Borderline Personality Features As A Moderator Of The Association Of Social Rejection With Impulsive Behaviour

by

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Abstract

The primary goal of this research was to examine whether borderline personality (BP) features moderate the effect of social rejection on impulsive behaviours. Previous research suggests that individuals with BPD report greater impulsiveness than non-psychiatric controls and that following a fear induction, university students high in BP features engage in more impulsive responding than low BP individuals. In the present study, 77 individuals from a mixed community and undergraduate sample were randomly assigned to either listen to and visualize a social rejection scenario, or to sit through a neutral emotion induction. Impulsive responding was then measured in a passive avoidance learning task. Against prediction, BP features failed to moderate the relationship between assigned condition and the frequency of impulsive responses. This suggests that social rejection operates distinctly from other forms of negative emotional experience (e.g., fear) that have been shown to elicit more impulsive responding in individuals high in BP features.

Keywords: borderline personality; impulsivity; social rejection; passive avoidance learning; rejection sensitivity

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Introduction

The features of Borderline Personality Disorder (BPD) can be conceptualized as instability across multiple domains: unstable emotions, cognitions, and identity, volatility in interpersonal relationships, and impulsive, possibly self-damaging behaviours (American Psychiatry Association, 2001). Impulsivity is recognized as a core feature of the BPD construct (Hurt, Clarkin, Munroe-Blum, & Marshall, 1992; Zanarini, 1993), with substance abuse, unsafe sexual behaviour, binge eating, self-mutilation, suicidal behaviours, verbal outbursts, physical fights, and reckless spending and driving subsumed under the spectrum of impulsive behaviours contributing to the diagnosis (American Psychiatry Association, 2001; Zanarini, Gunderson, Frankenburg, & Chauncey, 1989). The clinical presentation of BPD is further distinguished by high prevalence of suicide attempts (75%), death by suicide (10%), and self-injury (69-80%; Skodol, Gunderson, Pfohl, Widiger, Livesley, & Siever, 2002). These behaviours have been characterized as impulsive and emotion-driven (Brodsky, Malone, & Ellis, 1997; Chesin, Jeglic, & Stanley, 2010; McGirr et al., 2007).

In this context, it is important to clarify the distinction between impulsive and maladaptive behaviours. Impulsive behaviours are generally defined according to a few characteristic features, including engaging in behaviours absent forethought or planning and failure to inhibit responses despite intrinsic and/or extrinsic motivation to do so (Hochhausen, Lorenz, & Newman, 2002). In terms of the broader construct of impulsivity, individuals may have trait-like vulnerabilities to engage in actions with these qualities. As a category, impulsive behaviours may include actions that are both maladaptive and impulsive (e.g., risk-taking behaviours mentioned previously), to subtler forms of behavioural disinhibition, poor planning and rapid responding, evident in neuropsychological and laboratory-based experimental assessment. Of particular interest are maladaptive behaviours commonly seen among individuals with BPD which typically trade-off long-term negative consequences in favour of immediate benefits, including emotion regulation, social communication, or self-gratification. For example,

poor delay discounting (the tendency to prefer short-term over longer-term rewards) is another form of impulsivity associated with BPD (e.g., Lawrence, Allen, & Chanen, 2010), however, associations between delay-discounting and other conceptualizations of impulsive behavior (e.g., poor response inhibition) are typically non-significant in laboratory studies, and principal components analyses suggest these measures load on separate factors (Lane, Cherek, Rhodes, Pietras, & Tcheremissine, 2003; Reynolds, Ortengren, Richards, & de Wit, 2006). It is unclear at present which constructs (and by extension, which measures) most accurately reflect the form of impulsive and maladaptive behaviors associated with BPD.

Researchers have traditionally examined the relationship between borderline personality (BP) features and impulsivity using a variety of self-report measures (e.g., van Reekum, Links, & Fedorov, 1994). BP features have been positively associated with impulsivity related personality traits, in particular NEO-PI measures of trait disinhibition (Ball et al., 1997; Costa & McRae, 1992; Trull, 2001), and clinical BPD samples have been shown to score higher on impulsivity self-report measures than individuals with other personality disorders (Morey et al., 2002). Impulsivity self-reports are positively related to probability of BPD diagnosis, severity of symptoms, and poorer prognosis in treatment (Koenigsberg et al, 2001; Lejuez et al., 2003; Morey et al., 2002). Further, impulsivity is a predictor of suicide attempt frequency among individuals with BPD after controlling for depression and substance use (Brodsky et al., 1997).

More recent research has incorporated laboratory-based behavioural assessment of impulsivity into the study of BP features, though findings have typically been equivocal (for a review, see Bornovalova, Rosenthal, Daughters, Lynch, & Lejuez, 2005). In a sample of hospitalized women diagnosed with BPD, individuals displayed more impulsive aggression, manifesting as a greater number of retaliatory responses toward a fictitious other participant that apparently interfered with the participant's opportunities to attain monetary reward (Dougherty, Bjork, Huckabee, Moeller, & Swann, 1999). These same individuals did not show heightened impulsivity in a laboratory task assessing delay of gratification. Difficulties in response inhibition have been uniquely associated with BP features in a community sample of individuals diagnosed with BPD, compared to individuals with ADHD, history of mood or anxiety disorders, and healthy controls assessed with the Stop-Signal task (Logan, 1994; Nigg, Silk, Stavro, & Miller,

2005). In contrast, a more recent study involving individuals with BPD and non-psychiatric controls failed to find significant group differences on the Stop-Signal task (Jacob et al., 2010).

In many cases, behavioural patterns observed in the laboratory fail to align with impulsivity measured by self-report. One reason this might be the case is that impulsivity has traditionally been conceptualized as an enduring trait-based construct by most prevailing self-report measures, reflected in the reported stability of individual performance on these measures over time. (i.e., one month test-retest reliability, r_s = 0.83; Stanford et al., 2009). This "impulsivity as personality trait" emphasis is perhaps endemic to the structure of self-report measures in two ways. First, individual questions typically involve making generalizations about impulsive behaviour across context in order to arrive at an estimate of how frequently or how accurately an item applies to the respondent. Second, subscale and total scores further aggregate items where impulsivity varies in form or context, perhaps meaningfully so. In contrast, a behavioural task within a laboratory research paradigm typically measures a singular form of impulsive responding as it occurs in the present moment. Systematic influences of context, which may be dampened in the self-report methodology, may have a greater impact on individual performance in a behavioural measure of impulsivity, and identifying these influences may be of direct interest to the researcher. Indeed, arguably, the examination of the conditions under which discrete forms impulsivity are heightened or dampened may hold greater promise for clinical applications, as compared with examination of performance on aggregated, context-free trait measures.

Research into the factor structure of impulsivity in non-clinical and clinical populations also suggests that performance on various self-report and behavioural measures may relate to different facets of a multidimensional impulsivity construct (Evanden, 1999; Kirby & Finch, 2010; Monterosso, Ehrman, Napier, O'Brien, & Childress, 2001; White, Moffitt, Caspi, Bartusch, Needles, & Stouthamer-Loeber, 1994). In a study of healthy adults by Reynolds, Ortengren, Richards, & de Wit (2006), multiple behavioural measures of impulsivity were largely uncorrelated with each other and unassociated with responses on self report measures of impulsivity. Principal components analysis produced two sub-categories of impulsive behaviour, impulsive decision-making and impulsive disinhibition, which were differentially related to various

behavioural tasks and self-report measures. It follows that impulsivity may be an empirically specious, albeit convenient, conglomeration of action tendencies that align along these two, and possibly additional, dimensions. One important consideration for this research concerns which subset of these heterogeneous traits and behaviours may be relevant to understanding the manifestation of various maladaptive behaviours seen in BPD.

One aspect of impulsivity that may be particularly relevant to the behavioural difficulties of those with BPD is passive avoidance learning (PAL). PAL refers to a process wherein an individual learns to inhibit behaviour in order to avoid punishing consequences, typically a monetary deduction. PAL tasks measure an individual's ability to inhibit prepotent responses during trials where a previously rewarded response will elicit punishment. The primary measure of failure to inhibit such responses is the passive avoidance error (PAE), where the participant responds despite stimuli that signal response contingent punishment (i.e., commission errors). Another measure commonly reported is the omission error (OE), where the participant fails to respond to stimuli that signal response contingent reinforcement (monetary reward). While evidence for group differences in OEs is equivocal, PAEs appear to capture a form of impulsive behaviour important in individuals with BP features (Hochhausen et al., 2002; Leyton, 2001). Considerable research on passive-avoidance has centered on exploring psychopathy-related deficits in incarcerated samples (e.g., Newman & Kosson, 1986; Newman & Schmitt, 1998; Thornquist & Zuckerman, 1995), as well as identifying and distinguishing disinhibited groups (e.g., Milich, Hartung, Martin, & Haigler, 1994; Patterson, Kosson, & Newman, 1987) and disinhibiting factors (e.g., alcohol consumption; Finn, Justus, Mazas, & Steinmetz, 1999). Notably, subsequent studies have involved incarcerated females with BPD (Hochhausen et al., 2002), community-recruited individuals with BPD (Leyton, et al., 2001), and university students with varying levels of BP features (Chapman, Dixon-Gordon, Layden, & Walters, 2010; Chapman, Leung, & Lynch, 2008).

Altogether, mixed support for a relationship between a superordinate impulsivity factor and BP features is unsurprising. As mentioned, one reason for this is that BP features may be related to certain types of impulsive traits and behaviours and not others. It is therefore important to carefully select and consider the specific impulsive behaviour(s) under observation. A second reason for the lack of robust, persistent

associations is that these relationships may emerge under specific contexts. The form, frequency and extent of impulsive behaviour may jointly depend on individual personality characteristics (including BP features) and situational factors. In particular, affective instability and sensitivity to rejection are prominent clinical features of BPD (e.g., APA, 2000; Koenigsberg et al., 2001; Linehan, 1993; Skodol et al., 2002). Thus it is worth considering whether evidence suggests individual high in BP features facing a negative emotional experience, particularly social rejection, may be prone to responding impulsively.

BP Features, Impulsivity, and Affective State

According to Linehan's (1993) biosocial model, individuals with BPD are doubly disadvantaged when they experience emotional distress: these individuals are predisposed toward *emotion vulnerability*, which refers to emotional responding that is characterized by heightened intensity, involves a slow return to baseline, and is more likely to occur in a given situation (i.e., a lower threshold), and *emotion dysregulation*, an inability to modulate, control or abate emotion. Individuals with BPD consistently report elevated levels of negative affect relative to non-psychiatric controls (e.g., Farmer & Nelson-Gray, 1995; Stiglmayr, Shapiro, Stieglitz, Limberger, & Bohus, 2001; Stiglmayr et al., 2005). In addition, individuals with BPD appear to be more sensitive to facial expressions of emotion (Lynch, et al., 2006; Wagner, & Linehan, 1994; cf. Levine, Marziali, & Hood, 1997) and report negative emotions of greater intensity and with greater frequency than non-BPD controls (Levine et al., 1997; Stiglmayr et al., 2005). Notably, BP features are associated with the use of maladaptive avoidance strategies in order to cope with unpleasant emotions and thoughts (Bijttebier, & Vertommen, 1999; Chapman, Specht, & Cellucci, 2005; Rosenthal, Cheavens, Lejuez, & Lynch, 2005; Vollrath, Alnaes, & Torgersen, 1998), suggesting that the interplay between emotion dysregulation and disinhibition may underlie problems related to BP features (Svrakic, Whitehead, Przybeck, & Cloninger, 1993; Trull, 1992; Trull, Sher, Minks-Brown, Durbin, & Burr, 2000).

Why might an emotional trigger selectively interfere with PAL among those with BP features? One possibility is that it is the presence of heightened emotional arousal in

general impairs individuals with BP features on a variety of cognitive domains, including attention, problem solving, and learning from negative consequences. A second possibility is that individuals with BP features are likely to become more impulsive or to fail to learn from negative consequences because of some quality specific to certain emotional states or triggers. Thus it is important to determine whether or not these individuals respond more impulsively in response to a variety of emotional states.

Some evidence supports general arousal eliciting more impulsive behaviour in individuals with BP features. Chapman and colleagues (2010) explored the moderating effect of a fear induction on PAL performance as a function of BP features. Undergraduate student participants were divided into high and low-BP groups on the basis of self-report questionnaires and then randomly assigned to view either a scene from a horror film (fear induction) or a five-minute sequence of interchanging colors (neutral emotion induction). Subsequent performance on a PAL task was compared across BP and emotion induction conditions. Results indicated that only high-BP participants committed a greater number of impulsive responses in the fear condition compared with the neutral condition; performance for low-BP participants was not significantly affected by the type of emotion induction. Importantly, while high-BP participants also experienced more self-reported fear after the fear induction than low-BP participants, the BP group by emotion induction interaction effect on impulsive responses remained significant even after controlling for the self-reported intensity of fear. This implicates fear as a moderator of impulsive disinhibition in individuals with prominent BP features. This finding is somewhat counterintuitive given the putative role of fear in inhibiting behaviour. The authors instead suggest that it may not be fear specifically but the general distress and arousal occasioned by negative emotional contexts, fear included, that drive the BP feature-impulsivity relationship. The extent to which this relationship generalizes to clinically diagnosed BPD populations, other negative affective states, and other forms of impulsive behaviour are left as questions for future studies.

Neuropsychological evidence further suggests broad structural and functional differences related to BPD, emotion processing, and dysregulated behaviour. Findings from neuroimaging studies appear to implicate areas of prefrontal cortex and the limbic system in BPD behavioural dysfunction (for a review, see Schmahl & Bremner, 2006).

Herpertz et al. (2001) observed amgydala hyperactivation in six patients with BPD viewing standardized negative emotional images relative to controls. Amygdala and hippocampal volumes are consistently reduced in patients with BPD compared to healthy controls (Driessen et al., 2001; Schmahl et al., 2003; Tebartz van Elst et al., 2003). In addition, impaired serotonergic function in corticostriatal pathways of the medial frontal gyrus, anterior cingulate gyrus, temporal gyrus, and striatum has been shown to related to the commission of PAEs among individuals with BPD (Leyton et al., 2001). Taken together, introducing a negative emotional trigger to individuals with severe BP features might exacerbate functional impairment in cortical areas involved in PAL.

Lawrence, Allen, & Chanen (2010) used a social rejection task designed to induce feelings of anger and rejection to examine changes in impulsive decision-making of outpatients with BPD and healthy controls. Each participant took part in a computer simulation (Cyberball; Williams & Jarvis, 2006) where they were tasked with virtually tossing a ball amongst other "players" who, unbeknownst to participants, were part of the simulation. After ten trials, these computer-controlled players were preprogrammed to toss the ball only to one another, excluding the participant. Findings suggest that that the BPD group demonstrated a preference for immediate gratification and tendency to discount delayed rewards relative to healthy controls; however, contrary to the authors' predictions, impulsive decisions in the BPD group did not significantly differ following social rejection and impulsive decisions in the healthy control group actually decreased following rejection (i.e., self control improved; cf. Tice, Bratslavsky, & Baumeister, 2001). The authors suggest that social rejection may be a special class of negative experience that affects decision-making differently and that perhaps in this context, failure to reduce impulsivity is the key maladaptive response seen in individuals with BPD. Alternatively, the null effect of induced anger and rejection in the BPD group may be attributed to dissociation-related attenuation of emotional states. Indeed, two studies that did not control for dissociation did not find a relationship between BPD diagnosis and emotional responding to unpleasant images (Herpertz, Kunert, Schwenger, & Sass, 1999; Herpertz et al., 2000), and previous research suggests individuals with BPD engage in more dissociation than clinical and non-clinical controls in response to distress (Stiglmeyer et al., 2001, 2008). As a third explanation for these unexpected findings, levels of each

participant's impulsive decision-making were assessed twice, immediately before and after social rejection, and may be contaminated by differential carryover effects possible in this form of repeated-measures design.

Further research probing the effects of social rejection in relation to BP features is particularly important given existing evidence that BPD individuals are emotionally vulnerable to interpersonal distress. Clinically, relationship instability and heightened fear of abandonment are identified as central diagnostic features of BPD (APA, 2000; Morey, Gunderson, & Quigley, 2002; Skodol et al., 2002). In the laboratory, a social rejection stressor elicited heightened anger reactivity in individuals with high levels of BP features relative to low-BP individuals, whereas between-group differences in emotional responding were not significant following an academic rejection stressor (Chapman, Walters, & Dixon-Gordon, in press). Similarly, social rejection has been shown to impair social problem solving performance in undergraduate students high in BP features (Dixon-Gordon, Chapman, Lovasz, & Walters, 2011). Individuals with BPD have been previously shown to exhibit fewer positive and more "mixed" facial expressions relative to non-psychiatric controls following a social rejection task (Staebler et al., 2011), and individuals with BPD have shown greater sensitivity than control participants when judging the interpersonal emotional content of facial expressions (i.e., greater accuracy and shorter reaction-times; Lynch, Rosenthal, Kasson, Cheavens, Lejuez, & Blair, 2006). If impulsivity related to BP features has to do primarily with amount or magnitude of emotional arousal or distress, a social rejection paradigm would seem to be related to the most distress, and possibly the most impulsivity. In contrast, if emotion related impulsivity in BPD is more specifically related to particular triggers or emotional states and not others, we might expect different patterns of responding (e.g., Lawrence et al., 2010).

In examining relationships between BP features, social rejection and impulsive responding, it is important to also consider the influence of trait differences in rejection sensitivity (RS) as an additional predictor of impulsive disinhibition. Compared to BP feature measures, RS more directly captures the tendency to anxiously expect, be concerned with, and intensely react to social rejection (Downey & Feldman, 1996). Individuals with BP features, including those with BPD diagnosis, more readily endorse the belief that they will be abandoned and rejected relative to controls (Arntz, Dreessen,

Schouten, & Weertman, 2004; Arntz, Roos, & Dreessen, 1999; Ayduk et al., 2008). Similarly, individuals with BPD report higher levels of RS than both healthy controls and individuals with social anxiety disorder (Staebler, Helbing, Rosenbach, & Renneberg, 2011) (Staebler, Helbing, Rosenbach, & Renneberg, 2010). Given shared concerns over abandonment and relationship conflict seen in both individuals high in RS and individuals with BPD (Downey et al., 1996), it is important to consider whether RS accounts for possible relationships between BP features and impulsive responding.

Primary Aims and Hypotheses

The present study integrates and extends previous research findings by exploring the impact of a social rejection scenario on impulsive responding as a function of individual differences in BP features in a sample drawn from undergraduates and members of the community. Participants were randomly assigned to one of two emotion induction conditions; individuals either listened to a social rejection audio recording shown to elicit significant change in reported negative emotions (Dixon-Gordon, 2011), or underwent a neutral emotion induction (Jennings, Kamarck, Stewart, Eddy, & Johnson, 1992). Following the induction, individuals completed a PAL task. A multi-method approach to indexing emotional responding was employed including self-reported measures of emotion following each experimental phase and psychophysiological measures of arousal and emotional expressivity. Dissociation was concomitantly assessed via self-report in an attempt to disentangle its potential confounding influence on emotionality.

Importantly, the current study attempts to gauge the specific contribution of BP features to impulsive responding, independent of potential differences in general psychopathology seen in individuals. It may be the case that individuals high in BP features share a similar profile of clinical impairments not related to BP per se; in order to control for potentially confounding effects, individuals were assessed on a global measure of psychopathology, the Global Severity Index of the Brief Symptom Inventory (BSI; Derogatis, 1993). In this way, I intended to obtain a purer measure of the unique impact of BP features on dependent measures by partialing out potential effects of general severity of psychopathology.

The current study had three aims. Aim 1 was to examine whether BP features moderate the influence of current emotional state on impulsivity. This primary research aim was derived from predictions based on evidence from Chapman et al. (2010), and Lawrence et al. (2010). If persons with heightened BP features are vulnerable to difficulties learning behavioural inhibition in negative emotional contexts more generally, rather than fear contexts specifically, the present research should demonstrate similar findings as those of Chapman et al. (2010). Hypothesis 1, therefore, was that high-BP participants but not low-BP participants would commit significantly more PAEs in the social rejection condition than their counterparts in the neutral emotion condition. An alternative possibility that follows from Lawrence et al. was that social rejection differs from fear, reducing impulsive responding in individuals low in BP features and not influencing impulsive responding in individuals high in BP features. This differs from the relationship previously observed for fear, where impulsive responding was invariant for low-BP individuals and heightened among high-BP individuals. For this pattern to hold in the proposed study, low-BP individuals should commit significantly fewer PAEs following social rejection than following the neutral emotion induction and high-BP individuals should instead show no significant difference in PAEs.

Aim 2 was to examine the relationship between BP features and various aspects of impulsivity on self-report measures using two common impulsivity questionnaires, the Barratt Impulsiveness Scale (BIS-11; Patton, Stanford, & Barratt, 1995) and the UPPS (Whiteside & Lynam, 2001), as well as PAEs for participants in each of the emotion induction conditions. While BP features were expected to be uniquely associated with each impulsivity measure, and self-report scales were expected to show a significant association with one another, the relationships between self-reports and PAEs were expected to be small and/or non-significant, suggesting these measures tap into separate, possibly orthogonal dimensions of impulsivity that are independently related to BP features.

Aim 3 was to investigate the possibility that impulsive responding related to BP features can be accounted for by an individual's vulnerability to social rejection, as measured by RS. It was expected that an individual's impulsive responding would jointly depend on the emotion induction condition they were assigned to and their level of RS. Similar to hypothesis 1, hypothesis 3a was that RS should also moderate the

relationship between the form of the emotion induction (social rejection, neutral) and PAEs. Following social rejection, the magnitude of the relationship between RS and PAEs should be comparable to, if not stronger than the relationship between BP features and PAEs. Further, hypothesis 3b was that RS mediated the relationship between BP features and PAEs following social rejection.

Method

Participants

87 participants were drawn from the undergraduate student population at Simon Fraser University (SFU) as well as the broader Burnaby-Vancouver community. A majority of participants (N=73) were recruited from the student population enrolled in Psychology courses at SFU. These students were invited to participate in a study of "emotions and impulsivity" in exchange for course credit. As convenience sampling psychology students is liable to produce an attenuated range of BP features, individuals with elevated BP features (N=14) were oversampled. Recruitment materials (posters and online advertisements) at the university and in the community solicited individuals with difficulty regulating their emotions. In addition, individuals that participated in prior studies in our lab and gave consent to be re-contacted for future studies were recruited as part of the oversample. Specifically, individuals were administered the Personality Assessment Inventory – Borderline Features scale (PAI-BOR; Morey, 1991), detailed below. Individuals with raw scores of 38 and above on the PAI-BOR (corresponding to *T*-scores ≥ 70 in a student standardization sample; Morey, 1991) were invited to participate in the full study. All participants were remunerated with course credit, where applicable, or $20.

Among eligible participants, four withdrew before completing all aspects of the study. In addition, the data for six participants were excluded on the basis of atypical responding on the PAL task; these participants responded (or failed to respond) on greater than 90% of all trials, suggesting they either misunderstood the task instructions or were not motivated to comply with the task. This left a sample of 77 participants (64 psychology students, 13 community members) with useable data. Of these participants, 10 (13%) reported scores on the PAI-BOR in the clinical range.

The demographic characteristics of the sample are summarized in Tables 1-3. With respect to ethnicity and acculturation, most participants reported an ethnicity of White/Caucasian (40.26%) or Chinese/Chinese Canadian (29.87%). Nearly two-thirds of participants were born in Canada (64.49%) and most participants reported English as a first language (61.04%). A majority of the sample was female (80.52%). With respect to past and current relationships, nearly all participants reported that they were primarily heterosexual in orientation (96.1%) and had never married (97.4%). The age of participants ranged from 17 to 46 years (*M* = 20.29). Reflecting the socioeconomic status of a primarily undergraduate sample, most participants reported a gross annual income of less than $5,000 (59.74%) and some university or college education (less than 2 years = 48.05%; 2-4 years = 36.36%).

Table 1. Demographics: Ethnicity and Acculturation Variables

	Total sample (*N* = 77)		**Social rejection (*N* = 42)**		**Neutral emotion (*N* = 35)**	
Variable	***N***	**%**	***N***	**%**	***N***	**%**
Ethnicity						
White/Caucasian	31	40.26	20	47.62	11	31.43
Chinese/Chinese Canadian	23	29.87	12	28.57	11	31.42
East Indian/Indo-Canadian	6	7.79	3	7.14	3	8.57
Korean/Korean-Canadian	4	5.19	1	2.38	3	8.57
Middle Eastern/Arab	2	3.90	1	2.38	1	2.86
Black/African-American	1	1.30	0	0	1	2.86
Other	6	7.79	2	4.76	3	8.57
More than one racial group	4	5.19	2	4.76	2	5.71
Birthplace						
Canada	50	64.94	29	69.05	21	60.00
Other	27	35.06	13	30.95	14	40.00

First Language						
English	47	61.04	29	69.05	18	51.43
Other	27	35.06	12	28.57	16	42.86
Chose not to answer	3	3.90	1	2.38	2	5.71

Table 2. Demographics: Sex, Sexual Orientation & Martial Status

	Total sample (*N* = 77)		**Social rejection (*N* = 42)**		**Neutral emotion (*N* = 35)**	
Variable	***N***	**%**	***N***	**%**	***N***	**%**
Sex						
Female	62	80.52	31	73.81	31	88.57
Male	15	19.48	11	26.19	4	11.43
Sexual Orientation						
Primarily heterosexual	74	96.10	42	100	32	91.43
Bisexual	3	3.90	0	0	3	8.57
Primarily homosexual	0	0	0	0	0	0
Other	0	0	0	0	0	0
Marital Status						
Single, never married	75	97.40	41	97.62	34	97.14
Married	1	1.30	1	2.38	0	0
Separated	1	1.30	0	0	1	2.86

Table 3. Demographics: Income & Education

	Total sample	**Social**	**Neutral**

	(*N* = 77)		rejection (*N* = 42)		emotion (*N* = 35)	
Variable	***N***	**%**	***N***	**%**	***N***	**%**
Income						
Less than $5,000	46	59.74	25	59.52	21	60.00
$5,000 - $9,999	21	27.27	12	28.57	9	25.71
$10,000 - $14,999	4	5.19	2	4.76	2	5.71
$15,000 - $19,999	5	6.49	2	4.76	3	8.57
$20,000 - $24,999	1	1.30	1	2.38	0	0
Education						
High school graduate	10	12.99	3	7.14	7	20.00
Less than 2 years of university/college	37	48.05	23	54.76	14	40.00
2-4 years of university/college	28	36.36	14	33.33	14	40.00
Bachelor's degree or equivalent	2	2.60	2	4.76	0	0

Procedure

The overall flow of study procedures can be seen in Table 4, below. Prior to the laboratory session, participants were randomly assigned to a social rejection or neutral emotion condition. Upon arriving in the laboratory, individual participants were familiarized with the experimental testing room and then administered the initial assessment self-report measures, described previously. Physiological recording equipment was then attached to the participant, and sensor readings were verified. Experimenters situated in an adjoining observation room separated by one-way glass communicated experimental instructions via intercom.

Participants reported their initial emotional state via questionnaire (see below). They were then instructed to sit still for a 5-minute baseline period while physiological activity was recorded. Participants then completed a second set of emotion self-report questionnaires. Next, participants underwent either the social rejection or neutral emotion induction (described below), according to condition. During this period, physiological activity was recorded. Participants then completed a third set of emotion self-report measures as well as a measure of self-reported dissociation. All participants then engaged in the PAL task assessing level of impulsive disinhibition (described below). They then completed a fourth set of emotion self-reports. A 5-minute baseline recovery period followed; like the original baseline, participants were asked to sit still and physiological activity was recorded. Finally, participants completed a fifth set of emotion self-reports.

Borderline personality features.

BP features were assessed using the Personality Assessment Inventory – Borderline Features scale (PAI-BOR; Morey 1991), a 24-item measure that assesses BP features in adults. In previous studies, a cut-off score of 38 (T = 70) has shown good diagnostic efficiency (e.g., positive predictive power = .97; Jacobo, Blais, Baity, & Hartley, 2007) when differentiating outpatient individuals diagnosed with BPD on the basis of structured or semi-structured interview from outpatient individuals with

prominent BP features that do not meet full criteria for diagnosis (Jacobo et al., 2007; Stein, Pinsker-Aspen, & Hilsenroth, 2007). The PAI-BOR has been used in similar studies of BP features involving university students, demonstrating strong psychometric properties; Chapman et al. (2010), reported excellent internal consistency (α = .93) and test-retest reliability (r = .93) within a similar sample and a comparable experimental design. In the present study, participants demonstrated acceptable internal consistency of responses (α = .85).

Table 4. Flow and Duration of Laboratory Procedures

Procedure	Average Duration
Completion of initial self-report measures (PAI-BOR, BSI, BIS-11, UPPS, RSQ)	15 min
Cognitive ability assessment (Wonderlic)	15 min
Hookup to Biopac equipment	10 min
Risk assessment (UWRAP)	5 min
Baseline psychophysiology recording*	5 min
Completion of PANAS, DSS	5 min
Social rejection audio-recording induction or neutral emotion induction*	5 min
Completion of PANAS, DSS	5 min
Passive avoidance learning task*	10 min
Completion of PANAS, DSS	5 min
Recovery period psychophysiology recording*	5 min
Completion of PANAS, DSS	5 min
Removal of Biopac equipment	5 min
Debriefing	5 min
Total	100 min

Note. PAI-BOR = Personality Inventory, Borderline Features Scale; BIS = Brief Symptom Inventory; BIS-11 = Barratt Impulsiveness Scale, Version 11; UPPS = UPPS Impulsive Behaviour Scale; RSQ = Rejection Sensitivity Questionnaire; UWRAP = University of Washington Risk Assessment Protocol

* Psychophysiology recording period

Psychological distress and general severity of psychopathology.

The Global Severity Index (GSI), a scale derived from the Brief Symptom Inventory (BSI; Derogatis, 1993), was administered as a measure of overall psychological distress and psychopathology. The BSI is a 53-item measure of psychopathology representing nine primary symptom dimensions and three global indices. Individual responses are recorded on a 5-point Likert scale. The GSI aggregates both the number of psychological symptoms reported and the intensity of distress associated with each symptom to produce a global index of psychopathology. The BSI has demonstrated adequate psychometric properties in general (Derogatis, 1993); in particular, high internal consistency of this measure was shown in a comparable laboratory study of impulsivity (α = .98; Chapman et al., 2010). Internal consistency was similarly excellent in the present study (α = .95).

Cognitive Ability.

In order to control for differences in cognitive ability potentially impacting performance on the PAL task, participants were administered the Wonderlic Personnel Test (WPT; Wonderlic, 1992). Respondents attempt to correctly answer as many of 50 multiple-choice questions as is possible in 12 minutes. A person's score is their number of correct responses. Items increase in difficulty; a score of 20 is approximately equivalent to a Full-Scale IQ (FSIQ) of 100 on the Weschler Adult Intelligence Scale (WAIS; Wechsler, 1955). The WPT was selected because it is relatively quick to administer with minimal training on the part of the assessor and has been previously shown to have excellent convergent validity with WAIS FSIQ in nonclinical samples (*r* = .91 - .93; Dodrill, 1981).

Self-reported impulsivity.

Impulsivity was assessed using the Barratt Impulsiveness Scale, version 11 (BIS-11; Patton, et al., 1995) and the UPPS Impulsive Behaviour Scale (Whiteside et al., 2001). The BIS is a 30-item measure of trait impulsivity along three dimensions – motor, nonplanning, and attentional. The BIS has demonstrated adequate internal consistency among psychiatric and non-psychiatric samples (α = .79 - .83; Patton et al., 1995). In previous studies, individuals diagnosed with BPD scored significantly higher on the BIS than both individuals with other personality disorders and individuals with bipolar II disorder (Henry et al., 2001), and the number of BPD symptoms predicted total BIS score in an undergraduate sample (Fossati et al., 2004). Responses of the present sample exhibited good internal consistency (α = .80).

The UPPS Impulsive Behaviour Scale is a 46-item measure that divides impulsivity along four dimensions – urgency, (lack of) premeditation, (lack of) perseveration, and sensation seeking. The UPPS scales have shown good internal consistency in clinical and non-clinical samples (αs = .82 - .90; Whiteside et al., 2001; Whiteside, Lynam, Miller, & Reynolds, 2005). Urgency and premeditation scales have been shown to be related to BP features in undergraduates (Tragesser & Robinson, 2009) with urgency predicting BP features after controlling for Antisocial personality and alchohol misuse in a mixed sample of individuals with BPD, individuals with alcohol abuse problems, pathological gamblers, and control participants (Whiteside et al., 2005). In the present study, internal consistency of responses within scales was good (αs = .80 - .89).

Rejection sensitivity.

Participants' level of RS was measured using the 18-item Rejection Sensitivity Questionnaire (RSQ; Downey et al., 1996). Items present hypothetical situations that young adults, particularly undergraduate students, are likely to encounter and which may involve rejection (e.g., "You ask your friend to do you a big favor"). Each item is rated separately on a 6-point Likert scale according to the respondent's degree of anxiety over the outcome ("very unconcerned" to "very concerned") and their expectations of acceptance or rejection ("very unlikely" to "very likely"). The RSQ yields a score on a

unitary RS dimension and has been shown to demonstrate good internal consistency in undergraduate samples (α = .81). Previous validation research has shown individuals high in RS are more likely to experience rejection following ambiguous feedback from a new acquaintance and to report negative behaviour by a new romantic partner (e.g., being distant or insensitive) as being intentionally hurtful (Downey et al., 1996). Responses to the RSQ showed adequate internal consistency in the present study (α = .78).

Current self-reported emotional state.

At multiple points during the experiment, participants completed the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) as a measure of subjective emotional state in the present moment (i.e., state affect). Participants rated 20 emotion words on a 5-point Likert scale ("very slightly or not at all" to "extremely") based on the extent to which they were feeling each emotion "right now (that is, at the present moment)". Responses on specific emotions yield scores on two general dimension scales, Positive Affect (PA; sum of scores on active, alert, attentive, determined, enthusiastic, excited, inspired, interested, proud, and strong items) and Negative Affect (NA; sum of scores on afraid, scared, nervous, jittery, irritable, hostile, guilty, ashamed, upset, and distressed items). Minor but significant wording changes allow the PANAS to be employed as either a measure of state affect or trait affect (Watson & Clark, 1994). Assessing self-reported emotional state in this manner served as a manipulation check, with significant changes in PA and NA scores following the induction phase suggesting the emotion inductions elicited an emotional response (or non-response, in the case of the neutral emotion induction) and significant differences in scores following induction indicating a differential impact on state affect according to the induction type.

Previous studies using the PANAS as a measure of state affect, as it was utilized in the present study, have demonstrated good internal consistency (αs = .83-.91; Watson et al., 1994). In the present study internal consistency of responses ranged from good to excellent for positive affect (αs = .86 - .92) and acceptable to good for negative affect (αs = .68 - .88). In addition, studies provide evidence of convergent validity, particularly when comparing reports of the negative emotions anger, sadness, and fear to well validated measures such as the Beck Depression Inventory (BDI; Beck, Ward,

Mendelson, Mock, & Erbaugh, 1961), State Anxiety Scale (STAI; Spielberger, Gorsuch, & Luchene, 1970), and the Hostility scale of the Symptom Checklist 90 (SCL-90; Derogatis, 1977), as well as divergent validity (Watson & Clark, 1992). An additional advantage of the PANAS is that it is a brief, quick measure, unlikely to interfere with or shorten the effects of the emotion inductions.

Dissociation.

Dissociative symptoms experienced during the emotion induction were assessed with Dissociation Tension Scale acute (DSS-acute; Stiglmayr, Braakmann, Haaf, Stieglitz, & Bohus, 2003). Participants provided responses indicating intensity on a 10-point Likert scale ("none" to "very strong") for 19 symptom items combining aspects of psychological dissociation (e.g., "I had that feeling as if my body did not belong to me") and somatoform dissociative phenomena (e.g., "I felt as if I was paralyzed, numbed"). Previous studies suggest this measure has excellent internal consistency (αs = .89 - .94; Dixon-Gordon, 2011; Stiglmayer et al., 2003), and that subjective stress and BPD diagnosis predict elevations on this measure (Stiglmayr et al., 2008). Responses provided by present sample exhibited excellent internal consistency (αs = .91).

Psychophysiological measures.

As with emotion self-reports, psychophysiological recordings of autonomic system response were an indicator of emotional change and differential levels of state affect following the social rejection and neutral emotion induction.

Respiratory sinus arrhythmia.

Respiratory sinus arrhythmia (RSA) was assessed as an index of cardiac vagal control (i.e., vagal tone), indicative of the degree of parasympathetic nervous system activity. RSA was quantified in terms of heart-rate variability; specifically, heart-rate was decomposed into bands of frequency data using discrete Fourier transforms in order to measure the power spectral density of high frequency information (> .15 Hz; for methodology, see Grossman & Taylor, 2007). Previous research suggests differential responses to emotional arousal for individuals with BPD and healthy controls; whereas non-BPD participants show an increase in RSA over time, individuals with BPD tend to

exhibit a decrease in RSA suggestive of parasympathetic inhibition (i.e., the "fight or flight" response; Austin et al., 2007). RSA data was recorded via ECG electrodes connected to an ECG100C amplifier (Biopac Systems, Inc., Santa Barbara, CA) with a sampling rate of 1000 samples per second.

Skin conductance response.

Skin conductance responses (SCRs) were measured as an index of sympathetic nervous system activity. SCRs are phasic changes in the electrical conductivity of the tips of the fingers as a result of eccrine sweat gland secretions and are typically elicited by either orienting responses or increased arousal, occurring 1-3 seconds post stimulus onset (Dawson, Schell, & Filion, 2007). For the purposes of the present study, an SCR was operationalized as a rapid (< 3s) increase in skin conductance of at least .5 microsiemens (μS). SCRs were recorded from two electrodes attached to the third and fourth distal phalanges on the non-dominant hand, connected to a GSR100C amplifier (Biopac Systems, Inc., Santa Barbara, CA).

Facial electromyography.

Facial electromyography (EMG) data were recorded from two sites, corresponding to the *corrugator supercilli* and *zygomaticus major* skeletomotor muscle regions, following recording conventions set forth in Fridlund & Caccioppo (1986). Electrodes measure the voltage activity produced by the formation of overt or incipient expressions of negative and positive emotion. Readings were processed by an EMG100C amplifier (Biopac Systems, Inc., Santa Barbara, CA).

Social rejection induction.

In the social rejection condition, participants were instructed to close their eyes and imagine that a series of events unfolding over a five-minute audio recording are happening to them, responding to these events as they would in real life. In the recording the protagonist (referenced throughout in the second-person) experiences a series of described rejections including a) having another female answer their boyfriend's phone b) noticing their boyfriend out in public with another woman, c) overhearing two friends in a coffee shop criticize their appearance, behaviour, and

values, and d) hearing these same friends speculate that the boyfriend is being unfaithful to the protagonist. The exact version of the audiotape varied according to the gender and reported sexual orientation of the participant appropriately substituting nouns and pronouns pertaining to the gender of the participant's significant other. Multiple studies have demonstrated that this recording elicits a significant increase in negative affect in undergraduate participants high and low in BP features, as well as individuals diagnosed with BPD and non-psychiatric controls from the community (Dixon-Gordon, 2011; Dixon-Gordon et al., 2011; Robins, 1988).

Neutral emotion induction.

In the neutral mood induction condition, participants viewed a sequentially displayed sequence of colors for 5 minutes. Previous research indicates that this procedure elicits a reduction in emotions consistent with neutral mood more effectively than 5 minutes of no activity (Jennings et al., 1992). Prior to the induction, participants are instructed to choose a color and count the number of times it appears over 5 minute period, in order to encourage participants to attend to the task.

Passive avoidance learning task.

The computerized PAL task in the current study shared the essential features of previous PAL assessments of impulsive disinhibition administered in similar studies (Chapman et al., 2008; Chapman et al., 2010; Hochhausen et al., 2002; Newman & Schmitt, 1998). The current version was created and administered using E-Prime 2.0 (Psychology Software Tools, Inc., Sharpsburg, PA). In the task, 5 two-digit numbers were associated with monetary reward (S+) and 5 two-digit numbers were associated with monetary punishment (S-). At the start of the task, the following set of instructions were displayed on the screen:

> In this experiment, the computer will be flashing a series of two-digit numbers on the screen (e.g., 51, 38, etc.). Each number will come on for about 2 seconds and then disappear. During the experiment, you will see the same numbers over and over again. Each time that a number appears, you have to decide whether or not you are going to press the spacebar. Your task is to use the numbers to win as many points as you can. Press any key to start.

As numbers appeared and participants did or did not respond, participants would learn to discriminate S+ and S- stimuli on the basis of rewards and punishments. Participants began with $1 in dimes. In each trial, a two-digit number appeared (one from either the S+ or S- sets) and the participant could either press the spacebar or withhold a response. For each correct response to S+, participants were awarded 10¢, and were provided feedback in the form of text ("You WIN 10 cents!") and a high pitched auditory tone (400 Hz). For each incorrect response to S-, participants were penalized 10¢, with corresponding visual and auditory feedback ("You LOSE 10 cents!" paired with a 100 Hz tone). Participants had up to 3s of stimulus presentation to respond; otherwise no reward, punishment, or feedback was given and the next trial commences. The first five pretreatment trials served to establish a dominant response set by presenting each of the 5 S+ stimuli in sequence; the following 90 test trials presented the S+ and S- stimuli 9 times each, in pseudorandomized order. At the conclusion of the task, participants kept all money they had earned.

Incorrect responses to S- stimuli (i.e., errors of commission; failure to inhibit previously punished responses) are referred to as passive avoidance errors (PAEs). Impulsive disinhibition was operationalized as the total number of PAEs committed over the 90 test trials and served as the primary dependent variable in this study. A secondary potential measure of disinhibition, fewer omission errors (i.e. fewer failures to respond to previously rewarded S+ stimuli), was also examined, though previous findings are equivocal (Chapman et al., 2010; Hochhausen et al. 2002).

Debriefing.

Immediately following data collection, all participants were debriefed as to the full purpose of the study. As part of standard risk-assessment practices in our research lab, all participants were administered the initial risk assessment portion of the University of Washington Risk Assessment Protocol (UWRAP) immediately before and after the laboratory phase of the study. Participants rated their level of distress, anger, and urges to engage in self-damaging behaviours on a scale of 1 to 7 and were then asked to consider strategies they could use to reduce distress should it arise. A risk management protocol is triggered should a participant endorse a 4 or greater for suicidal or homicidal ideation. In this instance, clinical backup (a masters- or doctoral-level clinician) is

contacted, risk factors (e.g., presence of a plan, access to lethal means) are more directly assessed, medical and/or treatment resources are provided, and research assistants maintain contact with the participant until clinical backup establish a safety plan. No participants in the present study triggered this protocol.

Data Analytic Plan

Descriptive statistics.

Prior to data analysis, the descriptive statistics and distribution properties of all dependent variables were examined (BSI-GSI, BIS, UPPS, RS, PANAS-PA, PANAS-NA, DSS, RSA, SCRs, EMG-Zygomaticus, EMG-Corrugator, PAL-PAEs, PAL-omissions). Given instances of significant non-normality, defined here as distributions with standardized skew or kurtosis ≥ ±2.0, problematic variables were log transformed. Outliers were defined as values > 3 *SD* units from the mean. For these cases, values were winsorized (i.e., outlier scores were replaced by the most extreme non-outlier scores in the data). Subsequent analyses were performed on both raw and corrected (i.e., transformed and winsorized) distributions and differences in results are noted.

Sample differences.

Given the participant recruitment methods discussed previously, I initially intended to examine pre-existing differences between undergraduate and community participants in the final sample. Ultimately, the small number of community participants included in the sample did not allow for meaningful comparisons of group differences.

Covariates.

The role of six potential covariates was considered—the impact of initial psychological distress (GSI), cognitive ability (Wonderlic), age, gender, and ethnicity on PAEs as well as the effect of dissociation (DSS) on subjective emotional state (PANAS). For each independent variable, correlation analyses were performed between each variable and the number of PAEs. Variables significantly associated with PAEs were

included as covariates in subsequent analyses. Analyses performed with and without covariates included were then compared.

Manipulation check.

In order to establish whether participants experience emotional responses to social rejection in the corresponding condition, a Condition (social rejection, neutral emotion) × Time (baseline, post-induction) ANOVA was performed for each of the post-induction emotion self-reports (PANAS-PA and PANAS-NA). A significant Condition × Time interaction would suggest a differential changes in self-reported emotion following the induction phase, driven by the type of the induction. Planned comparisons between emotion self-reports across conditions at Time 2 were conducted in order to clarify how each induction did (or did not) differentially influence state affect.

A series of univariate ANOVAs tested for significant patterns of responding across psychophysiological measures (RSA, SCRs, EMG-Zygomaticus, and EMG-Corrugator). Significant Condition × Time interactions might indicate induction-specific physiological reactivity; planned comparisons demonstrating a significant Time 2 difference in physiological activation by condition would provide converging evidence of emotional responsiveness to the social rejection induction relative to the neutral emotion induction.

Hypothesis 1: The impact of emotion induction (social rejection vs. neutral) on impulsive responding depends on level of BP features.

Hypothesis 1 was that the impact of emotion induction (social rejection vs. neutral) on impulsive responding depends on level of BP features. Specifically, significantly higher PAEs in the social rejection condition compared with the neutral condition only among the high-BP participants would support this hypothesis. A hierarchical linear OLS regression was conducted comparing social rejection versus neutral emotion, with number of PAEs committed as the criterion variable. For the purposes of these analyses, all predictors were centred (i.e., expressed as the difference between each participant's score and the mean score for that variable). Covariates

identified using bivariate correlations discussed previously were included in block 1. Condition and Condition × BP feature interaction terms were input into block 2 of the regression and simple regression equations were constructed for high, medium and low levels of BP features (upper, middle, and lower tertile, respectively). Constructing 95% confidence intervals about simple slopes indicated whether or not the difference in induction conditions (social rejection versus neutral) was significantly related to the number of PAEs committed after controlling for covariates in block 1. Intervals not containing zero would suggest that the difference in number of PAEs between induction conditions was significant at that level of BP features. It is expected that for high-BP but not low-BP individuals, significantly more PAEs occur following social rejection than following the neutral emotion induction.

Previous research using the PAL task suggests that differential performance between groups may be most apparent after the first 30 trials of the task (Chapman et al., 2008; Farmer & Rucklidge, 2006). Learning effects (i.e., discriminating between S+ and S- given prior reward and punishment) accrue over time such that participants may respond at or near ceiling on later trials and therefore fail to commit PAEs or omission errors. Second, the effects of the emotion inductions are expected to diminish over time; differences in performance would be most likely in the initial learning trials. To test this, the PAL task was divided into 3 blocks of 30 trials and paired samples t-test compared the number of PAEs in block 1 to blocks 2 and 3. In light of significant differences, examination of PAEs would involve separate regression equations for the entire task and for each 30 trial block.

A related possibility is that social rejection precipitates a more cautious pattern of responding in low-BP individuals but not in high-BP individuals (Lawrence et al., 2001). This possibility will be tested in a series of supplementary analyses of OEs, following the form of the PAE analyses. It is predicted that for high-BP but not low-BP individuals, significantly fewer OEs occur following social rejection than following the neutral emotion induction.

Hypothesis 2: Strength of association between self-reported impulsivity is significantly greater than association between self-reported impulsivity and impulsive responding.

Discordant endorsements of impulsivity previously observed when comparing across various self-report and behavioural measures, were evaluated in the current study. Bivariate correlations were computed for combinations of BP features (PAI-BOR score), BIS-11 total score and subscale scores, UPPS subscale scores, and PAEs. Based on relationships established in prior studies it was hypothesized that the magnitude of the (positive) correlation between BIS-11 total and UPPS subscale scores will be significantly greater than between BIS-11 total and PAEs (hypothesis 2a), and between UPPS subscales and PAEs (hypothesis 2b). The relationship between PAEs and the self-report impulsivity measures are expected to be small or non-significant, in accordance with prior findings (Reynolds et al., 2006).

Hypothesis 3a and 3b: The impact of emotion induction (social rejection vs. neutral) on impulsive responding depends on level of RS.

Similar to Hypothesis 1, the impact of emotion induction (social rejection vs. neutral) on impulsive responding was expected to depend on level of RS. This would be reflected in significantly more PAEs for the social rejection condition compared with the neutral condition, but only among the high-RS participants. As with Hypothesis 1, a comparable hierarchical linear OLS regression comparing social rejection versus neutral emotion, with number of PAEs committed as the criterion variable was performed, substituting RS for BP features. Hypothesis 3a is that for high-RS but not low-RS individuals, significantly more PAEs will occur following social rejection than following the neutral emotion induction.

If it can be demonstrated that individuals in the social rejection and/or neutral emotion conditions show associations between BP features and impulsive responding and also RS and impulsive responding, one possibility is that level of RS is a mediator of the former relationship. A supplemental test of the indirect effect of RS on the relationship between BP features and PAEs would be performed for each emotion condition using bootstrapping (Preacher & Hayes, 2004). Hypothesis 3b is that there will

be a significant difference between the total effect of BP features on PAEs (i.e., path c) and the direct effect (path c') given the influence of RS.

Power analysis.

A power analysis was conducted using G*Power 3 (Faul, Erdfelder, Lang, Buchner, 2007). Chapman et al. (2010) reported a magnitude of effect estimate in the medium range ($\eta^2 = .07$), derived from an analysis of the interaction between BP features and a fearful emotion induction on PAEs with undergraduate participants. In order to have 80% power to detect hypothesized effects of medium size ($f^2 = .15$), the multiple linear OLS regression model and simple slopes tests specified previously require 55 participants complete the laboratory session. It should be noted that this effect size estimate assumed a comparable distribution of BP features to previous studies using community and undergraduate participants. Previous studies using comparable samples have grouped participants according to high- and low-BP features (Chapman et al., 2010; Chapman et al., 2008). In these studies, mid-BP participants were excluded (34-40% of initial samples). Presumably, this focus on high- and low-BP group comparisons would yield larger effects. In the present study, BP features are continuous. To the extent that individuals at each level of BP features are over or under-represented relative to previous research, effect sizes may be larger or smaller than anticipated.

Results

Preliminary Analyses

Descriptive Statistics.

The distribution properties of study variables were inspected for instances of non-normality. Of the 40 variables examined, 30 exhibited problematic skewness and/or kurtosis (skewness = -0.57 – 4.95; kurtosis = 1.06 – 25.70). Logarithmic transformations resulted in distributions that were more normal for 27 of 30 measures and were used in subsequent analyses (skewness = -0.57 – 2.95; kurtosis = -0.92 – 11.64). Altogether, measures of sensation-seeking, self-reported negative-affect, dissociation, RSA, and EMG activation had substantially non-normal distributions even after transformation. For the distribution properties of these data, see Tables 5-9.

Unresolvable noise artifact impacted the recording of a subsample of physiological data. These cases were excluded from further analyses. Missing data accounted for 0-9.09% of all data collected for each physiological variable, depending on the measure and the phase of the study (see Table 8). Missing physiological data may have been systematic. Participants with missing RSA data were significantly more likely to have missing SCR data, $r_{\phi} = .41$, $p < .001$. Participants with missing RSA data also reported significantly more positive emotion at baseline, $r_{pb} = .23$, $p < .05$. Participants with missing SCR data reported significantly more negative emotion at baseline, $r_{pb} = .24$, $p < .05$. Missing data was not significantly associated with emotion induction condition, or to any demographic variables, ps > .50.

Table 5. Descriptive Statistics of Individual Differences Across Conditions

	Total	Social	Neutral

	Sample (*N* = 77)			Rejection (*N* = 42)	emotion (*N* = 35)
Variable	***Min***	***Max***	***M* (*SD*)**	***M* (*SD*)**	***M* (*SD*)**
Age	18	46	20.29 (4.27)	20.19 (3.62)	20.40 (5.00)
Psychopathology	0.04	2.34	0.80 (0.47)	0.76 (0.50)	0.84 (0.44)
BP features	6	42	23.62 (9.87)	23.12 (9.55)	24.23 (10.36)
Rejection sensitivity	0.17	2.90	1.04 (0.44)	1.03 (0.45)	1.06 (0.43)
Cognitive ability	10	35	22.79 (5.76)	22.36 (6.16)	23.31 (5.27)
Barratt Impulsiveness					
Total	45	88	62.79 (9.15)	62.38 (8.73)	63.29 (9.71)
Attention	11	24	17.64 (3.42)	17.12 (3.53)	18.26 (3.22)
Motor	14	28	20.90 (3.23)	21.02 (3.15)	20.77 (3.38)
Nonplanning	14	36	24.25 (4.86)	24.24 (4.81)	24.26 (5.00)
UPPS Impulsive Behaviour					
Negative urgency	1.08	3.92	2.30 (0.58)	2.30 (0.55)	2.30 (0.62)
(lack of) Premeditation	1.00	3.18	1.89 (0.42)	1.84 (0.39)	1.96 (0.46)
(lack of) Perseveration	1.10	3.56	2.04 (0.53)	2.10 (0.51)	1.97 (0.55)
Sensation seeking	1.08	4.00	2.79 (0.62)	2.78 (0.69)	2.81 (0.52)

Table 6. Distribution Properties of Untransformed and Transformed Trait Measures

	Untransformed	Log_{10}

Variable	M (SE)	Skew	Kurtosis	Skew	Kurtosis
BP features	23.62 (1.13)	0.22	-0.89	-	-
Psychopathology	0.80 (0.05)	0.67*	-0.29	0.19	-0.64
Rejection sensitivity	1.04 (0.05)	0.68*	0.99	-0.04	0.25
Cognitive ability	22.79 (0.66)	0.14	-0.70	-	-
Barratt impulsiveness					
Total	62.79 (1.04)	0.14	-0.30	-	-
Attention	17.63 (0.39)	0.12	-0.60	-	-
Motor	20.91 (0.37)	0.37	-0.40	-	-
Nonplanning	24.25 (0.55)	-0.20	-0.42	-	-
UPPS impulsive behaviour					
Negative urgency	2.30 (0.07)	-0.07	-0.32	-	-
(lack of) Premeditation	1.89 (0.05)	0.71*	1.22*	0.16	0.65
(lack of) Perseveration	2.04 (0.06)	0.43	0.37	-	-
Sensation seeking	2.79 (0.70)	-0.57**	-0.04	-	-

Note. * Significant departure from normality – amenable to further transformation
** Significant departure from normality – transformation does not improve this statistic

Table 7. Distribution Properties of Untransformed and Transformed Self-Report Measures

		Untransformed		Log_{10}	
Variable	M (SE)	Skew	Kurtosis	Skew	Kurtosis
Positive affect					
Baseline	19.95 (0.76)	0.46	-0.68	-	-
Post-induction	17.51 (0.63)	0.93*	0.62	0.28	-0.53

Recovery	14.62 (0.52)	0.99*	0.22	0.49	-0.68
Negative affect					
Baseline	13.19 (0.35)	1.02*	0.35	0.64*	-0.47
Post-induction	14.04 (0.51)	1.37*	0.89	0.96*	-0.07
Recovery	12.04 (0.32)	2.08*	4.70*	1.50*	2.17*
Dissociation					
Baseline	26.58 (2.85)	1.26*	1.11*	-0.53*	-0.32
Post-induction	31.19 (3.20)	1.30*	1.08*	-0.46	-0.15
Recovery	27.26 (3.05)	1.10*	0.08	-0.58*	-0.35

Note. * Significant departure from normality – amenable to further transformation

Table 8. Distribution Properties of Untransformed and Transformed Physiological Measures

			Untransformed		Log_{10}	
Variable	***N***	***M* (*SE*)**	**Skew**	**Kurtosis**	**Skew**	**Kurtosis**
SCRs						
Baseline	70	7.63 (1.49)	2.89*	9.54*	0.40	-0.84
Post-induction	71	9.24 (1.54)	2.60*	6.96*	-0.03	-0.80
Recovery	71	4.85 (0.85)	4.23*	22.32*	0.45	-0.92
SCL						
Baseline	70	6.57 (0.40)	0.80**	0.53	-	-
Post-induction	71	6.91 (0.38)	0.48	-0.19	-	-
Recovery	71	7.38 (0.41)	0.79**	1.06**	-	-
RSA						

Baseline	70	1.95 (0.25)	4.95*	25.70*	2.95*	11.67*
Post-induction	70	1.57 (0.08)	2.04*	4.54*	1.22*	2.15*
Recovery	70	1.60 (0.08)	2.24*	5.49*	1.41*	2.69*
EMG-Z						
Baseline	77	12.01 (0.68)	2.13*	5.53*	0.95*	0.73
Post-induction	76	13.00 (0.76)	1.98*	4.00*	0.95*	0.71
Recovery	77	12.18 (0.83)	2.34*	5.85*	1.15*	1.15*
EMG-C						
Baseline	76	30.41 (2.19)	1.61*	2.14*	0.26	0.29
Post-induction	76	36.74 (3.63)	2.32*	5.70*	-0.32	2.85*
Recovery	76	27.94 (2.48)	2.13*	4.94*	-0.82*	4.52*

Note. SCRs = Number of Skin Conductance Responses, SCL = Skin Conductance Level (μmho), RSA = Respiratory Sinus Arrhythmia ($msec^2$), EMG-Z = Electromyographic Activation over *Zygomaticus Major* (μV), EMG-C = Electromyographic Activation over *Corrugator Supercilii* (μV)
* Significant departure from normality – amenable to further transformation
** Significant departure from normality – transformation does not improve this statistic

Table 9. Distribution Properties of Untransformed and Transformed Passive Avoidance Learning Task Variables

		Untransformed		Log_{10}	
Variable	***M* (*SE*)**	**Skew**	**Kurtosis**	**Skew**	**Kurtosis**
Passive avoidance errors					
Total	12.56 (0.82)	1.18*	1.00	-0.07	-0.02
Trials 1-30	6.30 (0.37)	0.68*	0.13	-0.14	-0.91
Omission errors					
Total	14.90 (1.00)	0.72**	0.43	-	-
Trials 1-30	4.99 (0.50)	0.65**	-0.23	-	-

Note. * Significant departure from normality – amenable to further transformation
** Significant departure from normality – transformation does not improve this statistic

Covariates.

A participant's initial psychological distress (GSI), cognitive ability, age, gender or ethnicity did not appear to be related to their performance on the PAL task given non-significant bivariate correlations between these variables and both PAEs and OEs, *p*s > .10. While the relationship between dissociation and positive affect was non-significant at baseline, post-induction, and recovery, *p*s > .10, dissociation was positively associated with endorsements of negative affect at all time points, *r* = .35-.43, *p*s < . 01. Consequently, dissociation was included as a covariate in analyses involving self-reported negative affect.

Manipulation Check.

For self-reported positive and negative emotions, a significant interaction between Condition (Social Rejection, Neutral) and Time (Baseline, Post-induction) was observed after controlling for dissociation, $F(2,82) = 9.23$, $p < .001$, Wilk's $\lambda = 0.81$, partial $\eta^2 = .19$. Specifically, negative affect increased following social rejection but not following the neutral emotion induction, $F(1,80) = 18.66$, $p < .001$, partial $\eta^2 = .19$. For positive affect, the interaction between Condition and Time was not significant, $F(1,80) = 0.04$, $p = .85$, partial $\eta^2 = .00$, the main effect of Condition was not significant, $F(1,80) = 0.03$, $p = .87$, partial $\eta^2 = .00$, and the main effect of Time was not significant, $F(1,80) = 2.92$, $p = .09$, partial $\eta^2 = .04$.

For SCRs, the interaction between Condition and Time was not significant, $F(1,73) = 3.65$, $p = .06$, partial $\eta^2 = .05$. There was a significant main effect of Time indicating the number of SCRs increased from baseline to post-induction, $F(1,73) = 10.55$, $p < .01$, partial $\eta^2 = .13$. The main effect of Condition was not significant, $F(1,73) = 0.0004$, $p = .98$, partial $\eta^2 = .00$. For SCL, the interaction between Condition and Time was not significant, $F(1,73) = 0.36$, $p = .55$, partial $\eta^2 = .005$. While a significant main effect of Time showed SCL increased from baseline to post-induction, $F(1,73) = 7.14$, $p < .01$, partial $\eta^2 = .09$, the effect of Condition was not significant, $F(1,73) = 0.08$, $p = .93$, partial $\eta^2 = .00$.

For RSA, the interaction between Condition and Time was not significant, $F(1,73) = 2.19$, $p = .14$, partial $\eta^2 = .03$. With respect to main effects, the effect of Condition was

non-significant, $F(1,73) = 0.25$, $p = .62$, partial $\eta^2 = .003$, while the effect of Time was borderline, suggesting a decrease in RSA from baseline to post-induction, $F(1,73) = 3.84$ $p = .05$, partial $\eta^2 = .05$.

Considering EMG activity, specifically in the Zygomaticus region, the interaction between Condition and Time was not significant, $F(1,80) = 0.12$, $p = .73$, partial $\eta^2 = .002$. The main effect of Time was significant, with mean activation increasing from baseline to post-mood induction, $F(1,80) = 6.82$, $p = .01$, partial $\eta^2 = .08$. The main effect of Condition was not significant, $F(1,80) = 0.82$, $p = .37$, partial $\eta^2 = .01$. Examining Corrugator activity, the interaction between Condition and Time was significant, $F(1,79) = 8.28$, $p = .005$, partial $\eta^2 = .10$. This interaction was driven by an increase in Corrugator activation from baseline to post-induction in the neutral emotion condition, $t(38) = 4.41$, $p < .001$, $d = 0.49$. In the social rejection condition, the difference between baseline and post-induction activation was non-significant, $t(41) = 0.25$, $p = .81$, $d = 0.04$. The main effect of Time was also significant, with Corrugator activity increasing from baseline to post-induction, $F(1,79) = 6.20$, $p = .02$, partial $\eta^2 = .07$. The main effect of Condition was not significant, $F(1,79) = 1.08$, $p = .30$, partial $\eta^2 = .01$.

Hypothesis 1: The impact of emotion induction (social rejection vs. neutral) on impulsive responding depends on level of BP features.

In order to determine whether trial sequence in the PAL task influenced the likelihood of committing a PAE or omission error, trials were divided into three blocks and error rates were compared, see Table 10. The number of PAEs decreased with each successive trial block and pairwise t-tests revealed that difference in PAEs between Block 1 and Block 2, Block 1 and Block 3, and Block 2 and Block 3 were each significant, ps < .00001. Subsequently regressions were performed separately for the full 90 trial task and for each 30 trial block. Counter to prediction, a model containing Condition, BP-Features and their interaction term did not significantly predict the total number of PAEs in the PAL task overall, $F(3,73) = 0.95$, $p = .42$, $R^2 = .04$, see Table 11. Similar to results for the entire task, this model did not significantly predict PAEs in each 30 trial block, $F(3,73) = 0.51$-1.35, $p = .26$-$.68$, $R^2 = .02$-$.05$, see Tables 12-14.

Table 10. Passive Avoidance Errors and Omission Errors by Trial Block

Trial Block	PAEs		OEs	
	M	***SE***	***M***	***SE***
Block 1 (trials 1-30)	6.30	0.37	4.99	0.36
Block 2 (trials 31-60)	3.05	0.35	4.81	0.40
Block 3 (trials 61-90)	2.50	0.28	5.10	0.40

Note. PAEs = Passive Avoidance Errors, OEs = Omission Errors

Table 11. Multiple Regression Equation – Condition and BP Features Predicting Number of Passive Avoidance Errors on the Passive Avoidance Learning Task

Predictors entered in block	*F* for model	R^2	*B*	SE *B*	β	*p*
1	0.95	.04				.42
Condition			-0.003	0.05	-0.006	.96
BP features			-0.001	0.01	-0.053	.75
Condition × BP features			-0.005	0.01	-0.15	.35

Note. Passive Avoidance Errors were $\log_{10}$ transformed

Similar regression models were constructed to test whether BP features, Condition, and their interaction predicted OEs. The model predicting OEs for the whole task was not significant, $F(3,73) = 0.41$, $p = .75$, $R^2 = .02$. The equivalent models predicting OEs for each trial block were also not significant, $F(3,73) = 0.27$-0.95, $p = .42$-$.85$, $R^2 = .01$-$.04$. These models are summarized in Tables 15-18.

Table 12. Multiple Regression Equation – Condition and BP Features Predicting Number of Passive Avoidance Errors on Trials 1-30 of the Passive Avoidance Learning Task

Predictors entered in block	*F* for model	R^2	*B*	SE *B*	β	*p*
1	1.33	.05				.27

Condition	-0.06	0.05	-0.14	.22
BP features	-0.0001	0.01	-0.006	.97
Condition × BP features	-0.005	0.01	-0.18	.27

Note. Passive Avoidance Errors were $\log_{10}$ transformed

Table 13. Multiple Regression Equation – Condition and BP Features Predicting Number of Passive Avoidance Errors on Trials 31-60 of the Passive Avoidance Learning Task

Predictors entered in block	*F* for model	R^2	*B*	SE *B*	β	*p*
1	1.35	.05				.26
Condition			0.07	0.05	0.12	.31
BP features			-0.005	0.01	-0.18	.26
Condition × BP features			-0.0004	0.01	-0.01	.95

Note. Passive Avoidance Errors were $\log_{10}$ transformed

Table 14. Multiple Regression Equation – Condition and BP Features Predicting Number of Passive Avoidance Errors on Trials 61-90 of the Passive Avoidance Learning Task

Predictors entered in block	*F* for model	R^2	*B*	SE *B*	β	*p*
1	0.51	.02				.68
Condition			0.06	0.07	0.09	.42
BP features			0.0005	0.01	0.02	.93
Condition × BP features			-0.005	0.01	-0.12	.49

Note. Passive Avoidance Errors were $\log_{10}$ transformed

Table 15. Multiple Regression Equation – Condition and BP Features Predicting Number of Omission Errors on the Passive Avoidance Learning Task

Predictors entered in block	*F* for model	R^2	*B*	SE *B*	β	*p*
1	0.41	.02				.75

Condition	1.44	2.03	0.08	.48
BP features	0.11	0.15	0.12	.47
Condition × BP features	-0.17	0.21	-0.14	.41

Note. Omission Errors were untransformed (i.e., raw scores)

Table 16. Multiple Regression Equation – Condition and BP Features Predicting Number of Omission Errors on Trials 1-30 of the Passive Avoidance Learning Task

Predictors entered in block	*F* for model	R^2	*B*	SE *B*	β	*p*
1	0.92	.04				.44
Condition			-0.10	0.72	-0.016	.89
BP features			0.05	0.05	0.17	.32
Condition × BP features			-0.12	0.07	-0.27	.11

Note. Omission Errors were untransformed (i.e., raw scores)

Table 17. Multiple Regression Equation – Condition and BP Features Predicting Number of Omission Errors on Trials 31-60 of the Passive Avoidance Learning Task

Predictors entered in block	*F* for model	R^2	*B*	SE *B*	β	*p*
1	0.95	.04				.42
Condition			1.20	0.81	0.17	.14
BP features			0.03	0.06	0.09	.60
Condition × BP features			0.01	0.08	0.02	.90

Note. Omission Errors were untransformed (i.e., raw scores)

Table 18. Multiple Regression Equation – Condition and BP Features Predicting Number of Omission Errors on Trials 61-90 of the Passive Avoidance Learning Task

Predictors entered in block	*F* for model	R^2	*B*	SE *B*	β	*p*
1	0.27	.01				.85

Condition	0.33	0.81	0.05	.68
BP features	0.02	0.06	0.07	.70
Condition × BP features	-0.06	0.08	-0.13	.45

Note. Omission Errors were untransformed (i.e., raw scores)

Hypothesis 2: Strength of association between self-reported impulsivity is significantly greater than association between self-reported impulsivity and impulsive responding.

Bivariate correlations between self-reported and behaviourally observed impulsivity measures (PAEs and OEs) are reported in Table 19, below. As expected, while self-reported impulsivity scales show small to moderate positive associations with one-another, relationships with performance on the PAL task are largely non-significant. Sensation Seeking was an exception to this pattern; Sensation Seeking was not significantly associated with BP features, Negative Urgency, or Perseveration, *p*s > .10, and was positively associated with the total number of PAEs on the PAL task, $r = .27$, $p < .05$. Negative Urgency and (lack of) Premeditation were both significantly negatively associated with PAEs, but only in block 2 (trials 31-60) of the PAL task, *r*s = -.24, -.28; *p*s <.05.

Supplementary analyses compared bivariate correlations across the separate emotion-induction conditions (Tables 20 and 21). Of note, in the social rejection condition, Sensation Seeking was directly related to a participant's total number of PAEs on the PAL task, $r = .36$, $p < .05$. This relationship was not found for participants in the neutral emotion condition, $r = .12$, $p > .10$.

Hypothesis 3a and 3b: The impact of emotion induction (social rejection vs. neutral) on impulsive responding depends on level of RS.

Similar to Hypothesis 1, the impact of RS, the emotion induction condition, and their interaction on PAEs were first examined across the entire experiment. These predictors were centred and entered in block 1. The full model did not significantly predict the total number of PAEs in the PAL task, $F(3,73) = 2.51$, $p = 0.07$, $R^2 = .09$, see Table 22.

Table 19. ***Intercorrelations Between BP Features, Self-Reported and Behavioural Measures of Impulsivity***

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. BP features	-																
2. BIS-Tot	.58**	-															
3. BIS-Att	.54**	.72**	-														
4. BIS-Mot	.36**	.83**	.50**	-													
5. BIS-NP	.46**	.84**	.32**	.56**	-												
6. UPPS-Neg	.70**	.65**	.57**	.52**	.51**	-											
7. UPPS-Prem	.40**	.58**	.41**	.44**	.52**	.48**	-										
8. UPPS-Pers	.43**	.47**	.32**	.31**	.48**	.36**	.40**	-									
9. UPPS-Sens	.00	.27*	.30**	.31**	.09	.34**	.15	-.07	-								
10. PAEs-Total	-.16	-.08	-.10	-.10	-.22	-.22	-.16	-.16	.27*	-							
11. PAEs-1-30	-.13	-.01	-.02	-.00	-.16	-.16	-.08	-.16	.19	.80**	-						
12. PAEs-31-60	-.20	-.16	-.19	-.18	-.05	-.24*	-.28*	-.13	.21	.79**	.40**	-					
13. PAEs-61-90	-.07	-.05	-.15	-.08	.06	-.07	-.06	-.09	.20	.69**	.34**	.44**	-				
14. OEs-Total	-.02	-.00	-.11	.04	.05	-.05	-.03	-.09	-.05	-.29*	-.38**	-.21	.05	-			
15. OEs-1-30	-.03	-.06	-.12	-.02	.02	-.02	.03	.03	.03	-.31**	-.43**	-.20	.03	.82**	-		
16. OEs-31-60	.09	.10	-.06	.11	.15	.10	-.07	-.02	-.03	-.23*	-.24*	-.23*	.06	.89**	.60**	-	
17. OEs-61-90	-.03	-.05	-.11	.01	-.02	.01	-.02	-.22	-.12	-.22*	-.32**	-.13	.04	.88**	.56**	.69**	-

Note. BIS = Barratt Impulsiveness Scale, Tot = Total score, Att = Attention subscale, Mot = Motor subscale, NP = Nonplanning subscale, UPPS = UPPS Impulsive Behaviour scale Neg = Negative Urgency scale, Prem = Premeditation scale, Pers = Perseveration scale, Sens = Sensation seeking scale, PAEs = # of passive avoidance errors OEs= # of omission errors, Total = entire passive avoidance learning task, 1-30 = trials 1-30, 31-60 = trials 31-60, 61-90 = trials 61-90 * Significant at the .05 level; ** Significant at the .01 level

Table 20. ***Intercorrelations Between BP Features, Self-Reported and Behavioural Measures of Impulsivity following Social Rejection***

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. BP features	-																
2. BIS-Tot	.64**	-															
3. BIS-Att	.59**	.67**	-														
4. BIS-Mot	.30	.79**	.43**	-													
5. BIS-NP	.53**	.81**	.21	.48**	-												
6. UPPS-Neg	.75**	.58**	.44**	.41**	.47**	-											
7. UPPS-Prem	.44**	.52**	.30	.29	.53**	.41**	-										
8. UPPS-Pers	.41**	.53**	.33**	.33**	.51**	.38**	.38**	-									
9. UPPS-Sens	.02	.17	.17	.25	.02	.29	.01	-.09	-								
10. PAEs-Total	-.25	-.05	-.07	-.02	-.03	-.25	-.24	-.13	.36*	-							
11. PAEs-1-30	-.23	.04	.05	.03	.01	-.19	-.24	-.14	.29	.85**	-						
12. PAEs-31-60	-.20	-.14	-.22	-.06	-.05	-.24	-.33*	-.10	.21	.77**	.47**	-					
13. PAEs-61-90	-.15	-.10	-.15	-.09	-.01	-.14	.04	-.09	.38*	.71**	.43**	.41**	-				
14. OEs-Total	-.06	-.11	-.17	-.04	.04	-.09	-.02	-.16	-.09	-.24	-.35*	-.16	.03	-			
15. OEs-1-30	-.19	-.23	-.26	-.12	-.14	-.23	-.07	.00	-.05	-.26	-.44**	-.10	.02	.84**	-		
16. OEs-31-60	.10	.07	-.03	.05	.11	.05	.01	-.15	-.02	-.21	-.22	-.22	-.00	.93**	.67**	-	
17. OEs-61-90	-.10	-.15	-.19	-.06	-.09	-.08	.01	-.26	.18	-.17	-.29	-.09	.07	.90**	.60**	.77**	-

Note. BIS = Barratt Impulsiveness Scale, Tot = Total score, Att = Attention subscale, Mot = Motor subscale, NP = Nonplanning subscale, UPPS = UPPS Impulsive Behaviour scale Neg = Negative Urgency scale, Prem = Premeditation scale, Pers = Perseveration scale, Sens = Sensation seeking scale, PAEs = # of passive avoidance errors OEs= # of omission errors, Total = entire passive avoidance learning task, 1-30 = trials 1-30, 31-60 = trials 31-60, 61-90 = trials 61-90 * Significant at the .05 level; ** Significant at the .01 level

Table 21. ***Intercorrelations Between BP Features, Self-Reported and Behavioural Measures of Impulsivity following Neutral Emotion***

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. BP features	-																
2. BIS-Tot	.52**	-															
3. BIS-Att	.49**	.76**	-														
4. BIS-Mot	.44**	.87**	.62**	-													
5. BIS-NP	.40*	.86**	.40**	.62**	-												
6. UPPS-Neg	.66**	.69**	.66**	.60**	.52**	-											
7. UPPS-Prem	.35*	.55**	.39*	.55**	.44**	.48**	-										
8. UPPS-Pers	.47**	.41**	.31**	.30**	.40**	.27	.42**	-									
9. UPPS-Sens	-.03	.28	.34*	.28	.17	.30	.25	-.15	-								
10. PAEs-Total	-.06	-.12	-.15	-.22	-.01	-.18	-.06	-.20	.12	-							
11. PAEs-1-30	-.01	-.09	-.11	-.13	-.02	-.13	-.09	-.15	-.00	.74**	-						
12. PAEs-31-60	-.18	-.17	-.12	-.30	-.05	-.24	-.20	-.20	.23	.84**	.39*	-					
13. PAEs-61-90	.02	.00	-.12	-.07	.13	-.01	-.13	-.12	-.02	.67**	.27	.47**	-				
14. OEs-Total	.16	.17	.04	.19	.18	.27	-.01	.00	.05	-.41*	-.43*	-.36*	.06	-			
15. OEs-1-30	.19	.15	.08	.13	.14	.33	.16	.06	.17	-.39*	-.45**	-.33	.04	.82**	-		
16. OEs-31-60	.12	.17	-.03	.20	.22	.17	-.15	.14	-.06	-.28	-.23	-.32	.13	.80**	.49**	-	
17. OEs-61-90	.08	.11	.05	.13	.09	.15	-.05	-.19	.01	-.32	-.35*	-.23	-.03	.82**	.51**	.49**	-

Note. BIS = Barratt Impulsiveness Scale, Tot = Total score, Att = Attention subscale, Mot = Motor subscale, NP = Nonplanning subscale, UPPS = UPPS Impulsive Behaviour scale Neg = Negative Urgency scale, Prem = Premeditation scale, Pers = Perseveration scale, Sens = Sensation seeking scale, PAEs = # of passive avoidance errors OEs= # of omission errors, Total = entire passive avoidance learning task, 1-30 = trials 1-30, 31-60 = trials 31-60, 61-90 = trials 61-90 * Significant at the .05 level; ** Significant at the .01 level

Table 22. ***Multiple Regression Equation – Condition and Rejection Sensitivity Predicting Number of Passive Avoidance Errors on the Passive Avoidance Learning Task***

Predictors entered in block	*F* for model	R^2	*B*	SE *B*	β	*p*
1	2.51	.09				.07
Condition			-0.004	0.05	-0.008	.94
RS			-0.54	0.41	-0.22	.19
Condition × RS			-0.32	0.55	-0.10	.56

Note. RS = Rejection sensitivity; RS and Passive Avoidance Errors were $\log_{10}$ transformed

Next, the association between predictors and PAEs committed during the each 30 trial block of the PAL task was explored separately. These models also failed to significantly predict PAEs, $F(3,73) = 1.60\text{-}2.28$, $p = .09\text{-}.20$, $R^2 = .02\text{-}.09$, see Tables 23-25.

Table 23. ***Multiple Regression Equation – Condition and Rejection Sensitivity Predicting Number of Passive Avoidance Errors on Trials 1-30 of the Passive Avoidance Learning Task***

Predictors entered in block	*F* for model	R^2	*B*	SE *B*	β	*p*
1	2.28	.09				.09
Condition			-0.06	0.05	-0.14	.21
RS			-0.41	0.37	-0.19	.28
Condition × RS			-0.26	0.49	-0.09	.60

Note. RS = Rejection sensitivity; RS and Passive Avoidance Errors were $\log_{10}$ transformed

Table 24. ***Multiple Regression Equation – Condition and Rejection Sensitivity Predicting Number of Passive Avoidance Errors on Trials 31-60 of the Passive Avoidance Learning Task***

Predictors entered in block	*F* for model	R^2	*B*	SE *B*	β	*p*
1	2.00	.08				.12

Condition	0.07	0.07	0.12	.31
RS	-0.77	0.55	-0.24	.16
Condition × RS	-0.01	0.73	-0.003	.99

Note. RS = Rejection sensitivity; RS and Passive Avoidance Errors were $\log_{10}$ transformed

Table 25. Multiple Regression Equation – Condition and Rejection Sensitivity Predicting Number of Passive Avoidance Errors on Trials 61-90 of the Passive Avoidance Learning Task

Predictors entered in block	*F* for model	R^2	*B*	SE *B*	β	*p*
1	1.60	.02				.20
Condition			0.05	0.07	0.09	.43
RS			-0.35	0.55	-0.11	.52
Condition × RS			-0.55	0.73	-0.13	.45

Note. RS = Rejection sensitivity; RS and Passive Avoidance Errors were $\log_{10}$ transformed

Tests of the above predictors on OEs yielded similar results. The model predicting OEs for the whole task was not significant, $F(3,73) = 0.65$, $p = 0.59$, $R^2 = .03$. The equivalent models predicting OEs for each of the 30 trial blocks were also not significant, $F(3,73) = 0.49\text{-}1.06$, $p = .37\text{-}.69$, $R^2 = .02\text{-}.04$. These models are summarized in Tables 26-29.

Table 26. Multiple Regression Equation – Condition and Rejection Sensitivity Predicting Number of Omission Errors on the Passive Avoidance Learning Task

Predictors entered in block	*F* for model	R^2	*B*	SE *B*	β	*p*
1	0.65	.03				.59
Condition			1.56	2.02	0.09	.43
RS			20.03	16.73	0.21	.25
Condition × RS			-21.16	22.16	-0.17	.34

Note. RS = Rejection sensitivity; RS was $\log_{10}$ transformed, Omission Errors were untransformed (i.e., raw scores)

Table 27. ***Multiple Regression Equation – Condition and Rejection Sensitivity Predicting Number of Omission Errors on Trials 1-30 of the Passive Avoidance Learning Task***

Predictors entered in block	*F* for model	R^2	*B*	SE *B*	B	*p*
1	0.91	.03				.58
Condition			-0.03	0.72	-0.004	.97
RS			8.19	5.98	0.24	.18
Condition × RS			-9.78	7.92	-0.22	.22

Note. RS = Rejection sensitivity; RS was $\log_{10}$ transformed, Omission Errors were untransformed (i.e., raw scores)

Table 28. ***Multiple Regression Equation – Condition and Rejection Sensitivity Predicting Number of Omission Errors on Trials 31-60 of the Passive Avoidance Learning Task***

Predictors entered in block	*F* for model	R^2	*B*	SE *B*	B	*p*
1	1.06	.04				.37
Condition			1.21	0.80	0.17	.14
RS			5.35	6.65	0.14	.42
Condition × RS			-1.51	8.81	-0.03	.87

Note. RS = Rejection sensitivity; RS was $\log_{10}$ transformed, Omission Errors were untransformed (i.e., raw scores)

Table 29. ***Multiple Regression Equation – Condition and Rejection Sensitivity Predicting Number of Omission Errors on Trials 61-90 of the Passive Avoidance Learning Task***

Predictors entered in block	*F* for model	R^2	*B*	SE *B*	B	*p*
1	0.49	.02				.69
Condition			0.38	0.81	0.06	.64
RS			6.49	6.69	0.17	.34
Condition × RS			-9.87	8.87	-0.20	.27

Note. RS = Rejection sensitivity; RS was $\log_{10}$ transformed, Omission Errors were untransformed (i.e., raw scores)

Discussion

Despite evidence linking individuals with high levels of BP features to heightened emotional reactivity to interpersonal distress and to self-reports of impulsive behaviours, relatively few studies have explored joint effects of BP features and social rejection on impulsive responding in the laboratory. This study investigated relations between BP features, laboratory-induced social rejection, RS, self-reported trait measures of impulsivity, and behavioural measures of impulsive responding. In a mixed undergraduate and community sample I found that experimentally induced social rejection did not lead to an increase in impulsive responding (i.e. more PAEs or OEs) in the laboratory measure of impulsivity. Similarly, a participant's level of BP features did not predict their degree of impulsive responding. The anticipated interaction of BP features and emotion induction condition, where high levels of BP features were expected to increase the association between experienced social rejection (versus neutral emotion) and impulsive responding, was not supported by the data.

I then investigated whether initial self-reported measures of impulsivity were predictive of subsequent impulsive responding. This was largely not the case, with one exception; higher levels of self-reported sensation seeking on the UPPS impulsive behaviour scale predicted more PAEs on the PAL task. Further investigation revealed that this prediction was significant only for participants exposed to the social rejection induction; sensation seeking was unrelated to PAEs for participants in the neutral emotion condition.

Finally, I investigated whether an association between RS and impulsive responding could account for the putative relationship between BP features and impulsive responding. This was not the case for two reasons. First, there was no significant relationship between BP features and impulsive responding in this study. Second, RS did not significantly predict impulsive responding, either as a main effect, or in interaction with the type of emotion induction. Given these findings, testing for mediation was not necessary.

That BP features did not moderate the effect of a social rejection induction on impulsive responding is a surprising, though not entirely unanticipated result. There are at least three reasonable explanations for why no relationship was found. The first possibility is that this result is bona fide and social rejection is not associated with individuals high in BP features engaging in more impulsive behaviours. In other words, the negative emotional trigger previously shown to induce more impulsive responding in high BP individuals may be specific only to certain specific negative emotions (e.g., fear; Chapman et al., 2010) and not include social rejection. This result is consistent with prior research. Laboratory induced social rejection failed to elicit significant increases in impulsive behaviour in another study, albeit using a different behavioural measure of impulsivity – delay-discounting (Lawrence et al., 2010). Evidence of other experimentally induced negative affective states influencing impulsive responding is limited and similarly mixed. An fMRI study examining the effects of an anger induction on response inhibition showed increased brain activation in the subthalamic nucleus and decreased activity in the left anterior frontal cortex of BPD individuals relative to controls (Jacob et al., 2013); despite these differences in neurological function, there were no group or induction effects on impulsive behaviour. Interestingly, a recent study involving the experimental induction of stress as a potential trigger for impulsive responding in BPD individuals actually yielded less impulsive responding than BPD individuals in a resting control group (Krause-Utz et al., 2013). Taken together, these studies suggest that differences in the emotion induction procedure and possibly the specific negative emotions elicited may alternately produce or fail to produce impulsive behaviour in the laboratory.

A second possibility is that the range of BP features in the current sample was limited, with participants predominantly endorsing subclinical levels of BP features (M = 23.62, SD = 9.87). Established guidelines for suggest a cut-off score of 38 on the PAI-BOR distinguishes clinically severe levels of BP features (Jacobo et al., 2007; Stein et al., 2007); using this approach, only 13% (n = 11) of the sample meet or exceed the cut-off. The distribution of BP features in the current study is similar to the distribution observed in a large undergraduate validation sample (M = 26.63, SD = 10.68; Trull, 1995), which contained a comparable percentage of clinically severe respondents (14.8%). If an interaction between BP features and social rejection is nonlinear across the full range of the PAI-BOR and driven by changes only in the clinical range, these

effects may not be detectable in the current study given the small contribution of individuals with these scores to the sample. Note that this highlights a problem with sample composition and is not strictly a power issue: not only was there no evidence of a relationship in the current sample, but also non-significant associations were in the opposite direction (i.e., individuals higher in BP features in the social rejection condition committed slightly fewer PAEs).

Attempts to oversample participants high in BP features were largely unsuccessful. Chapman and colleagues' (2010) study involving a fear induction included a substantially larger sample of high BP individuals (n = 44; 60.2%) and demonstrated a significant BP feature × emotion induction condition interaction on impulsive responding. Other studies involving these three components (BP features, induced emotion, and behavioural measures of impulsivity) have involved clinical samples of individuals diagnosed with BPD (Jacob et al., 2013; Krause-Utz et al., 2013; Lawrence et al., 2010). It is possible that with a greater representation of high BP individuals or with a clinical BPD sample a reliable relationship could be observed.

A third possibility is that one or both of the emotion induction conditions did not work as intended. Self-reported changes in negative affect showed shifts in the expected directions following each induction condition; negative affect significantly increased following social rejection whereas the difference in negative affect was not significant following the neutral emotion induction. This suggests a successful manipulation of negative affect by the two induction conditions. Unfortunately, measures of physiological activity failed to support differential changes by condition. Almost every physiological measure failed to show significant effects related to the emotion induction condition. The failure to observe differences by condition in these physiological measures may have been due to limited power to detect these effects. An exception occurred in the EMG results: muscular activity in the *corrugator supercilii* increased following neutral emotion induction. Motor activity in the eyebrow can be interpreted as incipient frowning indicative of greater negative affect (Codispoti, Surcinelli, & Baldaro, 2008; Larsen, Norris, & Cacioppo, 2003). This may suggest increased frustration with what was intended to be a neutral control condition. Should this be the case, the aforementioned null results would not be surprising, as both induction groups may have elicited comparable increases in impulsive responding leading to non-significant differences

between these groups post-induction. Given impulsive responding was not assessed pre- and post-induction, this is not clear, however. Further, possible carry-over effects endemic to such a study design would not be conducive to evaluating impulsive behaviour via the PAL task where learning is a core component.

The discordance between self-report and behavioural measures of impulsivity seen in the present study has been replicated elsewhere in the literature (Lane et al., 2003; Reynolds et al., 2006; Jacob, 2010). Studies consistently show that individuals with BPD endorse higher levels of impulsivity on self-report measures, while evidence for differences in impulsive responding between individuals with BPD and controls on behavioural tasks is mixed (Hochhausen et al., 2002; Jacob et al., 2010; Leyton et al., 2001; Rentrop et al., 2008). Self-report and behaviour-based measures of impulsivity are qualitatively distinct from one another. Two assumptions of most self-report measures are that impulsive features are relatively stable and that individuals can accurately assess the motives, antecedents, and consequences of their impulsive behaviours. While laboratory tasks assessing various impulsive behaviours are thought to be more objective and less subject to incorrect or biased self-perceptions and self-presentations, they assess narrow cognitive or behavioural facets of impulsivity. The conclusions that can be reasonably drawn from these responses are similarly circumscribed. In sum, behavioural and self-report measures of impulsivity may differ because they actually tap different underlying constructs that require delineation through further study.

Limitations

It is unclear to what extent null findings observed in this mixed student and community sample generalize to strictly clinical or treatment-seeking samples. Two assumptions underpin the design of the current study. First, relationships between BP features, sensitivity to social rejection, and impulsive disinhibition can be understood continuously. Second, these relationships can be observed in non-clinical populations. Previous research has suggested that BP features are distributed continuously in the population (Ekselius, Lindstrom, von Knorring, Bodlund, & Kullgren, 1993). In addition, the range of BP features seen in undergraduate samples predict poorer functioning in similar domains to clinical samples, including dysphoric mood, interpersonal distress,

general psychopathology symptoms and history of anxiety and mood disorders (Trull, 1995). Nevertheless, there were only a small number of individuals with BP features at the upper end of the spectrum in this sample. As such, trying to predict performance of clinical populations using these models would involve extrapolation. Relationships between BP features, antecedent social rejection, rejection sensitivity and impulsive disinhibition may operate differently for individuals with BPD. Further research should attempt to define and test these relationships in clinical samples.

A related limitation is that endorsements of BP features on the PAI-BOR do not reveal who in the sample would have met clinical criteria for BPD, though it is probable that this proportion is small. An alternative strategy would have involved diagnosis using structured clinical interview (e.g., *Structured Clinical Interview for Diagnostic Statistical Manual III-R Axis II Disorders*, First, Gibbon, Spitzer, Williams, & Benjamin, 1997). The flexibility of the PAI-BOR is such that when it is used to differentiate clinical and non-clinical groups using a cut-off score, the instrument shows excellent correspondence with diagnostic interview (Jacobo et al., 2007; Stein et al., 2007).

A third limitation is the choice of the PAL task as the sole behavioural measure of impulsive disinhibition in this study. Participants committed relatively few PAEs. This may have been due to low task difficulty. Future studies may consider increasing memory load by increasing the size of the reward and punishment stimulus sets, reducing stimulus presentation time or increasing the confusability of stimuli (e.g., stimuli are three digit numbers and only one digit discriminates between reward and punishment). Alternately, few PAEs may suggest a lack of motivation to respond. Given the manipulation of social rejection in this study, the monetary rewards and deductions in the PAL task are not particularly reinforcing and punishing, respectively. It is possible that substituting social reinforcement and punishment may elicit impulsive responding in those most impacted by social rejection. Finally, a small number of participants appear to either misunderstand the purpose of the PAL task or failed to comply for other reasons. Future studies should consider including a practice phase using irrelevant stimuli.

Significance

The current study adds to the literature by exploring the direct effects of a social rejection induction on a laboratory measure of impulsivity in order to determine whether or not relative impairments in passive avoidance learning (i.e., more PAEs) occur according to an individual's severity of BP features. My primary prediction, that high-BP (but not low-BP) individuals should commit a greater number of PAEs following social rejection than following a neutral emotion induction, was not supported. When considered alongside previous research implicating induced fear as a moderator of impulsive responding in individuals with BP feature elevations (Chapman et al., 2010), this would suggest vulnerability in these individuals to loss of inhibition and poor learning from negative consequences only under conditions of specific negative emotions. It is important to note that in terms of temporal separation, PAL represents an ideal form of response-contingent learning. Outside of the laboratory, the negative consequences associated with many forms of impulsive behaviour may occur well after the behaviour itself. Individuals that are able to learn from negative consequences under an emotional state in a laboratory controlled best-case scenario might instead show difficulties learning from negative consequences that arise well after the behaviour occurs.

Overall, the current study offered a relatively rigorous test of the differential influence of social rejection on one measure of impulsive responding in the laboratory, according to the severity of BP features. Results failed to support differences in impulsive responding that were related to these factors, independently or in interaction. These results distinguish social rejection from other negative emotions in the nascent literature on emotionally induced impulsive responding. This is not to suggest social rejection is unrelated to maladaptive behaviours often characterized as impulsive (e.g., substance abuse, self-injurious behaviours) in high-BP individuals, but casts doubt on impulsive disinhibition as an underlying mechanism. Future research is needed to clarify the role social rejection may play in triggering or maintaining these maladaptive behaviours directly, particularly in individuals with BPD. In addition, future studies should continue to examine other emotional triggers and different aspects of impulsivity in order to identify contexts in which individuals with BP features and those with BPD are most vulnerable to acting impulsively.

References

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

Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry*, *4*, 561-571.

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

Bornovalova, M. A., Lejuez, C. W., Daughters, S. B., Rosenthal, M. Z., & Lynch, T. R. (2005). Impulsivity as a common process across borderline personality and substance use disorders. *Clinical Psychology Review*, *25*, 790–812.

Brodsky, B. S., Malone, K. M., Ellis, S. P., Dulit, R. A., & Mann, J. J. (1997). Characteristics of borderline personality disorder associated with suicidal behaviour. *American Journal of Psychiatry*, *152*, 1715–1719.

Chapman, A.L., Dixon-Gordon, K.L., Layden, B.K., & Walters, K.N. (2010). Borderline personality features moderate the effect of a fear induction on impulsivity. *Personality Disorder; Theory, Research and Treatment*, *1*(3) 139-152.

Chapman, A. L., Leung, D., & Lynch, T. R. (2008). Impulsivity and emotion dysregulation in borderline personality disorder. *Journal of Personality Disorders*, *22*, 148-164.

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

Chapman, A.L., Walters, K.N., & Dixon-Gordon, K.L. (in press, accepted Dec 2011). Emotional reactivity to social rejection and negative evaluation among persons with borderline personality features. *Journal of Personality Disorders*.

Chesin, M. S., Jeglic, E. L., & Stanley, B. (2010). Pathways to high- lethality suicide attempts in individuals with borderline personality disorder, *Archives of Suicide Research*, *14*(4), 342-362.

Codispoti, M., Surcinelli, P., & Baldaro, B. (2008). Watching emotional movies: affective reactions and gender differences. *International Journal of Psychophysiology*, *69*(2), 90-95.

Curran, P. J., West, S. G, & Finch, J. F. (1996). The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis. *Psychological Methods*, *1*, 16-29.

Derogatis, L. R. (1977). *The SCL-90 Manual I: Scoring, administration, and procedures for the SCL-90*. Baltimore: Johns Hopkins U School of Medicine.

Dixon-Gordon, K. L., Chapman, A. L., Lovasz, N., & Walters, K. (2011). Too upset to think: the interplay of borderline personality features, negative emotions, and social problem solving in the laboratory. *Personality Disorders: Theory, Research, and Treatment*, *2*(4), 243-260.

Dodrill, C. B. (1981). An economical method for the evaluation of general intelligence in adults. *Journal of Consulting and Clinical Psychology*, *49*, 668–673.

Ekselius, L., Lindstrom, E., von Knorring, L., Bod- lund, O., & Kullgren, G. (1993). Personality disorders in *DSM–II–R* as categorical or dimensional. *Acta Psychiatrica Scandinavica, 88,* 183–187.

Farmer, R. F., Nelson-Gray, R. O. (1995). Anxiety, impulsivity, and the anxious fearful and erratic dramatic personality disorders. *Journal of Research in Personality*, *29*, 189.

Farmer, R. F., & Rucklidge, J. J. (2006). An evaluation of the response modulation hypothesis in relation to attention deficit/hyperactivity disorder. *Journal of Abnormal Child Psychology, 34,* 545-557.

Faul, F., Erdfelder, E., Lang, A.G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis for the social, behavioural, and biomedical sciences. *Behaviour Research Methods*, *39*, 175-191.

Hochhausen, N. M., Lorenz, A. R., & Newman, J. P. (2002). Specifying the impulsivity of female inmates with borderline personality disorder. *Journal of Abnormal Psychology*, *111*, 495–501.

Hurt, S. W., Clarkin, J. F., Munroe-Blum, H., & Marziali, E. (1992). Borderline behavioural clusters and different treatment approaches. In J. F. Clarkin, E. Marziali, & H. Munroe-Blum (Eds.), *Quantitative analysis of behaviour* (Vol. 5, pp. 55–73). Hillsdale, NJ: Erlbaum.

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

Kirby, K. N., & Finch, J. C. (2010). The hierarchical structure of self-reported impulsivity. *Personality & Individual Differences*, *48*(6), 704-713.

Koenigsberg, H.W., Harvey, P.D., Mitropoulou, V., New, A.S., Goodman, M., Silverman, J., et al. (2001). Are the interpersonal and identity disturbances in the borderline personality disorder criteria linked to the traits of affective instability and impulsivity? *Journal of Personality Disorders*, *15*, 358-370.

Lane, S. D., Cherek, D. R., Rhoades, H. M., Pietras, C. J., & Tcheremissine, O. V. (2003). Relationships among laboratory and psychometric measures of impulsivity: implications in substance abuse and dependence. *Addictive Disorders & Their Treatment*, *2*(2), 33-40.

Lawrence, K. A., Allen, J. S., & Chanen, A. M. (2010). Impulsivity in borderline personality disorder: reward-based decision-making and its relationship to emotional distress. *Journal of Personality Disorders*, *24*(6), 786-799.

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

Leyton, M., Okazawa, H., Diksic, M., Paris, J., Rosa, P., Mzengeza, S., … Benkelfat, C. (2001). Brain regional α-[11C]methyl-L-tryptophan trapping in impulsive subjects with borderline personality disorder. *Am J Psychiatry*, *158*, 775– 782.

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

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

McGirr, A., Paris, J., Lesage, A., Renaud, J., & Turecki, G. (2007). Risk factors for suicide completion in borderline personality disorder: a case-control study of cluster b comorbidity and impulsive aggression. *J Clin Psychiatry*, *68*(5), 721-729.

Morey, L. C. (1991). *Personality Assessment Inventory*. Lutz, FL: Psychological Assessment Resources, Inc.

Morey, L.C., Gunderson, J.G., Quigley, B.D., Shea, M.T., Skodol, A.E., McGlashan, T.H., et al. (2002). The representation of borderline, avoidant, obsessive-compulsive, and schizotypal personality disorders by the five-factor model. *Journal of Personality Disorders*, *16*, 215-234.

Newman, J. P., Schmitt, W.A. (1998) Passive avoidance in psychopathic offenders: A replication and extension. *Journal of Abnormal Psychology*, *107*, 527.

Nigg, J.T., Silk, K.R., Stavro, G., Miller, T. (2005). Disinhibition and borderline personality disorder. *Dev Psychopathol*, *17*, 1129–1149.

Rentrop, M., Backenstrass, M., Jaentsch, B., Kaiser. S., Roth, A., Unger, J., … Renneberg, B. (2008). Response inhibition in borderline personality disorder: performance in a go/no go task. *Psychopathology, 41*, 50–57.

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

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

Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. (1970). *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.

Staebler, K., Renneberg, B., Stopsack, M., Fiedler, P., Weiler, M., & Roepke, S. (2011). Facial emotional expression in reaction to social exclusion in borderline personality disorder. *Psychological medicine*, *41*(9), 1929-1938.

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

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

Svrakic, D.M., Whitehead, C., Przybeck, T.R., & Cloninger, C.R. (1993). Differential diagnosis of personality disorders by the seven-factor model of temperament and character. *Archives of General Psychiatry*, *51*, 991-999.

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

Trull, T.J. (1992). DSM-III-R personality disorders and the five-factor model of personality: An empirical comparison. *Journal of Abnormal Psychology*, *101*, 553-560.

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

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

Trull, T.J., Sher, K.J., Minks-Brown, C., Durbin, J., & Burr, R, (2000). Borderline personality disorder and substance use disorders: A review and integration. *Clinical Psychology Review*, 20, 235-253.

van Reekum, R., Links, P. S., & Fedorov, C. (1994). Impulsivity in borderline personality disorder. In K. R. Silk (Ed.), *Biological and neurobehavioural studies of borderline personality disorder* (pp. 1–22). Washington, DC: American Psychiatric Press.

Vollrath, M., Alnaes, R., & Torgersen, (1998). Coping styles predict change in personality disorders. *Journal of Personality Disorders*, 12, 198–209.

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

Watson, D., & Clark, L. A. (1992). Affects separable and inseparable: On the hierarchical arrangement of the negative affects. *Journal of Personality and Social Psychology*, 62, 489-505.

Watson, D., & Clark, L. A. (1994). *The PANAS-X: Manual for the Positive and Negative Affect Schedule—Expanded Form*. Unpublished manuscript. University of Iowa, Iowa City, IA.

Wagner, A. W., & Linehan, M. (1994). Relationship between childhood sexual abuse and topography of parasuicide among women with borderline personality disorder. *Journal of Personality Disorders*, *8*, 1-9.

Wechsler, D. (1955). *Manual for the Wechsler Adult Intelligence Scale*. New York: Psychological Corporation.

Williams, K. D., & Jarvis, B. (2006). Cyberball: A program for use in research on interpersonal ostracism and acceptance. *Behaviour Research Methods*, *38*, 174–180.

Wonderlic, E. F. (1992). *Wonderlic Personnel Test and scholastic level exam user's manual.* Libertyville, IL: Wonderlic Personnel Test.

Zanarini, M. C. (1993). Borderline personality disorder as impulse spectrum disorder. In: J. Paris (Ed.), *Borderline Personality Disorder Etiology and Treatment* (pp.67-85). Washington, DC: American Psychiatric Press.

Zanarini, M. C., Gunderson, J. G., Frankenburg, F. R., & Chauncey, D. L. (1989). The revised Diagnostic Interview for Borderlines: Discriminating BPD from other Axis II disorders. *Journal of Personality Disorders*, *3*, 10–18.

Appendices

Appendix A

Social Rejection Script (adapted from Robins et al., 1984)

Narrator: Please listen to this taped message very carefully. You will hear a description of a series of events, and you are to imagine that these things are happening to you. In order to help your imagination, please close your eyes, become relaxed and pay attention only to this tape. Try to imagine what you hear as vividly as you can. Form a mental picture of what is described, trying to include as much detail as you can. Try to get involved in what you hear, and experience how you might feel if this were really happening to you. Imagine yourself in this situation.

You have been in town for only a short time, and you have found it a difficult transition in many ways. In particular, you have been trying to meet people, make new friends, and this has been difficult. Fortunately, you have made a few friends, and particularly important, you have been seeing a guy who you like very much, and at this point, you feel very committed to him. However, last night, he didn't call when he was supposed to. So after a couple of hours, you called him. You were surprised to hear another girl answer. You felt startled and confused about what to say, and so you hung up. You wondered who this could be, and what she was doing there so late in the evening. Now today, walking to an appointment, you see your boyfriend walking with another girl. They are ahead of you, with their backs to you, and they do not notice you. Could this be the girl who picked up the phone last night? Did they even spend the night together? As they turn the corner, he puts his arm around her. Your worst suspicion seems confirmed. You feel utterly rejected.

After your appointment, you decide to go to a coffee shop to get something to drink, and hopefully, meet some of your friends to talk to, to take your mind off this. You order and sit at an empty booth. The booths have high partitions between them. As you sit down, you immediately recognize the voices of the people in an adjoining booth. They are two friends of yours, and you are about to go around and join them when you notice that they seem to be talking about you, so you sit and listen. This is what you overhear:

Male: Did you see what she was wearing at that party?

Female: Yeah. Unbelievable!

Male: I couldn't believe it either. She looked so out of place. Everyone must have noticed.

Female: If I'd come like that, I'd have died.

Male: She certainly looked pretty dumb.

Female: And she made such a fool of herself with those silly comments! Very unaware and close-minded!

Male: Yeah. Did you see everyone's reactions to what she was saying? I know she's argumentative over a lot of things. Sometimes she can be pretty reasonable, but you get her on to some things...

Female: Watch out!

Male: Yeah, and she just keeps on going! I don't know. I think it makes her look pretty bad. People just don't want to talk to her when she's being like that.

Female: It's really a pity because in some ways she's really nice. But I'm afraid she's going to lose friends this way.

Male: Yeah. Did you see her boyfriend today with that other girl? I bet she doesn't know about that. Maybe we should tell her what's happening.

Female: Yeah maybe we should. I saw them together last night too. I can certainly see why he'd want to see someone else, but still, it's a pretty bad Rum thing to do behind her back. I really feel sorry for her.

Narrator: Now please try to remember the events described on this tape, and spend a minute going over them in your mind's eye. Remember your situation at school, the telephone call to your boyfriend, the walk down the street, the overheard conversation. Keep your eyes closed, and imagine these events until you're asked to stop.