: Please carefully read each group of statements below. Circle the one statement in each group that best describes how you have been feeling for the past week, including today. Be sure to read all of the statements in each group before making a choice.

- (850) 0 I have a moderate to strong wish to live.  
1 I have a weak wish to live  
2 I have no wish to live
- (2) 0 I have no wish to die.  
1 I have a weak wish to die.  
2 I have a moderate to strong wish to die.
- (3) 0 My reasons for living outweigh my reasons for dying.  
1 My reasons for living or dying are about equal.  
2 My reasons for dying outweigh my reasons for living.
- (4) 0 I have no desire to kill myself.  
1 I have a weak desire to kill myself.  
2 I have a moderate to strong desire to kill myself.
- (5) 0 I would try to save my life if I found myself in a life-threatening situation.  
1 I would take a chance on life or death if I found myself in a life-threatening situation.  
2 I would not take the steps necessary to avoid death if I found myself in a life-threatening situation.

If you circled the zero statements for both Groups (4) and (5) above, skip to (20). If you marked a 1 or 2 in either Group (4) or Group (5), then continue with group (6).

- (6) 0 I have brief periods of thinking about killing myself which pass quickly.
  - 1 I have periods of thinking about killing myself which last for moderate amounts of time.
  - 2 I have long periods of thinking about killing myself.
  
- (7) 0 I rarely or only occasionally think about killing myself.
  - 1 I have frequently thoughts about killing myself.
  - 2 I continuously think about killing myself.
  
- (8) 0 I do not accept the idea of killing myself.
  - 1 I neither accept nor reject the idea of killing myself.
  - 2 I accept the idea of killing myself.
  
- (9) 0 I can keep myself from committing suicide.
  - 1 I am unsure that I can keep myself from committing suicide.
  - 2 I cannot keep myself from committing suicide.
  
- (10) 0 I would not kill myself because of my family, friends, religion, possible injury from an unsuccessful attempt, etc.
  - 1 I am somewhat concerned about killing myself because of my family, friends, religion, possible injury from an unsuccessful attempt, etc.
  - 2 I am not or only a little concerned about killing myself because of my family, friends, religion, possible injury from an unsuccessful attempt.
  
- (11) 0 My reasons for wanting to commit suicide are primarily aimed at influencing other people, such as getting even with people, making people happier, making people pay attention to me, etc.

- 1 My reasons for wanting to commit suicide are not only aimed at influencing other people, but also represent a way of solving my problems.
  - 2 My reasons for wanting to commit suicide are primarily based upon escaping from my problems.
- (12)
- 0 I have no specific plan about how to kill myself.
  - 1 I have considered ways of killing myself, but have not worked out the details.
  - 2 I have a specific plan for killing myself.
- (13)
- 0 I do not have access to a method or an opportunity to kill myself.
  - 1 The method that I would use for committing suicide takes time, and I really do not have a good opportunity to use this method.
  - 2 I have access or anticipate having access to the method that I would choose for killing myself and also have or shall have the opportunity to use it.
- (14)
- 0 I do not have the courage or the ability to commit suicide.
  - 1 I am unsure that I have the courage or the ability to commit suicide.
  - 2 I have the courage and the ability to commit suicide.
- (15)
- 0 I do not expect to make a suicide attempt.
  - 1 I am unsure that I shall make a suicide attempt.
  - 2 I am sure that I shall make a suicide attempt.
- (16)
- 0 I have made no preparations for committing suicide.
  - 1 I have made some preparations for committing suicide.
  - 2 I have almost finished or completed my preparations for committing suicide.
- (17)
- 0 I have not written a suicide note.
  - 1 I have thought about writing a suicide note or have started to write one, but have not completed it.
  - 2 I have completed a suicide note.

- (18) 0 I have made no arrangements for what will happen after I have committed suicide.  
1 I have thought about making some arrangements for what will happen after I have committed suicide.  
2 I have made definite arrangements for what will happen after I have committed suicide.
- (19) 0 I have not hidden my desire to kill myself from people.  
1 I have held back telling people about wanting to kill myself.  
2 I have attempted to hide, conceal, or lie about wanting to commit suicide.
- (20) 0 I have never attempted suicide.  
1 I have attempted suicide once.  
2 I have attempted suicide two or more times.

If you have previously attempted suicide, please continue with the next statement group.

- (21) 0 My wish to die during the last suicide attempt was low.  
1 My wish to die during the last suicide attempt was moderate.  
2 My wish to die during the last suicide attempt was high.

## APPENDIX D

### COGNITIVE EMOTION REGULATION QUESTIONNAIRE

When you're upset, please rate how often you do the following 1 (never) to 5 (very often):

5. I often think about how I feel about what I have experienced

1      2      3      4      5

6. I often think that what I have experienced is much worse than what other people have experienced

1      2      3      4      5

7. I am preoccupied with what I think and feel about what I have experienced

1      2      3      4      5

8. I keep thinking how terrible it is what I have experienced

1      2      3      4      5

9. I want to understand why I feel the way I do about what I have experienced

1      2      3      4      5

10. I often think that what I have experienced is the worst that can happen to a person

1      2      3      4      5

11. I continually think about how horrible the situation has been

1      2      3      4      5

12. I dwell upon the feelings that the situation has evoked in me

1      2      3      4      5

## APPENDIX E

### PDA QUESTIONNAIRE VARIABLES

#### Affect Assessment

Please rate how much you are feeling RIGHT NOW from 1(low) to 10(high)

Happy  
Angry  
Excited  
Worried  
Sad  
Bored  
Numb  
Ashamed

#### Rumination Assessment

Please rate how much the following are on your mind RIGHT NOW: 1(not at all) to 10(very much so)

Current Upsetting Situation  
Upsetting Past Events  
Concerns About the Future  
The Emotions I am Feeling  
How to Solve a Problem

#### Behavior Checklist

Since the last signal have you done any of the following Behaviors? Check ALL that apply:

Binged on Alcohol  
Drove Recklessly  
Purposely Injured Self  
Went on Shopping Spree  
Used an Illicit Drug  
Binged on Food

Physical Fight with Someone  
Threw Something  
Slammed a Door  
Cried  
Yelled at Someone  
Hung up Phone on Someone  
Insulted Someone  
Begged or Pleaded with Someone  
Accused Someone  
Lost Track of Time and Place  
Your View of Yourself Changed  
A Positive Behavior

#### Interpersonal Event Checklist

Since the last signal have you experienced any of the following? Check ALL that apply:

Someone Insulted You  
Someone Rejected You  
Someone Criticized You  
Someone Ignored You  
Someone Gave you an Order  
Someone Gave you a Dirty Look  
Someone Disappointed You

#### Personal Event Checklist

Since the last signal have you experienced any of the following? Check ALL that apply:

You Failed at Something  
You Disappointed Yourself



## APPENDIX F

Office of the Vice President For Research  
Human Subjects Committee  
Tallahassee, Florida 32306-2742

### RE-APPROVAL MEMORANDUM

Date: 4/10/2009

To: Edward Selby

Dept.: PSYCHOLOGY DEPARTMENT

From: Thomas L. Jacobson, Chair

Re: Re-approval of Use of Human subjects in Research  
Contextual Features of Behavioral and Emotional Dysregulation

Your request to continue the research project listed above involving human subjects has been approved by the Human Subjects Committee. If your project has not been completed by 4/7/2010, you must request renewed approval by the Committee.

If you submitted a proposed consent form with your renewal request, the approved stamped consent form is attached to this re-approval notice. Only the stamped version of the consent form may be used in recruiting of research subjects. You are reminded that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report in writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor are reminded of their responsibility for being informed concerning research projects involving human subjects in their department. They are advised to review the protocols as often as necessary to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

Cc: Thomas Joiner, Advisor

HSC No. 2009.2391

## APPENDIX G

### INFORMED CONCENT FORM

Title of Research: Contextual Features of Behavioral and Emotional Dysregulation II

Principle Investigators: Eddie Selby, M.S., and Thomas Joiner, Jr., Ph.D.

I, \_\_\_\_\_, being 18 years of age or older, freely and voluntarily and without undue inducement or any element of force, fraud, deceit, duress, or other form of constraint or coercion, consent to be a participant in the above named research project, to be conducted at the Florida State university from March 19, 2009 through March 19, 2010. Listed below are the procedures to be followed in this research and their purposes, any risks, discomfort, and benefits associated with participation in this study, and the measures which will be taken to ensure confidentiality of the information obtained.

**Purpose of the research:** This project is being conducted by Eddie Selby, a graduate student in psychology who is being trained by Thomas Joiner, Ph.D., the Bright-Burton Professor of Psychology at Florida State University. I understand the purpose of their research project is to better understand what situational factors make people really upset and how that relates to impulsive behaviors.

**Procedures for the research:** I understand that if I have met criteria to participate in this study and that if I participate in the project I will fill out questionnaires which ask me about my feelings, thoughts, and behaviors multiple times each day on a palm pilot that will be provided to me for two nonconsecutive weeks. I understand that participation in the project involves usual procedures. Usual procedures involve signing this informed consent form and filling out the questionnaires on the palm pilot when signaled. The total time commitment will consist of about 1 month, during which time I will be signaled to answer the questions on the palm pilot 5 times each day for 16 days. I also understand that I may fill out the questionnaires when I have the desire to engage in certain target behaviors or when I am really upset. I understand that I

will be trained on how to use the palm pilot. I understand that I will be called by the primary investigator in the days before the second monitoring week begins in order to be reminded of my participation.

**Potential risks or discomforts:** I understand there is a possibility of a minimal level of risk involved if I agree to participate in this study. I might experience distress while answering questions about mental health symptoms. I understand I am able to stop my participation at any time I wish and am free to omit questions which I am not comfortable answering. At my request, I may be given a referral for mental health services. I understand that if at any point during monitoring I experience extreme distress or suicidal intent I should contact the researcher or call one of the mental health crisis lines that has been provided.

**Potential benefits to you or others:** I understand there may be societal benefits for participating in this research project. Increasing the scientific community's knowledge of how our management of emotions affects our behaviors will allow for the creation of better interventions. I also understand that I will receive monetary compensation in return for my participation.

**Confidentiality:** I understand my participation is totally voluntary and I may stop participation at any time. All my answers to the questions will be kept confidential to the full extent allowed by law. Every questionnaire I fill out will be saved in a locked file on the palm pilot that only the primary investigators will have the password to access the file in order to keep other people from viewing my answers. My name will not appear on any of the results. No individual responses will be reported. Only group findings will be reported. My confidentiality will be protected to the full extent allowed by law. The data collected from this study will be stored in a file cabinet in this lab to which only the primary investigators will have a key. The hard copies of these data will be destroyed by March 19, 2016.

I understand that this consent may be withdrawn at any time without prejudice, penalty or loss of benefits to which I am otherwise entitled. I have been given the right to ask any inquiry concerning the study. Questions, if any, have been answered to my satisfaction.

I understand that I may contact Edward A. Selby, Florida State University, Department of Psychology, for answers to questions about this research or my rights. Group results will be sent to me upon my request.

I understand that if I have any questions about my rights as a participant in this research, or if I feel I have been placed at risk, I can contact the Chair of the Human Subjects Committee, Institutional Review Board, through the Vice President for the Office of Research.

I have read and understand this consent form.

---

(Participant)

---

(Date)

## APPENDIX H

### Debriefing Form

#### **“Contextual Features of Behavioral and Emotional Dysregulation II”**

Thank you for participating in this study! The data you provided will help us gain a better understanding of emotion dysregulation, self-injurious behavior, and suicidal behavior. In the future, this knowledge may inform the creation of interventions to help with self-harming behavior and other impulsive behaviors. We realize that thinking about self-harm and emotional difficulties may be unpleasant, and that this study may have become tiresome over the last month, but hope that you find the experience of participating in this study worthwhile because you are in a literal sense helping other people!

Previous research has demonstrated that an individual’s who engage in self-harming behavior and other impulsive behaviors may do so when they are upset. This may be because these behaviors distract people from upsetting thoughts and emotions. Research has shown that the more someone thinks about how upset they are, the more upset they become. Engaging in these behaviors may be a way to stop thinking about upsetting emotions. We asked you questions and interviewed you about emotions and behaviors to determine if engaging in these behaviors actually made you feel better when upset and if you stopped thinking about your upsetting situations after engaging in these behaviors.

We plan on running more studies in the future so we ask that you please not discuss the procedures of this study with any of your classmates at FSU – they might be our future participants! If you would like to learn more about this study, or see group results once they are completed, you may contact the experimenter:

Eddie Selby

Mail: Department of Psychology, FSU, Tallahassee, FL 32306-1270

Please note that we cannot provide you with your individual responses to the questionnaires. Your responses gain meaning by looking at them relative to others' responses: individuals only score high or low on a questionnaire relative to everyone else's scores. If after this study you have concerns about your safety or mental health, please ask the experimenter for information on where you can obtain mental health services, or call any of the numbers listed below:

FSU Student Counseling Center: 850-644-2003

FSU Psychology Clinic: 850-644-3006

Helpline, a 24-hour crisis hotline, based in Tallahassee: Dial 211

Hopeline: a national suicide prevention hotline: Dial 1-800-SUICIDE

FSU Crisis Management Unit: Dial 850-644-1234

## 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.
- Abela, J. R. Z., Payne, A. V. L., & Moussaly, N. (2003). Cognitive vulnerability to depression in individuals with borderline personality disorder. *Journal of Personality Disorders*, 17(4), 319-329.
- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders*, fourth edition. Washington, D.C.: Author.
- Arney, M.F., & Crowther, J.H. (2008). A comparison of linear versus non-linear models of aversive self-awareness, dissociation, and non-suicidal self-injury among young adults. *Journal of Consulting and Clinical Psychology*, 76(1), 9-14.
- Anestis, M.D., Anestis, J.C., Selby, E.A., & Joiner, T.E. (in press). Anger rumination across forms of aggression. *Personality and Individual Differences*.
- Beck, A. T., & Steer, R. A. (1993). *Beck Scale for Suicide Ideation*. San Antonio, TX: Psychological Corporation.
- Briere, J., & Gil, E. (1998). Self-mutilation in clinical and general population samples: Prevalence, correlates, and functions. *American Journal of Orthopsychiatry*, 68, 609-620.
- Brown, M. Z., Comtois, K. A., & Linehan, M. M. (2002). Reasons for suicide attempts and nonsuicidal self-injury in women with borderline personality disorder. *Journal of Abnormal Psychology*, 111, 198–202.
- Burnham, K. P., & Anderson, D. R. (2004). Multimodel inference: Understanding AIC and BIC in model selection. *Sociological Methods and Research*, 33(2), 261-304.
- Bushman, B.J., Baumeister, R.F., & Phillips, C.M. (2001). Do people aggress to improve their mood? Catharsis beliefs, affect regulation opportunity, and aggressive responding. *Journal of Personality and Social Psychology*, 81(1), 17-32.
- Bushman, B.J., Bonacci, A.M., Pederson, W.C., Vasquez, E.A., & Miller, N. (2005). Chewing on it can chew you up: Effects of rumination on triggered displaced aggression. *Journal of Personality and Social Psychology*, 88(6), 969-983.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2<sup>nd</sup> ed.). New York: Academic Press.



- Cooper, M. L., Frone, M. R., Russell, M., & Mudar, P. (1995). Drinking to regulate positive and negative emotions: A motivational model of alcohol use. *Journal of Personality and Social Psychology*, 69, 990-1005.
- Cowdry, R. W., Gardner, D. L., O'Leary, K. M., Leibenluft, E., & Rubinow, D. R. (1991). Mood variability: a study of four groups. *American Journal of Psychiatry*, 148, 1505-1511.
- Donaldson, C. & Lam, D. (2004). Rumination, mood, and social-problem solving in major depression. *Psychological Medicine*, 34, 1309-1318.
- Duberstein, P. R., & Conwell, Y. (1997). Personality disorders and completed suicide: A methodological and conceptual review. *Clinical Psychology: Science and Practice*, 4, 359-376.
- Ebner-Priemer, U. W., Eid, M., Kleindienst, N., Stabenow, S., & Trull, T. J. (2009). Analytic strategies for understanding affective (in)stability and other dynamic processes in psychopathology. *Journal of Abnormal Psychology*, 118(1), 195-202.
- Ebner-Priemer, U. W., Kuo, J., Kleindienst, N., Welch, S. S., Reisch, T., Reinhard, I., Lieb, K., Linehan, M. M., & Bohus, M. (2007). State affective instability in borderline personality disorder assessed by ambulatory monitoring. *Psychological Medicine*, 37(7), 961-970.
- Ebner-Priemer, U. W., Kuo, J., Schlotz, W., Kleindienst, N., Rosenthal, M. Z., Detterer, L., Linehan, M. M., & Bohus, M. (2008). Distress and affective dysregulation in patients with borderline personality disorder: A psychophysiological ambulatory monitoring study. *Journal of Nervous and Mental Disease*, 196, 314-320.
- Fredrickson, B. L., & Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition and Emotion*, 19(3), 313-332.
- First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. (1997). *Structured Clinical Interview for DSM-IV Axis II personality disorders (SCID-II)*. Washington, DC: American Psychiatric Press.
- Garnefski, N., Kraaij, V., & Spinhoven, P. (2001). Negative life events, cognitive emotion regulation, and emotional problems. *Personality and Individual Differences*, 30, 1311-1327.
- Glaser, J. P., Van Os, J., Mengelers, R., & Myin-Germeys, I. (2008). A momentary assessment study of the reputed emotional phenotype associated with borderline personality disorder. *Psychological Medicine*, 38, 1231-1239.
- Hilt, L. M., Cha, C. B., & Nolen-Hoeksema, S. (2008). Nonsuicidal self-injury in young adolescent girls: moderators of the distress-function relationship. *Journal of Consulting and Clinical Psychology*, 76(1), 63-71.

- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6, 1-55.
- Hueston, W. J., Mainous, A. G., & Schilling, R. (1996). Patients with personality disorders: Functional status, health care utilization, and satisfaction with care. *The Journal of Family Practice*, 42, 54-60.
- Just, N., & Alloy, L. B. (1997). The response styles theory of depression: Tests and an extension of the theory. *Journal of Abnormal Psychology*, 106, 221-229.
- Koenigsberg, H. W., Harvey, P. D., Mitropoulou, V., Schmeidler, J., New, A. S., Goodman, M., Silverman, J., Serby, M., Schopick, F., & Siever, L. J. (2002). Characterizing affective instability in borderline personality disorder. *American Journal of Psychiatry*, 159, 784-788.
- 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.
- Lavender, A., & Watkins, E.R. (2004). Rumination and future thinking in depression. *British Journal of Clinical Psychology*, 43, 129-142.
- Linehan, M.M. (1993). *Cognitive-Behavioral Treatment for Borderline Personality Disorder*. New York: Guilford Press.
- Linehan, M. M., Comtois, K. A., Murray, A. M., Brown, M. Z., Gallop, R. J., Heard, H. L., Korslund, K. E., et al. (2006). Two-year randomized controlled trial and follow-up of Dialectical Behavior Therapy vs therapy by experts for suicidal behaviors and borderline personality disorder. *Archives of General Psychiatry*, 63, 757-766.
- Moberly, N.J., & Watkins, E.R. (2008). Ruminative self-focus and negative affect: An experience sampling study. *Journal of Abnormal Psychology*, 117(2), 314-323.
- Moskowitz, D.S., & Zuroff, D.C. (2004). Flux, pulse, and spin: Dynamic additions to the personality lexicon. *Journal of Personality and Social Psychology*, 86, 880-893.
- Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology*, 100(4), 555-561.
- Nolen-Hoeksema, S., & Harrell, Z. A. (2002). Rumination, depression, and alcohol use: Tests of gender differences. *Journal of Cognitive Psychotherapy*, 16, 391-405.
- Nolen-Hoeksema, S. & Morrow, J. (1991). A prospective study of depression and posttraumatic stress symptoms after a natural disaster: the 1989 Loma Prieta earthquake. *Journal of Personality and Social Psychology*, 61, 115-121.

- Nolen-Hoeksema, S., Stice, E., Wade, E., & Bohon, C. (2007). Reciprocal relations between rumination and bulimic, substance abuse, and depressive symptoms in female adolescents. *Journal of Abnormal Psychology, 116*(1), 198-207.
- Papageorgiou, C., & Wells, A. (2001). Positive beliefs about depressive rumination: development and preliminary validation of a self-report scale. *Behavior Therapy, 32*, 13-26.
- Russell, J.J., Moskowitz, D.S., Zuroff, D.C., Sookman, D., & Paris, J. (2007). Stability and variability of affective experience and interpersonal behavior in borderline personality disorder. *Journal of Abnormal Psychology, 116*(3), 578-588.
- Rusting, C.L., & Nolen-Hoeksema, S. (1998). Regulating responses to anger: Effects of rumination and distraction on angry mood. *Journal of Personality and Social Psychology, 74*, 790-803.
- Salovey, P. (1992). Mood-induced self-focused attention. *Journal of Personality and Social Psychology, 62*(4), 699-707.
- Selby, E.A., Anestis, M.D., Bender, T., & Joiner, T.E., Jr. (2009). An exploration of the emotional cascade model in borderline personality disorder. *Journal of Abnormal Psychology, 118*(2), 375-387.
- Selby, E.A., Anestis, M.D., & Joiner, T.E. (2008). Understanding the relationship between emotional and behavioral dysregulation: Emotional Cascades. *Behaviour Research and Therapy, 46*, 593-611.
- Sheehan, D.V., Lecrubier, Y., & Sheehan, K.H. (1998). The Mini-International Neuropsychiatric Interview: The development and validation of a structured diagnostic interview for DSM-IV and ICD-10. *Journal of Clinical Psychiatry, 59*, 22-33.
- Smith, J.M., Grandin, L.D., Alloy, L.B., Abramson, L.Y. (2006). Cognitive vulnerability to depression and Axis II personality dysfunction. *Cognitive Therapy and Research, 30*, 609-621.
- Smyth, J.M., Wonderlich, S.A., Heron, K.E., Sliwinski, M.J., Crosby, R.D., Mitchell, J.E., & Engel, S.G. (2007). Daily and momentary mood and stress are associated with binge eating and vomiting in bulimia nervosa patients in the natural environment. *Journal of Consulting and Clinical Psychology, 75*(4), 629-638.
- Steiger, H., Gauvin, L., Engelberg, M. J., Ng Ying Kin, N. M. K., Israel, M., Wonderlich, S. A., & Richardson, J. (2005). Mood- and restraint-based antecedents to binge episodes in bulimia nervosa: Possible influences of the serotonin system. *Psychological Medicine, 35*, 1553-1562.
- Thomsen, D.K. (2006). The association between rumination and negative affect: A review. *Cognition and Emotion, 20*(8), 1216-1235.

- Treynor, W., Gonzalez, R., & Nolen-Hoeksema, S. (2003). Rumination reconsidered: A psychometric analysis. *Cognitive Therapy and Research*, 27(3), 247-259.
- Trull, T.J., Solhan, M.B., Tragesser, S.L., Jahng, S., Wood, P.K., Piasecki, T.M., & Watson, D. (2008). Affective Instability: Measuring a core feature of borderline personality disorder with ecological momentary assessment. *Journal of Abnormal Psychology*, 117(3), 647-661.
- Widiger, T. A., & Trull, T. J. (1993). *Borderline and narcissistic personality disorders*. In H. Adams & P. Sutker (Eds.), *Comprehensive handbook of psychopathology* (2<sup>nd</sup> ed., pp. 371–394). New York: Plenum Press.
- Yen, S., Zlotnick, C., & Costello, E. (2002). Affect regulation in women with borderline personality disorder traits. *Journal of Nervous and Mental Disease*, 190, 693–696.

## BIOGRAPHICAL SKETCH

Edward Andrew Selby

Edward A. Selby is currently a psychology resident at Brown University – Warren Alpert School of Medicine and a doctoral candidate in clinical psychology at Florida State University. He was born and raised in Cheyenne, Wyoming. He attended the University of Wyoming, where he received a Bachelor of Science in Zoology and Physiology with a focus on neuroscience, as well as a Bachelor of Arts degree in Psychology with a minor in International - Asian Studies. He received his Master of Science degree in Clinical Psychology from the Florida State University in 2007. His research interests are primarily focused on the intersection between emotion dysregulation, suicidal and self-injurious behaviors, personality disorders, and eating disorders. His primary line of work has involved the generation and testing of a novel model of emotion dysregulation and self-sabotaging behaviors called the *Emotional Cascade Model*. He enjoys spending his free time with his wife and best friend, Calista.