Positive and Negative Emotion Vulnerability Following a Positive Mood Induction in the
Context of Borderline Personality Disorder

by

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Abstract
Studies to date have demonstrated that greater borderline personality disorder (BPD) symptom severity is related to greater negative emotional experience, and that depression, trait negative affect, and difficulties regulating emotion each play a role in this relationship. Additional research is necessary, however, to determine if positive emotional experience may be similarly affected by BPD features. In the current study, data was collected from 120 undergraduate students pertaining to baseline intensity, reactivity, and post-induction stability for both positive and negative emotion in the context of three discrete positive mood inductions. Measures of BPD and depression symptom severity, trait negative affect, and maladaptive emotion regulation were administered at baseline. It was found that greater BPD symptom severity predicted greater concurrent negative reactivity and less positive emotion decay at 3-minute follow-up. These findings may portend to intervention strategies designed to foster healthier positive emotional experience for those with BPD.
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Chapter 1
Examining Positive Emotional Experience in the Context of Borderline Personality and Depression Symptomatology

Borderline personality disorder (BPD) is a mental disorder characterized by extreme emotional lability, interpersonal difficulties, destructive impulsivity, and identity issues. More specifically, according to the Diagnostic and Statistical Manual for Mental Disorders, 5th Edition (DSM-5; American Psychological Association, 2013), a diagnosis of BPD requires five of nine possible criteria, including: frantic efforts to avoid abandonment, patterns of relationship instability, identity disturbance, potentially self-damaging acts of impulsivity, recurrent suicidal or self-harming behaviours, rapid and recurrent mood swings, chronic feelings of emptiness, intense anger, and stress-related paranoid or dissociative symptoms. Though such criteria suggest a heterogenic quality to BPD, theoretical accounts point to common symptomological factors.

1.1 The Biosocial Theory of BPD

Linehan’s (1987) biosocial theory is perhaps the most prominent of these accounts. The biosocial theory posits that BPD can be characterized as a disorder of emotion dysregulation, and that all other symptoms relate back to this core dysfunctional element. The biosocial theory further suggests that this pattern of emotion dysregulation is characterized by a combination of emotional vulnerability and a lack of a proper skillset to subsequently regulate the resulting intense emotions in an effective way. This vulnerability is believed to manifest in three ways: 1) a heightened baseline level of emotional arousal; 2) a greater amount of emotional reactivity to emotionally evocative stimuli; and 3) a slower return to baseline following stimulus response. While the theory does not clearly distinguish between positive and negative emotion with regard to the
vulnerability hypothesis, there is a clear emphasis on the latter. As such, the degree to which this theory may apply to positive emotional experience remains largely unknown.

1.2 Emotion and Emotion Regulation

Before examining these potential aspects of emotional experience within a BPD framework, an operationalization the concepts of emotion and emotion regulation is warranted to provide context and assist in distinguishing negatively and positively valenced regulatory goals. Gross (2013) describes two core features of emotion: first, emotions occur “when an individual attends to and evaluates (appraises) a situation as being relevant to a particular goal” (p. 4); second, emotions are “whole-body phenomena that involve loosely coupled changes in the domains of subjective experience, behaviour, and central and peripheral physiology” (p. 4). Taken together, this conceptualization of emotion infers that emotions take place as a response to either an internal event (e.g., a thought) or external event (e.g., a thunderclap) that is given attention and implicitly appraised, resulting in changes to physiological arousal, driving action urges, and colouring perceptions of the experience (again, both internally and externally).

Consistent with the multifaceted nature of this conceptualization of emotion, measurement of emotional experience can involve the collection of a variety of different response data (Mauss & Robinson, 2009). More specifically, while self-report measures aim to capture the experiential aspect of emotion, other techniques measure responses to meaningful stimuli by way of psychophysiological responding (e.g., increases or decreases in autonomic nervous system [ANS] activity). The ANS as a whole is multi-purpose system responsible for the regulation of a variety of bodily systems, including heart rate, respiration, digestion, and urination (Robinson, Biaggioni, Burnstock, & Low,
2004). At the same time, the two branches of this system – the parasympathetic and sympathetic nervous systems – are each uniquely associated with various aspects of emotional responding. Specifically, the sympathetic system is tied to emotional activation (e.g., the “fight or flight” response associated with perceived threat or danger) (Dawson, Schell, & Filion, 2007). Conversely, the parasympathetic system is associated with relaxation, sexual arousal, and positive emotion more generally (Gruber, Dutra, Eidelman, Johnson, & Harvey, 2011; Mauss & Robinson, 2009). Given these associations, methods of measuring activity with respect to these systems, in addition to one’s self-described emotional experience, may add to the overall picture of the emotion response. As such, in the context of the biosocial theory, measurements of psychophysiological arousal at baseline and following exposure to evocative stimuli (i.e., emotional reactivity) should provide additional insight into these aspects of emotion vulnerability.

Two techniques of assessing psychophysiological arousal specific to the ANS include the measurement of respiratory sinus arrhythmia (RSA) and galvanic skin response (GSR). RSA reflects a high-frequency portion of the spectrum of heart rate variability connected to changes in respiratory patterns, which is directly tied to activation of the vagus nerve, otherwise known as vagal tone (Allen, Chambers, & Towers, 2007; Grossman & Taylor, 2007). Research suggests that vagal tone is determined by the parasympathetic branch of the autonomic nervous system (Berntson, Cacioppo, & Quigley, 1993). Oveis et al. (2009) examined correlates of resting RSA (i.e., measured while the participant is seated, no tasks) among a sample of 80 college students, finding that RSA_{REST} was positively associated with trait measures of positive
mood. In addition, RSA_{REST} was also found to be significantly positively correlated with positive emotional reactivity to a neutral stimulus, but not with positive reactivity to discrete positive mood induction stimuli. Building on these findings, Wang, Lü, and Qin (2013) found that trait positive (but not negative) affect and positive emotion expressivity (i.e., physically demonstrating positive emotionality) each correlated positively with RSA as measured when participants viewed a neutral stimulus. Gruber, Dutra, Eidelman, Johnson, and Harvey (2011) found that exposure to happy films (for both a bipolar disorder group and control group) produced greater vagal tone, greater self-reported positive emotion, and greater displays of positive emotion (using facing behaviour coding). In the context of BPD, Austin, Riniolo, and Porges (2007) found that individuals with BPD responded to video clips (negative and neutral) with greater decreases in RSA as compared to controls, suggesting that this population may have a greater propensity toward vagal withdrawal, at least to negative or neutral stimuli.

GSR, conversely, is a measure of electrical conductance of the skin (i.e., electrodermal activity), which varies based on sweat gland activation, and has been found to be reflective of sympathetic nervous system activation (Dawson, Schell, & Filion, 2007). Reagh and Knight (2013) examined GSR in response to a startle probe (in this case, a loud noise) while being exposed to both positive and negative emotional stimuli among a sample of undergraduate students. It was found that greater GSR was elicited during the negative but not positive stimulus exposures as compared to baseline. In exploring the coherence among emotion experience, behaviour, and physiology among a sample of female undergraduates, Mauss, Levenson, McCarter, Wilhelm, and Gross (2005) found that physiology, including heart rate and GSR, was found to be modestly
associated with continuous self-reported levels of emotional reactivity when participants were exposed to amusement- and sadness-inducing film stimuli. Other studies have found that self-reported emotional arousal in response to picture stimuli (but not valence) was strongly positively associated with GSR (Greenwald, Cook, & Lang, 1989; Lang, Greenwald, Bradley, & Hamm, 1993). Given the role that psychophysiological responses play in emotional responding, a multimodal method in examining emotional experience may provide a more comprehensive picture of emotion vulnerability.

Emotion *regulation*, which may share a unique association with emotion vulnerability, refers to “shaping which emotions one has, when one has them, and how one experiences or expresses these emotions” (Gross, 2013, p. 6). Emotion regulation, in this context, is conceptualized as being comprised of several core features, including the activation of a goal to modify the emotional process, engagement with processes that are seen as responsible for altering emotion (which exist along a continuum from explicitly/consciously to implicitly/automatically), and the impact of this engagement on emotional experience (including latency, magnitude, and duration). In this sense, the biosocial theory of dysregulation in BPD points to both disordered emotional experience and failed regulation attempts that serve to maintain or exacerbate these features of experience. Both positive and negative emotions have unique relationships to mental health and well-being, as well as their own regulatory goals (Carl, Soskin, Kerns, & Barlow, 2013), therefore warranting independent consideration. Two common goals of regulation involve decreasing (“down-regulating”) negative emotions and increasing (“up-regulating”) positive emotions. Because positive emotional experience has been less studied, it remains to be seen whether pervasive aspects of dysfunctional regulatory
efforts that have been found in relation to negative emotions (e.g., experiential avoidance) may exist in both contexts.

The current study will first review the literature pertaining to negative emotional experience in the context of BPD symptomatology, including relevant dysfunctional regulatory processes. The role of depression in relation to BPD will subsequently be addressed, including the potential shared element of negative affect. Literature pertaining to positive emotional experience in relation to depression and BPD will then be reviewed separately, as it may differ from that of negative emotion in terms of impact and vulnerability factors.

1.3 Negative Emotional Experience in BPD

Relative to positive emotion, negative emotional experience has been given considerably more attention in the context of BPD. Many of these studies have looked at negative emotion in the context of dysregulation, and some with particular regard to emotional vulnerability in the context of the biosocial theory. Kuo and Linehan (2009), for example, used a multimodal method to test two aspects of emotional vulnerability in BPD: baseline emotional intensity and emotional reactivity to a negative mood induction. Data pertaining to both self-report and physiological measures of emotion were collected from individuals meeting criteria for BPD or social anxiety disorder, as well as a group of matched controls. Results demonstrated support for heightened baseline intensity of negative emotion among the BPD group via self-report ratings, in addition to higher GSR levels. The BPD group, however, did not exhibit greater levels of emotional reactivity on either self-report or physiological measures (RSA and GSR).
Schmahl et al. (2004) examined psychophysiological responses to scripts involving themes of trauma and abandonment in BPD and posttraumatic stress disorder (PTSD). Using measures of heart rate, GSR and blood pressure, it was found that those with BPD were more likely to show greater GSR in response to the abandonment-themed scripts. While the BPD group and PTSD group did not differ at baseline on any measures, there was no healthy control group to make comparisons with regard to baseline arousal levels, which could limit the interpretations in the context of the biosocial theory.

In another study that examined ANS activity among a BPD sample, Weinberg, Klonsky, and Hajcak (2009) measured parasympathetic activity via RSA and sympathetic activity via cardiac sympathetic index (CSI), also derived from heart rate variability. Measures were collected at baseline and during a stressor task for both a BPD and control group. Results indicated that the BPD showed lower parasympathetic activity overall but the stressor task did not impart any between-groups differences. The BPD group was also found to exhibit greater overall sympathetic activity, and a greater increase from the first half of the stressor to the second half (the control group, in fact, showed a decrease in CSI in this context).

These findings have also been replicated by Feliu-Soler et al. (2013), who presented a negative mood induction to patients with BPD and healthy controls by way of standardized unpleasant imagery. Levels of emotion were measured via self-report and levels of both salivary cortisol and alpha-amylase. Higher cortisol levels are associated with greater stress responses, while alpha-amylase is used as an indirect measure of sympathetic nervous system activity, an indication of emotional arousal. The BPD group was found to have lower levels of cortisol but higher levels of alpha-amylase at baseline.
In addition, the BPD group reported greater emotional intensity at baseline, but did not report greater reactivity to the negative stimuli. Taken together, these results suggest that heightened emotional reactivity may not be a universal hallmark of the disorder. It may be that heightened reactivity may pertain to a specific type of particularly evocative stimuli, though this remains to be verified.

More recently, studies have begun to examine the third theoretical component of emotion vulnerability – a slower return to emotion baseline. Scheel et al. (2013) looked specifically at the discrete emotion of shame while comparing a BPD group to a group of depressed individuals and a group of healthy controls. The groups were compared in terms of self-reported intensity of shame at baseline, in response to a shame induction (a story about a job interview gone awry), and with regard to their return to baseline following the induction. Ratings of anger, annoyance, anxiety, sadness, joy, and boredom were also collected at five different time points during the experiment. It was found that the BPD groups reported higher baseline levels of all emotions but boredom compared to controls, and reported greater baseline shame and sadness compared to the depressed group. However, the BPD group did not show greater net reactivity or a slower return to baseline compared to the other groups, except in terms of greater anger reactivity. Ebner-Priemer et al. (2015) examined emotional baseline, reactivity, and return to baseline using an experience sampling method. In three separate studies, individuals with BPD and healthy controls completed an electronic diary of emotional responding over a 4-day period. Results demonstrated support for all aspects of the biosocial theory, though indicators of a slower return to baseline were less robust. Fitzpatrick and Kuo (2015) looked specifically at return to baseline in a study comparing a BPD group to a group of
individuals with social anxiety disorder and a healthy control group. Using a multimodal method of emotion measurement (RSA, GSR, self-report), the authors found that the BPD group did not differ significantly with regard to rate of return to emotional baseline, but the BPD group did exhibit lower RSA in the recovery period following an anger mood induction. These findings suggest that individuals with BPD may not show a pronounced difference in their emotional recovery in the context of negatively valenced affect, though more research is warranted to better elucidate if such a pattern exists.

Other studies have examined the role of maladaptive emotion regulation in the context of BPD, particularly with regard to two similar processes: *experiential avoidance* and *suppression*. Experiential avoidance is a term first coined by Hayes and Wilson (1994) that refers to behaviour (either internal or external) that functions to avoid or escape from unwanted experiences. Similarly, suppression can refer to attempts to avoid or reduce unwanted emotions, thoughts, or emotion-expressive behaviours. They may both be seen as antithetical to *acceptance*, which in the context of emotions refers to a nonjudgmental allowing or “taking in” of emotional experience, be it positive or negative (Blackledge & Hayes, 2001).

Chapman, Dixon-Gordon, and Walters (2011) reviewed possible connections between BPD and experiential avoidance in the literature, with particular regard to how it may tie in to emotional vulnerability and emotion dysregulation in the context of the biosocial theory. The authors suggest that emotion regulation skills deficits among those with BPD (as evidenced by maladaptive behaviours in response to emotional distress, as opposed to healthy coping strategies) increase the likelihood of experiential avoidance among this population. In an examination of both experiential avoidance and emotion
dysregulation among a sample of young adult outpatients with BPD symptoms, Iverson, Follette, Pistorello, and Fruzzetti (2012) had participants complete measures of both constructs in addition to measures of depression and distress tolerance. Analyses revealed that scores on measures of both experiential avoidance and emotion dysregulation were significantly associated with BPD symptoms; only experiential avoidance was significantly associated with BPD symptom severity after controlling for depressive symptomatology.

While the implications for how these constructs may mediate the relationship between BPD symptoms and emotional experience remain unclear, results suggest that maladaptive emotion regulation strategies like experiential avoidance have relevant implications regarding the predictive relationship between BPD and maladaptive emotional patterns.

1.4 BPD, Depression, and Trait Negative Affect

When considering emotional dysfunction in BPD, it is also important to acknowledge the potential role of depression. Depression is primarily characterized by pervasive low mood, a loss of interest or pleasure in activities that are normally enjoyable, or both of these symptoms (American Psychological Association, 2013). Studies have consistently demonstrated that BPD and depression are highly comorbid (e.g., Shea, et al., 2004). Grant et al. (2008) reported lifetime comorbid depression among individuals with BPD to be 32.1%. This study also found that lifetime comorbidity of any mood disorder (including depression, dysthymia, and bipolar disorders) among individuals with BPD to be 75%. Furthermore, Klein and Schwartz (2002) examined this relationship in the context of BPD and co-occurring dysthymia, finding that the best
fitting of four models tested was one that suggested a common underlying factor, indicating partial overlap to the underlying mechanisms of each disorder. Given this overlap, depression and its related symptoms must be considered when examining emotional experience in the context of BPD. As such, common elements of BPD and depression may be relevant to understanding positive emotional experience in the context of BPD.

Some research suggests that negative affect may be a potentially unifying element of depression and BPD (Clark, 2005). Rosenthal, Cheavens, Lejuez, and Lynch (2005) extended research surrounding suppression and BPD symptoms to include the possible role of negative affect. Results indicated that negative affect intensity was a strong predictor of BPD symptoms, and that thought suppression mediated this relationship. Furthermore, Salsman and Linehan (2012) examined the relationships among negative affect, emotion regulation difficulties, and BPD features. Results indicated that emotion regulation difficulties, particularly with regard to skill deficits, had significant indirect effects on BPD features when accounting for negative affect intensity and negative emotional reactivity. These findings demonstrated that emotion regulation difficulties were specific to BPD symptomatology above and beyond what was common to negative affect.

Cheavens et al. (2005) examined thought suppression in relation to parental criticism, negative affect, and BPD features in a sample of college students. In demonstrating the potential detrimental impact of this maladaptive emotion regulation approach, results showed that thought suppression fully mediated the relationship between BPD features and negative affect. Cheavens and Heiy (2011) examined
dimensions of affect (valence and intensity) and avoidance (i.e., experiential avoidance and suppression) in relation to both depression and BPD symptoms. Negative affect was found to be related to both depressive and BPD symptoms, supporting the notion that this may be representative of a temperament common to both disorders. Positive affect, conversely, was only related to depression symptomatology, while affect intensity was only related to BPD features. Avoidance was found to partially mediate the relationship between negative affect and symptomatology in both the depression and BPD models.

This research suggests that both depression and negative affect have conceptual overlap with BPD symptomatology. As such, these two factors may be responsible for part of the relationship between BPD symptoms and emotional experience, at least with regard to negative emotional intensity. In light of this possibility, it may be of value to examine the unique predictive value of each of these variables when examining emotion vulnerability. In addition, maladaptive emotion regulation strategies like experiential avoidance may mediate these relationships, and therefore also warrants consideration when attempting to elucidate how these pathological constructs may influence emotional experience.

1.5 Positive Emotion and BPD

While much research has been devoted to understanding the negative emotional experiences often related to BPD, less is known about BPD in relation to positive emotional experience. Despite this current disparity, research suggests that healthy positive emotional experience plays an important role in well-being and merits further consideration. For example, Catalino and Frederickson (2011) examined the role of positive emotional reactivity in optimal mental health. The authors found that individuals
who reported greater day-to-day “boosts” in positive emotion in response to pleasant events were more likely to be classified as flourishers (i.e., those in a state of optimal mental health). In addition, it was found that greater reactivity in these day-to-day positive events predicted higher levels of mindfulness, and that mindfulness was associated with greater post-study flourishing after controlling for baseline levels. Other research has shown that happiness and trait positive affect lead to greater workplace success, better health, and greater success across multiple life domains (Boehm & Lyubomirsky, 2008; Lyubomirsky, King, & Diener, 2005; Pressman & Cohen, 2005).

Furthermore, Diener and Seligman (2002) found that higher levels of happiness correlated with stronger romantic relationships and other social relationships. Adding to these findings, Nelson and Sim (2014) tested the effects of generated positive affect on social problem solving. It was found that participants who received a positive mood induction generated more steps to solving a hypothetical interpersonal problem and more solutions to their own self-described social problems. These results may have particular relevance to a BPD population, as interpersonal difficulties are a core feature of the disorder. Also related to BPD symptoms, Victor and Klonsky (2014) examined daily emotion in individuals who engaged in nonsuicidal self-injury, a maladaptive behavioural form of emotion regulation that is common among those with the disorder. It was found that individuals who self-injured experienced more negative emotion as compared to controls, but also reported less positive emotion, suggesting this may be a potential vulnerability factor. Reed, Fitzmaurice, and Zanarini (2012) examined positive states of individuals with BPD over a 10-year period, finding that recovered patients reported more positive states as compared to those who had not recovered. Taken together, these
findings suggest that positive affect and positive emotional reactivity are important aspects of psychological, occupational, and social wellbeing, and therefore merit their own consideration in the context of emotional disorders like BPD.

Despite this merit, studies examining positive emotional experience specifically have only emerged in the last several years. Herpertz, Kunert, Schwenger, and Sass (1999) may have been the first to do so, examining experiential (self-report) and physiological reactions of BPD patients and healthy controls in response to pleasant, neutral, or unpleasant picture slides. The BPD group reported the pleasant slides to be significantly less pleasant as compared to controls. It was also noted that the groups did not differ with regard to self-report or physiological measures of emotion/arousal at baseline. Further to this, Herpertz et al. (2000) compared a group of female patients with BPD to a group with avoidant personality disorder and a control group using a similar experimental design. Once again, no differences were seen at baseline for self-reported emotion, GSR, or heart rate, and the BPD group reported more negative emotion experience in response to the pleasant slides. Interestingly, the BPD group also exhibited lower GSR across all three (positive, neutral, negative) picture categories relative to the other groups.

Staebler, Gebhard, Barnett, and Renneberg (2009) examined emotional reactivity to both positive and negative film stimuli among an inpatient sample meeting criteria for either BPD or depression, plus a control group. Of note, 63% of the BPD patients also met criteria for major depressive disorder. Participants rated levels of the following discrete emotions prior to and immediately following a mood-inducing film segment: contempt, anger, disgust, loneliness, despair, fear, sadness, hurt, affection, amusement,
contentment, and surprise. Negative emotions were separated into either “self-focused” (loneliness, despair, fear) or “other-focused” (contempt, anger, disgust). Groups did not differ at baseline with regard to other-focused negative emotions, but both clinical groups reported significantly greater self-focused negative emotions and significantly lower positive emotions compared to controls. As well, the BPD group displayed the lowest ratings of positive emotion of the three groups, though scores did not differ significantly from the depression group. For the positive mood induction, all groups reported higher positive emotion scores relative to baseline. In addition, self-focused negative emotions decreased following the positive stimulus exposure. This study again supports the notion that individuals with BPD do not exhibit greater emotional reactivity, and this was demonstrated for both negative and positive emotions.

Jayaro et al. (2011) showed a series of pleasant, unpleasant, or neutral images to a group of non-depressed individuals with BPD and a control group. Images were rated in terms of arousal, valence, and dominance. Results showed that the BPD group reported greater arousal toward unpleasant and neutral images, but more positive emotion for these images. In terms of positive images, the BPD group reported significantly lower dominance ratings (i.e., greater insecurity and discomfort) as compared to controls. These results suggest that individuals with BPD are less comfortable experiencing positive emotions, a finding that provides context for any avoidance responses that may ensue. This result also suggests that those with greater BPD symptomatology may be more inclined to down-regulate rather than up-regulate positive emotions.

Elices et al. (2012) showed six discrete emotion-eliciting film clips to women with BPD and matched controls. Each film was selected to elicit one of: anger, fear,
sadness, disgust, amusement, and shame, plus one neutral clip. A multimethod approach was used, including self-report measures, heart rate, and GSR. Regarding the amusement induction in particular, results showed that the BPD group did not differ from controls in terms of positive reactivity, but also reported significantly greater levels of anger, anxiety, and disgust. This finding suggests that individuals with BPD may exhibit a greater constellation of emotional reactivity to positive stimuli, including more negative emotions, though replication of this result is needed. It also may be that the specific stimulus chosen, a clip of a man fighting with a small dog, could contain elements that evoke more negative response patterns for individuals with BPD. Other research, however, has shown some tangential support for the constellation theory. Napolitano and McKay (2007) found that participants with BPD exhibited highly polarized positive and negative evaluations of characters in a positive film scene, and that these evaluations were tied to self-reported emotions. More research may be of value to determine whether this theory holds true.

Using an ambulatory monitoring approach, Ebner-Priemer et al. (2007) compared individuals with BPD to healthy controls who were asked to provide subjective reports of their emotional experience over a 24-hr period while ambulatory equipment collected physiological data (heart rate and physical activity). It was found that the BPD group reported significantly more specific negative emotions and significantly fewer positive emotions. The overall intensity of emotions reported (independent of valence) was also found to be higher in the BPD group, though this difference was not maintained when only looking at positive emotions. With regard to physiological measurements, it was found that the BPD group also exhibited a higher metabolic heart rate increase,
suggesting greater sympathetic arousal, but this finding was less robust as medication played a confounding role. It was also noted that individuals with BPD were more likely to report the concurrent presence of multiple emotions, though they were not more likely to report both positive and negative emotions at the same time.

In the first of two studies to examine experiential avoidance with regard to positive emotional experience in the context of BPD, Beblo et al. (2013) administered measures of emotion suppression and emotion regulation difficulties to BPD patients and matched controls. Findings confirmed that BPD patients reported greater attempts to suppress both negative and positive emotions relative to controls, and these results were confirmed for patients with or without a concurrent mood disorder (e.g., depression). Further to this, Jacob, Ower, and Buchholz (2013) examined the potential roles of experiential avoidance and BPD features in experiencing positive emotions through a path analysis approach. Participants completed measures of BPD symptomatology, trait positive and negative affect, experiential avoidance, and general psychopathological symptoms. Participants were also shown two positive emotion-inducing film clips, and asked to rate discrete emotional responses (joy, fun, anxiety, and sadness) on a visual analog scale both prior to and following each clip. Three models were tested using path analyses to determine best fit. Results showed that trait positive emotion and increases in joy and fun scores following the film clips were all significantly predicted by experiential avoidance, and that experiential avoidance was itself predicted by BPD features, general psychopathology and trait negative affect. These studies provide strong support that experiential avoidance does not just play a role in negative emotional experience in the context of BPD, but also factors in to positive emotion experience as well.
1.6 Positive Emotion and Depression

As mentioned, given the comorbidity between BPD and depression, there may be common underlying elements to both disorders that contribute to negative emotional experience. With these common factors in mind, it may be prudent to examine whether depression accounts for any observable relationship between positive emotional experience and BPD. Several studies have examined depression in relation to positive emotional experience. In a meta-analysis of emotional reactivity in depression, Bylsma, Morris, and Rottenberg (2007) reviewed 19 laboratory studies that compared individuals with major depressive disorder with controls on reactivity to both positive and negative stimuli. In doing so, the authors tested three competing theories regarding the ways individuals with depression may differ in these contexts: positive attenuation, negative potentiation, and emotion context insensitivity (ECI), which refers to both positive and negative reactivity attenuation. Results supported the ECI theory, with a particularly robust effect size for reduced positive reactivity. Of note, however, support for attenuated positive reactivity came primarily from studies using self-report data, and was non-significant based on pooled data from four studies that employed physiological measurements of emotional response.

Further to these findings, Gruber, Oveis, Keltner, and Johnson (2011) looked at associations between depression and discrete trait and state positive emotions using both self-report and psychophysiological measurements of emotional response (specifically, heart rate, RSA, and GSR). For both trait and state measurements, the authors looked specifically at three functionally distinct positive emotions: pride, happiness, and amusement. It was found that depression was related to lower trait pride, and that trait
positive emotional experience was most attenuated in the depressed group as compared to controls. These findings suggest that particular emotions that fall within the umbrella of positive affect may be differentially affected by symptoms of depression.

1.7 Current Study

The current study examined positive emotional vulnerability using the framework of Linehan’s biosocial theory, with specific regard to baseline emotional intensity, emotional reactivity, and emotional stability (degree of return toward emotional baseline). This study also explored the potential role of maladaptive emotion regulation in the relationship between BPD symptoms, depression symptoms, trait negative affect, and positive and negative emotion vulnerability in response to three positive mood inductions. This study employed a multimethod approach in order to best encapsulate the full emotional experience. As such, emotion vulnerability was examined in the context of both experiential and psychophysiological measurements. In addition, video stimuli, selected to elicit a variety of discrete positive emotions, were used with the intent of gaining a more comprehensive understanding of potential areas of vulnerability. An analog sample was used, where BPD and depression symptoms were measured dimensionally rather than dichotomously.

Given that the current study examined vulnerability in a positive emotion context, it is worth noting that differences in emotion regulatory efforts were expected. Specifically, because positive emotion is typically deemed more desirable, dysregulation in this context would likely infer an inability to up-regulate or maintain positive emotion rather than down-regulate a negative emotional response. Nevertheless, similar trait deficits in emotion regulation (i.e., a tendency to engage in maladaptive strategies) may
play a role regardless of emotional valence. This study will be the first to examine emotional stability immediately following a positive mood induction, with the intent of providing some insight into the effects of any regulatory responses (either implicit or explicit) that may be triggered by initial emotional reactivity. Emotion stability (or conversely, emotion decay) over time may be tied to emotion regulation more than baseline or reactivity if specific regulatory processes need to unfold temporally in order to go from a reactive state back to the emotional baseline.

The present study had three main objectives: (1) To compare three competing models of emotion vulnerability in the context of both positive and negative emotion in response to positive stimuli; (2) to elucidate how self-reported levels of BPD symptom severity, depression symptom severity, and trait negative affect may predict positive and negative emotion vulnerability (i.e., emotional intensity at baseline, emotional reactivity to emotional stimuli, and stability of positive emotions over time) in response to positive stimuli; and (3) to determine what role maladaptive emotion regulation plays in these relationships.

1.8 Hypotheses

Broadly, it was hypothesized that measures of BPD symptom severity, depression symptom severity, and trait negative affect would each uniquely predict both positive and negative emotion vulnerability. More specifically, in the case of positive emotion, greater vulnerability would represent lower baseline levels, lower reactivity, and greater return toward baseline at 3-minute follow-up). With the regard to negative emotion, greater vulnerability would refer to a higher baseline, greater reactivity, and more stability over time (less of a return toward baseline). As such, it was believed that greater BPD
symptom severity would uniquely predict greater positive and negative vulnerability in response to positive stimuli. Because the study employed a positive mood induction, support for a relationship with negative vulnerability, and reactivity in particular, would also provide additional evidence for the constellation theory (i.e., individuals with BPD may be more likely to experience a greater range of emotions in response to positive stimuli, including both positively and negatively valenced affect). In addition, it was hypothesized that a latent construct that encapsulated maladaptive emotion regulation (i.e., a greater tendency to use maladaptive regulation strategies, including experiential avoidance and suppression) would act as an intervening variable in the relationships between BPD symptom severity, depression symptom severity, and trait negative affect on one hand, and emotion vulnerability on the other.

To test these main hypotheses, three separate measurement models were proposed and compared, in order to best account for the structure of emotion vulnerability for both positive and negative emotion (see Figures 2-4). In keeping with the context of the biosocial theory, it was believed that emotion vulnerability for both negative and positive emotion would be best represented by a three-factor solution, with each factor representing the individual components of the construct (i.e., baseline, reactivity, and return to baseline). Again, both experiential and physiological measurements of emotion were included in each model tested, with the postulation that these different aspects of emotional experience would converge to some degree. RSA was included with models positive emotion, as it was hypothesized to be associated with this type of response, as found in similar paradigms (e.g., Gruber, Dutra, Eidelman, Johnson, & Harvey, 2011). GSR was hypothesized to be associated with negative response to positive stimuli, as it
has been found to be positively associated with baseline negative emotion in a BPD sample (e.g., Kuo & Linehan, 2009), and is reflective of overall emotional arousal in response to both positive and negative stimuli (e.g., Lang, Greenwald, Bradley, & Hamm, 1993).

Chapter 2
Methods and Results

Method

2.1 Participant Characteristics

One hundred twenty individuals between the ages of 17 and 37 completed the study, with 87.5% of the sample being 20 years of age or younger ($M = 19.08$ years, $SD = 2.35$). Of the total sample, 60% were female, 54.2% reported English to be their first language, and 48.3% reported Canada to be their place of birth. The ethnicity of the sample was comprised as follows: 12.5% East Asian, 16.7% South East Asian, 23.3% South Asian, 8.3% Black (African), 1.7% Black (Caribbean), 2.5% Black (North American), 4.2% Indian (Caribbean), 1.7% Latin American, 5.8% Middle Eastern, 11.7% White, and 7.5% of mixed background, with 2% of participants declining to answer.

Thirteen individuals (10.8% of the sample) reported that they were currently taking medication. Participants were also asked to rated their baseline subjective energy level ranging from 0 (No energy) to 7 (The most energy I have ever felt). Mean energy level was found to be 3.68 ($SD = 1.21$).

2.2 Sampling Procedures

All participants were students enrolled in an introductory psychology class at the University of Toronto Scarborough (UTSC). Students were recruited through The Online Pool System (TAPS), a computerized registration system that allows those seeking credit
to find and enroll in studies being offered on campus. All participants received two TAPS credits for participation. The research protocol was approved by the Social Sciences, Humanities and Education Research Ethics Board at the University of Toronto and all testing took place in a quiet room in the Personality, Psychopathology, and Psychotherapy Laboratory on the UTSC Campus. There were no inclusion criteria for this study. One exclusion criterion, international student status, was chosen because a pride induction video used in the current study involving Canadian themes and likely would not have had the desired effect on students visiting from abroad. This screening question was completed and reviewed prior to study enrollment.

2.3 Sample Size

Because the current study employs a structural equation modeling-based analytic approach, the intended sample size was calculated by virtue of the number of indicators per latent factor in the hypothesized models in addition to the hypothesized factor loadings for each indicator (Gagné & Hancock, 2006). Two latent factors were hypothesized – emotion regulation difficulties and emotion vulnerability. There were three indicators for the latent emotion regulation difficulties factor, with estimated factor loadings of 0.6 based on their theoretical overlap. There were 14 indicators each for positive and negative emotion vulnerability, with estimated factor loadings of 0.4. Taken together, based on the recommendations of Gagné and Hancock (2006), a sample size of 100 was determined to be satisfactory. The current study included a total of 120 with the expectation that not all participants would take part in psychophysiological data collection and not all RSA and GSR raw data would be of high enough quality to be included in analyses.
2.4 Measures

2.4.1 Demographics Form. Demographic information was collected, including age, sex, English as a first language, Canadian nationality, race/ethnicity, energy level, and medication usage. Energy level was measured on a Likert scale ranging from 0 (No energy) to 7 (The most energy I have ever felt).

2.4.2 Emotion Rating Form. The Emotion Rating Form used for this study employed a visual analogue scale (VAS) that was intended to measure acute emotional intensity. The respective scales for each discrete emotion ranged from Not at all to Extremely. As part of the instructions for this measure, participants were advised that the end point represented by Not at all referred to “Not feeling even the slightest bit of the emotion,” while the end point represented by Extremely referred to “The most you have ever felt the emotion in your life.” These instructions were consistent with Gross and Levenson (1995) who provided similar instructions when validating film clips as emotion-eliciting stimuli. Eight discrete emotions were measured in the current study, three positively valenced (amusement, joy, and pride), and five negatively valenced (anxiety, sadness, anger, disgust, and shame). These emotions were selected to provide a broad range of both positive and negative emotional responses while also minimizing the time required to complete the form. The VAS measured 10 centimetres, and a score out of 10 was obtained based on the distance from the left endpoint of the scale to a tick mark placed on the line by the participant representing their self-perceived emotional experience. Ratings were measured to the nearest millimetre, and completed independently by two research assistants to ensure accuracy. If measurements differed by more than 1 mm, the rating
was re-measured and corrected as needed. Following this procedure, an average was obtained for all measurements across raters.

2.4.3 Borderline Symptom List-23. The Borderline Symptom List-23 (BSL-23; Bohus et al., 2009) is a measure of BPD symptom severity that contains 23 items pertaining to relevant thoughts or feelings experienced in the last week. The measure also includes an overall rating of the quality of one’s personal state in the last week, with response options ranging from 0% (absolutely down or very bad) to 100% (excellent). In addition, a supplement is included in addition to the measure that consists of 11 items pertaining to BPD-related behaviours that were engaged in over the last week. Items 18, S2, S3 were omitted in the current study as they contain information pertaining to suicidality and were not approved by the REB. Internal consistency for the measure (excluding the supplement) is excellent with $\alpha$ coefficients ranging from .94 to .97 (Bohus et al., 2009). In the current study, internal consistency was found to be .94 for the measure and .52 for the supplement (see Table 2 for a full list of baseline measures and psychometric properties). For the current study, a total BSL score was obtained by standardizing and summing the total scores from the main measure and the supplement respectively.

2.4.4 Beck Depression Inventory-II. The Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996) is a 21-item questionnaire designed to measure severity of depression symptomatology. Internal consistency has found to be high ($\alpha = .91$) (Beck, Steer, Ball, & Ranieri, 1997). Item 9 was omitted as it pertains to suicidality and was not approved by the REB. The version used for the current study had an internal consistency of .92.
2.4.5 Positive and Negative Affect Schedule. The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) is a 20-item self-report measure consisting of two scales: Positive Affect (PA) and Negative Affect (NA). Items consist of specific emotions (e.g., Interested, Distressed, etc.) and are scored based on the extent they are felt (either in the present moment or over a period of time) on a scale ranging from 1 (very slightly or not at all) to 5 (extremely). For the current study, participants were asked to rate items based on the past week in order to get a better sense of trait-level affect. Alphas have been shown to be good for both scales (α = .86 for PA; α = .87 for NA), and test-retest reliability over an 8-week span was found to be .47 for both PA and NA scales based on these time instructions (Watson, Clark, & Tellegen, 1988). Internal consistency for the NA scale used in the current study was found to be .85.

2.4.6 Difficulties in Emotion Regulation Scale. The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) is a self-report scale containing 36 items. The measure includes six subscales: Nonacceptance of emotional responses, difficulty engaging in goal-directed behavior, impulse control difficulties, lack of emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity. A total score can also be obtained for an overall measure of emotion regulation difficulties; this total will be used for the current study. Internal consistency for the scale as a whole is very good (α = .93) (Gratz & Roemer, 2004). Internal consistency was found to be .93 for the current study as well.

2.4.7 Acceptance and Action Questionnaire-II. The Acceptance and Action Questionnaire (AAQ-II; Bond et al., 2011) is a 7-item, one factor self-report measure that assesses psychological inflexibility (i.e., experiential avoidance). Items are scored on a 7-
point Likert scale ranging from 1 (never true) to 7 (always true). The measure has shown good reliability (mean $\alpha = .84$) and good concurrent and discriminant validity (Bond et al., 2011). For the current study, $\alpha$ was calculated to be .93.

### 2.4.8 White Bear Suppression Inventory

The White Bear Suppression Inventory (WBSI; Wegner & Zanakos, 1994) is a 15-item self-report measure designed to assess a general tendency to avoid or suppress thoughts. Alphas have shown to range from .87 to .89, indicating good internal consistency (Wegner & Zanakos, 1994). The alpha for the current study was found to be .92.

### 2.4.9 Psychophysiological Measurements

Autonomic arousal was assessed in two ways: RSA (parasympathetic nervous system activation), and GSR (sympathetic nervous system activation). Both measures of autonomic arousal were collected using BIOPAC Technologies hardware, Model MP45 (BIOPAC Technologies, Goleta, CA). RSA was measured by way of electrocardiogram (ECG) data, via electrodes attached to the wrist of the nondominant arm and both ankles. GSR was measured by way of electrodermal response (EDR; measured in microsiemens), via electrodes attached to the base of the palm of the nondominant hand. Gain was set at 5000 for both ECG and EDR.

Log RSA and GSR values were used in all analyses. Log RSA was calculated using QRS Tool (Version 1.2.2) and CMetX (Version 2.63) software (Allen, Chambers, and Towers, 2007). For each participant, individual heart beats were identified by flagging R spikes in the electrocardiogram (ECG) data. Once each beat was identified, interbeat interval (IBI) values for baseline and reactivity were obtained for one-minute epochs beginning at the 10 s mark of each video and ending at the 70 s mark of each video. (denoted as RSA$_1$ and GSR$_1$, respectively). The baseline values (RSA$_{N1}$ and
GSR\textsubscript{N1}, respectively) were determined using the IBI series during the Neutral video stimulus. Separate one-minute epochs were obtained for the minute-long period that began exactly 1 min 50 s following the end of the video and ended 2 min 50 s post-video (denoted as RSA\textsubscript{2} and GSR\textsubscript{2}, respectively). Once each epoch was determined, calculations for corresponding RSA values were computed by exporting the heart beat interval data via CMetX software into an output file (see Allen, Chambers, and Towers, 2007). The software calculated the natural log of the band-limited (.12-.40 Hz) time-sampled IBI series. Log RSA values (measured in ms\textsuperscript{2}) measured post-video (RSA\textsubscript{2}) were subtracted from values measured during the video (RSA\textsubscript{1}) to obtain a difference score representing return toward baseline.

Log GSR values were calculated using Biopac software (Biopac Student Lab Version 4; Goleta, CA) using the same one-minute epochs used for RSA calculations. An average GSR value was obtained for each epoch based on the raw electrodermal response data and subsequently log transformed using the software. Again, log values at 3-minute follow-up (GSR\textsubscript{2}) were subtracted from values obtained during stimulus exposure (GSR\textsubscript{1}) to obtain a difference score representing return toward baseline.

2.5 Mood Induction

Video clips were selected as the mood induction stimuli in order to maximize reactivity and ensure attention focused on the stimuli while maintaining a standardized exposure across participants (controlling for order effects) (Rottenberg, Ray, & Gross, 2007). Film clips also carry some ecological validity, in that they represent situations we may encounter in everyday life (Rottenberg, Ray, & Gross, 2007). Four video clips were shown to elicit a neutral or positive emotional response from participants. The first video
clip (“Neutral”) presented neutral content to provide an emotional baseline, while the second (“Amusement”), third (“Joy”), and fourth (“Pride”) videos were shown with the intention of eliciting amusement, joy, or pride respectively (see Table 1 for a description of each video). Baseline was determined via the neutral clip as opposed to a resting state because it controls for the exposure to a novel dynamic stimulus and prevents the variability that may emerge as the result of each participant’s ability to comply with a resting state (Rottenberg, Ray, & Gross, 2007). Each video was between 1 min 46 s and 2 min 16 s in duration, which fell within the recommended range of 1 min – 3 min based on Rottenberg et al. (2007). Each clip was informally tested prior to inclusion to ensure it elicited the desired response. A manipulation check was conducted when the sample size of the current experiment reached 10 to confirm emotional responses to the positive stimuli.

2.6 Procedure

Upon consent, participants were invited to complete all measures, excluding the Emotion Rating Forms, via an online survey tool (www.surveymonkey.com). Once baseline measures were completed, the participant was introduced to the physiological data collection equipment and electrodes were attached as described above.

Once baseline measures were completed, participants watched four short video clips (see Figure 1 for full procedural timeline). Physiological data was collected from the beginning of the first video to the end of the fourth video. A neutral video clip was always shown first, while the sequence of latter three videos was randomized using a random number generator to counterbalance ordering effects. Upon conclusion of the neutral video clip, an emotion rating (ERN1) was collected, followed by a pause, which
lasted for 3 min following the end of the video, after which point another ER measurement was obtained (ER\textsubscript{N2}). No instructions were provided during the pause, nor were any distractor tasks provided; the participant was simply asked to sit still as the stimulus screen went to black. This method was chosen so that participants could engage in regulation as they saw fit in order to maintain some ecological validity (i.e., free to choose to think about the videos, or pay attention to other external stimuli, or otherwise). The same process of data collection took place with the second, third, and fourth video clips (emotion ratings immediately following each of the positive mood induction videos and at 3 min follow-up are referred to as ER\textsubscript{1} and ER\textsubscript{2} respectively. Time stamps were inserted into the physiological data recording software at the beginning and end of each video clip to identify epochs for GSR and RSA data collection. Upon conclusion of the fourth video clip, the physiological data equipment was removed and the participant was fully debriefed.

2.7 Data Analytic Plan

Prior to hypothesis testing, data was assessed for normality, outliers and other potential anomalies by examining means and distributions for each of the measures by way of descriptive statistics, stem-and-leaf plots, box plots, and histograms in SPSS (v. 21). Furthermore, \textit{t}-tests were examined to determine whether there were significant differences between each positively-valenced discrete emotion (amusement, joy, and pride) and each negatively-valenced discrete emotion (anxiety, sadness, anger, disgust, shame) for each of the three videos. Next, manipulation checks were run to ensure that the stimuli produced some meaningful change in emotional response. As such, \textit{t}-tests were used to examine whether there were significant differences between: (a) mean
baseline levels of emotion and mean levels of emotion immediately following each video (i.e., reactivity), and (b) levels of emotion immediately following each video and 3 minutes after the video had concluded (stability, or return to baseline).

Next, demographic variables were examined via examination of correlation tables and one-ways ANOVAs to determine whether they may have unduly influenced stimulus effects. In particular, ANOVAs were conducted to assess whether the pride manipulation, which included Canadian content, was affected by one’s status as a Canadian by birth.

To test hypotheses, confirmatory factor analyses and structural equation modeling analyses were completed using MPlus software (v. 7.1; Muthén & Muthén, 2012). Structural models were proposed to reflect hypothesized relationships between BPD symptoms, depression symptoms, emotion regulation difficulties, and emotion vulnerability for both positive emotion and negative emotion. Given that emotion regulation difficulties and emotion vulnerability were characterized as latent variables, measurement models were tested for each to determine if the data appropriately reflected the theorized construct. Emotion regulation difficulties were measured by total scores on the ERQ, the DERS, the WBSI, and the AAQ. Positive emotion vulnerability was measured by way of the following variables: experiential emotional baseline (ER\(_N1\)), experiential reactivity (ER\(_1\)), and experiential stability (ER\(_1\) minus ER\(_2\)), RSA baseline (RSA\(_N1\)), RSA reactivity (RSA\(_1\) of positive stimulus videos), and RSA stability (RSA\(_1\) minus RSA\(_2\)). Negative emotion vulnerability was measured by way of the following variables: experiential emotional baseline (ER\(_N1\)), experiential reactivity (ER\(_1\)), and experiential stability (ER\(_1\) minus ER\(_2\)), GSR baseline (GSR\(_N1\)), GSR reactivity (GSR\(_1\) of
positive stimulus videos), and GSR stability (GSR$_1$ minus GSR$_2$). As such, three variations of the measurement model of emotion vulnerability were tested: (a) a one-factor model solution (see Figure 2); (b) a two-factor model solution, separating experiential emotion from physiological arousal (see Figure 3); and (c) a three-factor model solution, separating baseline emotion from reactivity and return to baseline (see Figure 4). To assess the goodness-of-fit of each measurement model, fit indices were examined, including root mean square error of approximation (RMSEA), comparative fit index (CFI), and standardized root mean square residual (SRMR). A CFI of .90 or above is considered to reflect a good fitting model, whereas an RMSEA above .10 is typically viewed as reflective of a poor fitting model (Loehlin, 2004). An SRMR value of .08 or below is generally considered to represent good fit (Loehlin, 2004). Akaike information criteria (AIC) values were also used to determine if meaningful differences existed between models. AIC can be used to compare measurement models by providing a derivation of the model’s maximum likelihood estimate, which in turn offers a measure of “distance” between a candidate model and the true model (Vrieze, 2012). As such, lower values are associated with better fit.

Once the best-fitting measurement models were established, the model was tested without the intervening variable to determine if BPD symptomatology, depression symptomatology, and trait negative affect predicted emotion vulnerability in the context of (a) positive emotion and (b) negative emotion. Again, goodness-of-fit was tested based on the aforementioned fit indices. This was done for both the positive emotion model and negative emotion model. Lastly, maladaptive emotion regulation was tested as a potential intervening variable in the relationships between the independent variables (BPD
symptom severity, depression symptom severity, and trait negative affect) and the dependent variables (positive and negative emotion vulnerability). To do so, the relationships between the independent variables and the potential intervening variable were first tested. Next, the relationships between the potential intervening variable and the dependent variables were tested. If maladaptive emotion regulation was found to associate with both dependent and independent variables, the full model, including the potential intervening variable, was tested for indirect effects.

**Results**

**2.8 Participant Flow**

One hundred twenty-five participants completed the experiment. Of these, three were excluded because they were found to be of international student status. One participant was excluded from analyses because their emotion ratings were collected incorrectly, which may have compromised the data collected. Data was then inspected for possible outliers and other anomalies. It was found that one participant exhibited a very unusual pattern of self-reported emotional response to the video stimuli, which may have been due to an emotion reaction to something outside of the manipulation, or due to some random responding. This participant was also excluded from final analyses, leaving a total sample size of 120. One potential outlier with regard to BSL was examined and retained for two reasons: (1) At least one outlier is to be expected in a sample over 100 (Osborne & Overbay, 2004); and (2) Post-hoc analyses with and without this subject revealed that the outlier did not unduly influence main findings.

**2.9 Manipulation Checks**

A series of *t*-tests was conducted to determine if the different video clips
produced discriminant positive emotions (e.g., did the Pride video produce significantly higher self-reported pride as compared to self-reported amusement and joy). Results indicated that discrete emotional responses were produced for the Amusement and Joy videos, but not the Pride video (see Table 3), so emotion responses were collapsed into broader categories distinguishing positive emotions (amusement, joy, pride) and negative emotions (anxiety, sadness, anger, disgust, shame) for all subsequent analyses.

Manipulation checks were then conducted to determine if: (a) the stimulus videos effectively produced positive and/or negative emotional responses at ER₁ relative to the neutral baseline (representing reactivity); and (b) the time that elapsed from ER₁ to ER₂ was sufficient to demonstrate a change in emotion (representing a return toward baseline) (see Table 4). It was found that participants responded to each of the stimulus videos with significantly more positive emotion than endorsed at baseline and at follow-up. For negative emotion, where greater emotional response was less expected given the nature of the stimuli, it was found that participants endorsed greater levels following only the Joy video relative to baseline and follow-up. Conversely, no significant differences were seen with regard to negative reactivity to the Amusement or Pride videos relative to baseline or follow-up.

Similar tests were also conducted for physiological responses (see Table 5). With regard to GSR, it was found that levels were significantly greater during each stimulus video relative to baseline and follow-up. With regard to RSA, responses to each positive stimulus were significantly lower than baseline, but no differences were seen between RSA₁ and RSA₂ for any of the stimulus videos. Given that no evidence of a return toward baseline was seen for this measure, it was not included in model fit testing.
One-way ANOVAs were conducted to determine possible group differences based on categorical variables. It was found that the order of the videos played no role in any outcome measures. Differences based on the researcher conducting the experiment were seen with regard to GSR at baseline, $F(2, 116) = 6.85, MSE = 0.17, p < .01, \eta^2 = .11$, and GSR in response to the Amusement video $F = 3.84, MSE = 0.04, p < .05, \eta^2 = .09$. Canadian citizenship status was only associated with RSA stability for the Amusement video, $F = 4.27, MSE = 0.51, p < .05, \eta^2 = .05$, though this may be a chance result. Of note, this variable played no role with regard to reactivity to the Pride video. There were also no associations between self-reported energy level at baseline and any outcome variables. Medication was found to be associated with BSL score, with those scoring higher more likely to report taking medication, $F = 10.34, MSE = 2.78, p < .01, \eta^2 = .09$. In addition, those taking medication reported a greater return toward baseline following the Joy video, $F = 4.20, MSE = 0.20, p < .05, \eta^2 = .04$. Sex was found to be associated with many variables, with females scoring higher on the BDI, $F = 7.88, MSE = 89.39, p < .01, \eta^2 = .06$, DERS, $F = 9.14, MSE = 407.69, p < .01, \eta^2 = .07$, AAQ, $F = 8.81, MSE = 97.93, p < .01, \eta^2 = .07$, WSBI, $F = 6.99, MSE = 141.61, p < .01, \eta^2 = .06$, and PANAS-N $F = 5.06, MSE = 48.66, p < .05, \eta^2 = .04$. In addition, females reported lower GSR, $F = 8.01, MSE = 0.17, p < .01, \eta^2 = .06$, and positive emotion, $F = 6.44, MSE = 3.80, p < .05, \eta^2 = .05$, during the Neutral video, lower positive emotion during the Amusement video, $F = 5.34, MSE = 4.44, p < .05, \eta^2 = .04$, and a greater return toward baseline with regard to positive emotion following the Joy video, $F = 6.37, MSE = 2.78, p < .05, \eta^2 = .05$.

2.10 Model Testing – Positive Emotional Experience

*Measurement Models*
Missing data for all model testing was accounted for using full information maximum likelihood, which yields unbiased parameter estimates for data missing at random (Enders, 1999). Table 6 displays the fit indices for each of the measurement models tested. Both the one-factor model and three-factor model included a method factor to account for method variance due to the disparate nature of each type of emotional data collection. Of the three potential measurement models representing the structure of positive emotion vulnerability, the three-factor solution demonstrated the best fit (see Figure 4). The one-factor model testing results suggested a nonsensical method factor that was highly correlated with the latent variable. Heywood cases (i.e., nonsensical loadings) for both the two- and three-factor models suggested that the higher order factor did not adequately represent the data, and subsequent examination of correlations revealed that there was not enough common variance among the lower order factors to justify a higher order variable for the two- or three-factor models (the subsequent two-factor model is denoted as adjusted two-factor model in Table 6). In the case of the three-factor solution for positive emotion, reactivity was found to correlate with both baseline \( (r = .56, p < .05) \), and stability \( (r = .47, p < .001) \), but the latter two did not correlate \( (r = -.16, p = .22) \). In addition, examination of modification indices suggested correlated errors among reactivity and stability indicators for each respective video, and the final positive emotion vulnerability measurement model was subsequently adjusted to account for these errors (denoted as adjusted three-factor model in Table 6).

The measurement model for maladaptive emotion regulation demonstrated good fit and was therefore used for structural model testing for both positive and negative emotion vulnerability.
Structural Models

Structural model fit indices are presented in Table 7. The direct relationships between the three predictor variables (BSL score, BDI score, and PANAS-N score) and the emotion vulnerability variables was tested (see Figure 5). It was found that none of the predictor variables (BSL score, BDI score, PANAS-N score) was associated with baseline levels of positive emotion. With regard to positive emotional reactivity, only PANAS-N was found to be associated, with greater trait negative affect predicting greater positive reactivity were found to be associated with stability, albeit in different directions. Higher BSL score was associated with less decay in positive emotion at follow-up, whereas higher BDI score was associated with greater decay over the same period. While PANAS-N was not significantly associated with stability, there was a trend suggesting a similar association with greater decay. Next, the relationships between the predictor variables and maladaptive emotion regulation was tested (see Figure 6). Maladaptive emotion regulation was found to be significantly, positively associated with BSL score, BDI score, and PANAS-N score. Baseline positive emotion, positive reactivity, and positive stability were then regressed on maladaptive emotion regulation (see Figure 7). In the context of positive emotion vulnerability, no significant associations were found for baseline, for reactivity, or for stability. As a result, the full model including the potential intervening variable was not tested.

2.11 Model Testing – Negative Emotional Experience

Measurement Models

Identical model testing was carried out with regard to negative emotion vulnerability. Again, three competing models were tested (see Table 6). Similar errors
were observed suggesting that a higher order factor did not adequately represent the data in the context of negative emotion, and was eliminated in subsequent model testing for both the two-factor (denoted as *adjusted two-factor model* in Table 6) and three-factor models. In addition, modification indices suggested similar correlated errors, so the identical adjustments to the model were made, and this three-factor model was determined to be the best fitting (denoted as *adjusted three-factor model* in Table 6).

**Structural Models**

The structural model was again tested, first without the potential intervening variable (see Figure 8). It was found that BSL score was significantly associated with negative emotional baseline and negative reactivity to the positive stimuli. PANAS-N was also associated with baseline, though no other significant associations were observed. The relationships between maladaptive emotion regulation and emotion vulnerability was examined, with maladaptive emotion regulation positively associated with baseline and reactivity, and negatively associated with stability (see Figure 7). As such, the full model was tested, however no significant indirect effects were found (see Figure 9).

Chapter 3

**Discussion**

3.1 **Summary of Findings**

This study sought to ascertain the best structure to represent two contrasting types of emotion vulnerability in the context of a positive mood induction. Furthermore, this study sought to build on the current literature pertaining to positive emotional experience in relation to BPD symptom severity by examining it in the context of three distinct
aspects of emotional vulnerability: baseline emotional intensity, emotional reactivity, and emotional stability (degree of return toward emotional baseline following stimulus response). The current study also examined the potential role of maladaptive emotion regulation in the relationships between three theoretically overlapping predictors (BPD symptom severity, depression symptom severity and trait negative affect) and both positive and negative emotion vulnerability.

With regard to this mood induction, the study used three short video clips that had not previously been validated in a research context. In testing the effectiveness of the manipulation, results demonstrated that all of the videos employed in the current study generated greater levels of self-reported positive emotion, including the discrete emotions of amusement, joy, and pride, relative to a neutral video. It was found, however, that the videos selected and labelled to represent Amusement, Joy, and Pride, respectively, did not elicit these specific discrete emotions relative to other types of positive emotion. While this result did not impact hypothesis testing, future research seeking to elicit discrete emotions would likely require alternative stimuli.

To test hypotheses, it was first necessary to determine the best fitting measurement model with regard to both positive and negative emotion vulnerability. It was hypothesized that a three-factor solution would best represent the data. Of the three measurement models tested, this solution emerged as the best fit to the data for both types of vulnerability. A one-factor model failed to generate a solution for positive emotion, and showed poor fit when tested in the context of negative emotion. A two-factor model also showed poor fit relative to the three-factor model, though it did represent an improvement relative to the one-factor solution. This finding offers some support for the
biosocial theory conceptualization of emotion vulnerability, particularly because the same three-factor structure was supported for both positive and negative emotion vulnerability. It should be noted, however, that despite this being the best measurement model of the three, fit indices for this iteration did not suggest an excellent fit to the data.

In addition, the higher order variable representing the latent construct of emotion vulnerability was not supported by the data, suggesting that emotional baseline, emotional reactivity, and return toward emotional baseline are not measurable aspects of a single overarching construct. While Linehan’s biosocial theory posits that these represent various aspects of emotion vulnerability in the context of BPD, it may be that they reflect unique aspects of emotional experience that operate independently of each other. In particular, baseline levels of emotion and return toward baseline following stimulus exposure were found to be unrelated. This finding is in line with some previous research in the context of BPD, as Scheel et al. (2013) found that participants with BPD reported higher baseline shame but showed no evidence of a slower return to baseline as compared to controls. Conversely, Ebner-Priemer et al. (2015) did find evidence in support of the biosocial model of emotion vulnerability, though findings regarding return to baseline were less robust. Furthermore, other research has found that individuals with BPD may exhibit higher baseline arousal as compared to controls but do not show any differences in emotional reactivity (Kuo and Linehan, 2009). With regard to emotion stability specifically, in keeping with Gross’ (2013) conceptualization of emotion regulation, it may be that baseline emotion and reactivity could be more indicative of emotion vulnerability, whereas return to baseline is more reflective of regulation vulnerability. Because regulatory processes are expected to unfold following the initial
emotional response, the degree of return toward one’s original baseline level of emotion may more accurately reflect one’s success in regulation. More research is needed to establish whether this is the case, and how one’s specific regulatory goals (e.g., to up- or down-regulate) are differentially affected.

Once the measurement model for positive emotion vulnerability was established, the relationships between it and BPD symptom severity, depression symptom severity, and trait negative affect were tested. Because the higher order factor encompassing all three aspects of emotion vulnerability was not supported for either positive or negative emotion, these factors (baseline emotion, reactivity, and stability) were examined individually. In contrast with hypotheses, no associations were found with regard to baseline levels of positive emotion for any of the three predictors. While some research has suggested those with BPD do not exhibit less positive emotion at baseline (e.g., Herpertz et al., 2000), other studies have found lower baseline levels (e.g., Staebler, Gebhard, Barnett, & Renneberg, 2009). Given that individuals with BPD have been found to experience fewer positive emotions over a typical day, though not necessarily with less intensity (Ebner-Priemer et al., 2007), it may be that collecting a baseline level of positive emotion in response to a neutral video may not capture this nuance. As such, this type of baseline may represent an atypical point during the day where positive emotion is not conspicuously muted.

Findings with regard to positive emotional reactivity were also in contrast to hypothesized relationships. Neither BPD nor depression symptom severity predicted levels of positive emotion in response to the video stimuli. As previous findings with regard to BPD specifically in this context have been mixed, further research is necessary
to determine if such a relationship exists. Most unexpectedly, it was found that higher self-reported trait negative affect predicted greater positive reactivity, and that this relationship was relatively robust. It may be that the measure used to capture trait negative affect also inadvertently reflected a tendency towards greater overall affect intensity. Were this the case, however, one might expect similar associations with PANAS-N score and baseline levels of positive emotion, but this was not found. Given the unexpected nature of the relationship, more research is necessary to replicate and elucidate the nature of this finding.

This is the first study to examine emotional stability following a reaction to positive stimuli, thereby providing some insight into the effects of any regulatory responses (either implicit or explicit) that may be set in motion by initial emotional reactivity to this type of mood induction. Somewhat unexpectedly, model testing indicated that individuals with greater BPD symptom severity demonstrated more positive emotion stability. Conversely, those with greater depression symptom severity and trait negative affect, as expected, showed more emotional decay in this regard. This finding, though preliminary, adds a potentially crucial element to the limited understanding of positive emotional experience unique to BPD. It remains to be seen if such a result can be attributed to successful up-regulation or unsuccessful down-regulation of positive emotion. There is, however, some evidence to suggest that individuals with BPD exhibit more discomfort with positive emotions (Jayaro et al., 2011). If this is the case, a failure to effectively down-regulate may be more likely. Such a deficit could portend to further maladaptive behaviours or coping strategies, as positive emotion, while adaptive, has also been associated with impulsivity when not properly
regulated (Muhtadie, Johnson, Carver, Gotlib, & Ketter, 2014). Furthermore, an inability to differentiate these emotions, which has been found to predict urges to engage in maladaptive behaviours (see Dixon-Gordon, Chapman, Alexander Weiss, & Rosenthal, 2014) may explain difficulties in the ability to properly regulate. More research is necessary to determine if this is indeed the case.

Models of negative emotional vulnerability were also tested. It was found that greater baseline negative emotion was predicted by greater BPD symptom severity and greater trait negative affect, which is in line with previous research. BPD symptom severity was also associated with greater negative reactivity to the positive stimuli. This finding also provides potentially valuable insight into the nature of positive emotional experience in BPD. It may be that while individuals with BPD do not show a different pattern of positive emotion in response to positive stimuli, these individuals are also simultaneously experiencing a negative response to the same stimulus. This finding was also demonstrated by Elices et al. (2012), and provides additional support for the theory that those with BPD are more likely to experience a greater constellation of emotions, both negatively and positively valenced, to a single stimulus. Such a pattern may lead to an increased likelihood that neutral or positively valenced stimuli in one’s environment would lead to negative emotional responses. Coupled with poor regulatory strategies, seemingly innocuous stimuli could ultimately contribute to eventuate maladaptive coping strategies and behaviours. This finding may also relate to poor emotion differentiation, with the implication that those with BPD may not only struggle to differentiate discrete positive emotions, but may struggle to differentiate between positive and negative emotions.
In the final step, self-reported trait-level tendencies to engage in maladaptive emotion regulation was tested as a potential intervening variable. As expected, BPD symptom severity, depression symptom severity, and trait negative affect were all found to be associated with maladaptive emotion regulation. In addition, while no associations were seen between maladaptive emotion regulation and aspects of positive emotion vulnerability, it was found that this variable predicted aspects of negative emotion vulnerability. Contrary to hypotheses, however, it was found that any such indirect effects of this latent variable were not significant. In other words, it did not explain a significant portion of the variance in the aforementioned relationships found between the predictors and the aspects of either positive or negative emotion vulnerability.

These results suggest that trait-level self-reported maladaptive emotion regulation may indeed be associated with negative emotional vulnerability, but that this relationship is unique and exists outside the relationships seen with BPD symptom severity, depression symptom severity, and trait negative affect. This result is in contrast to past research suggesting that maladaptive emotion regulation strategies such as experiential avoidance explain some of the relationship between BPD symptoms and both negative emotion vulnerability (e.g., Chapman, Dixon-Gordon, and Walters, 2011) and positive emotion vulnerability (e.g., Jacob, Ower, and Buchholz, 2013). This finding may be explained in part by the differential nature of the relationships seen between these variables. Whereas BPD symptom severity was most robustly associated with negative emotional reactivity, the maladaptive emotion regulation variable, as one might expect based on the Gross (2013) model, was most strongly associated with a smaller return toward baseline. It may be the case that those with BPD are more likely to experience
more negative emotion in response to positive stimuli, but that the ability to down-
regulate the negative emotion is predicted much more robustly by one’s regulation
skills (i.e., the ability to select adaptive strategies) than by one’s BPD symptom severity.
The current study’s use of a more encompassing latent variable to reflect these
maladaptive emotion regulation strategies may have helped to elucidate this distinction.
At the same time, associations seen among these variables, though not statistically
significant, were found to be in the same direction (i.e., both BPD symptom severity and
maladaptive emotion regulation were positively associated with reactivity and negatively
associated with stability. As such, a larger sample size may bolster support for the
indirect effects hypothesis.

3.2 Limitations and Future Directions

While this study offers new insight into the relationship between BPD
symptomatology and positive emotional experience, there are several limitations that
warrant attention. First, this study used an analogue sample, which in turn limits the
ability to generalize results to clinical populations. Future research should extend these
findings to clinical populations to determine if differences exist between those who meet
criteria for BPD and those who do not. That stated, BPD is a disorder that exists on a
continuum of personality pathology, which lends credence to the current methodological
approach (see Rothschild, Cleland, Haslam, & Zimmerman, 2003). In addition, video
selections for the positive mood induction for the current study were not previously
validated. While several validated video clips exist in the literature (e.g., Gross &
Levenson, 1995), it was decided that these selections may be dated and less emotionally
evocative to young university students. As such, clips were selected on the basis that they
would carry wider appeal to the current sample. Future research may wish to validate mood inductions prior to carrying out the full experiment.

The current study also bore some methodological limitations. First, the self-reported emotion ratings were collected via a paper-and-pencil method, and as such, each rating was collected post-video. A more sophisticated paradigm may include a device that could allow a participant to report continuous emotional response in the moment, both during and after each video. This kind of continuous data could provide a more nuanced look at emotional response patterns. Second, future research in this context may also wish to collect separate ratings with regard to emotional valence and intensity, also in the interest of gaining nuance. Doing so may come at the cost of establishing differently valenced emotions taking place simultaneously, so this trade off must be considered if shifting from a discrete emotion approach. As a final methodological limitation, it bears mentioning that emotion was assessed in two ways – self-report and physiological responses – but other aspects of emotion, such as expression and action urges, were not collected. Future paradigms may wish to include these elements to capture an even more complete conceptualization of emotional experience.

Some limitations also emerged in the examination of demographic and possible confounding variables on variables of interest. It was found that physiological response (GSR specifically) was influenced by which research assistant ran the participant. This may have compromised the ability to interpret this physiological measure, and would need to be better controlled for in the future. As well, there were strong sex differences found in the data. While not necessarily a limitation, future research should examine the specific ways that sex influence emotional patterns in the context of BPD. Findings for
this study contrast with Chentsova-Dutton and Tsai (2007), who found greater emotional reactivity in women. More research would be valuable to further ascertain the nature of these sex differences,

Looking ahead, this research may have important clinical implications. Specifically, because healthy positive emotional experience is tied to well-being, including abilities to effectively up-regulate emotion (e.g., Nezlek & Kuppens, 2008), it may be important to address any such deficiencies in a clinical context. As such, psychotherapeutic approaches may improve treatment efficacy by incorporating additional targets and goals that relate specifically to fostering healthy positive emotional experience. In the context of BPD, difficulties down-regulating positive emotion may lead to a unique set of challenges, including a greater propensity for impulsive behaviours. Dialectical behavior therapy (DBT; Linehan, 1993), is a current empirically validated treatment for BPD that incorporates didactic skills teaching for improving emotion regulation strategies. Teaching strategies in the context of a DBT framework may wish to include discussion about group members’ experience with positive emotion, and whether these experiences may be difficult to regulate in a similar manner to that of negative emotions, and whether there are any negative behavioural consequences that emerge as a result.

The potential for individuals with BPD to respond to positive stimuli with both positive and negative emotion also warrants particular attention in a treatment context, as this can be seen as a vulnerability factor. Within a DBT framework, therapists conducting chain analyses that explore very specific sequences of behavioural and environmental antecedents to negative outcomes may wish to consider the potential role that a positive
stimulus may have, even when a portion of the emotional response is also positively valenced. Ignoring the potential for stimuli in the environment to evoke both positive and negative emotions may lead to overlooking important antecedents to eventual destructive behaviours. These additions may in turn lead to better outcomes for clients who suffer from BPD.
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doi:http://dx.doi.org/10.1111/jasp.12254


doi:http://dx.doi.org/10.1037/0033-2909.131.6.925


### Table 1

**Video Selections for Mood Inductions**

<table>
<thead>
<tr>
<th>Emotion Elicitation</th>
<th>Duration</th>
<th>Video Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral</td>
<td>1 min 47 s</td>
<td>A video of wooden bowls being manufactured.</td>
</tr>
<tr>
<td>Pride</td>
<td>2 min 16 s</td>
<td>A montage of Canadians cheering and singing the national anthem in response to the goal medal win by the men’s hockey team at the 2010 Winter Olympics in Vancouver.</td>
</tr>
<tr>
<td>Joy</td>
<td>1 min 46 s</td>
<td>A baby laughing in response to her father ripping sheets of paper.</td>
</tr>
<tr>
<td>Amusement</td>
<td>2 min 06 s</td>
<td>A parody of a commercial for a new album featuring “The best tweets of Kanye West” as sung by Josh Groban.</td>
</tr>
</tbody>
</table>
Table 2

*Psychometric Properties of the Study Variables*

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>α</th>
<th>Potential</th>
<th>Actual</th>
<th>Skew</th>
</tr>
</thead>
<tbody>
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<td>BSL_ALL</td>
<td>120</td>
<td>0</td>
<td>1.71</td>
<td>.94/.52</td>
<td>n/a&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-1.65-10.09</td>
<td>2.44</td>
</tr>
<tr>
<td>BDI_TOT</td>
<td>120</td>
<td>14.13</td>
<td>9.72</td>
<td>0.92</td>
<td>0-60</td>
<td>0-52</td>
<td>0.93</td>
</tr>
<tr>
<td>DERS_TOT</td>
<td>120</td>
<td>84.24</td>
<td>20.87</td>
<td>0.92</td>
<td>36-180</td>
<td>47-156</td>
<td>0.71</td>
</tr>
<tr>
<td>AAQ_TOT</td>
<td>120</td>
<td>21.49</td>
<td>7.00</td>
<td>0.93</td>
<td>7-49</td>
<td>7-49</td>
<td>0.60</td>
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<td>WSBI_TOT</td>
<td>113</td>
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<td>15-75</td>
<td>15-75</td>
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</tr>
<tr>
<td>PANAS_N</td>
<td>120</td>
<td>21.53</td>
<td>7.09</td>
<td>0.85</td>
<td>10-50</td>
<td>10-44</td>
<td>0.58</td>
</tr>
</tbody>
</table>

<sup>a</sup>Because BSL_ALL is standardized, the potential range depends on the sample size and scores.
Table 3

*Paired-samples t-test of Discrete Positive Emotions to Stimulus Videos*

<table>
<thead>
<tr>
<th></th>
<th>Type</th>
<th>M</th>
<th>SD</th>
<th>Type</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>p</th>
<th>Cohen's d</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amusement Video</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair 1</td>
<td>AMU</td>
<td>5.81</td>
<td>2.66</td>
<td>JOY</td>
<td>5.10</td>
<td>2.72</td>
<td>4.14</td>
<td>.00</td>
<td>0.26</td>
</tr>
<tr>
<td>Pair 2</td>
<td>AMU</td>
<td>5.81</td>
<td>2.66</td>
<td>PRI</td>
<td>1.99</td>
<td>2.36</td>
<td>14.47</td>
<td>.00</td>
<td>1.52</td>
</tr>
<tr>
<td><strong>Joy Video</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair 1</td>
<td>JOY</td>
<td>6.44</td>
<td>2.37</td>
<td>AMU</td>
<td>6.19</td>
<td>2.47</td>
<td>2.16</td>
<td>.00</td>
<td>0.10</td>
</tr>
<tr>
<td>Pair 2</td>
<td>JOY</td>
<td>6.44</td>
<td>2.37</td>
<td>PRI</td>
<td>2.50</td>
<td>2.38</td>
<td>15.50</td>
<td>.00</td>
<td>1.66</td>
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<tr>
<td><strong>Pride Video</strong></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pair 1</td>
<td>PRI</td>
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<td>2.98</td>
<td>AMU</td>
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<td>2.62</td>
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<td>PRI</td>
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<td>2.69</td>
<td>-0.12</td>
<td>.90</td>
<td>-0.01</td>
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</tbody>
</table>

*Note.* AMU = self-reported rating of amusement; JOY = self-reported rating of joy; PRI = self-reported rating of pride.
### Paired-sample t-tests of Positive and Negative Emotional Responses

<table>
<thead>
<tr>
<th></th>
<th>Emotion Rating 1</th>
<th>Emotion Rating 2</th>
<th>t</th>
<th>p</th>
<th>Cohen's d</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Measure</td>
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<td>SD</td>
<td>Measure</td>
<td>M</td>
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<td><strong>Positive Emotion</strong></td>
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<td></td>
</tr>
<tr>
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<td>ER\textsubscript{N1}</td>
<td>2.61</td>
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<td>ER\textsubscript{1}</td>
<td>4.30</td>
</tr>
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<td>4.30</td>
<td>2.15</td>
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<td>2.44</td>
</tr>
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<td>Joy Video</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair 1</td>
<td>ER\textsubscript{N1}</td>
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<td>1.99</td>
<td>ER\textsubscript{1}</td>
<td>5.04</td>
</tr>
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<td><strong>Negative Emotion</strong></td>
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</tr>
<tr>
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</tr>
<tr>
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<td></td>
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<tr>
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<td>0.64</td>
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<td>0.53</td>
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<td>0.60</td>
</tr>
</tbody>
</table>

*Note.* ER\textsubscript{N1} = emotion rating immediately following neutral stimulus; ER\textsubscript{1} = emotion rating immediately following positive stimulus; ER\textsubscript{2} = emotion rating 3 min following positive stimulus.
### Table 5

**Paired-sample t-tests of Psychophysiological Emotional Responses**

<table>
<thead>
<tr>
<th></th>
<th>Emotion Rating 1</th>
<th>Emotion Rating 2</th>
<th>t</th>
<th>p</th>
<th>Cohen's d</th>
</tr>
</thead>
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<td><strong>Measure</strong></td>
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<td><strong>SD</strong></td>
<td><strong>M</strong></td>
<td><strong>SD</strong></td>
<td><strong>M</strong></td>
</tr>
<tr>
<td>Respiratory Sinus Arrhythmia</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amusement Video</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair 1</td>
<td>RSA_{N1}</td>
<td>6.38</td>
<td>1.01</td>
<td></td>
<td>RSA_1</td>
</tr>
<tr>
<td>Pair 2</td>
<td>RSA_1</td>
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<td>1.13</td>
<td></td>
<td>RSA_2</td>
</tr>
<tr>
<td>Joy Video</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair 1</td>
<td>RSA_{N1}</td>
<td>6.38</td>
<td>1.01</td>
<td></td>
<td>RSA_1</td>
</tr>
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<td></td>
</tr>
<tr>
<td>Pair 1</td>
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<tr>
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</tr>
<tr>
<td>Amusement Video</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Pair 1</td>
<td>GSR_{N1}</td>
<td>0.84</td>
<td>0.23</td>
<td></td>
<td>GSR_1</td>
</tr>
<tr>
<td>Pair 2</td>
<td>GSR_1</td>
<td>0.93</td>
<td>0.21</td>
<td></td>
<td>GSR_2</td>
</tr>
<tr>
<td>Joy Video</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair 1</td>
<td>GSR_{N1}</td>
<td>0.84</td>
<td>0.23</td>
<td></td>
<td>GSR_1</td>
</tr>
<tr>
<td>Pair 2</td>
<td>GSR_1</td>
<td>0.95</td>
<td>0.20</td>
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<td>GSR_2</td>
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<tr>
<td>Pride Video</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Pair 1</td>
<td>GSR_{N1}</td>
<td>0.84</td>
<td>0.23</td>
<td></td>
<td>GSR_1</td>
</tr>
<tr>
<td>Pair 2</td>
<td>GSR_1</td>
<td>0.92</td>
<td>0.22</td>
<td></td>
<td>GSR_2</td>
</tr>
</tbody>
</table>

*Note.* RSA_{N1} = respiratory sinus arrhythmia during neutral stimulus; RSA_1 = respiratory sinus arrhythmia during positive stimulus; RSA_2 = respiratory sinus arrhythmia following positive stimulus; GSR_{N1} = galvanic skin response during neutral stimulus; GSR_1 = galvanic skin response during positive stimulus; GSR_2 = galvanic skin response following positive stimulus.
Table 6

Summary of Fit Indices for Measurement Models

<table>
<thead>
<tr>
<th>Model Description</th>
<th>Akaike (AIC)</th>
<th>CFI</th>
<th>RMSEA [90% CI]</th>
<th>SRMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Emotion Vulnerability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One-factor solution</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Err</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two-factor solution</td>
<td>4066.05</td>
<td>0.66</td>
<td>0.25 [0.22, 0.27]</td>
<td>0.12</td>
</tr>
<tr>
<td>Adjusted two-factor solution</td>
<td>4064.05</td>
<td>0.66</td>
<td>0.25 [0.22, 0.27]</td>
<td>0.12</td>
</tr>
<tr>
<td>Three-factor solution</td>
<td>3973.10</td>
<td>0.77</td>
<td>0.22 [0.19, 0.25]</td>
<td>0.09</td>
</tr>
<tr>
<td>Adjusted three-factor solution</td>
<td>3784.18</td>
<td>0.98</td>
<td>0.06 [0.00, 0.10]</td>
<td>0.06</td>
</tr>
<tr>
<td>Negative Emotion Vulnerability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One-factor solution</td>
<td>757.52</td>
<td>0.38</td>
<td>0.26 [0.24, 0.28]</td>
<td>0.20</td>
</tr>
<tr>
<td>Two-factor solution</td>
<td>Err</td>
<td>Err</td>
<td>Err</td>
<td>Err</td>
</tr>
<tr>
<td>Adjusted two-factor solution</td>
<td>472.24</td>
<td>0.67</td>
<td>0.19 [0.17, 0.21]</td>
<td>0.14</td>
</tr>
<tr>
<td>Three-factor solution</td>
<td>433.06</td>
<td>0.72</td>
<td>0.19 [0.17, 0.21]</td>
<td>0.11</td>
</tr>
<tr>
<td>Adjusted three-factor solution</td>
<td>239.35</td>
<td>0.92</td>
<td>0.11 [0.08, 0.13]</td>
<td>0.10</td>
</tr>
<tr>
<td>Maladaptive Emotion Regulation</td>
<td>2689.39</td>
<td>1.00</td>
<td>0.00 [0.00, 0.00]</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Note. Err = no solution could be obtained, therefore fit indices not calculable. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual
Table 7

Summary of Fit Indices for Structural Models

<table>
<thead>
<tr>
<th>Model Description</th>
<th>CFI</th>
<th>RMSEA [90% CI]</th>
<th>SRMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSL_ALL, BDI_TOT, PANAS_N predicting MER</td>
<td>1.00</td>
<td>0.00 [0.00, 0.07]</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Positive Emotion Vulnerability</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MER predicting BL, RCT, RTB</td>
<td>0.96</td>
<td>0.06 [0.03, 0.09]</td>
<td>0.07</td>
</tr>
<tr>
<td>BSL_ALL, BDI_TOT, PANAS_N predicting BL, RCT, RTB</td>
<td>0.98</td>
<td>0.05 [0.00, 0.08]</td>
<td>0.09</td>
</tr>
<tr>
<td><strong>Negative Emotion Vulnerability</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MER predicting BL, RCT, RTB</td>
<td>0.89</td>
<td>0.10 [0.09, 0.12]</td>
<td>0.10</td>
</tr>
<tr>
<td>BSL_ALL, BDI_TOT, PANAS_N predicting BL, RCT, RTB</td>
<td>0.87</td>
<td>0.11 [0.09, 0.13]</td>
<td>0.17</td>
</tr>
<tr>
<td>BSL_ALL, BDI_TOT, PANAS_N predicting BL, RCT, RTB; MER included as intervening variable</td>
<td>0.90</td>
<td>0.09 [0.07, 0.11]</td>
<td>0.15</td>
</tr>
</tbody>
</table>

*Note.* CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; BSL_ALL = aggregated standardized score from Borderline Symptom List-23 measure (22 items) and supplement (9 items); BDI_TOT = total score of Beck Depression Inventory-II; PANAS_N = total score of negative affect subscale of Positive and Negative Affect Schedule (in the context of the last two weeks); MER = maladaptive emotion regulation latent variable; BL = baseline emotion latent variable; RCT = emotional reactivity latent variable; RTB = emotional return toward baseline latent variable.
Figure 1. Experiment timeline. ER$_{N1}$ = emotion rating immediately following neutral stimulus; ER$_{N2}$ = emotion rating 3 min following neutral stimulus; ER$_1$ = emotion rating immediately following positive stimulus; ER$_2$ = emotion rating 3 min following positive stimulus.
**Positive**

![Positive Emotion Vulnerability Diagram]

**Negative**

![Negative Emotion Vulnerability Diagram]

*Figure 2*. One-factor measurement models of positive and negative emotion vulnerability. Not pictured is the method factor. Solution could not be obtained for positive emotion vulnerability. BL_POS = aggregated self-reported positive emotion rating to neutral video; RSA_BL_1 = respiratory sinus arrhythmia response to neutral video; A1_POS = aggregated self-reported positive emotion rating to Amusement video; J1_POS = aggregated self-reported positive emotion rating to Joy video; P1_POS = aggregated self-reported positive emotion rating to Pride video; RSA_A_1 = respiratory sinus arrhythmia response to Amusement video; RSA_J_1 = respiratory sinus arrhythmia response to Joy video; RSA_P_1 = respiratory sinus arrhythmia response to Pride video; ADIF_POS = difference between positive emotion rating immediately following Amusement video and at 3-min follow-up; JDIF_POS = difference between positive emotion rating immediately following Joy video and at 3-min follow-up; PDIF_POS = difference between positive emotion rating immediately following Pride video and at 3-min follow-up. BL_NEG = aggregated self-reported negative emotion rating to neutral video; GSR_BL_1 = galvanic skin response to neutral video; A1_NEG = aggregated self-reported negative emotion rating to Amusement video; J1_NEG = aggregated self-reported negative emotion rating to Joy video; P1_NEG = aggregated self-reported negative emotion rating to Pride video; GSR_A_1 = galvanic skin response to Amusement video; GSR_J_1 = galvanic skin response to Joy video; GSR_P_1 = galvanic skin response to Pride video; ADIF_NEG = difference between negative emotion rating immediately following Amusement video.
and at 3-min follow-up; JDIF_NEG = difference between negative emotion rating immediately following Joy video and at 3-min follow-up; PDIF_NEG = difference between negative emotion rating immediately following Pride video and at 3-min follow-up; A_DifGSR = difference between galvanic skin response during Amusement video and post-video; JDifGSR = difference between galvanic skin response during Joy video and post-video; PDifGSR = difference between galvanic skin response during Pride video and post-video. *p < .05 ***p < .001.
Figure 3. Two-factor measurement models of positive and negative emotion vulnerability. Solution could not be obtained for negative emotion vulnerability. BL_POS = aggregated self-reported positive emotion rating to neutral video; RSA_BL_1 = respiratory sinus arrhythmia response to neutral video; A1_POS = aggregated self-reported positive emotion rating to Amusement video; J1_POS = aggregated self-reported positive emotion rating to Joy video; P1_POS = aggregated self-reported positive emotion rating to Pride video; RSA_A_1 = respiratory sinus arrhythmia response to Amusement video; RSA_J_1 = respiratory sinus arrhythmia response to Joy video; RSA_P_1 = respiratory sinus arrhythmia response to Pride video; ADIF_POS = difference between positive emotion rating immediately following Amusement video and at 3-min follow-up; JDIF_POS = difference between positive emotion rating immediately following Joy video and at 3-min follow-up; PDIF_POS = difference between positive emotion rating immediately following Pride video and at 3-min follow-up. BL_NEG = aggregated self-reported negative emotion rating to neutral video; GSR_BL_1 = galvanic skin response to neutral video; A1_NEG = aggregated self-reported negative emotion rating to Amusement video; J1_NEG = aggregated self-reported negative emotion rating to Joy video; P1_NEG = aggregated self-reported negative emotion rating to Pride video; GSR_A_1 = galvanic skin response to Amusement video; GSR_J_1 = galvanic skin response to Joy video; GSR_P_1 = galvanic skin response to Pride video.
to Joy video; P1_NEG = aggregated self-reported negative emotion rating to Pride video;
GSR_A_1 = galvanic skin response to Amusement video; GSR_J_1 = galvanic skin
response to Joy video; GSR_P_1 = galvanic skin response to Pride video; ADIF_NEG =
difference between negative emotion rating immediately following Amusement video
and at 3-min follow-up; JDIF_NEG = difference between negative emotion rating
immediately following Joy video and at 3-min follow-up; PDIF_NEG = difference
between negative emotion rating immediately following Pride video and at 3-min follow-
up; A_DifGSR = difference between galvanic skin response during Amusement video
and post-video; JDifGSR = difference between galvanic skin response during Joy video
and post-video; PDifGSR = difference between galvanic skin response during Pride video
and post-video. *p < .05 ***p < .001.
Figure 4. Three-factor measurement models of positive and negative emotion vulnerability. Not pictured is the method factor. BL_POS = aggregated self-reported positive emotion rating to neutral video; RSA_BL_1 = respiratory sinus arrhythmia response to neutral video; A1_POS = aggregated self-reported positive emotion rating to Amusement video; J1_POS = aggregated self-reported positive emotion rating to Joy video; P1_POS = aggregated self-reported positive emotion rating to Pride video; RSA_A_1 = respiratory sinus arrhythmia response to Amusement video; RSA_J_1 = respiratory sinus arrhythmia response to Joy video; RSA_P_1 = respiratory sinus arrhythmia response to Pride video; ADIF_POS = difference between positive emotion rating immediately following Amusement video and at 3-min follow-up; JDIF_POS = difference between positive emotion rating immediately following Joy video and at 3-min follow-up; PDIF_POS = difference between positive emotion rating immediately following Pride video and at 3-min follow-up. BL_NEG = aggregated self-reported negative emotion rating to neutral video; GSR_BL_1 = galvanic skin response to neutral video; A1_NEG = aggregated self-reported negative emotion rating to Amusement video; J1_NEG = aggregated self-reported negative emotion rating to Joy video; P1_NEG = aggregated self-reported negative emotion rating to Pride video; GSR_A_1 = galvanic skin response to Amusement video; GSR_J_1 = galvanic skin response to Joy video; GSR_P_1 = galvanic skin response to Pride video; ADIF_NEG = difference between negative emotion rating immediately following Amusement video and at 3-min follow-up; JDIF_NEG = difference between negative emotion rating immediately following Joy video and at 3-min follow-up; PDIF_NEG = difference between negative emotion rating immediately following Pride video and at 3-min follow-up.
immediately following Pride video and at 3-min follow-up; A_DifGSR = difference between galvanic skin response during Amusement video and post-video; J_DifGSR = difference between galvanic skin response during Joy video and post-video; P_DifGSR = difference between galvanic skin response during Pride video and post-video. *p < .05  **p < .01 ***p < .001.
Figure 5. Positive emotion vulnerability model with correlations, standardized regression weights, and standardized factor loadings. Not pictured is the method factor. BSL_ALL = aggregated standardized score from Borderline Symptom List-23 measure (22 items) and supplement (9 items); BDI_TOT = total score of Beck Depression Inventory-II; PANAS_N = total score of negative affect subscale of Positive and Negative Affect Schedule (in the context of the last two weeks); BL_POS = aggregated self-reported positive emotion rating to neutral video; RSA_BL_1 = respiratory sinus arrhythmia response to neutral video; A1_POS = aggregated self-reported positive emotion rating to Amusement video; J1_POS = aggregated self-reported positive emotion rating to Joy video; P1_POS = aggregated self-reported positive emotion rating to Pride video; RSA_A_1 = respiratory sinus arrhythmia response to Amusement video; RSA_J_1 = respiratory sinus arrhythmia response to Joy video; RSA_P_1 = respiratory sinus arrhythmia response to Pride video; ADIF_POS = difference between positive emotion rating immediately following Amusement video and at 3-min follow-up; JDIF_POS = difference between positive emotion rating immediately following Joy video and at 3-min follow-up; PDIF_POS = difference between positive emotion rating immediately following Pride video and at 3-min follow-up. *p < .05 **p < .01 ***p < .001.
Figure 6. Model of maladaptive emotion regulation regression on BSL score, BDI score, and PANAS-N score. Not pictured are the indicators for maladaptive emotion regulation. BSL_ALL = aggregated standardized score from Borderline Symptom List-23 measure (22 items) and supplement (9 items); BDI_TOT = total score of Beck Depression Inventory-II; PANAS_N = total score of negative affect subscale of Positive and Negative Affect Schedule (in the context of the last two weeks). **p < .01 ***p < .001.
Figure 7. Structural models for both positive and negative emotion vulnerability regressed on maladaptive emotion regulation. Not pictured are the indicators for each latent variable and the method factors for each model. *p < .05 ***p < .001.
Figure 8. Negative emotion vulnerability model with correlations, standardized regression weights, and standardized factor loadings. Not pictured is the method factor. BSL_ALL = aggregated standardized score from Borderline Symptom List-23 measure (22 items) and supplement (9 items); BDI_TOT = total score of Beck Depression Inventory-II; PANAS_N = total score of negative affect subscale of Positive and Negative Affect Schedule (in the context of the last two weeks); BL_NEG = aggregated self-reported negative emotion rating to neutral video; GSR_BL_1 = galvanic skin response to neutral video; A1_NEG = aggregated self-reported negative emotion rating to Amusement video; J1_NEG = aggregated self-reported negative emotion rating to Joy video; P1_NEG = aggregated self-reported negative emotion rating to Pride video; GSR_A_1 = galvanic skin response to Amusement video; GSR_J_1 = galvanic skin response to Joy video; GSR_P_1 = galvanic skin response to Pride video; ADIF_NEG = difference between negative emotion rating immediately following Amusement video and at 3-min follow-up; JDIF_NEG = difference between negative emotion rating immediately following Joy video and at 3-min follow-up; PDIF_NEG = difference between negative emotion rating immediately following Pride video and at 3-min follow-up; A_DifGSR = difference between galvanic skin response during Amusement video and post-video; J_DifGSR = difference between galvanic skin response during Joy video and post-video; P_DifGSR = difference between galvanic skin response during Pride video and post-video.*p < .05 **p < .01 ***p < .001.
Figure 9. Negative emotion vulnerability model including hypothesized intervening variable with correlations, standardized regression weights, and standardized factor loadings. Not pictured are the indicators for maladaptive emotion regulation, negative emotion vulnerability, and the method factor. BSL_ALL = aggregated standardized score from Borderline Symptom List-23 measure (22 items) and supplement (9 items); BDI_TOT = total score of Beck Depression Inventory-II; PANAS_N = total score of negative affect subscale of Positive and Negative Affect Schedule (in the context of the last two weeks). *p < .05 **p < .01 ***p < .001.