

A Journey through Rejection Sensitivity: The Roadmap Model to Posttraumatic Stress Disorder

Submitted by Sila Jittayuthd to the University of Exeter

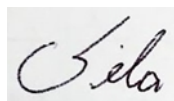
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Declaration of authorship

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I am the author of this thesis, and the studies contained within were carried out by myself. Some exceptions may apply which are described in detail before each chapter.

While the thesis should be read as a whole, the chapters are written as standalone papers and hence there some repetition may present.

The case study used for this thesis is a work of fiction. Name, character, events and incidents are the products of the author's imagination. Any resemblance to actual persons, living or dead, or actual events is purely coincidental.

Abstract

Rejection sensitivity, a propensity to perceive and act strongly to potential rejection, can impact many aspects of one's life, including having a negative effect on mental health. With a possible detrimental effect of rejection sensitivity on stress-related disorders, it is important to gain more understanding of the subject in order to prevent and treat the negative effect of rejection sensitivity. **Chapter 1**, presents a literature review on the impacts of rejection sensitivity, including impacts on behaviour, cognition, physiology, and emotion. From this, a model is proposed that incorporates rejection sensitivity into Ehlers and Clark's cognitive model of posttraumatic stress disorder (PTSD). The empirical studies of the PhD investigate different aspects of this extended theoretical framework. **Chapter 2** presents findings of a cross-sectional survey in trauma survivors showing that rejection sensitivity is associated with vulnerable attachment, social support, and posttraumatic-stress disorder. The results of this study supported important aspects of the proposed theoretical model of the thesis. **Chapter 3** focused on possible mechanisms how social rejection can impact the level of stress and physiological stress responses, and how individual differences in rejection sensitivity moderates these effects. The finding indicated that whilst being rejected or accepted through an experimental vignette task did not influence subjective stress level, high levels of rejection sensitivity made a significant contribution to increases in stress level following social evaluation and thus partially supported the extended theoretical model. Building on Chapter 3, **Chapter 4** investigated the contribution of rejection sensitivity to the psychophysiological responses during a virtual reality lab trauma, as well as the role of subsequent rejecting or accepting social interaction on trauma recovery. No associations between rejection sensitivity and variations in physiological responses were found. Social rejection following traumatic experience also did neither contribute to increase in stress reactivity nor subsequent intrusions. This finding suggested that recovery from trauma may not be influenced by immediate social interaction following the traumatic experience and hence did not support the theoretical model. In **Chapter 5**, a secondary

data analysis revealed that rejection sensitivity was associated with childhood trauma, substance use experiences, perceived social support, stress and depression. These findings provide support for parts of the theoretical model and highlight the importance of rejection sensitivity for trauma recovery and stress-related disorder. **Chapter 6** presents an overall discussion of the findings of the thesis, including the discussion related to literature reviews; specifically, the impacts of rejection sensitivity on physiology and stress-related mental health. The chapter also provides limitations and strengths of the studies with the main focused on the methodology used for the rejection tasks. Finally, how the findings can be used as a guide for future directions, and clinical implications, were presented.

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Table of Contents

Abstract.....	3
Acknowledgements.....	5
Table of Contents.....	7
List of Tables.....	13
List of Figures.....	14
Chapter 1: Literature Review.....	16
1.1: The (Brief) History of Rejection Sensitivity.....	17
1.2: The Origin of Rejection Sensitivity.....	18
1.3: The Effect of Rejection Sensitivity on Cognition and Physiology.....	20
1.4: The Effect of Rejection Sensitivity on Emotion Regulation and Coping Behaviours.....	22
1.5: The Social Impact of Rejection Sensitivity.....	28
1.5.1: Social Support.....	29
1.6: The Impact of Rejection Sensitivity on Stress Related Disorder.....	30
1.6.1: Psychological Traumas.....	31
1.6.2: Posttraumatic Stress Disorder (PTSD)	33
1.6.3: Extending the Cognitive Model of PTSD.....	35
1.7: Aims of the Thesis.....	37
1.7.1: Research Questions.....	41

Chapter 2: Rejection Sensitivity and Vulnerable Attachment: Associations with Social Support and PTSD Symptoms in Trauma Survivors.....	42
2.1: Abstract.....	44
2.2: Introduction.....	46
2.3: Method.....	51
2.3.1: Design.....	51
2.3.2: Participants.....	52
2.3.3: Materials.....	53
2.3.4: Procedures.....	55
2.3.5: Analyses Strategy.....	55
2.4: Results.....	56
2.4.1: Descriptive Analysis.....	56
2.4.2: Zero-Order Correlations.....	57
2.4.3: Regression Analysis.....	57
2.4.4: Mediation Analysis.....	58
2.5: Discussion.....	59
2.5.1: Limitations and Strengths.....	62
2.5.2: Conclusion.....	64
Chapter 3: The Effect of Rejection Sensitivity on Physiological Responses After Lab-Induced Rejection.	65
3.1: Abstract.....	67

3.2: Introduction.....	68
3.2.1: Hypotheses.....	70
3.3: Method.....	70
3.3.1: Design.....	70
3.3.2: Participants.....	70
3.3.3: Materials.....	71
3.3.4: Procedures.....	73
3.3.5: Data Analyses Approach.....	74
3.4: Results.....	76
3.4.1: Descriptive Analysis.....	76
3.4.2: Manipulation Check.....	76
3.4.3: Hypotheses Testing.....	76
3.5: Discussion.....	85
3.5.1: Limitations and Strengths.....	90
3.5.2: Future Directions.....	91
3.5.3: Implications.....	91
Chapter 4: Rejection Sensitivity and its Contribution to the Effect of Social Rejection Following Virtual Reality Trauma and Subsequent Recovery.....	93
4.1: Abstract.....	95
4.2: Introduction.....	96

A Journey through Rejection Sensitivity	10
4.3: Method.....	103
4.3.1: Design.....	103
4.3.2: Participants.....	103
4.3.3: Measures and Materials.....	104
4.3.4: Procedure.....	110
4.3.5: Data Analysis.....	110
4.4: Results.....	112
4.4.1: Physiological Arousal and Parasympathetic Activity During the VR Trauma Paradigm – Manipulation Check.....	112
4.4.2: Physiological Response During Trauma.....	114
4.4.3: Physiological Responses to the Modified Ostracism Task.....	115
4.4.4: Emotional Responses to Virtual Trauma and Subsequent Rejection Conditions.....	118
4.4.5: Diary Task Analyses.....	125
4.5: Discussion.....	125
4.5.1: Rejection sensitivity and the response to VR trauma.....	127
4.5.2: The role of social rejection for recovery from the VR trauma.....	129
4.5.3: Strengths and Limitations.....	132
4.5.4: Conclusions and Future Directions.....	133
Chapter 5: Increased Rejection Sensitivity Following Childhood Emotional Neglect Increases Subjective Wanting for Opioids.....	135

5.1: Abstract.....	137
5.2: Introduction.....	138
5.3: Method.....	142
5.3.1: Design.....	142
5.3.2: Participants.....	142
5.3.3: Materials.....	144
5.3.4: Procedure.....	147
5.3.5: Statistical Analysis.....	148
5.4: Results.....	148
5.4.1: Childhood Trauma and Rejection Sensitivity.....	148
5.4.2: Substance Use.....	148
5.4.3: Effect of Rejection Sensitivity on Mental Health.....	152
5.4.4: Exploratory Analyses.....	153
5.5: Discussion.....	156
5.5.1: Strengths and Limitations.....	159
5.5.2: Theoretical and Clinical Implications.....	160
5.5.3: Conclusion.....	160
Chapter 6: General Discussion.....	162
6.1: Findings Summary.....	164
6.1.1: Factors Relating to Rejection Sensitivity and their Associations with PTSD...164	

6.1.2: Association between Rejection Sensitivity and Physiological Responses to Rejection.....	164
6.1.3: The Role of Rejection Sensitivity and Experimental Rejection Following Virtual-Reality Trauma.....	165
6.1.4: Rejection Sensitivity Following Childhood Traumas and Associations to Wanting Opioids.....	165
6.2: Applications to the Theoretical Backgrounds.....	166
6.2.1: Precursor to the Development of Rejection Sensitivity.....	167
6.2.2: Rejection Sensitivity on Mood and Behaviour.....	168
6.2.3: Physiology Indicators of Rejection Sensitivity.....	170
6.2.4: Socialising with Rejection Sensitivity.....	171
6.2.5: Rejection Sensitivity on Stress-Related Mental Health.....	172
6.3: Limitations and Strengths.....	175
6.4: Future Directions and Implications.....	178
Appendices.....	180
Appendix A.....	181
Appendix B.....	187
Appendix C.....	193
References.....	200

List of Tables

Table 2.1. The descriptive statistics for the measured variables.....	56
Table 2.2. The zero-order correlation analysis between measured variables.....	57
Table 2.3. The summary of regression analysis where PCL-5 was a dependent variable.....	58
Table 3.1. Descriptive statistics of the main dependent variables.....	76
Table 3.2. Summary of the correlational analysis.....	77
Table 3.3. Summary of moderation analyses for the stress parameters following the experimental task.....	79
Table 4.1. Pearson’s correlations between rejection sensitivity and physiological responses during the film.....	112
Table 4.2. Summary of moderation analyses for moods following modified ostracism task.....	116
Table 4.3. Summary of moderation analyses for number of intrusions throughout the 7 days.....	124
Table 5.1. The means and standard deviations for the measures used in the analyses.....	141
Table 5.2. Zero order correlations between rejection sensitivity and childhood trauma subcategories along with drugs use behaviour, loneliness, and social support.....	149
Table 5.3. The summary of regression analyses on loneliness, perceived social support, and DASS with rejection and childhood traumas as predictors.....	150
Table 5.4. Zero-order correlations between Cyberball measures, rejection sensitivity, and the DASS measures.....	153

List of Figures

Figure 1.1. A hot-cross bun model (Greenberger & Pedesky, 1995)	26
Figure 1.2. The cognitive model of PTSD (Ehlers & Clark, 2000)	34
Figure 1.3. A proposed model for this thesis.....	36
Figure 1.4. A combined model for PTSD.....	37
Figure 1.5. The components of the simplified model tested in each study.....	40
Figure 2.1. A proposed model of the relationship between rejection sensitivity, social support, attachment styles, and PTSD symptoms.....	51
Figure 2.2. A flow chart summarising the participants included in the study.....	53
Figure 2.3. Standardised Regression Coefficients for the Relationship Between Vulnerable Attachment Style and PTSD Symptoms as Mediated by Rejection Sensitivity and Perceived Social Support.....	59
Figure 3.1. Participation flow chart.....	71
Figure 3.2. The summary of computer task procedure.....	74
Figure 3.3. The results of repeated measure ANOVA analyses between the three experimental conditions.....	78
Figure 4.1. Cognitive model of PTSD (Ehlers & Clark, 2000)	99
Figure 4.2. Summary of participants involved in the study.....	102
Figure 4.3. The modified ostracism task.....	106
Figure 4.4. The breakdown of the procedure with experiment timeline included.....	108

Figure 4.5. Changes in physiological responses across 8-minutes during the trauma film. a) heartrate, b) skin conductance, c) percentage deviation of heartrate variability.....111

Figure 4.6. Physiological changes during ostracism task between the three conditions. a) change in heartrate, b) skin conductance, c) percentage deviation in heartrate variability.....115

Figure 5.1. Summary model of the mediation analysis for a) wanting more morphine b) depression c) stress.....147

Chapter 1:

1.1: The (Brief) History of Rejection Sensitivity

The term rejection sensitivity was first used in the field of social phobia in 1980s to define a component of atypical depression and hysteroid dysphoria where an individual experienced a mild interpersonal conflict as devastating, which could plunge them into the state of dysphoria (Liebowitz, 1987). It was not until the 1990s that the term started to solidify into a concept. Feldman and Downey (1994) used the term to refer to those “who anxiously expect, readily perceive, and overreact to rejection”. Downey and Feldman then operationalised and conceptualised the term further by using open-ended interviews in their 1996 paper. In the process, they developed the first measure for rejection sensitivity that captured the anxious expectations in interpersonal relationships. This measure was then adapted for specific situations such as appearance-based rejection (McClure Brenchley & Quinn, 2016) and gender-based rejection (Pachankis et al., 2008). The main findings from the series of Downey and Feldman’s studies were that those with high rejection sensitivity: i) readily perceived rejection in ambiguous situations, ii) enter relationships with anxious expectations and experience intense rejection from insensitive behaviours, such as spending less time with their significant others, and iii) behave intensely in a relationship including, jealousy and hostility towards their partners, which diminished supports they received and satisfaction in their relationships. It is no surprise that this constant anxious state can generate considerable distress which then impacts one’s mental health and wellbeing (Liu et al., 2014). The impact of rejection sensitivity will be discussed further in detail in later section.

Whereas rejection sensitivity is known to be associated with borderline personality disorder (BPD), depression, and anxiety (Foxhall et al., 2019; Gao et al., 2017; Tops et al., 2008), less is known about the association of rejection sensitivity with traumatic stress and related mental health conditions such as posttraumatic stress disorder (PTSD). Rejection sensitivity can impact many aspects of a person’s social life. The benefits of having supportive social networks in relation to stress and mental health has long been observed. Yet with rejection sensitivity, one can be

prevented from forming a strong bond within the social circle. Thus, understanding the role of rejection sensitivity in the development of PTSD is necessary as it could be identified as a risk factor that bridges the gap in our understanding how experiencing traumatic events leads to PTSD symptoms. The aim of this thesis is therefore to further investigate the relationship between rejection sensitivity and traumatic stress, as well as exploring the pathways via which rejection sensitivity can affect recovery from social rejection and traumatic stress and contribute to the development of stress-related illnesses, specifically PTSD. Through a series of studies, my thesis aims to further investigate mechanisms of rejection sensitivity and social rejection and how they can contribute to PTSD. In this introductory chapter, I first review how rejection sensitivity develops through past experiences in section 1.2. Then, the available empirical evidence for the impact of rejection sensitivity are presented in section 1.3 and 1.4, specifically looking at cognitions, physiology, emotions, and behaviours. The social impact of rejection sensitivity is then explored in section 1.5, and more importantly how this could affect mental health is discussed further in section 1.6. Moreover, the theory of PTSD is integrated along with the model of PTSD to combine all aspects of what is discussed into one theory.

1.2: The Origin of Rejection Sensitivity

To help guide the story, I am going to use a hypothetical case of a person I will call Kevin. Kevin has developed high levels of rejection sensitivity. This was not caused by a one-off experience but rather through multiple negative events. A prominent theory for explaining the development of rejection sensitivity posited that the trait came from early parental rejection (Feldman & Downey, 1994). The idea was based on the interpersonal acceptance-rejection theory (IPART; Rohner, 2016) which suggested that combinations of childhood traumas could be the root of rejection sensitivity. The IPART theory posited that when an individual was rejected as a child, they formed negative representations of the self. The pain of rejection also induced negative worldview, which amplified the perception of social threats in those sensitive to rejection. As a child, Kevin could have

experienced emotional neglect, aggression, and/or the dismissal of behaviourally expressed affection from his parents or primary attachment figures. Such traumas can have a socio-cognitive impact on Kevin by sensitising him to subsequent possible rejection and invoking extreme anxiety in interpersonal relationships, as well as by distorting the perception of social situations (Downey & Feldman, 1996). There is evidence for a strong link between remembrance of past parental rejection and rejection sensitivity (Rohner et al., 2015). Moreover, rejection sensitivity positively correlated with all domains of childhood traumas (physical abuse, emotional abuse, physical neglect, emotional neglect, and sexual abuse subdimensions) (Erozkan, 2015). The effect of such traumas could further affect how Kevin experiences interpersonal relationship with other people. For instance, he could readily perceive rejection from his peers when a teacher asked him to pair up for a school project, which could lead him to behave avoidantly, by not asking his friends to pair up, or hostility, by getting angry for not being chosen. He could even feel betrayed by his close friends if they agreed to pair up with other friends. His reactions can in turn exacerbate peer rejection and thus anxious perceptions of interpersonal relationships can have a self-fulfilling prophecy effect. Those with high rejection sensitivity were found to behave more negatively, such as making insults during a conflict in romantic relationship, which was later reported by their partners as a reason for rejecting them (Downey et al., 1998). Therefore, this self-fulfilling prophecy could drive Kevin to become more isolated from his peers and could make him experience more rejection later in life. This repeated rejection from peers leads to a vicious cycle in which Kevin is further sensitised to rejection, which increases his rejection sensitivity. A study found that both parental and peer rejections predict the level of rejection sensitivity, which then predicts the level of psychological maladjustment (Rosenbach & Renneberg, 2014).

The IPART theory is also grounded and reflected in the attachment theory by John Bowlby (1958). The theory proposed that early experiences with primary care givers shapes a person's internal working model about themselves and others which impacts on subsequent relationships with other people. For instance, warm responsive caregiving helps the individual to form secure

attachment bonds because they learn that they are safe and loved and others mean well and can be trusted. However, in case of Kevin, he was raised by cold and unresponsive parents which made him more anxiously insecure in his interpersonal relationships. A study showed that such negative parenting, which may signify emotional neglect type of traumatic experience for a child, can be internalised in a form of rejection sensitivity, which then underlies both avoidance and ambivalent pattern of insecure attachments in adults (Feldman & Downey, 1994). Building on the attachment theory, the IPART then postulates that these impacts of attachment then perpetuate in a vicious cycle that that maintain rejection sensitivity. Therefore, Kevin could have internalised the interpersonal trauma of rejection from his parents into an insecure attachment, which led him to have difficulties with peer relationships. Such difficulties were maintained in a vicious cycle and into adulthood, which interfered with the relationships he has as an adult. Unsurprisingly, such dysfunctional relationships would have huge impacts on Kevin.

1.3: The Effect of Rejection Sensitivity on Cognition and Physiology

Rejection sensitivity can lead to attentional bias, defined as a tendency to readily perceived and process one type of stimuli over the others within the same environment (Azriel & Bar-Haim, 2019). When Kevin was growing up, his childhood experiences shaped his schemas, a set knowledge that guides cognitive processing, including attention and memory recollection, and interpretation of information (Barlett, 1932). Due to Kevin's past traumas, he developed negative schemas about relationships and the world, and these schemas are readily accessible and prime him to misinterpret social situations, such as not receiving a reply from a friend, and perceive rejection. This can again perpetuate the cycle of self-fulfilling prophecy that led to actual rejection. A study showed that those with high rejection sensitivity have attention bias towards rejecting words when completing a self-referential encoding task (Mor & Inbar, 2009). This would suggest that Kevin would have been able to quickly access the negative rejecting schemas about himself, making him prone to rejection cues around him.

Moreover, the attention bias can extend beyond his schemas and affect bias to social cognition and facial emotion recognition. High rejection sensitivity can disrupt the processing of facial expression in social situations. Those with high rejection sensitivity were prone to detecting facial expression that signal rejections, which can be seen at the neural level. Through fMRI, a study found greater activation of dorsal anterior cingulate (a site that activates during social rejection) in rejection sensitive participants when looking at disapproving faces (Burklund et al., 2007). Moreover, people with high rejection sensitivity also showed difficulty disengaging from rejecting facial cues, as well as sustained avoidance of accepting faces during dot-probe task. More importantly, these attention biases highly correlated with adverse childhood experiences (Cardi et al., 2013). What this seemed to suggest is that Kevin may have acquired these negative attentional biases from his childhood traumas, which are the biases he maintained throughout his life. These biases made it difficult for him to experience acceptance, navigate social cues, and predisposed him to rejections.

The attentional biases can further exert their effect on Kevin's physiological responses to stressful stimuli. Sensitivity to rejection cues can be moderated by attention control. Those with low attention control are then more susceptible to perceive rejection, which is in turn associated with fight-or-flight response as measured with startled blinking response (Gyurak & Ayduk, 2007b). Such inability to shift and control attentions can regulate Kevin's physiological responses to the surrounding cues. Social threats, specifically ostracism, can evoke a strong physiological stress responses such as increased blood pressure and cortisol levels (Gerber & Wheeler, 2009). Repeated activation of the stress system can lead to insensitive downregulation of the stress response in the brain, which then increases physiological arousal to stressful situations (Agorastos et al., 2018). Therefore, it would not be surprising for someone like Kevin, who consistently attends to and misinterprets ambiguous social cues as threats, to have prolonged and altered physiological stress responses to his surroundings. One study found that high rejection sensitivity was associated with increased sympathetic nervous system (SNS) responses and decreased parasympathetic nervous response (PNS), indicated by increased skin conductance (SCL) and resting respiratory sinus

arrhythmia (RSA) respectively, after relational victimisation by peers, such as being left out (Breslend et al., 2018). The observed physiological responses in those with high rejection sensitivity can be described as psychosocial stress responses; they activate the physiological changes in response to social stimuli (Slavich et al., 2010). However, there is a very limited number of studies that have directly investigated the associations between rejection sensitivity and physiological responses to stress. Whereas there are some experimental studies that have found associations between being ostracised (being socially excluded from groups) and increased physiological arousal (Iffland et al., 2014), none have considered the effect of rejection sensitivity on the physiological stress response when individuals experience social interactions. Based on the reviewed literature it could be suggested that Kevin would show higher physiological responses to stressful interpersonal situations due to his constant perception of threats as a result of his rejection sensitivity, which sensitised him to stress and made it challenging to down regulate his physiological stress responses. Underlying theoretical and empirical considerations to further understand Kevin's physiological and emotion regulation difficulties and potentially maladaptive coping behaviours will be provided in the next section.

1.4: The Effect of Rejection Sensitivity on Emotion Regulation and Coping Behaviours

Rejection sensitivity is often accompanied by strong negative emotions in relation to social threats (Downey & Feldman, 1996). Such overwhelming emotions could be down to poor emotion regulation. Emotion regulation refers to one's attempt to influence their emotions at a specific time and situation. The process is not limited to up and down-regulation of negative affect, but also include up and down-regulation of positive affect as well (McRae & Gross, 2020). Adaptive emotion regulation would encompass identifying and attending to important aspects of a situation. Once identified, an 'appropriate' strategy is deployed in order to modulate emotional response to the situation according to one's personal goal (Gross, 2015). Rejection sensitivity was found to be associated with rumination, a form of maladaptive repeated thinking pattern that can amplify

negative emotions, of negative events and emotional suppression (Gardner & Zimmer-Gembeck, 2018; Watson & Nescdale, 2012). This finding suggested that those with high rejection sensitivity might be prone to deploying maladaptive strategies for emotion regulation. One physiological marker of emotion regulation is resting respiratory sinus arrhythmia (RSA) defined as variations of the intervals between heartbeats that changes with respiration (Beauchaine, 2015). RSA denotes an ability to adapt to stressful situations, especially in social interaction (Appelhans & Luecken, 2006). Higher RSA indicates good self and emotional regulation by increasing parasympathetic influence on the heart, which leads to adaptability to the surroundings (Bernstein et al., 2003; Thayer & Lane, 2000). Similarly, heart rate variability (HRV) refers to the variations of beat-to-beat intervals in heart rates, which is directly proportional to RSA, and is also an indication of parasympathetic nervous system (PNS) activation (Thayer & Lane, 2000). Thus, it would not be surprising that those with high rejection sensitivity, who have difficulty managing emotions, would show distinctly lower RSA and HRV compared to those with lower rejection sensitivity. To date there is only one study investigating this: Gyurak and Ayduk (2008) found that those high in rejection sensitivity and lower RSA have also shown increased hostility during conflict (Gyurak & Ayduk, 2008). Often, dysfunctional emotional responses in rejection sensitivity can lead to lack of impulse control, which can sometimes be driven by the need for approval or the need to avoid rejection (Butler et al., 2007; Peters et al., 2014; Purdie & Downey, 2000). A study found lack of impulsive control, risk-taking behaviour and short-term gain favouring (e.g. gambling) and rejection sensitivity to be interconnected. This may lead to other behavioural problems such as substance abuse as a result of the attempt to regulate negative emotions. Moreover, emotional dysregulation can drive an individual to exhibit other maladaptive behaviours, such as social withdrawal, which can then affect their wellbeing (Gardner et al., 2020a). Assuming Kevin is in a relationship where his partner refused his invitation to spend time together, he might be ruminating about this event in a negative light, thinking that his partner is no longer interested in him, which makes him feel angry causing him to be aggressive towards his partner. A study has found increased emotion regulation to be a strong factor that mediates the

relationship between rejection sensitivity and behaviour responses (Hafner et al., 2020). The study presented the importance of emotion regulation, as noted by physiological markers, in subsequent behaviours.

Taken together, without effective emotional control, Kevin could employ maladaptive behaviours in an attempt to cope with potential rejections. There are two main behaviours commonly employed amongst those with high rejection sensitivity; avoidance and aggression (Downey et al., 1998). Those with high rejection sensitivity may choose to cope by avoiding the stressful situation altogether. People with high rejection sensitivity who exhibited fearfulness and weariness of relationships could choose to avoid relationship in order to avoid the pain of rejection that comes with it and behaviours they could feel ashamed for (Horney, 2013). A study that looked into individuals' behaviours towards their romantic partners revealed that those who were invested in romantic relationship but expect rejection highly anxiously were more likely to behave in a hostile way. However, those with anxious expectation of rejection who showed low investment in romantic relationships exhibited more avoidance behaviours towards social situations (Downey et al., 2000). Considering Kevin's previous conflict in this situation, the findings from Downey et al (2000) would suggest that Kevin was very invested in his relationship, but because of high fear of rejection, he reacted strongly towards an unintentional insensitive response from his partner. This could potentially break the relationship, leaving him isolated, perpetuating the vicious cycle through self-fulfilling prophecy once again. Suppose now that Kevin starts dating again, he is now less invested in this new relationship but still filled with anxious expectation of rejection, he could overreact by avoiding getting too close to the new partner or chose to terminate the relationship at an early stage. In fact, Watson and Nesdale (2012) found that those with high rejection sensitivity have higher tendency to withdraw from social situations to avoid rejection. However, such behaviour can potentially have negative impacts, including lower self-esteem, and loneliness.

An alternative strategy to cope with negative emotions is through aggressive behavioural response. Aggression is believed to stem from the internal working model related to insecure attachment to their partners. In particular, the fear and anxiety of being abandoned by their partner can contribute to feelings of jealousy, which drives violence in relationships (Holtzworth-Munroe et al., 1997). Because rejection sensitivity increases perception of rejections even to benign intention by their partners, such as not responding to a message because they are busy, those with high rejection sensitivity can feel overwhelmed by fear and jealousy which leads them to act aggressively. The effect of rejection sensitivity on behaviours can also extend to other impulsive behaviours. For example, dysfunctional emotion regulation is prominent in those with high rejection sensitivity and is associated with impulsive behaviours as a coping mechanism for overwhelming emotions (Crews & Boettiger, 2009). One study found a significant association between emotional dysregulation (anger rumination) and impulsive behaviours (drinking in response to negative affect) which served as distractions for negative emotions (Selby et al., 2008). Moreover, the lack of emotion regulation in general was found to predict both behavioural addictions (i.e., gambling, internet) and substance addictions (i.e., drugs, alcohol) (Estévez et al., 2017). Associations between emotion dysregulation and addiction has been shown in those with history of psychological trauma, such as the lack of ability to control emotion-based impulses (Radomski & Read, 2016). In addition, acting on impulse can help cope with negative mood and adverse physical responses to stress in the short term (Ricketts & Macaskill, 2003) but has detrimental effects for interpersonal relationships. A neuroimaging study found that rejection from romantic partners affected four areas of the brains; ventral tegmental area (the motivation and reward systems), nucleus accumbens (drugs cravings), forebrain areas (emotional regulation), and insular cortex (central nervous system) (Fisher et al., 2010). What this study showed was that the experience of rejection can activate the systems associated with negative emotions and physiological arousals, while also activating areas that drive impulsive behaviours with drug use. Thus, a constant activation of a stress response to potential rejection in those with high rejection sensitivity could be accompanied by an impulse to take drugs

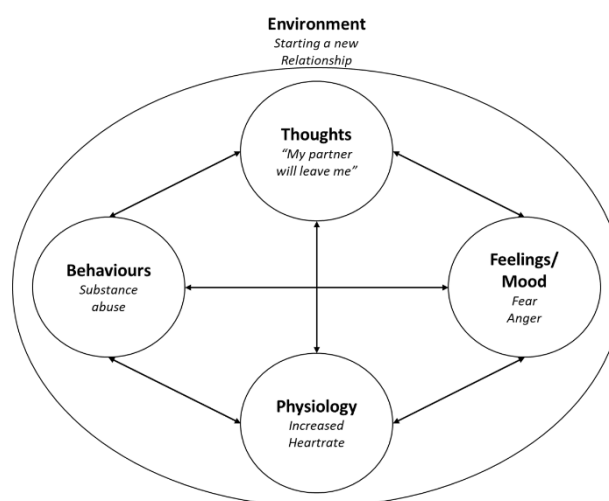
as a self-soothing response to overwhelming emotions and physiological arousals, as well as increase feeling of connectedness to cope with social isolation (Rokach & Orzeck, 2003).

What these studies suggested for Kevin was that as a result of his latest relationship breakdown, he may act on an impulse to use illicit substances to soothe the pain of the event. He started experimenting with opiates, which can help ease the social pain (Nobile et al., 2020). The effect of opiates alleviates the unpleasant emotions and physiological response to the rejection Kevin had been experiencing. Thus, when Kevin experiences further threat of rejection, which is often due to his rejection sensitivity, he craves the effects of opiates leading him to impulsively use the substance as a coping mechanism. Moreover, the use of drugs can make Kevin feel more isolated, which may contribute to the co-occurrence of other disorders such as depression and PTSD.

Taken together, the research reviewed here suggests that rejection sensitivity affects several different intraindividual domains. Greenberger and Pedesky (1995) introduced a 'hot-cross-bun model' for cognitive behavioural therapy (CBT) which helps explain how emotions, physiology, cognitions, and behaviours interact to perpetuate a negative cycle that can be detrimental to an individual's mental health (Figure 1.1). Kevin's experience of high rejection sensitivity amplified the negative effect in each domain, and the impacts of this will be discussed further in the next section.

Figure 1.1

A hot-cross bun model (Greenberger & Pedesky, 1995)



A quick recap on Kevin's life so far. Kevin was raised by cold and rejecting parents. This led him to become a child with insecure attachment. His insecurity was internalised into negative thoughts, such as "other people don't care about me", which became a base for his interpersonal relationships. With this thought his behaviour, feelings, and physiology were affected. As a child, Kevin believed no one care about him making him feel insecure and anxious around his peers. These feelings increased physiological arousal in his body, which in turn served a self-fulfilling prophecy that drove him to withdraw from his friends and led to peer rejection. These interactions are represented in the model (Figure 1.1). This repeated exposure to rejection was internalised into rejection sensitivity, which then perpetuate and introduced more negative thoughts. Because of this, Kevin started to form a negative perception about social relationships, e.g. that social interaction will only lead to pain and rejection. He perceives the world as being full of rejection, and his attentions started to attune and become sensitive to the possibilities of rejection around him. In an event where the intentions of others are ambiguous, such as when someone has not replied to his message, he perceived the situation as threats, which is incredibly stressful for him. In accordance with the hot-cross-bun model, this pattern of thinking will impact his physiological response in order to adapt and respond to the surrounding stress by increased arousal to threat and slower recovery. When he got into his first romantic relationship, he wished not to experience rejection again. However, his rejection sensitivity attunes his attention to a small mistake in the relationship. His physiology becomes sensitised to surrounding threats, and with prominent activation of SNS comes the inability to regulate his emotions and control his impulse effectively. He became angry, anxious, and frustrated with his former partner's insensitive actions. His wish not to be rejected drove him to become aggressive in his relationship. He accused his former partner of being cold and distant, he overreacted to a small conflict, and then attempted to solve problems he created. Without realising, his behaviour drove his former partner away, leaving him with yet another rejection. He is now even more sensitive to rejection. He started experimenting with illicit drugs as a way to soothe the pain of the stressful experience. Now, he has found someone new and wishes to start a new relationship.

However, his previous experiences have influenced his behavioural response to forming a new relationship, which has then impacted his social life and mental health. His experience (summarised in Figure 1.1) suggested how rejection sensitivity can disrupt the formation of new social connections which will be considered in the next section.

1.5: The Social Impact of Rejection Sensitivity

Rejection sensitivity has a detrimental impact on social life that is not just limited to romantic relationships. We see how rejection sensitivity can interfere with peer relationships, especially early in life, through negative affect and maladaptive coping strategies (Ayduk et al., 2001). A longitudinal study found a strong negative relationship between rejection sensitivity and social competence, an ability to understand and adapt to different social situations, in later years. Furthermore, the absence of a reciprocal cross-lagged relationship suggested that rejection sensitivity did not come from lack of social competence but preceded it (Butler et al., 2007; Marston et al., 2010). Another longitudinal study found that an increase in anxious expectation in those with high rejection sensitivity predicted social withdrawal as well as loneliness later in life (London et al., 2007). Family relationships can also be affected by rejection sensitivity. As discussed in the previous section, dysfunctional family relations can be the root of rejection sensitivity. Therefore, it is not surprising that those with high rejection sensitivity often perceive their family in a negative light and prefer to keep some distance (Ibrahim et al., 2015). Specifically, it was found that higher rejection sensitivity was associated with negative evaluations of perceived intimacy with family, as well as lower thoughts communication and feeling expression towards family members (Overall & Sibley, 2009).

The relationship that is affected the most by rejection sensitivity (or is most focused on in the research) is romantic relationships. Rejection sensitivity can lead to a fixation on romantic relationships. However, this can become unhealthy, especially when there is increased level of anxiousness about a partner's commitments. Such fear of rejection can lead to hostility during

conflict, which breaks the bond in romantic relationships (Purdie & Downey, 2000). Another way rejection sensitivity can be damaging to a person in a relationship is through self-silencing (Jack, 1991). Self-silencing refers to when an individual maintains a relationship in a self-sacrificing way, that is, at the expense of their own wellbeing, such as agreeing to engage in risky sexual relations. Rejection sensitivity was found to be highly correlated with self-silencing behaviours (Welsh et al., 2006). This correlation is not a surprise since those high in rejection sensitivity try to avoid rejection at all costs, even through self-sacrifice. Thus, individuals are unable to express their thoughts and feelings in a relationship even when they need support from their partners. These maladaptive behaviours related to rejection sensitivity can then interrupt the ability to form and experience positive and supportive relationships (Romero-Canyas et al., 2010).

1.5.1: Social Support

Social support refers to both the amount and quality of caring interactions an individual receives from those around them. The term was first defined and operationalised in the 1980s, where it was found that social support was strongly linked to positive life changes and the ability to perform under stressful tasks (Sarason et al., 1983). Later, the term was slightly redefined as “the perception or experience that one is cared for, esteemed, and part of a mutually supportive social network” (Taylor, 2011). Having social support can buffer against psychological and behavioural difficulties such as anxiety, depression, and addiction (Harandi et al., 2017).

One of the ways that social support can boost positive health is through its intervention on stress regulation. A study found that greater interaction with supportive individuals significantly reduced the stress hormone cortisol (Eisenberger et al., 2007). More importantly, social support helps regulate cortisol responses from the activity in the dorsal anterior cingulate cortex which is associated with social distress. Thus, high levels of social support can be beneficial. On the other hand, lack of social support was found to be associated with psychological vulnerability following

stressful life events (Thoits, 1984). Similarly, low levels of social support can also predict the likelihood of developing depression and anxiety (Boyd, 2002).

Rejection sensitivity, with its detrimental effect on interpersonal relationships as described above, can dampen social support in many ways. The most important mechanism is through behavioural modification. Those high in rejection sensitivity tend to seek less physical contact and closeness from others, which in turn prevents them from receiving social support (Schaan et al., 2020). Previously discussed behaviours such as avoidance and hostility can also have negative impact on social support (Luecken, 2000; Polman et al., 2010). It is expected that rejection sensitivity would be associated with lower social support, but there are not many studies that have directly investigated this association. However, one study found that rejection sensitivity fully mediated the relationship between borderline personality features, which are prominent in those with high rejection sensitivity, and the level of perceived social support (Zielinski & Veilleux, 2014). Such detrimental effect on social support can further impact the mental health of those with high rejection sensitivity as well as perpetuating the cycle of absent social support.

Getting in a new relationship is stressful for Kevin as the event poses a huge potential for rejection. However, due to Kevin's past experiences, he is unable to seek support from his family and friends because of the fear being rejected by them. Without social support, his physiological response goes out of control due to chronic activation of stress responses. He then becomes more distressed and anxious about the new relationship. He is unable to express these emotions to his new partner due to the fear of rejection, which means he is unable to form a supportive relationship with his new partner. His rejection sensitivity has driven him to suffer in silence in order to avoid conflicts, which has now taken toll on his mental health.

1.6: The Impact of Rejection Sensitivity on Posttraumatic Stress Disorder (PTSD)

In the previous sections, we have seen the biopsychosocial impact rejection sensitivity can have on an individuals' functioning. Rejection sensitivity has therefore been associated with mental

health conditions such as borderline personality disorder (BPD) (Foxhall et al., 2019) and depression (Gardner et al., 2020). The relationships between rejection sensitivity and BPD, and depression, can be understood through the hot-cross-bun model (Anderson et al., 2008; Fenn & Byrne, 2013).

However, the relationship between rejection sensitivity and PTSD is less understood.

This section will describe PTSD as a stress-related disorder following psychological trauma. In light of the association between rejection sensitivity and childhood traumas reviewed above, this section will first critically discuss the role of psychological trauma in the aetiology of PTSD. In particular, it will review the definition of trauma to highlight current controversies in the diagnosis of PTSD. It will then review our current theoretical understanding of the development and maintenance of PTSD and how rejection sensitivity could contribute to it. The section will also briefly review the role of rejection sensitivity for two common comorbid conditions, depression and substance abuse.

On one occasion when Kevin was under the effect of opiates, he got into a car accident where he lost control of the car, due to slippery road caused by the rain, and crashed into a tree. Following the incident, he started to experience nightmares, poor concentrations, irritability, and social withdrawals. These are examples of PTSD as defined in the DSM–5. PTSD is defined as a disorder following psychological trauma, a stressful life event that included actual or threatened death, serious injury, or sexual violence (American Psychiatric Association, 2013).

1.6.1: Psychological Traumas and PTSD

The Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM–5; American Psychiatric Association [APA], 2013) defines psychological trauma as being directly exposed, having witnessed or learned about, or experienced work-related vicarious exposure to actual or threatened death, serious injury, or sexual violence. Psychological traumas are broadly classified into single event (Type I) and repeated, prolonged (Type II) traumas (Terr, 1991); they are also often classified

into accidental (severe accidents and natural disasters), or interpersonal (man-made such as rape, assault, sexual abuse) traumas (Thomas et al., 2021).

PTSD is the inability to recover from psychological trauma. It is a stress-related disorder in the DSM-5 and characterised by symptoms such as intrusions and alterations in physiological arousal. PTSD is observed in about 12% of trauma survivors (Shalev et al., 2019) suggesting that there are considerable individual differences in recovery from psychological trauma.

The definition of what is considered “psychological trauma” had gone through a paradigm shifts within the past decades, where many changes in life events can be considered traumatic. The latest change concerns the comparison between the DSM-IV and DSM-5 where they introduced a stricter criteria for psychological traumas. In DSM-5, the inclusion of subjective feeling of “intense fear, helplessness, or horror” in traumas survivors was removed. On one side, the change is beneficial for diagnosing PTSD as the disorder often accompanied by peritraumatic dissociation meaning the feeling of fear and horror could be absent (Briere et al., 2005). Moreover, vicarious exposure through jobs is included in the new DSM-5. The change helps for an inclusion of those such as first responders who may not have directly experienced or witnessed traumatic events, but repeated exposure to traumatic scene can still be damaging their psychological health (Vrklevski & Franklin, 2008). These transitions make the definition of psychological trauma straight-forward and clear, allowing researchers and clinicians to conceptualise PTSD in a unified way (Spitzer et al., 2007). However, some did not agree with such change. They believed that the concept of trauma should be subjective, that is what is considered not traumatic for someone may be traumatic for others (Brewin et al., 2009). The change in the trauma definition poses problems, especially in the context of diagnosis. Some events defined as ‘childhood traumas’ as assessed by the adverse childhood experiences (ACEs; Felitti et al., 1998), such as emotional abuse, are no longer defined as psychological trauma that can lead to a PTSD diagnosis. This means those who had previously been diagnosed for PTSD due to such experience will no longer be diagnosed according to the new DSM-5,

which may lead to misdiagnosis even in the presence of PTSD-like symptoms (Jones & Cureton, 2014).

To put this in context, Kevin's early experiences of repeated rejection and emotional neglect would not meet the DSM-5 psychological trauma definition. They would however be in line with Lanius's (2011) emotion regulation model of PTSD, where a developmental pathway to PTSD via insecure attachment and impaired emotion regulation is stipulated (see section 1.6.3). In contrast, his motor vehicle accident would meet the psychological trauma criteria of DSM-5. Due to these discrepancies, the terms related to childhood traumas were used as a precursor to rejection sensitivity in the context of this thesis. However, in relation to PTSD, the psychological trauma only referred to a strict definition as defined by the DSM-5. This means that it is possible that childhood trauma may contribute to the development of PTSD, yet the studies in this thesis only considered PTSD in the presence of rejection sensitivity and under a strict definition of psychological trauma in compliance with the DSM-5. In which case, the impact of high rejection sensitivity Kevin has could be a potential risk factor for the symptoms of PTSD he is experiencing following the motor vehicle accident. This association between rejection sensitivity and PTSD can be understood using the cognitive model of PTSD proposed by Ehlers and Clark (2000; see Figure 1.2 and 1.4).

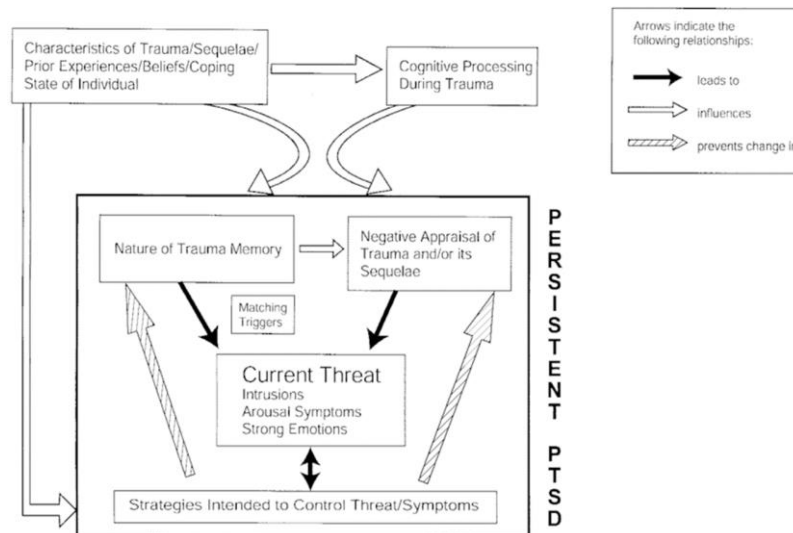
1.6.2: The Cognitive Model of Posttraumatic Stress Disorder (PTSD)

The cognitive model (Figure 1.2) begins with core beliefs a person holds from their previous experiences, which are used to appraise the trauma experiences and their sequelae. The appraisal of traumas influences the cognitive processing during the trauma, including memory and perceptual priming. Taken together, the appraisal of trauma and cognitive processing influence the memory of trauma as well as how the trauma was perceived in a negative way. Experiencing similar stimuli as the ones experienced during traumas can lead to the threats associated with PTSD symptoms. Thus, in order to control these symptoms, one might find a coping strategy to deal with them. However,

when the strategies are maladaptive, it can exacerbate the symptoms of PTSD as well as preventing the change in the appraisal and memory of traumas.

Figure 1.2

The cognitive model of PTSD (Ehlers & Clark, 2000)



Using Kevin’s experiences as an example, the cognitive model can explain why Kevin has developed the symptoms of PTSD. His childhood traumas formed schemas about himself and the world. When the incident happens, his schemas influence his appraisal of the event, that he ‘attracts disasters’. His rejection sensitivity can interfere with how he appraises the trauma sequelae. When other people offer him supports, he may perceive them to be thinking he is weak. However, when other people do not discuss the incident with him, he may perceive the no one cares. These negative appraisals can also affect how he perceives his emotions. He could feel anger towards himself because he was driving under the influence. We have seen that Kevin does not know how to regulate his emotions as the result of his rejection sensitivity, which may contribute to the rise in persistent PTSD symptoms. These appraisals influence the memory of the incident. For instance, his rejection sensitivity could have made him vigilant to negative faces of the people who witnessed the incident. This made the memory of the actual trauma very fragmented, and he became fixated in the responses in other people’s faces, which may lead him to feel judged or shame towards the traumas. This fixation led him away from processing other stimuli, such as the rain. He became fearful of rain because of this but was not able to understand why, which could make him think that there is

something wrong with him. Moreover, his hyperarousal of physiological responses to the incident can also affect the nature of his trauma memory. During trauma, his body tried to regulate the stressful event via SNS. Because of his rejection sensitivity and how it alters his physiological responses, Kevin often experiences the similar kind of hyperarousal, which then triggers the memory of his traumas, even in a benign situation. With overwhelming symptoms of PTSD, he needs to find a way to cope with them. With his high rejection sensitivity, he was unable to receive social support to cope with the trauma. Therefore, he resorted to withdrawal from other people, and turn to the use of opiates as a coping mechanism. However, these maladaptive behaviours perpetuate the feeling of loneliness and prevent him from challenging his negative appraisals associated with the trauma.

Several empirical studies have supported the components of the model. For instance, a longitudinal study found that the peritraumatic cognitive process, including negative appraisals, significantly predicted PTSD symptoms after assaults (Halligan et al., 2003). Additionally, chronic stress can alter stress-responsive neurobiological systems, which can influence the development of PTSD (Bremner & Vermetten, 2001). Emotional dysregulation and negative cognitive appraisals, including self-blame, may contribute to PTSD symptoms by lowering positive affect and life satisfaction. Greater emotional suppression, difficulty regulating emotions, and lack of cognitive reappraisal (i.e. the ability to reinterpret situations that can impact emotions) towards stressful stimuli were all significant predictors of PTSD symptoms (Shepherd & Wild, 2014). Lastly, PTSD was linked to the maintenance of impulsive behaviours and substance abuse. Current threats of PTSD were found to associates with increase impulsive behaviour, especially in those with substance use disorder (Tripp & McDevitt-Murphy, 2015). Further, this association was fully mediated by lack of emotion regulation (Weiss et al., 2012). The result from this study fits in the cognitive model of PTSD where the persistent symptoms of PTSD lead to impulsivity and substance uses as a strategy to control the current threats of PTSD symptoms, which includes strong emotions from being unable to regulate emotions.

1.6.3 Extending the Cognitive Model of PTSD

Summarising the empirical and theoretical underpinnings of the biopsychosocial impact of rejection sensitivity and of the cognitive model of PTSD, it can be hypothesised that rejection sensitivity contributes to how individuals recover from psychological trauma and to the development or maintenance of PTSD.

The first theoretically informed model proposed for this thesis suggests rejection sensitivity as a pre-trauma vulnerability factor which results from vulnerable attachment associated with childhood adversity. This is also extending Lanius' model (2011) in which she proposes a path to PTSD via insecure attachment and associated maladaptive emotion regulation. Figure 1.3 illustrates how this triad of vulnerability factors distorts an individual's physiological, cognitive, behavioural, and emotional functioning in specific stressful or traumatic situations and diminishes the effectiveness of social support, dampening it as a protective factor for PTSD.

Figure 1.3

A proposed model for this thesis

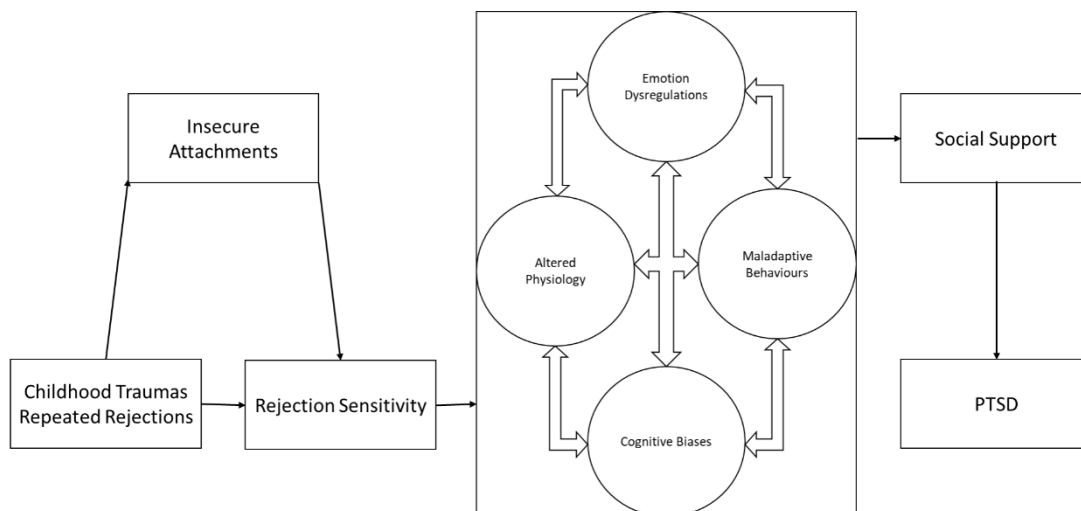
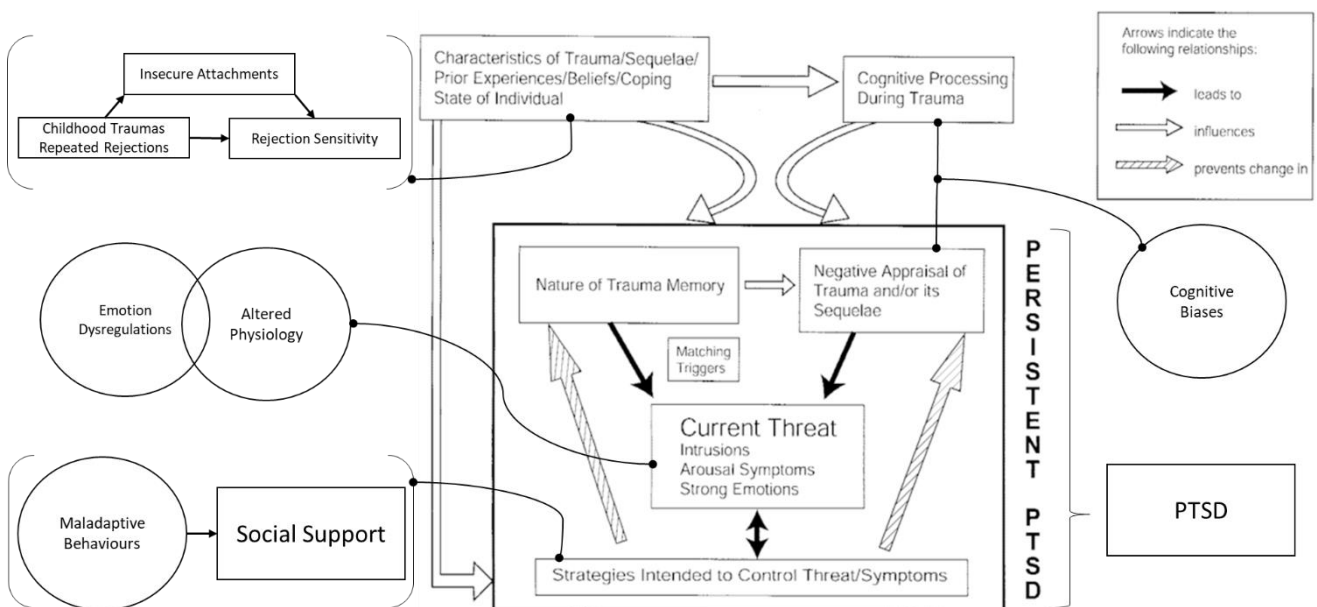


Figure 1.4 shows the extended PTSD model combining elements of proposed model (Figure 1.3) with the cognitive model of PTSD, synthesising the effects the triad of vulnerability factors can play in PTSD. The figure referred the vulnerability factors, including rejection sensitivity, as the prior experience in the cognitive model of PTSD. These factors can then influence the cognitive processing during trauma and subsequently the appraisal of trauma. For instance, with high rejection sensitivity

the appraisal of traumatic experience may be negative (e.g. “the accident happened because of me”). Such appraisal can lead to the symptoms of PTSD, including low mood from emotion dysregulation and arousal symptoms from altered physiology. These undesirable symptoms lead to attempts to control them through behaviours, such as substance use and social withdrawal. Rejection sensitivity trait can also influence these behavioural strategies which are driven by the fear of rejection. These maladaptive behaviours then maintain the symptoms of PTSD as well as prevent the change in the appraisal of trauma, thus manifest into persistent PTSD.

Figure 1.4

A combined model for PTSD



Rejection sensitivity has been studied in the field of social psychology. Many of Downey and Feldman’s studies have shown strong associations between rejection sensitivity and maladaptive social relationships. Their studies employed a longitudinal follow up method which supported the idea that rejection sensitivity is the predecessor of maladaptive social relationship. This shows that the studies by Downey and Feldman had provided a foundation for rejection sensitivity and contributed to the understanding of what could precede them. However, studies that investigate the predecessor of rejection sensitivity, i.e. early rejection, used cross-sectional design. Their findings were based on correlational and mediation analyses; thus, the findings may not reflect a causal relationship between parental rejection and rejection sensitivity. The effects of rejection sensitivity

were also observed from cross-sectional studies, especially the effects on coping behaviours and emotions. Thus, the causal relationships cannot be drawn from the empirical literature base, and so the experimental or intervention research would be necessary to understand the causal effect of rejection sensitivity. Due to the nature of rejection sensitivity as a trait, it is difficult to manipulate the level of rejection sensitivity. Yet, the study into the effect of rejection sensitivity and cognition (Mor & Inbar, 2009) employed an experimental design to show that those with high rejection sensitivity are biased towards negative self-description. This means it is possible to infer that those with high rejection sensitivity would have higher negative self-descriptions, which may be used to understanding the mechanism of factors closely relation to rejection sensitivity. The effect of individual differences in rejection sensitivity on physiological responses has not been directly investigated. However, experimental studies have shown that being rejected produced strong physiological arousal and negative affect in healthy participants. Such finding, combined with the many findings that those high in rejection sensitivity would react very strongly to rejection, would strongly suggest that rejection sensitivity is associated with further physiological arousal due to an influx of social stress.

In addition, the cognitive model of PTSD and its components, especially the tole of pre-trauma vulnerability factors, were also extensively studied using various methodologies, providing robust evidence for the model. More importantly, studies that investigated the long-term protective effects of social support on the maintenance of PTSD symptoms highlighted the importance of social support. Whilst there is no evidence for the associations between rejection sensitivity and PTSD, considering the robustness of the evidence for the role of predisposition vulnerability and cognitions from the PTSD model, association between rejection sensitivity and social relations, and associations between social support and PTSD, it would be possible to speculate that there will be an association between rejection sensitivity and PTSD. Thus, the main goal of this thesis was to provide stronger evidence for the models that has not been addressed directly in the previous literature. In particular,

the thesis aimed to explore the gaps in the literature and to provide evidence for inconsistencies and disagreements in the field of rejection sensitivity.

Whereas previous research provided a good foundation for the proposed model, there are gaps in the literature that need to be addressed in order to strengthen the proposed model further. Firstly, there are limited amounts of research that directly investigate the relationship between rejection sensitivity and the components of PTSD. This includes how rejection sensitivity plays a role in the maintenance social relationships can potentially associates with the manifestation of PTSD. Secondly, the idea that rejection sensitivity could be related to physiological changes has not been investigated and understanding this relationship could help identify the underlying mechanism associated with physiological changes in those with high rejection sensitivity. Lastly, there is still a gap in how rejection sensitivity could play an important role in during traumatic experiences, including how rejection sensitivity relates to psychophysiological responses during and after trauma, which may be important for the maintenance of PTSD symptoms through reinforcing the negative appraisal of the traumatic events and its sequelae. Investigating these gaps can contribute further to the understanding of the impact rejection sensitivity has on an individual. Studies in this area will also extend the knowledge of how psychosocial traits can contribute to the changes in psychophysiological responses under stressful conditions. Moreover, the addressing the gaps between rejection sensitivity and PTSD could shed lights on the importance of predisposition traits that contributed to the maintenance of PTSD as well as give insights into possible treatments and prevention strategies that can be deployed to support trauma survivors.

1.7: Aims of the Thesis

The thesis aimed to conduct a series of studies that investigate the assumptions of the extended cognitive model of PTSD.

Study 1 investigated assumptions of a theoretically informed path model in which rejection sensitivity is conceptualised as a mediator between vulnerable adult attachment and PTSD symptom

severity. In addition to the relationship between rejection sensitivity and other risk factors such as vulnerable attachment and PTSD, the study also examined how rejection sensitivity is associated with individuals' perceived social support, and how this in turn is associated with PTSD symptom severity. In particular, it was tested if more severe PTSD is explained by higher levels of vulnerable attachment and rejection sensitivity and lower levels of perceived social support. The importance of this study is that whereas previous research has established associations between PTSD and attachment or social support, and an association between attachment and rejection sensitivity, no previous studies have tested all the effects in the same model and no research has explored the role of rejection sensitivity for PTSD severity. The study essentially investigated parts of the simplified model (Figure 1.5a).

In Study 2, two main aims were addressed to further understand the potentially stressful nature of social rejection and how it interacts with high dispositional rejection sensitivity. First, psychophysiological responses to experimentally induced social rejection or acceptance were investigated in order to examine whether the experience of social rejection induces a pattern of stress-related negative affect, high physiological arousal (indicated by elevated heartrate and skin conductance) and reduced parasympathetic activation (indicated by the heartrate variability) and whether experimentally induced social acceptance induced the opposite response pattern. For this, a biosketch task, involving the evaluation of participants' self-description as a basis of rejection or acceptance, was applied to induce social interactions leading the participant to experience rejection or acceptance. A second aim of this study was to understand how high levels of rejection sensitivity alter how individuals respond to stressful or secure social interactions. For this, moderation analyses were conducted to understand how rejection sensitivity interacts with the experience of rejection or acceptance. It was hypothesised that higher levels of rejection sensitivity would facilitate the psychophysiological stress response to rejection and dampen the beneficial secure response to acceptance. The study was done to address some inconsistencies in the variations in physiological

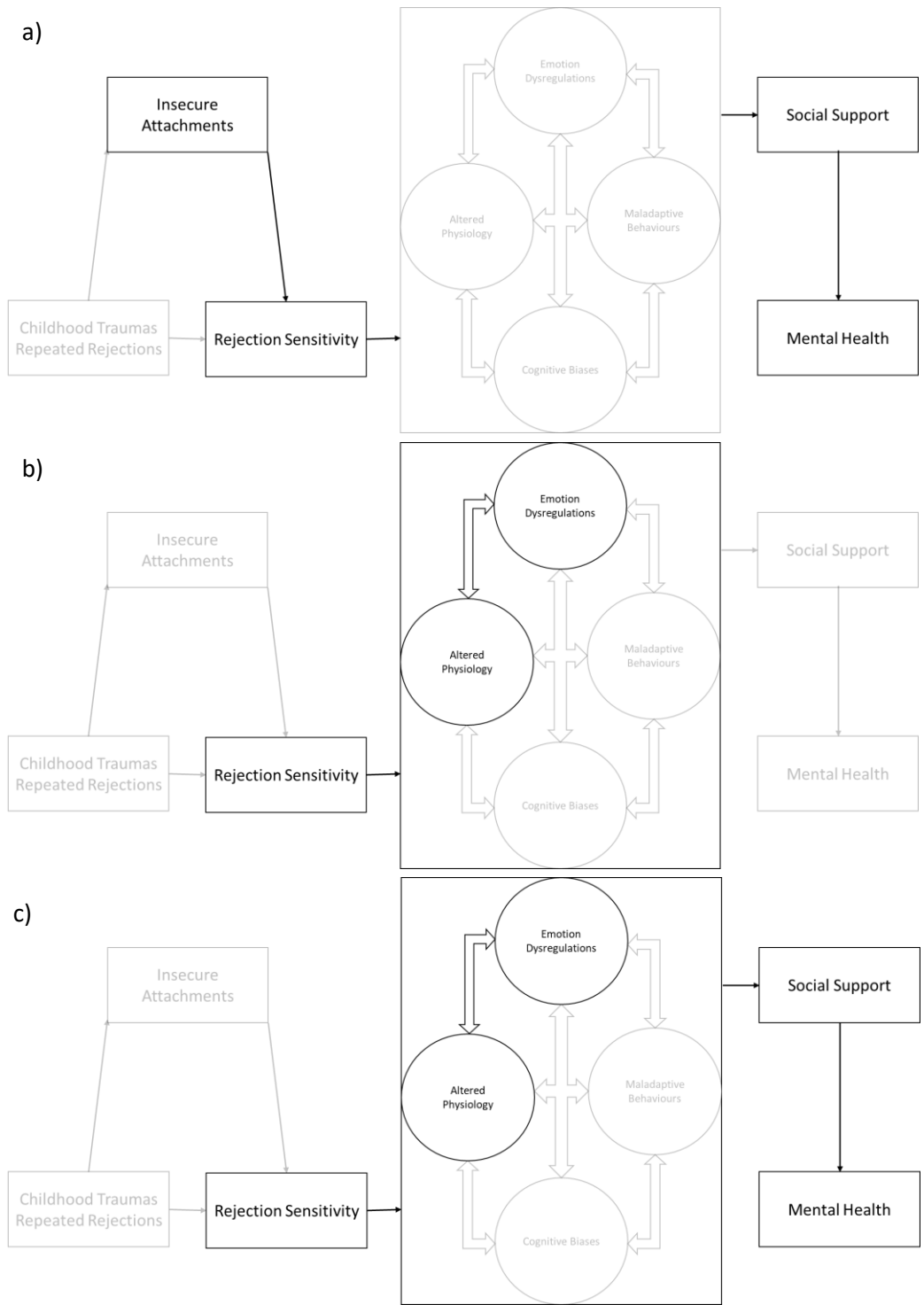
responses to rejection and to understand the role of individual differences in psychophysiological responses. The study tested the models as shown in Figure 1.5b.

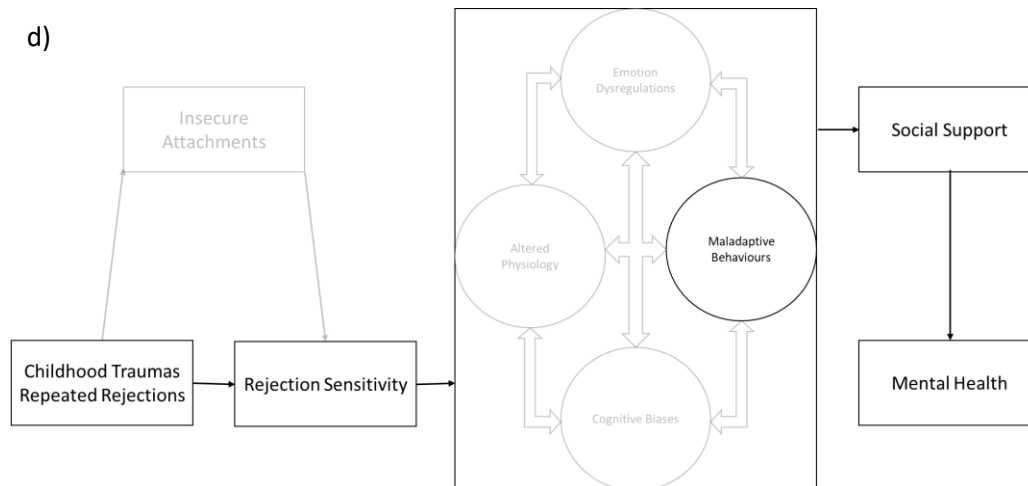
Study 3 extended the previous study by investigating the effect of experimentally induced social rejection on the recovery from a novel virtual reality (VR) trauma. In particular, it investigates if the experience of social rejection immediately after the VR trauma prevented recovery from it by increasing or sustaining high physiological arousal and low parasympathetic activity and by increasing the number of intrusive memories about the VR trauma in the week post-experiment. Conversely, it investigates if experiencing social acceptance immediately after the VR trauma supported stress recovery by reducing physiological arousal and increasing parasympathetic activity and by reducing intrusive memories. In addition, this study explored the impact of individual differences in rejection sensitivity on the psychophysiological responses to the VR trauma and the social rejection or acceptance and the subsequent number of intrusions. This study tested many components of the models (Figure 1.5c).

In the last study, Study 4, the role of rejection sensitivity in explaining the association between a history of childhood trauma and substance abuse, a maladaptive coping strategy often observed in trauma survivors with PTSD, was investigated. This study was a secondary data analysis of an experimental study on the effects of opiate administration in healthy individuals. It assessed history of childhood trauma, rejection sensitivity, history of substance use, levels of stress and depression, and perceived social support. Additionally, the effects of opiate administration on subjective wanting and liking of the effect of opiate were assessed. It was hypothesised that all types of childhood trauma are associated with rejection sensitivity and that high levels of rejection sensitivity are associated with higher levels of stress and depression, self-reported substance use, and lower levels of perceived social support. It was further hypothesised that higher levels of rejection sensitivity are associated with higher preference for the opiate administration. This study aimed to address the direct associations rejection sensitivity has with mental health and possibly

give insights into the coping strategy, specifically drug use, associated with high rejection sensitivity, which reflected in both models (Figure 1.5d).

Figure 1.5
The components of the simplified model tested in each study





1.7.1: Research Questions

Thus, the four studies aim to answer the following questions:

- 1) How is rejection sensitivity associated with vulnerable attachment, social support, and PTSD?
- 2) Whether rejection sensitivity is associated with the variations in physiological stress responses following social rejection?
- 3) What are the impacts of virtual-reality trauma and subsequent social rejection on physiological stress responses, mood, and intrusions; does rejection sensitivity moderate the relationship between traumas and mood?
- 4) Are childhood traumas associated with rejection sensitivity? How does rejection sensitivity associate with coping and mental health, specifically in relation to subjective experiencing of opioids, of those who had experienced childhood traumas?

Chapter 2:

Declaration Concerned the Article Entitled	
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Copyright Status	Copyright is retained by the publisher, but I have been given permission to replicate the material here.
Author's Contribution	The current study was formulated, recruited, conducted, analysed, and written by the author under supervision of the supervisor.
Author's Statement	This paper reports on original research conducted for the award of Doctor of Philosophy in Psychology

**Rejection Sensitivity and Vulnerable Attachment: Associations with Social Support and PTSD
Symptoms in Trauma Survivors**

Sila Jittayuthd and Anke Karl

Psychology, College of Life and Environmental Sciences, University of Exeter, Exeter, UK

Author Note

Address correspondence to Sila Jittayuthd, Psychology, College of Life and Environmental Sciences, Washington Singer Laboratories, University of Exeter, Perry Road, Exeter, EX4 4QG, e-mail:

sj423@exeter.ac.uk

Abstract

Background: Although social support has been consistently associated with recovery from psychological trauma and prevention of posttraumatic stress disorder (PTSD), individual differences in seeking or benefitting from social support in trauma survivors are not well understood. Factors associated with a negative internal working models of self and others, emotion dysregulation, and interrupted bonds with an individual's social support groups; such as vulnerable attachment and rejection sensitivity could contribute to lower experienced social support and higher levels of PTSD. **Objective:** The objective of this study was to test a theoretically informed model and investigate how psychosocial variables such as vulnerable attachment dimensions, rejection sensitivity, and social support are associated with PTSD. **Method:** Using a cross-sectional survey and path analyses in 141 survivors of trauma (aged 18-69, $M= 25.20$); the relationship between vulnerable attachment dimension, rejection sensitivity, and PTSD were investigated. **Results:** Higher vulnerable attachment, rejection sensitivity, and lower social support were found to be significant predictors of PTSD symptoms ($f^2= 0.75$). The relationships from vulnerable attachment to PTSD was mediated by rejection sensitivity and perceived social support. The results supported and extended theoretical models of PTSD that posit a role for predisposing factors in the development and maintenance of the disorder. **Conclusion:** The findings suggest a potential benefit of identifying vulnerable groups that could benefit from a refinement of existing PTSD interventions by targeting the maladaptive effects of vulnerable attachment and rejection sensitivity, thus allowing the individual to draw effectively on social support networks.

Keywords: Posttraumatic Stress Disorder, Social Support, Vulnerable Attachment, Rejection Sensitivity

Highlights

Rejection sensitivity (RS), vulnerable attachment, social support and PTSD are assessed. High RS positively associates with vulnerable attachment and PTSD, but negatively associates with social support. Attachment influence PTSD symptoms through RS and social support.

Disclosures

I confirm that this study is not sponsored or funded by any organisation. I also confirm that there are no financial or non-financial conflict of interest to report.

Psychological trauma, defined as a stressful life event that included actual or threatened death, serious injury, or sexual violence (DSM-5; American Psychiatric Association, 2013), is a common human experience. As many as 63.6% of adults surveyed in six European countries were found to have experienced at least one potential traumatic event in their lifetime (Darves-Bornoz et al., 2008). It is not a surprise that traumatic experiences would increase the risk of post-traumatic stress disorder (PTSD), especially after multiple instances of traumas (Breslau et al., 1999). With such a high prevalence and detrimental effect of traumas, it is important to explore factors that could contribute to the development of PTSD. Individuals with early childhood difficulties may be particularly vulnerable because early adversity impacts individuals' ability to form secure social bonds (i.e., secure attachment), which could be detrimental to their ability to regulate emotional and physiological responses to traumatic events throughout their lives (Lanius, Bluhm & Frewen, 2011). This emotion dysregulation could affect trauma survivors' ability to form beneficial social support networks with other people (Cloitre, Miranda, Stovall-McClough & Han, 2005) and, in turn, lead to a more serious impact on mental health.

Post-Traumatic Stress Disorder (PTSD) and Social Support

PTSD is described as a stress-related disorder following traumatic events as defined in the Diagnostic and Statistical Manual (DSM-5; American Psychiatric Association, 2013), where one experienced, witnessed, learned, or was repeatedly exposed to a situation where there is a sense of actual or threatened death, serious injury, or sexual violation. In England and Wales, PTSD has an 8% prevalence in young adults (Lewis et al., 2019). PTSD has a range of symptoms associated with functional impairments including, but not limited to, re-experiencing, avoidance, hyperarousal, and emotional numbing (DSM-5, 2013). There are numerous factors that could affect the development of PTSD (Ehlers & Clark, 2000) and among them social support has been identified as a consistent predictor with medium effect size (Brewin, Andrews & Valentine, 2000; Ozer, Best, Lipsey & Weiss, 2003).

Perceived social support was found to have a protective effect against the development of PTSD (Johansen et al., 2020) as well as acting as a buffer that helps to reduce the severity of PTSD symptoms (Schumm, Briggs-Phillips & Hobfoll, 2006). This observed protective effect could be because social support builds on a higher social functioning in an individual, which later improves overall life satisfaction that helps protect against PTSD (Tsai, Harpaz-Rotem, Pietrzak & Southwick, 2014). Another study suggested that social support builds resilience by providing guidance for coping with the situation and by boosting an individual's self-esteem (Hyman, Gold & Cott, 2003).

Similarly, the network orientation model draws on the idea that past experience shapes the attitude and expectation towards the usefulness of engaging with social support in time of need (Tolsdorf, 1976). It was found that negative network orientation, stemming from past social rejections (i.e., where an individual was being denied becoming part of a group or becoming someone, such as friends or significant others, they expected to be to others), mediates the relationship between social support and PTSD severity (Clapp & Beck, 2009). This suggests that the individual's perception of social support is important for the maintenance of PTSD symptoms. Moreover, psychological distress from PTSD may perpetuate the cycle of lack of social support due to negative appraisals of social interactions and social isolation (Gurung, Taylor & Seeman, 2003). Given the significance of social support for a person's resilience towards PTSD, it is important to understand individual differences in factors that precede or influence how individuals experience social support. In particular, we need to investigate factors that affect a person's ability to seek and gain from social support, adult vulnerable attachment and rejection sensitivity.

The Role of Adult Vulnerable Attachment for PTSD and Social Support

Through the network orientation model an individual's attitude and expectation of social support can be explained. Attachment theory complements our understanding of the nature of social bonds within the social support groups, and explains why social support is an important factor for PTSD (Flannery, 1990; Lanius, Bluhm & Frewin, 2011). People with insecure attachments are

readily more likely to appraise the support from their social support group as negative, especially in an ambiguous situation (Collins & Feeney, 2004), which is also consistent with the negative network orientation model. Bowlby's (1969) internal working model posited that infants form an interpersonal bond with their primary caregiver which shapes internal working models of self and others, and this specific type of bond is a base for social relationships later in life. For instance, when parents are responsive to a child's need, they will form a secure bond with each other. A securely attached baby will grow up to be an adult with effective emotional regulation that can easily adapt to stressful situations. In contrast, children who were not comforted by their parents form an insecure anxious bond with their caregiver. Anxiously attached children often have a negative internal working model of self and have hyperactivating emotional regulation, such as hypervigilance to abandonment, later in life. Avoidantly attached children often have a negative internal working model of others and avoid intimacy (hypoactivating emotion regulation) with others later in life due to inconsistent caregiving they received in the past. These two types of insecure attachments were defined in a clinical context as enmeshed and fearful vulnerable attachment dimensions respectively (Bifulco, Mahon, Kwon, Moran & Jacobs, 2003). These attachment styles were often stable from early childhood to adulthood, especially for secure attachment, but attachments can also vary over time (Opie et al., 2020). A longitudinal study found that early infant attachment was important for emotional regulation later in life (Girme et al., 2020). However, studies had focused on the relationship between adult attachments and mental health (Chopik, Nuttall & Oh, 2021; Dark-Freudeman, Pond Jr., Paschall & Grescovish, 2020). Moreover, it was found that insecure adult attachment plays an important role in social relationships, which subsequently led to poor mental health (Wei, Russell & Zakalik, 2005). Both, having anxious or avoidance adult attachment is highly associated with low perceived social support (Mallinckrodt & Wei, 2005). In fact, a study found that adults with insecure attachments perceived social support in a critically negative way, which was in line with the orientation network model (Wallance & Vaux, 1993). Those who have a secure relationship, on the other hand, reported higher levels of support and seek more social support in

times of need (Florian, Mikulincer & Bucholtz, 1995). It comes therefore as no surprise that attachment is related to PTSD. In fact, PTSD was found to be associated with higher levels of both anxious and avoidant types of attachment (Dekel, 2007), while others found that only anxious attachment was associated with PTSD whereas avoidant attachment was associated with lower posttraumatic growth (Arikan et al., 2006). Because the existing evidence is still inconsistent, it is important to investigate the association between attachment and PTSD, in particular the role of vulnerable attachment.

In summary, both attachment dimension and social support contribute to the development of PTSD, and attachment dimension and perceived social support have been associated, but it is not well understood how the three variables are associated. Theoretically informed by the cognitive model of PTSD (Ehlers & Clark, 2000), we would predict that vulnerable attachment dimension, as a predisposition factor, leads to lower perceived support which in turn is associated with higher PTSD. Moreover, previous research has emphasised the importance of adult attachment in psychosocial and psychopathological adjustment, and thus this study also focuses on adult attachment rather than early childhood. There is one additional factor that could determine how an individual accesses and perceives social support during recovery from trauma; rejection sensitivity. This is one's predisposition to expect and strongly react to being rejected (Downey, Khouri & Feldman, 1997). Rejection sensitivity is the result of rejection in caregiver and social interactions, and therefore could be the link between attachment and how social support is being perceived.

The Role of Rejection Sensitivity

Parental neglect or dismissive behaviours can also have an impact on an individual's rejection sensitivity. Rejection sensitivity refers to one's predisposition to expect and strongly react to being rejected (Downey, Khouri & Feldman, 1997).

In accordance with the network orientation model which explains social support, rejection sensitivity originates from past experience of rejection which then increases maladaptive social

behaviours, such as social avoidance (London, Downey, Bonica & Paltin, 2007). Rejection sensitivity is related to insecure attachment styles in many ways. For instance, they can both elicit hypoactivating and hyperactivating strategies of proximity-seeking under stress in an individual (Downey, Feldman & Ayduk, 2000). Vulnerable attachment styles and the caregiver's behaviours were also found to be significant predictors for rejection sensitivity, which supports the idea that rejection sensitivity is built from past experiences (Erozkan, 2009).

The network orientation model can also explain the relationship between rejection sensitivity and perceived social support. Individuals with high rejection sensitivity readily perceived social interaction as threatening which then lead to lower social network satisfaction and support (Lazarus, Southward & Cheavens, 2016). Moreover, rejection sensitivity was found to predict a decrease in level of social support (Zielinski & Veilleux, 2014). Interestingly, trauma exposure can also increase aggression in individuals with high rejection sensitivity, which may hinder their ability to seek support (Mendez, Mozley & Kerig, 2017) although research in this area is still very limited. Taken together, rejection sensitivity has a negative impact on social support and hence it could affect recovery from trauma and facilitate PTSD but to date the association between PTSD and rejection sensitivity has not been investigated. Therefore, this paper will focus on attachment, rejection sensitivity, and their involvement in social support, which were all significant social contributors that can sustain the symptoms of PTSD.

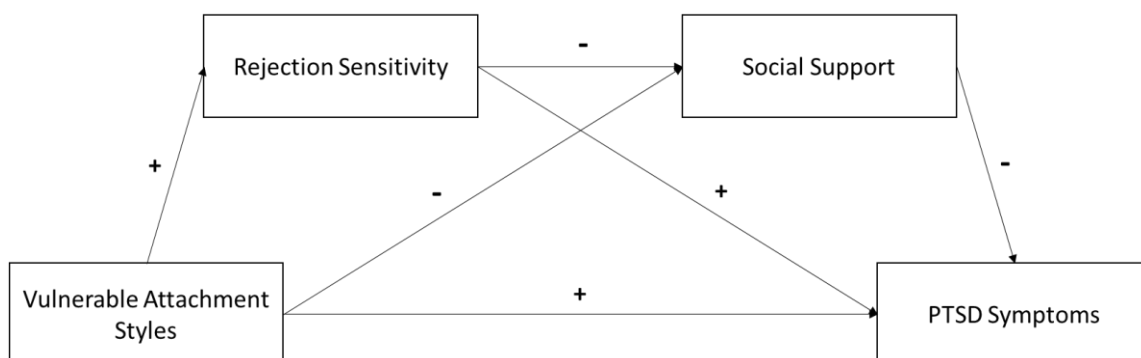
Rationale and Aims of the Study

The network orientation model stated the importance of attachment and rejection sensitivity in the maintenance of PTSD symptoms. However, there is still a lack of studies investigating associations between these factors, especially between rejection sensitivity and PTSD. Studies that provide evidence on how rejection sensitivity impacts PTSD will help identify early risk factors that could lead to the development of PTSD. This information will be useful for preventative measure, and potentially intervention, against PTSD. Therefore, the objective of this study is to test

the assumptions of the network orientation model by investigating the associations between rejection sensitivity, attachment dimension, social support, and PTSD symptoms. Based on the existing literature we reviewed here; a hypothetical model can be drawn (see Figure 2.1). From Erozkan's (2009) study, it was expected that vulnerable insecure attachment dimension would predict high rejection sensitivity. Based on the network orientation model (Tolsdorf, 1976), it was then expected that vulnerable attachment and high rejection sensitivity would predict low social support. Finally, a meta-analysis by Ozer, Best, Lipsey, and Weiss (2003) suggested that lower social support would predict higher PTSD symptoms. These paths can be visualised in the model in Figure 2.1. Thus, it is hypothesised that 1) there will be a significant positive association between rejection sensitivity, dysfunctional attachment dimensions, and PTSD symptoms; 2) there will be a significant negative association between perceived social support and rejection sensitivity, dysfunctional attachment dimensions, and PTSD symptoms; and 3) the effect of rejection sensitivity and attachment dimensions on PTSD symptoms will be mediated by perceived social support.

Figure 2.1

A proposed model of the relationship between rejection sensitivity, social support, attachment styles, and PTSD symptoms. + indicates positive relationship, – indicates negative relationships.



Method

2.3.1: Design

The study used a cross-sectional correlative survey design with rejection sensitivity, attachment dimensions anxiety and avoidance, social support as predictors, and PTSD symptoms as an outcome variable.

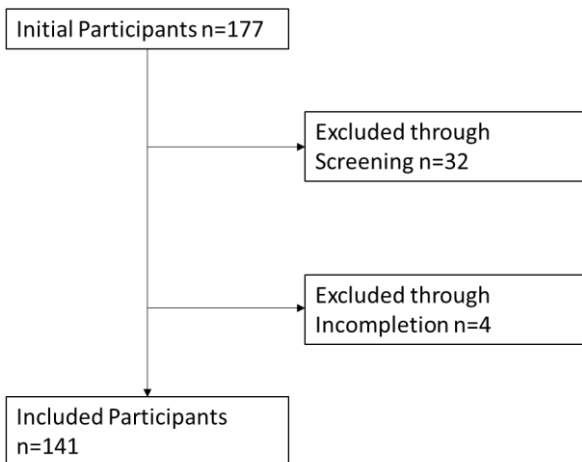
2.3.2: Participants

Participants were 141 adults (70 males, 67 females, 4 not specified) aged between 18-69 ($M= 25.20$; $SD= 7.86$) from all over the world, mostly in the UK but also included the US and Australia. The majority of the participants were students ($n= 56$; employed for wages = 44, others= 41) of diverse ethnic background ($n= 98$, British= 42). The participants were recruited via social media, Prolific Academic recruitment website, and advertisement flyers across the University of Exeter campus. The participants were screened using a "Life Event Checklist for DSM-5" (Weathers et al., 2013) in order to check if they had experienced trauma and were eligible for the survey. Participants who had never experienced any traumas were excluded from the study. Participants were given the opportunity to enter a prize draw to win a grand prize of £20 or four smaller prizes of £5. All participants gave written informed consent for study participation and the protocol was approved by the University of Exeter ethics committee.

Target sample size was determined using a power calculation in G*Power for multiple regression analysis with 4 predictors which indicated that a total sample size of 77 is needed to be recruited to detect a medium effect ($f^2= 0.15$) at a statistical power of 0.80 and an α of .05 (Faul et al., 2009).

Figure 2.2

A flow chart summarising the participants included in the study.



2.3.3: Materials

Life Events Checklist for DSM-5 (LEC-5; Gray, Litz, Hsu & Lombardo, 2004)

The questionnaire used as a screening tool for past traumatic experiences. The questionnaire consisted of 16 distressful events that could result in PTSD (e.g., natural disaster, physical assault, motor vehicle accident, etc.) and 6 responses (Happened to me, Witnessed it, Learned about it, Part of my job, Not sure, Doesn't apply). Participants were asked to go through each event and indicate if they had experienced any of them in the past.

Rejection Sensitivity Questionnaire- Adult Version (RSQ-A; Berenson et al, 2009)

This questionnaire is an adaptation of the RS questionnaire (Downey & Feldman, 1996). The questionnaire consisted of 9 questions. Each question presented a scenario of social situation. The participants then rated how they would respond to each situation. The questionnaire is widely used in the research of RS. The questionnaire also has high internal consistency (Cronbach alpha = 0.74) and test-retest reliability ($\alpha = .83$) (Berenson et al, 2011). To calculate the total rejection sensitivity scores, the score from sub-questions B were reverse coded to obtain an expected acceptance score. These scores were multiplied by the score from sub-questions A to obtain the rejection sensitivity

score for each question. These were then divided by 9 to obtain the total rejection sensitivity score for each participant. The higher score indicates higher sensitivity to rejection.

PTSD Checklist for DSM-5 (PCL-5; Blevin et al, 2015)

This is a 20-item self-report that assess the symptoms of PTSD. The questions involve the symptoms of PTSD and the participants rate whether they have experienced these symptoms in the past months. The PCL-5 showed a high internal consistency ($\alpha = .94$) and test- retest reliability ($r = .82$). They also show high validity.

The Multidimensional Scale of Perceived Social Support (Zimet, Dahlem, Zimet & Farley, 1988)

This is a 12-items self-report questionnaire about perceived social support. The questions are divided into 3 categories: family, friends, and significant other. The participants respond on a 7-points Likert scale whether they agree with each statement. The questionnaire showed high reliability on all categories (family= .90, friends= .94, significant other= .90). The questionnaire also showed high validity through a number of studies (Zimet et al, 1990).

Vulnerable Attachment Style Questionnaire (VASQ; Bifulco et al, 2003)

This is a 22-items self-report questionnaire assessing participants' attachment dimensions. Each item is a statement describing interpersonal relationship; for example, "I take my time getting to know people", and "People let me down a lot". The participants then rate how much they agree with each statement. The responses can be scored into two dimensions; insecurity/mistrust and degree of proximity/distance. Each subscale has somewhat high internal consistency (insecurity= .82, proximity= .67). Moreover, the scales also show high validity when compared with attachment style interview.

2.3.4: Procedure

The survey was set up on Qualtrics. Participants were recruited through various means, mostly through Prolific (n= 64). Interested participants were given a link to the survey. They were greeted with the information page, followed by a consent form page. This was immediately followed by the LEC as a screening questionnaire. Only participants who chose “happened to me”, “witnessed it”, “learned about it”, or “part of my job”, in at least one of items were able to proceed to the rest of the survey. This was to make sure the participants had experienced a trauma as defined by the DSM-5.

Those excluded were greeted with a debrief page explaining the study and why they were not eligible for the study. Included participants proceed to RSQ-A, PCL-5, perceived social support scale, and VASQ. Once completed, they were directed to a debrief page followed by the end page where they could leave their email for the prize draw.

2.3.5: Analyses Strategy

All analyses were performed using SPSS software version 27 (IBM,2020). There were no missing data or outliers in the data set. To check for normality a K-S test was done on the PCL-5 scores, which was found to be significantly non-normal ($D(141)= 0.97, p=.001$). For this reason, all the following tests were done with robust 95% bootstrapped confidence intervals. For regression analysis, the residuals of regression were investigated using a predicted probability plot and it showed that the residuals were normally distributed. Moreover, the predicted values and residuals scatter plot showed homoscedasticity in the data. For these reasons, the linearity can be assumed. The variance inflation factor values for all predictors were all below 1.30 which fulfilled the assumption of multicollinearity.

In order to investigate the first two hypotheses, a multiple linear regression analysis with PCL-5 as outcome variable and RSQ-A, VASQ, and MSPSS as predictor variables was done. The mean

VIF scores for the model was 1.27, therefore multicollinearity was not a concern (Bowerman & O'Connell, 1990). In accordance with the theory, both RSQ-A and VASQ were added to step one as they were believed to be equal predictors of PTSD symptoms. The MSPSS was then added to step two to see if it is also a significant predictor of PTSD.

To investigate the original proposed model and Hypothesis 3, a mediation analysis was done with 95% bootstrapped confident intervals (Hayes, 2017). This is to investigate if rejection sensitivity has an effect on PTSD symptoms, and if this effect is mediated through social support. Hence, the outcome variable is PCL-5 whereas independent variable and mediated variable are RSQ-A and MSPSS, respectively. Furthermore, gender and age were added to the model as covariates to check for the contributions they made to PTSD symptoms.

Results

2.4.1: Descriptive Analysis

The descriptive data are shown in Table 2.1. For the vulnerable attachment dimension scale, higher scores indicate high level of vulnerable attachment dimensions. Similarly, high MSPSS and PCL-5 scores indicate high perception of social support and symptoms of PTSD, respectively. 53.9% of the participants (n= 76) scored above 31 which indicated a probable PTSD (Wortmann et al.,

Table 2.1

The descriptive statistics for the measured variables.

	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
RSQ-A (1-49)	15.47	7.15	2.78	43.89
VASQ (22-110)	66.06	10.91	38.00	98.00
MSPSS (1-7)	5.02	1.29	1.00	7.00
PCL-5 (0-80)	32.96	19.14	0.00	71.00

Note: RSQ-A= Rejection Sensitivity Questionnaire-Adult Version; VASQ= Vulnerable Attachment Style Questionnaire;

MSPSS= Multidimensional Scale of Perceived Social Support; PCL-5= PTSD Checklist for DSM-5.

2016).

2.4.2: Zero Order Correlations

Table 2.2 indicated medium-to-large correlations amongst all of the measures given to the participants. All correlations were positive except the correlations between perceived social support and the rest of the of the measures.

Table 2.2

The zero-order correlation analysis between measured variables.

Variable	1	2	3	4
1. Rejection sensitivity (RSQ-A)	-			
2. Vulnerable attachment style (VASQ)	0.37**	-		
3. Social support (MSPSS)	-0.44**	-0.32**	-	
4. PTSD severity (PCL-5)	0.50**	0.54**	-0.45**	-

Note: RSQ-A= Rejection Sensitivity Questionnaire-Adult Version; VASQ= Vulnerable Attachment Style Questionnaire;

MSPSS= Multidimensional Scale of Perceived Social Support; PCL-5= PTSD Checklist for DSM-5.

2.4.3: Regression Analysis

Table 2.3 shows multiple regression analysis where PLC-5 measure was used as a dependent variable and RSQ-A, MSPSS, and VASQ were entered as predictor variables. The overall model was significant, $F(1,137) = 7.66$, $p = 0.006$, and explained 43% of variance. It was found that rejection sensitivity and vulnerable attachment dimensions significantly predicted PTSD symptoms in the study samples. When social support was added to the model, all variables still predicted the PTSD symptoms. This change in model was also significant.

Table 2.3

The summary of regression analysis where PCL-5 was a dependent variable.

	<i>b [95% Confident Intervals]</i>	<i>SE b</i>	<i>β</i>	<i>p</i>
Step 1				
Constant	-29.03 [-44.38, -13.68]	7.76		< .001
Rejection Sensitivity (RSQ-A)	0.94 [0.56, 1.32]	0.19	0.35	< .001
Vulnerable Attachment Dimensions (VASQ)	0.72 [0.47, 0.97]	0.13	0.41	< .001
Step 2				
Constant	-6.40 [-28.45, 15.65]	11.15		0.57
Rejection Sensitivity (RSQ-A)	0.74 [0.34, 1.13]	0.20	0.28	< .001
Vulnerable Attachment Dimensions (VASQ)	0.65 [0.41, 0.90]	0.12	0.37	< .001
Social Support (MSPSS)	-3.02 [-5.18, -0.86]	1.09	-0.20	.006

Note. $R^2 = .40$ for step 1; $\Delta R^2 = .03$ for step 2 ($p = .006$)

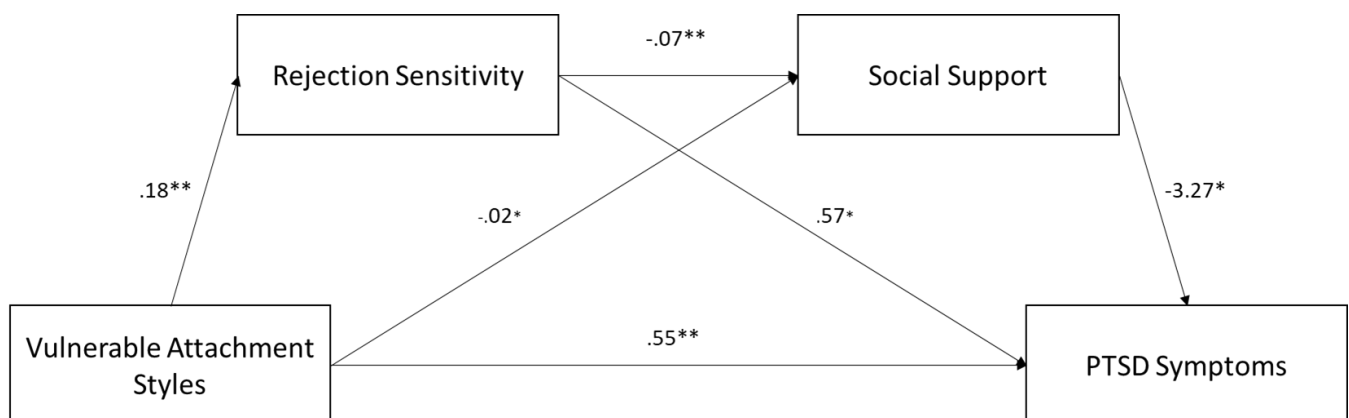
2.4.4: Mediation Analysis

The mediation analysis to test Hypothesis 3, revealed a significant indirect effect of vulnerable attachment dimensions via rejection sensitivity on PTSD symptoms ($b = .10$, 95% CI [.01, .23]). The effect of vulnerable attachment dimensions on PTSD via social support was also

significant ($b = .08$, 95% CI [.001, .19]). Overall, the indirect effect of vulnerable attachment dimensions on PTSD symptoms via rejection sensitivity and perceived social support was significant ($b = .04$, 95% CI [.01, .10]). A significant total direct effect from vulnerable attachment dimension to PTSD symptoms was retained ($b = .78$, 95% CI [.53, 1.02]). The summary of the mediation analyses between variable can be seen in Figure 2.3. It is worth noting that the analysis was done with age and gender as covariates in an attempt to control the contributions they made on the variables. Both gender ($b = 2.25$, $p = .03$) and age ($b = -.20$, $p = .006$) were significantly associated with reported rejection sensitivity. However, age ($b = 0.01$, $p = .48$) and gender ($b = -.03$, $p = .87$) were not significantly associated with social support, and only gender ($b = 8.94$, $p < .001$) was associated with PTSD symptoms.

Figure 2.3

*Standardised Regression Coefficients for the Relationship Between Vulnerable Attachment Style and PTSD Symptoms as Mediated by Rejection Sensitivity and Perceived Social Support. * $p < .05$, ** $p < .001$.*



Discussion

This study aimed to investigate psychosocial factors relating to PTSD. Using a regression approach, a theoretically informed model tested three hypotheses in a cross-sectional study. We found significant associations between rejection sensitivity, vulnerable attachment dimensions, social support, and PTSD symptoms. More specifically, high levels of vulnerable attachment were associated with higher rejection sensitivity and higher PTSD symptom severity. Social support was

negatively associated with these variables increase. Mediation analysis showed vulnerable attachment dimension, rejection sensitivity, and social support all contributed directly to the developments of PTSD symptoms. Both indirect effects from vulnerable attachment dimensions via rejection sensitivity, and via social support, were significant. Furthermore, there was a sequential mediation from vulnerable attachment to PTSD symptoms via rejection sensitivity and perceived social support. The results supported the hypothesis that the effect of rejection sensitivity and attachment dimensions on PTSD symptoms was partially mediated by perceived social support.

These findings extended our understanding of factors contributing to individual differences in social support and its effect on PTSD symptoms in the following ways:

Firstly, the findings suggested a sequential pathway from attachment to PTSD via rejection sensitivity and social support, which help address the importance of rejection sensitivity on PTSD symptoms. Similarly, the data revealed the importance of rejection sensitivity as a predictor of social support, which reflected the previous literature by both Lazarus, Southward and Cheavens (2016) and Zielinski and Veilleux (2014). The results also supported the network orientation model (Tolsdorf, 1976) through the mediation analysis. That is, rejection sensitivity and vulnerable attachment dimensions could associate with changes in the symptoms of PTSD through the influence they have on social support. Moreover, the analysis did reveal an association between rejection sensitivity and attachment dimensions, this again supported the previous evidence in the field of attachment (Khoshkam, Bahrami, Ahmadi, Fatehizade & Etemadi, 2012; Erozkhan, 2009).

Secondly, social support was found to be associated with lower levels of PTSD symptoms. This is congruent with previous research that suggests perceived social support has a protective effect and acts as a buffer against PTSD severity (Johansen et al., 2020; Schumm, Briggs-Phillips & Hobfoll, 2006). Based on theoretical considerations (Tolsdorf, 1976; Ehlers & Clark, 2000), we have conceptualised perceived social support as a mediator of the link between vulnerable attachment and rejection sensitivity with PTSD symptoms hypothesising that vulnerable attachment and

rejection sensitivity could lead to lower social support which in turn leads to higher PTSD. Whilst this needs to be replicated in a longitudinal design in which the predictor precedes the mediator and the mediator precedes the outcome, we found preliminary support for a protective effect of lower vulnerable attachment and rejection sensitivity and higher social support on lower PTSD in a path model. Conversely, we found that both higher rejection sensitivity and vulnerable attachment dimensions were associated with higher PTSD symptoms. We also found positive associations between vulnerable attachment and rejection sensitivity this supporting Feldman and Downey (1997) hypotheses that these two constructs are related.

Together our findings imply that both rejection sensitivity and attachment dimensions could be important predisposing factors that contribute to the development and maintenance of PTSD. This is in line with Ehlers and Clark's (2000) cognitive model of PTSD in which vulnerable attachment and rejection sensitivity can be conceptualised as prior experience/ beliefs that influence social support which acts as strategy intended to control symptoms of persistent PTSD. The correlation between vulnerable attachment dimensions and social support confirmed the finding by Mallinckrodt and Wei (2005). Moreover, the association between attachment and PTSD symptoms was also mediated by social support, which was congruent with network orientation model that predisposing factors could affect perceived social support, which in turn affect the severity of PTSD. It is important to point out that the observed mediation was found even after gender and age were added into the model as covariates. It was not surprising that gender and age would influence rejection sensitivity as previous studies suggested that younger women may experience higher level of interpersonal stress compared to their counterparts (Rudolph, 2002). Moreover, gender differences might associate with different levels of PTSD symptoms. This effect could be due to higher initial PTSD symptoms and dissociations during trauma, which are commonly higher in women than in men (Irish et al., 2011). Thus, controlling for these factors could improve the validity of model as they could influence the variables being investigated.

2.5.1: Limitations and strengths

It is worth noting that this study has some limitations. First, this study employed a cross-sectional design. This means the causal direction could not be inferred from the results and the authors are aware of the critique of mediation analyses in cross-sectional design (Antonakis et al., 2010). Due to this limitation, a reverse relationship between the variables is also possible. Thus, it is possible that PTSD symptoms could affect the level of social support, rejection sensitivity, and attachment. However, the aim of the study was to establish a theoretically informed relationship between the variables.

The study also used a scale that measured adult attachment only. This could potentially be a problem due to the instability in attachment dimensions across the lifespan. Because the study did not assess early childhood attachment, it is not possible to conclude whether childhood attachment has important influence on other variables investigated.

Due to the nature of the screening tool, participants' traumatic childhood experiences, such as those assessed by Childhood Trauma Questionnaire (Bernstein et al, 2003), were not assessed. This is because the study focussed and complied with the DSM-5 criteria for PTSD diagnosis. Therefore, it was not possible to conclude if the association with social support was directly related to childhood trauma as well. It was however inferred that higher levels of vulnerable attachment and rejection sensitivity have been previously associated with higher levels of childhood adversity (Bifulco, Mahon, Kwon, Moran & Jacobs, 2003; Downey and Feldman, 1997). The participants were also relatively young with the mean age of 25 as well as have relatively low rejection sensitivity scores which did not reflect those observed in clinical samples (Gao, Assink, Cipriani & Lin, 2017). The lack of variations in age and rejection sensitivity scores could affect the generalisability of the results. Although all study participants had a history of psychological trauma in line with DSM-5 criteria, only about 50% showed clinical levels of PTSD severity. Thus, the relationship between attachment dimensions, rejection sensitivity, and social support should be investigated in clinical

populations including those currently treatment seeking. Moreover, the use of a self-report questionnaire could affect the validity of the results due to factors such as varying introspective ability in participants. Therefore, the representation of data should be interpreted with caution.

The study only used English language questionnaires. The participants were recruited from all over the world, mostly English-speaking countries, but due to the nature of the online study it cannot be ruled out that non-native English speaker participants passed the screening. This is mainly through the Prolific platform, which allows anyone from any countries to join. This means there could be some misinterpretation of the questionnaire that used technical words as well as cultural differences. However, participants still need basic understanding of English to be able to join Prolific and navigate their website. It was also specified on the website that only those with some proficiency in English language could see the advertisement. The platform did allow the data to be collected across many different cultures, which improved the generalisability of the results.

Despite the limitations, this study had a number of strengths. Firstly, the study investigated novel associations between rejection sensitivity and PTSD symptoms, while using social support to help clarify the relationship between the two. Moreover, the results came from individuals with a wide range of trauma histories including natural disasters and sexual assaults, which reflected the experience of both physical and interpersonal trauma survivors.

To build up on these findings, further research should establish a causal direction of the relationship between these variables. A longitudinal design would help investigating the order in which, attachment, rejection sensitivity, social support, and PTSD symptoms develop over time. This will also help solidify the evidence for the network orientation model by taken childhood experiences into account to see how they progress over time. Thus, future studies that use lifespan longitudinal design could help validate the relationship between the variables investigated. Future studies may look at the underlying mechanism for the relationship between each variable. For instance, investigating the attitude of people with different levels of rejection sensitivity on their

perceived social support could provide an insight into why those with low rejection sensitivity have increased level of social support and lower PTSD symptoms. Instead of correlational studies, future research could use an experimental design to investigate the causal relationship between the variables. One example is to manipulate the feeling of rejection in those with high and low rejection sensitivity. Afterwards, their perception and reaction towards social situation can be measured. This will provide concrete evidence if rejection sensitivity affects or influence how social support is formed in a social situation. New studies can extend into the development of intervention. Based on the results, interventions can focus on building strong social support, especially for those with vulnerable attachment dimensions and high rejection sensitivity, after trauma experiences to prevent the development of PTSD.

2.5.2: Conclusion

This chapter aimed to investigate the contribution of adult vulnerable attachment, rejection sensitivity, and social support in explaining PTSD. Based on network orientation theory, a model hypothesising that vulnerable attachment and rejection sensitivity exert their effect on PTSD via the effect they have on social support was proposed and confirmed. Rejection sensitivity, dysfunctional attachment, and perceived social support were all significant predictors of PTSD symptoms. Moreover, the relationship between vulnerable attachment on PTSD symptoms and rejection sensitivity on PTSD symptoms were both mediated by perceived social support. These finding provided a support for the proposed model. This model is important as it brought to light the impact rejection sensitivity and vulnerable attachment dimensions have on PTSD.

Data availability statement

The data associated with this study is available at the University of Exeter Repository website at <https://doi.org/10.24378/exe.3323> and upon request from the author.

Chapter 3:

Declaration Concerned the Article Entitled	
The Effect of Rejection Sensitivity on Physiological Responses After Lab-Induced Rejection	
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Copyright Status	I hold the copyright for this material.
Author's Contribution	The current study was formulated, recruited, conducted, analysed, and written by the author under supervision of the supervisor.
Author's Statement	This paper reports on original research conducted for Doctor of Philosophy in Psychology.

The Effect of Rejection Sensitivity on Physiological Responses After Lab-Induced Rejection

Sila Jittayuthd and Anke Karl

Psychology, College of Life and Environmental Sciences, University of Exeter, Exeter, UK

Author Note

Address correspondence to Sila Jittayuthd, Psychology, College of Life and Environmental Sciences, Washington Singer Laboratories, University of Exeter, Perry Road, Exeter, EX4 4QG, e-mail: sj423@exeter.ac.uk

Abstract

Rejection sensitivity, a disposition to expect and strongly react to rejection which constantly activates defensive motivated systems and thus maintains high levels of stress, has been associated with stress-related disorders. Rejection sensitivity may be associated with elevated physiological responses to stressful stimuli, specifically from social interactions where rejection is possible, but this has not previously been investigated. The aim of the current study was therefore to explore how rejection sensitivity is associated with physiological response to a social rejection stressor. An experimental study invited 90 healthy participants to complete a biosketch paradigm that manipulated rejection whilst the levels of stress and physiological responses (heartrate, skin conductance, and heartrate variability) were measured. Dispositional rejection sensitivity was only significantly associated with baseline skin conductance. Whereas the biosketch task successfully induced physiological arousal, being rejected did not significantly increase subjective stress and physiological responses compared to being accepted or the control condition. Theoretical and clinical implications of the study are discussed.

Downey and Feldman (1994) state that a person with high levels of rejection sensitivity, a propensity to readily perceive and react to potential social rejection, is susceptible to avoidance or defensive behaviours, as a way to prevent themselves from being rejected. For example, following conflict in a romantic relationship, people with high rejection sensitivity tend to report feeling more angry and less accepted by their partners. This is due to self-fulfilling prophecies, i.e., they expected their partner to be less accepting of them, so they respond to the conflict in an angrier way (Downey, Freitas, Michalis & Khouri, 1998). These maladaptive behavioural responses can negatively impact and perpetuate the cycle of rejection that led to withdrawal and loneliness (London, Downey, Bonica & Paltin, 2007). Often, people with rejection sensitivity are not aware of such maladaptive behaviours, they use rejection sensitivity as a defensive motivated system (DMS; amplified monitoring and detecting rejection cues and preparing for threats) without realising the effect of it upon people around them. For instance, it was found that those with high rejection sensitivity have a higher startle blink magnitude, an indicator of DMS activation, when looking at rejecting negatively valenced paintings, i.e. paintings that showed disapproval facial expressions (Downey et al, 2004). This makes social situations where the outcome is uncertain (might be rejected or accepted) difficult for those with high rejection sensitivity, as they perceive the situation as a threat. This constantly perceived threat of potential rejection can be stressful and lead to constant activation of physiological stress systems (Gerber & Wheeler, 2009). Such prolonged stress response can lead to dysregulation of subsequent physiological stress responses, exaggerating physiological arousal to stressful situations (Agorastos et al., 2018).

In healthy individuals, social rejection produces activation of the sympathetic nervous system (SNS), indicated for example by increased heartrate or skin conductance, and the biological stress axis, the hypothalamic pituitary adrenal (HPA) axis, indicated by increased secretion of the stress hormone cortisol. Blackhart et al. (2007) showed increased cortisol levels in individuals who had experienced rejection from confederates who did not choose them to join their group indicating that social rejection can invoke strong physiological responses in healthy individuals. In contrast, a

lab-induced rejection where participants were accepted or rejected based on their photographs was found to induce higher heartrate variability (Moor et al., 2010), an indicator of parasympathetic response and effective emotion regulation (Thayer & Lane, 2000). Combined these findings suggest a marked stress response but a potentially effective recovery through adaptive emotion regulation in healthy individuals. However, high-risk individuals, such as those with psychopathology, showed marked alterations of physiological stress responses to performance-based stimuli, including higher heartrate compared to healthy samples (Stroud et al., 2009). Thus, it is expected that individuals with high rejection sensitivity could also exhibited similar excessive physiological responses to stressful social rejection stimuli. In support, one study found that high rejection sensitivity was associated with increased SNS responses indicated by increased skin conductance (SCL), and decreased PNS activation, as shown by respiratory sinus arrhythmia (RSA) respectively, after relational victimisation by peers, such as being left out (Breslend et al., 2018). However, there is a very limited number of studies that directly investigated the associations between rejection sensitivity and physiological responses to stress. Whereas there are some experimental studies that found associations between being ostracised (being socially excluded from groups) and increased physiological arousal (Iffland et al., 2014), none had considered the effect of rejection sensitivity on the physiological stress response when individuals experience social interactions. By studying rejection sensitivity, it may be possible to understand how individual differences can affect the observed physiological responses to stress. Hence, investigating the role of rejection sensitivity on the psychophysiological response to social rejection may shed some light on how rejection sensitivity can act an indicator of stress and maybe a risk factor for stress-related disorders.

Therefore, the present study aimed to establish the links between rejection sensitivity, self-reported stress, and physiological responses following rejection. Previous studies suggested a possible contribution of rejection sensitivity on physiological responses following lab-induced rejection. Moreover, as an indicator of less effective emotion regulation, individuals with high rejection sensitivity also have shown lower heartrate variability (Gyurak & Ayduk, 2008). To date, the

effect of experimentally-induced rejection and the direct associations with rejection sensitivity, stress level, and related physiological arousal has not been investigated together. The aim of this study was therefore to address the gaps in the literature and test the hypotheses that social rejection elicits psychophysiological stress response, and that rejection sensitivity exacerbates this effect. This could help in identifying rejection sensitivity as a vulnerable factor for stress-related disorders.

3.2.1: Hypotheses

1. Baseline rejection sensitivity will significantly correlate with baseline stress and baseline physiological responses
2. Stress level and physiological responses will be higher in the rejected condition compared to the others
3. Higher rejection sensitivity will be associated with higher physiological responses in the rejected condition

Method

3.3.1: Design

A 2x3 mixed-factorials design was employed with time (pre and post manipulation) as within-subjects factor, and groups (accepted, rejected, no feedback) as between-subjects factor. State stress, post-rejection sensitivity, physiological responses parameters were the dependent variables. Dispositional stress levels and rejection sensitivity were additional independent variables. Heart rate, heart rate variability, skin conductance, self-report stress, and rejection sensitivity were also measured.

3.3.2: Participants

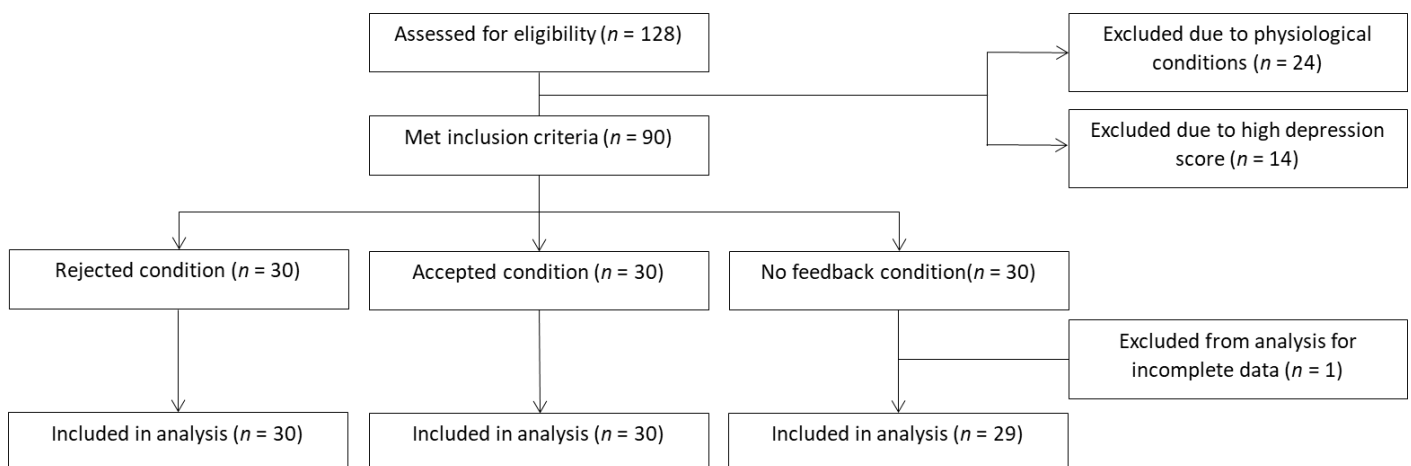
A final sample of 90 participants (male, female), age between 18 to 27 ($M= 19.43$, $SD= 2.10$) from the University of Exeter students were recruited through participants recruiting system (SONA).

Individuals with cardiovascular conditions (hypertension, history of heart surgery) and those who are using medications that may influence the results (cardio medication, thyroid medications, steroids, or psychotropic medications) were excluded from the study. Those who suffered from severe depression (above 20) were also excluded from the experiment. Figure 3.1 shows the participant flow chart. Participants were either paid £5 or received 5 credits for their time. All participants had given a written informed consent and were fully informed and debriefed. The study was approved by the Psychology Ethics Committee of the University of Exeter.

The target sample size was determined based on a power calculation of the main hypothesis that the rejection condition will affect the stress level after the manipulation conditions. Using a 2x3 repeated measure ANOVA analysis time (pre and post manipulation) as the within-subject variable, and experimental conditions (accepted, rejected, no feedback) as between-subject variables it was found that a sample size of 66 was needed to be recruited to detect a medium effect ($f^2 = 0.15$) at a statistical power of 0.95 and an α of .05.

Figure 3.1

Participation flow chart



3.3.3: Materials

The Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001)

A screening tool used to assess the level of depression, consisted of 9 items. The items described the symptoms of depression over the past week of the assessment and are scored on a 4-

points Likert scale (0-4). Those scored above 20 out of 27 indicates severe depression and were excluded from participating in the study.

Rejection Sensitivity Questionnaire- Adult Version (RSQ-A; Berenson et al, 2009)

To measure rejection sensitivity, the RSQ-A, an adaptation of the rejection sensitivity questionnaire (Downey & Feldman, 1996) was used. It consists of 9 questions each presenting a scenario of a social situation which participants then rate to indicate how they would response to each situation. The questionnaire is widely used in the research of rejection sensitivity. It has shown to correlates with related constructs ($r = .71, p < .001$). It also has high internal consistency and test-retest reliability ($\alpha = .83$) (Berenson et al, 2011).

Biosketch Essay Task (Ayduk, May, Downey & Higgins, 2003)

In order to manipulate rejection, participants were told that they will be paired with another person in the following task. They will be asked to spend 10-20 min writing a short biosketch about themselves to be read by the partner. This included anything about themselves that they think would make them a good partner. They return the biosketch to the experimenter and after a few minutes are given feedback on their biosketch. There were three types of feedbacks (rejected, accepted, no feedback). In the rejected condition, participants were told that they were not selected as a partner, while in accepted condition they were told that the partner would like to work with the participants. In the no feedback condition, the participants were told that the system was disconnected and the feedback could not be received.

Perceived stress (Beekman, Stock & Marcus, 2016)

Self-report stress was measured with two items: "I feel stressed" and "I feel distressed" which were presented using a visual-analogue scale. The questionnaire was given before and after the manipulations.

Perceived inclusion (Zadro, Williams & Richardson, 2004)

As a manipulation check, participants were asked whether they were content with feedback, how included they felt about it, and how much they enjoyed the task (1 = not at all to 7 = very much).

Psychophysiological data acquisition

The physiological responses were recorded using a BIOPAC MP150 system with AcqKnowledge 4.2 software (BIOPAC Systems; Goleta, CA), and the acquisition sampling rate was 2000Hz. The heartrate was assessed through an electrography (ECG) using a BIOPAC ECG100C amplifier at a sampling rate of 1kHz. The electrodes were placed just below the right collar bone and on the left ribcage.

Skin conductance was also recorded using a BIOPAC SCL100C amplifier. The data were produced through a skin-resistant transducer (TSD203), which was placed on the middle phalanx of the middle and the first fingers of the participants' non-dominant hands. The sampling rate for the skin conductance was 500Hz.

3.3.4: Procedure

The participants were recruited through the University of Exeter SONA system. Interested participants were given the screening questionnaires through email in order to check for eligibility before they come to the lab. The screenings were done through Qualtrics, starting with information sheet, followed by consent forms, PHQ-9, and screening for cardiovascular problems. The eligible participants were redirected to the SONA system to reserve a slot for the lab experiment.

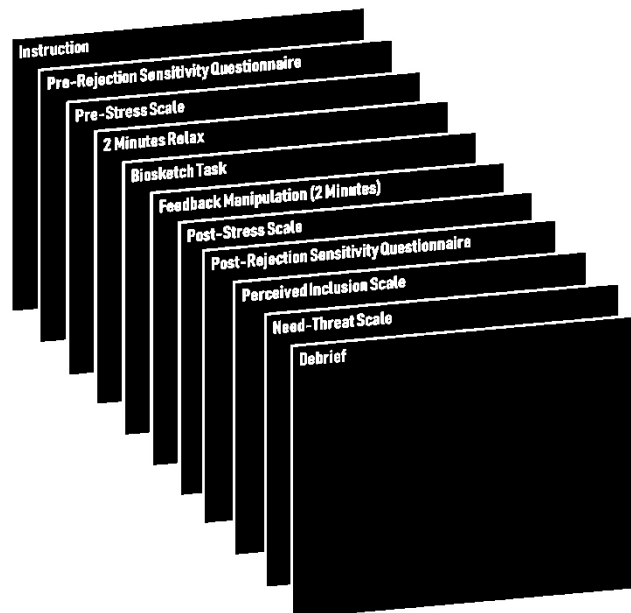
Once the participants arrived at the lab, they were asked to sit in front of a computer, in the room that was kept at 21C°. The experimenter then gave the participants the information sheet to read again and a consent form to sign. Once the electrodes were attached and the task instructions were given to the participants, the experimenter left the room to set up the task using ePrime from the outside computer mirroring the participant's screen.

Participants were greeted with an instruction for completing the computer task. Firstly, they were given the RSQ-A to complete, this was followed by a perceived stress questionnaire. Then they were left to rest for 2 minutes to establish the baseline. Afterwards, they were given about 10 minutes to complete the essay task. Once completed they were told that their biosketch is being reviewed by their partner and would receive a feedback shortly after. Participants received the feedback according to the condition they were in (rejected, accepted, no feedback). This was immediately followed by perceived stress, perceived inclusion, and another RSQ-A questionnaire.

Once completed, they were left to rest for another 2 minutes to let them go back to resting rate. The equipment was taken from the participants, and they were fully debriefed on the experiment. Participants were thanked and received the recompense for their participation. The summary of the procedure is shown in Figure 3.2.

Figure 3.2

The summary of computer task procedure



3.3.5: Data analysis approach

Data Pre-processing

All physiological data were processed using an analysis within the AcqKnowledge 4.2 software. The raw ECG data was filtered using the programme built-in digital filter band pass of 0.5-35 Hz. An R-wave detection algorithm script based on established procedure (Berntson, Quigley, Jang, & Boysen, 1990) was done on the filtered data. The heartrate (BPM) was then extracted from these R-waves. Baseline heartrate was calculated using the mean heartrate from relaxation minute 1 and 2. The change in heartrate was then calculated by subtracting the heartrate from the baseline heartrates.

High frequency heartrate variability (HF-HRV) was extracted from the same filtered ECG data using a single epoch HRV analysis within the programme for the frequency range between 0.15Hz and 0.4Hz, which was used to indicate PNS activation (Berntson et al., 1997). The percentage deviation for the heartrate variability was calculated by first calculating the mean heartrate variability of every minutes. The heartrate variability for each minute were then divided by these means.

Mean skin conductance level (SCL), maximum, and minimum SCL were extracted from the same data with a range correction (Lykken, Rose, Luther, & Maley, 1966) to control for individual differences.

The data were then checked for the assumptions (homogeneity of variance, outliers, normal distributions) before running the main analyses.

Main Analyses

Baseline rejection sensitivity will significantly correlate with the baseline stress and baseline physiological responses (H1). The Pearson's r analysis is done on rejection sensitivity, baseline heartrate, and baseline stress to check for relationships between variables. Bonferroni correction was used to adjust for multiple correlation analyses.

Stress level and physiological responses will be higher in rejected condition compared to the others (H2). Repeated measure ANOVA is conducted for this hypothesis with time (pre and post) as within subject variable, experimental conditions (rejected, accepted, no feedback) as between-subject variables, and stress parameters and physiological responses were dependent variables.

Higher rejection sensitivity will be associated with higher physiological responses in the rejected condition (H3). The groups (accepted, no feedback, rejected) are first dummy coded. The mean centred rejection sensitivity scores are calculated, which is then used to calculate the interaction terms between rejection sensitivity and each of the experimental conditions. Multiple regressions are done on the reported stress and physiological parameters while using each condition as a reference against the other two groups. In step 1 the condition along with rejection sensitivity are added as the predictors, then the interaction terms are added in step 2.

Results

3.4.1: Descriptive statistics

Table 3.1 shows the descriptive statistics for the main dependent variables per group and for the overall sample.

Table 3.1

Descriptive statistics of the main dependent variables

	Mean Rejection Sensitivity (Pre)	Mean Rejection Sensitivity (Post)	Mean Stress Level (Pre)	Mean Stress Level (Post)	Baseline Heartrate	Heartrate Response
Rejected	9.25 (0.84)	10.43 (1.16)	43.21 (5.39)	43.71 (5.95)	79.82 (2.02)	-3.10 (0.80)
No Feedback	10.49 (0.67)	10.33 (0.89)	33.34 (5.03)	34.48 (4.72)	80.77 (2.06)	0.79 (2.40)
Accepted	10.58 (0.66)	9.29 (0.73)	38.48 (5.39)	31.07 (5.16)	81.18 (2.37)	-4.27 (2.26)
Total	9.95 (3.83)	9.92 (4.94)	36.56 (28.07)	35.04 (28.13)	80.58 (11.25)	-2.13 (10.50)

3.4.2: Manipulation Check

A one-way ANOVA revealed that there was a significant difference in perceived inclusion between the groups, $F(2, 86) = 33.60, p < .001$. A Bonferroni post-hoc test revealed that those in accepted condition perceived felt more included than both no feedback ($M = 1.91, SE = 0.26, p < .001$), and rejected ($M = 1.74, SE = 0.26, p < .001$). No significant differences between no feedback and rejected groups ($M = 0.16, SE = 0.26, p = 1.00$).

3.4.3: Hypothesis Testing

Hypothesis 1: Baseline rejection sensitivity will significantly predict baseline stress and baseline physiological responses

To test Hypothesis 1, a Pearson's r correlational analysis was done between the pre-manipulation rejection sensitivity score, baseline heartrate, and baseline stress level. It was found that none of these variables were significantly correlated with each other, apart from a positive association between rejection sensitivity and skin conductance (see Table 3.2), suggesting higher SNS activation is linked with higher rejection sensitivity and partially supporting Hypothesis 1. However, no other associations between the dispositional measures prior to the manipulation were significant and when Bonferroni-corrections for multiple testing are applied the small-to-medium effect is no longer significant.

Table 3.2

Summary of the correlational analysis

	<i>M</i>	<i>SD</i>	1	2	3	4
1. Rejection Sensitivity	10.11	3.84				
2. Baseline Heartrate (BPM)	80.58	11.25	0.17			
3. Baseline Skin Conductance (μ S)	0.34	0.16	0.24*	0.21		

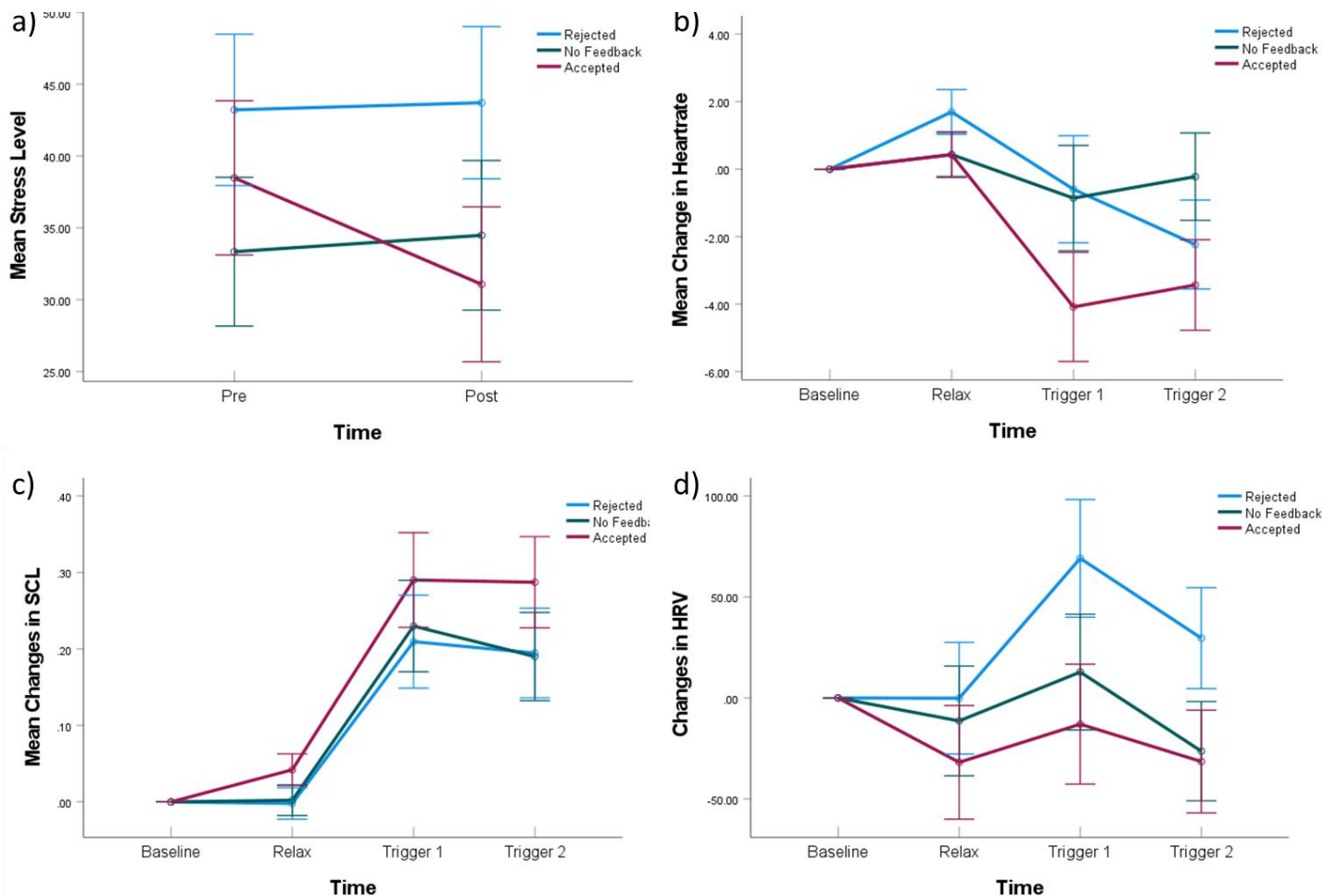
4. Baseline Percentage Deviations Heartrate Variability	-1.05	56.66	0.04	-0.08	-0.11	
5. Baseline Stress	38.29	27.84	0.08	0.06	0.14	-0.07

Hypothesis 2: There will be a significant time by group interaction in those experiencing social rejection; showing significantly increased stress and physiological arousal, and reduction in heartrate variability as compared to those in neural and accepted conditions.

The pre and post stress level were used as within-subject variables and the conditions were between-subject variables for the repeated measure ANOVA analysis on the following independent variables. The summary of these ANOVAs are summarised in Figure 3.3.

Figure3.3

The results of repeated measure ANOVA analyses between the three experimental conditions on a) stress, b) heartrate (BPM), c) skin conductance (μS), d) percentage deviation of heartrate variability. Trigger 1 marked the time when the feedbacks were received.



Perceived stress level. Mixed ANOVA revealed no significant main effects for time, $F(1, 81) = 0.67, p = .42, \eta_p^2 = .01$, or experimental condition, $F(2, 81) = 1.18, p = .31, \eta_p^2 = .03$. There was also no significant interaction effect between time and conditions, $F(2, 81) = 1.34, p = .27, \eta_p^2 = .03$.

Change in Heartrate. There was a significant effect of time, $F(3, 243) = 7.26, p < .001, \eta_p^2 = .08$. Simple contrast analyses revealed an overall decrease from the baseline minute after feedbacks were received, $F(1, 81) = 4.05, p = .05, \eta_p^2 = .05$ (see Figure 3.3). However, no significant effects were found for condition, $F(2, 81) = 1.37, p = .26, \eta_p^2 = .03$, and the time by condition interaction, $F(6, 243) = 1.55, p = .16, \eta_p^2 = .04$.

Change in Skin Conductance. There was also a significant effect of time, $F(3, 243) = 45.66, p < .001, \eta_p^2 = .36$, but post-hoc tests revealed a reversed pattern of the change in heartrate where the skin conductance increased after the receiving the feedback, $F(1, 81) = 47.90, p < .001, \eta_p^2 = .37$ (see Figure 3.3). Again, the between-subjects effect, $F(2, 81) = 0.85, p = .43, \eta_p^2 = .02$, and the time and conditions interaction were not significant $F(6, 243) = 0.51, p = .80, \eta_p^2 = .01$.

Change in Heartrate Variability. There was no significant main effect of time, $F(3, 243) = 2.53, p = .06, \eta_p^2 = .03$. A similar pattern to the change in heartrate was found for heartrate variability which increased after the feedbacks were received however, this was significant $F(1, 81) = 1.87, p = .18, \eta_p^2 = .02$ (see Figure 3.3). Neither the between-subjects effect, $F(2, 81) = 1.59, p = .21, \eta_p^2 = .04$, nor the time and conditions interaction effect was found $F(6, 243) = 0.51, p = .80, \eta_p^2 = .01$.

Hypothesis 3: Higher rejection sensitivity will be associated with higher stress and higher physiological responses in the rejected condition.

Perceived post-manipulation stress level. Multiple regressions on post-rejection stress were investigated against each other using each condition as a reference as well as pre-stress to control for the individual differences. The results showed that only the pre-stress level and rejection sensitivity significantly and independently contributed to the stress level after the experimental task (See Table 3.3). This suggests there was no moderation effect for rejection sensitivity on the

association between experimental condition and perceived stress, but rejection sensitivity explained perceived stress independent on the experimental condition.

Table 3.3

Summary of moderation analyses for the stress parameters following the experimental task

Parameters	Step	$\Delta F (p)$	ΔR^2		b	SE b	β	p
Stress	1	28.134 ($< .001$)	.573	Constant	-6.007	6.027		.322
				Rejected	1.947	2.500	.066	.438
				Accepted	-3.052	2.453	-.103	.217
				Pre-Stress	.677	.073	.676	$< .001$
				RSQ	1.601	.535	.218	.004
	2	0.929 (.399)	.009	Constant	-10.289	7.030		.147
				Rejected	1.823	2.510	.062	.470
				Accepted	-3.399	2.472	-.115	.173
				Pre-Stress	.688	.074	.686	$< .001$
				RSQ	2.011	.641	.274	.002
Stress	1	28.134 ($< .001$)	.573	Constant	-2.955	6.078		.628
				Rejected	4.999	2.461	.169	.045
				No Feedback	3.052	2.453	.102	.217
				Pre-Stress	.677	.073	.676	$< .001$
				RSQ	1.601	.535	.218	.004
	2	0.929 (.399)	.009	Constant	-.062	7.167		.993
				Rejected	5.222	2.469	.176	.037
				No Feedback	3.399	2.472	.114	.173
				Pre-Stress	.688	.074	.686	$< .001$

				RSQ	1.325	.645	.181	.043
				Rejected x RSQ	.172	.643	.023	.790
				No Feedback x	-.686	.696	-.093	.327
				RSQ				
Stress	1	28.134	.573	Constant	-7.954	6.234		.206
		($< .001$)						
				Accepted	-4.999	2.461	-.169	.045
				No Feedback	-1.947	2.500	-.065	.438
				Pre-Stress	.677	.073	.676	$< .001$
				RSQ	1.601	.535	.218	.004
	2	0.929	.009	Constant	-3.573	7.671		.643
		(.399)						
				Accepted	-5.222	2.469	-.176	.037
				No Feedback	-1.823	2.510	-.061	.470
				Pre-Stress	.688	.074	.686	$< .001$
				RSQ	1.153	.712	.157	.109
				Accepted x RSQ	-.172	.643	-.023	.790
				No Feedback x	-.858	.647	-.116	.188
				RSQ				
Heartrate	1	1.668	.059	Constant	-.272	3.292		.934
		(.180)						
				Rejected	-2.158	1.387	-.195	.124
				Accepted	-2.517	1.388	-.225	.073
				RSQ	-.344	.300	-.126	.256
	2	0.332	.008	Constant	1.195	4.068		.770
		(.719)						
				Rejected	-2.070	1.403	-.187	.144
				Accepted	-2.352	1.420	-.210	.102
				RSQ	-.472	.377	-.173	.214
				Rejected x RSQ	.026	.357	.009	.943
				Accepted x RSQ	-.267	.407	-.098	.514

Heartrate	1	1.668	.059	Constant	1.887	3.457		.587
		(.180)						
				Rejected	-.358	1.414	-.032	.801
				No Feedback	2.158	1.387	.197	.124
				RSQ	-.344	.300	-.126	.256
	2	0.332	.008	Constant	3.521	4.515		.438
		(.719)						
				Rejected	-.282	1.433	-.025	.844
				No feedback	2.070	1.403	.189	.144
				RSQ	-.498	.407	-.182	.225
				Rejected x RSQ	-.293	.377	-.107	.440
				No Feedback x	-.026	.357	-.009	.943
				RSQ				
Heartrate	1	1.668	.059	Constant	-.272	3.292		.934
		(.180)						
				Accepted	-2.158	1.387	-.195	.124
				No Feedback	-2.517	1.388	-.225	.073
				RSQ	-.344	.300	-.126	.256
	2	0.332	.008	Constant	1.195	4.068		.770
		(.719)						
				Accepted	-2.070	1.403	-.187	.144
				No Feedback	-2.352	1.420	-.210	.102
				RSQ	-.472	.377	-.173	.214
				Accepted x RSQ	.026	.357	.009	.943
				No Feedback x	-.267	.407	-.098	.514
				RSQ				
Heartrate	1	1.429	.051	Constant	22.743	17.695		.202
Variability		(.240)						
				Rejected	12.861	7.456	.217	.088
				Accepted	.025	7.458	.000	.997
				RSQ	-.535	1.615	-.037	.741

	2	0.240	.006	Constant	14.542	21.889		.508
		(.787)						
				Rejected	12.452	7.552	.210	.103
				Accepted	-.849	7.642	-.014	.912
				RSQ	.217	2.029	.015	.915
				Rejected x RSQ	.331	1.921	.022	.863
				Accepted x RSQ	1.452	2.191	.099	.510
Heartrate	1	1.429	.051	Constant	22.717	17.573		.200
Variability		(.240)						
				Rejected	12.835	7.598	.217	.095
				No Feedback	-.025	7.458	.000	.997
				RSQ	-.535	1.615	-.037	.741
	2	0.240	.006	Constant	29.833	20.623		.152
		(.787)						
				Rejected	13.301	7.711	.224	.088
				No Feedback	.849	7.642	.014	.912
				RSQ	-1.235	1.921	-.084	.522
				Rejected x RSQ	-1.120	2.029	-.076	.582
				No Feedback x	-1.452	2.191	-.099	.510
				RSQ				
Heartrate	1	1.429	.051	Constant	9.882	18.581		.596
Variability		(.240)						
				Accepted	-12.835	7.598	-.215	.095
				No Feedback	-12.861	7.456	-.219	.088
				RSQ	-.535	1.615	-.037	.741
	2	0.240	.006	Constant	5.388	24.294		.825
		(.787)						
				Accepted	-13.301	7.711	-.222	.088
				No Feedback	-12.452	7.552	-.212	.103
				RSQ	-.115	2.191	-.008	.958
				Accepted x RSQ	1.120	2.029	.076	.582

				No Feedback x	- .331	1.921	-.023	.863
				RSQ				
Skin	1	1.713	.060	Constant	.657	.049		<.001
Conductance		(.171)						
				Rejected	-.017	.020	-.101	.422
				Accepted	.010	.020	.059	.635
				RSQ	-.009	.004	-.224	.044
	2	1.285	.090	Constant	.604	.059		<.001
		(.282)						
				Rejected	-.019	.020	-.117	.355
				Accepted	.004	.021	.026	.839
				RSQ	-.004	.006	-.105	.444
				Rejected x RSQ	.002	.005	.061	.634
				Accepted x RSQ	.009	.006	.228	.124
Skin	1	1.713	.060	Constant	.647	.048		<.001
Conductance		(.171)						
				Rejected	-.026	.021	-.161	.212
				No Feedback	-.010	.020	-.060	.635
				RSQ	-.009	.004	-.224	.044
	2	1.285	.090	Constant	.692	.056		<.001
		(.282)						
				Rejected	-.023	.021	-.142	.269
				No Feedback	-.004	.021	-.026	.839
				RSQ	-.013	.005	-.333	.012
				Rejected x RSQ	-.007	.006	-.165	.223
				No Feedback x	-.009	.006	-.228	.124
				RSQ				
Skin	1	1.713	.060	Constant	.673	.051		<.001
Conductance		(.171)						
				Accepted	.026	.021	.159	.212
				No Feedback	.017	.020	.102	.422

			RSQ		-0.009	.004	-.224	.044
2	1.285	.090	Constant		.648	.066		<.001
	(.282)							
			Accepted		.023	.021	.141	.269
			No Feedback		.019	.020	.118	.355
			RSQ		-.007	.006	-.166	.261
			Accepted x RSQ		.007	.006	.167	.223
			No Feedback x		-.002	.005	-.062	.634
			RSQ					

Heartrate (HR) response to manipulation. None of the predictors or the interaction terms significantly contributed to the change in heartrate following the experimental task. The summary of the analysis is shown in Table 3.3.

Heartrate variability (HRV) response to manipulation. Similarly, the multiple regression analysis for the heartrate variability also showed no significant contribution of condition, rejection sensitivity, or the interaction terms (Tables 3.3).

Skin conductance (SCL) response to manipulation. Finally, the analysis on the skin conductance showed no contribution of the conditions or the interactions. However, rejection sensitivity did significantly contribute to the changes in skin conductance suggesting that rejection sensitivity was associated with generally higher skin conductance response independent of experimental condition (Table 3.3).

Discussion

This study aimed to investigate the effect of dispositional and experimentally induced rejection sensitivity on psychophysiological responses and perceived stress to rejection in participants. For this, the study employed a biosketch essay rejection task to manipulate rejection sensitivity and measured the stress level and physiological responses.

Contrary to the Hypothesis 1, dispositional levels of rejection sensitivity were not significantly associated with baseline measures of heartrate and stress levels. This is surprising given that other research (De Rubeis et al., 2016; Downey et al., 2004) found high rejection sensitivity to be positively associated with physiological arousal, including heartrate. However, De Rubeis et al (2016) included patients with severe depression whereas the present study excluded individuals with depression due to ethical reasons. This could explain the absence of the expected experimental stress effects because participants could have been more resilience to stress than the those with severe depression. Another difference between this and De Rubeis' study is the paradigm used. The biosketch task was chosen because it had previously reliably induced social rejection (Ayduk, May, Downey & Higgins, 2003) whereas De Rubeis used the Cyberball task which focused on ostracism rather than rejection. In the Cyberball task, participants are gradually excluded by two other confederates from receiving a ball in a three-person game. The biosketch task deliberately and explicitly refused to include the participant from joining a group after they have submitted a personal statement to a virtual group, which should induce strong feelings of rejection even in healthy individuals. It is possible that these differences could contribute to the discrepancies in results. In the Cyberball task, participants were required to be more attentive to the task as they must pass the ball to other people, which mean participants may constantly perceived exclusion, which in turn produced noticeable prolonged stress response. On the other hand, the biosketch task provide a rapid response, which may be enough for a quick startle response but not observable in a prolonged physiological stress response. Downey et al. (2004) found increased eye-blink startle responses as an indicator of the physiological defence response (Lang et al., 1990) in healthy participants who viewed the rejected-valance paintings, although heartrate was not measured and thus no direct comparison of findings is possible. Thus, the findings from Downey et al. (2004) might have been the result of a defensive response to the visual (Bradley et al., 1999). Taken together, task differences might have contributed to contradictory results between the present study and previous research (Williams, 2007).

More surprisingly, with only the resting skin conductance level showing small-to-medium effect size for a link with rejection sensitivity, we did not strongly support its association with dispositional stress measures. Skin conductance as an indicator of the sympathetic nerve system activation which has been related to the fast stress response (fight-flight response). Previous research showed that rejection sensitivity was related to increased cortisol levels; indicating hypothalamic-pituitary-adrenal axis (HPA) activation, which is a central stress response system (Tops et al., 2007; Saul, Miller, Schmidt & Eckel, 2010). Downey et al. (2004) suggested that constantly monitoring the possibility of rejection constitutes chronic stress which is accompanied by an overactivated fight-flight response and can lead to dysregulation of the HPA. In the present study, results were based on subjectively perceived stress, physiological arousal as indicated by SCL and HR, and parasympathetic activation as indicated by the high frequency HRV, but cortisol was not assessed. Previous research has suggested that physiological and self-reported stress responses can provide inconsistent results. For example, Vedhara et al. (2000) found that students who were going through exam period perceived higher level stress, but lower HPA activation, as indicated by lower cortisol level, compared to when they were not in the exam period. Thus, the discrepancies in the results, that rejection sensitivity was associated with SCL but not perceived subjective level of stress, could be because they operated through a similar system where there was a disconnection between physiology and subjective stress.

One explanation for the absence of strong associations between rejection sensitivity, perceived stress and psychophysiological parameters could be that participants in the present were healthy students with overall low levels of stress, compared to previous studies that used general population with varied level of stress. Furthermore, it is possible that the observed association was not detected because of the low-to-medium level of rejection sensitivity in this healthy sample.

The results of our study did also not fully support Hypothesis 2, which stated that there will be differences in stress levels and physiological responses between the manipulation groups with

those experiencing social rejection in the biosketch task expected to experience highest levels of stress and physiological arousal increase. None of the of the manipulation groups made a significant contribution to stress level or the psychophysiology. These results were still surprising considering previous evidence which showed that the rejection condition, induced by using a similar rejection paradigm, should lead to an increase in heartrate (e.g. Moor, Crone & van der Molen, 2010). In the present study, although not significant, heartrate response to rejection points rather to a deceleration which in the past has been associated to the freezing response, which is the activation of PNS in response to threats as a preparation for actions (van der Veen, Burdzina & Langeslag, 2019). However, the results from PNS activation, as indicated by heartrate variability, did not support this interpretation as there were no differences between the conditions. Interestingly, the absence of a significant effect cannot be attributed to the manipulation task itself because the manipulation check analysis showed that the rejected condition made a significant contribution to lower feeling of inclusion. Surprisingly, we observed increased physiological arousal, as indicated by increased SCL and heartrate, induced by the task regardless of the conditions the participants were in, even though participants did not report increased subjective stress. This was unexpected, in particular that being in the rejected condition was not accompanied by a significant increased stress and physiological arousal response as would be expected from previous research (Iffland et al., 2014). One possible explanation for this could be that individuals perceived the biosketch task generally as a socially evaluative threat. Prior to completing their biosketch writing they were told that they could be rejected or accepted and the possibility of receiving negative social feedback could have presented a social evaluative threat in itself. Socially evaluative threat has been described as potent elicitor of a stress response even in healthy individuals (Kirschbaum, Pirke & Hellhammer, 1993; Dickerson & Gruenewald, 2004).

The type of stimuli used in the study seem to be an important factor that influence the outcome. Downey et al. (2004) used rejection-valance painting to induce physiological responses subconsciously. Moor, Crone, and van der Molen (2010) used a similar paradigm to this study but

they asked for participant's photo before they came to the lab, which made the rejection appearance-based. This made the present study slightly different as the aspect of self-descriptive personal rejection task, especially by strangers, may not be enough to produce observable physiological responses (Inderbitzin et al., 2013). Furthermore, the healthy sample, indicated by relatively low rejection sensitivity in the sample, were used in this study as compared to Downey et al. (2004) study, who compared those with high and low rejection sensitivity; could mean that the participants were able to regulate the responses to the rejection better than those in other studies that included vulnerable participants.

Although we did not find moderation effects for rejection sensitivity on the association between experimental condition and stress or psychophysiological responses, higher rejection sensitivity was significantly associated with higher perceived stress and physiological arousal during the biosketch task. This is in line with Downey and Feldman (1994) proposal that rejection sensitivity amplified the stress of social interaction in general.

There is considerable debate about how to best investigate rejection sensitivity using experimental approaches. It has been argued that idiosyncratic stimuli work well. In fact, many studies found that when the rejection stimuli matched the type of rejection sensitivity, such as someone with high appearance-based rejection sensitivity who got rejected because of their looks, it increased the anxiety in their participants (London et al., 2012; Bowker, Thomas, Spencer & Park, 2012). Therefore, the absence of significant results in our study could be attributed to how important the stimulus was to the participants, which was not assessed in our study, but low-to-medium stress levels suggest low individual salience. In addition, the time window for assessing the heartrate (means over one-minute sequences) was possibly too long for transient physiological changes. Crone et al (2003) found that the maximum heartrate change occurs during the interbeat interval (IBI) following the feedback onset IBI. Thus, scrutinising heartbeat intervals might reveal more detailed insight into the time course of physiological response to rejection.

It is also possible that the rejection paradigm used in this study is not effective for several reasons. First, it may not be sensitive enough for stressing healthy and resilient individuals. Situations of rejection are part of the common human experience and occur quite frequent on social media accounts with which our sample may have regularly engaged which was unfortunately not assess. The paradigm may only work for individuals with elevated dispositional rejection sensitivity and thus future research should investigate if the interaction between dispositional rejection sensitivity and rejected condition will lead to a significant increase in stress and heartrate. Second, the paradigm itself may need to be improved. Care was taken to ensure that the rejection was not social-exclusion-based or appearance-based as in previous studies, because the aim was to match the stimuli task with a personal-rejection sensitivity measure used in the study. The participants were invited to write about themselves very personally thus ensuring that the subsequent rejection presents a psychosocial threat to the self and its integrity as this element of self-referential processing is affected in many mental health conditions (Bluhm et al., 2012). However, the salience and consequences of being rejected in the sample was not clear, thus the participants might not feel the stress of being rejected.

3.5.1: Limitations and Strengths

It is worth noting that the power calculation for the study was done for the main analysis and not for the interaction effect. Thus, a much larger sample is needed for the interaction effect to be observable. There were a few ethical considerations that were addressed during the planning of this study. All the participants were healthy university students as rejecting vulnerable people could massively induce distress. This means that it is possible that participants who would responses to the effect of manipulation may have been excluded during the screening process. During the experiment, it is not possible to subject participants to an extremely stressful stimuli, which means the task may not have the power to evoke changes in physiology. For this reason, the rejection task may only induce a small level of stress, which is reflected in the results. Moreover, the rejection task

used in this study focused on participant's perception of self being rejected. This is different from other type of social rejection, such as being rejected as a romantic partner, or being rejected for their appearances. For example, if participants were judged by physical attractiveness, they may have exhibited more anticipatory arousal when waiting for the feedback responses (Dogan & Colak, 2016). This is because rejection based on appearance threatens both belongingness and self-esteem (Park, 2007).

Regardless, the present study employed an experimental design in order to investigate the effect of rejection on stress responses. Moreover, the study measured subjective perception of stress as well as physiological responses which covered a wide range of stress indicators. Investigating heartrate variability also provided insights into the PNS response as well as possible indication of emotion regulations in response to rejection.

3.5.2: Future Direction

Future studies should aim to address some methodological issues in the task itself. Firstly, inducing trauma or investigate people who had an experience of trauma may help improve the results by establishing the gap between rejection sensitivity and the arousal through the nature of trauma memory. Other possible confounding variable should also be taken into consideration. For example, self-perception or self-esteem are factors that could interact with the effect of rejection sensitivity because people who have poor perception about self may pay more attention to the rejection, hence affected more by the task. Lastly, wider range of participants should be investigated, this includes patient samples, who might show a stronger effect.

3.5.3: Implications

So far, this study had provided a partial validation for the use of essay/biosketch task for rejection. This is important because it can be used to study the effect of rejection in future studies. Currently, most studies use ostracism, which implied social exclusion rather than being directly

rejected. Thus, could have produced different results. The study helps establish the link between rejection sensitivity and stress following a social interaction task. This potentially helps to mark high rejection sensitivity as a vulnerability for chronic stress. The finding also implied that rejection could have a bigger impact on stress for individuals with high rejection sensitivity. This provides a clinical implication that could help reduce stress in sensitive people. For example, emotion regulation training for those prone to rejection, which can help prevent increases in stress level in social situation.

All in all, the study looked at a novel association between two factors which provide the field of research with valuable theoretical implications. The results provide contribute to our understanding of the relationship between the investigated factors.

Chapter 4:

Declaration Concerned the Article Entitled	
Rejection Sensitivity and its Contribution to the Effect of Social Rejection Following Virtual Reality Trauma and Subsequent Recovery	
Publication Status	Draft for Publication.
References	N/A
Copyright Status	I hold the copyright for this material.
Author's Contribution	The current study was formulated, recruited, conducted, analysed, and written by the author under supervision of the supervisor. Part of data collected were done by undergraduate trainees under author's supervision.
Author's Statement	This paper reports on original research conducted for Doctor of Philosophy in Psychology.

**Rejection Sensitivity and its Contribution to the Effect of Social Rejection Following Virtual Reality
Trauma and Subsequent Recovery**

Sila Jittayuthd and Anke Karl

Psychology, College of Life and Environmental Sciences, University of Exeter, Exeter, UK

Abstract

Rejection sensitivity, the propensity to readily perceive and strongly react to potential rejection, is often associated with negative cognitive appraisals and often accompanied by a constant activation of stress response. Such prolonged activation of stress can possibly lead to increased arousal in response to stressful stimuli, such as those observed during traumatic experience. Further, in light of Ehlers and Clark's cognitive model of PTSD, rejection sensitivity may interfere with trauma recovery by influencing the appraisal of the trauma aftermath. Therefore, the present study aimed to understand how rejection sensitivity is associated with physiological responses during trauma through virtual reality. The study used experimental method to induced trauma in 105 participants using trauma film paradigm through virtual reality. Immediately followed was a modified ostracism task where participants were assigned into rejected, neutral, and accepted conditions. Along with rejection sensitivity, physiological arousal and parasympathetic activation were measured throughout the study to investigate the effect of the experimental manipulations. 7-days follow up diary task was also used to assess intrusions as proxy for PTSD symptoms. The results showed that being rejected or accepted after traumatic experience was not associated with changes in physiological stress response. However, rejection condition was associated with decreased subjective anxiety and stress, and rejection sensitivity also made an independent contribution to increased subjective stress. Lastly, neither rejection sensitivity nor experimental conditions made any contributions to the number of intrusions following the experiment. Possible explanations for the findings, along with strengths and limitations of the study, were discussed.

Keywords: Physiological Response, Virtual Reality, Rejection Sensitivity, Intrusions, Trauma, Online Rejection

Recovery from psychological trauma is negatively impacted by adverse social factors such as loneliness and low social support (Brewin et al., 2000). The mechanisms of this are, to date, not well understood. Adverse interpersonal/social experience, such as social rejection, in the aftermath of experiencing a traumatic event could signal to the individual that they cannot reach out for sharing emotional experiences and receiving validation or other forms of social support. Such support has been shown to be helpful for processing of traumatic events and for coming to terms with the experience. Furthermore, individuals sensitised to social rejection through early caregiver experience could potentially interpret social encounters in the aftermath as more rejecting or they could have exacerbated responses to experiences of social rejection. Given the large effect sizes that have been found for lack of social support impacting trauma recovery and contributing to the development of posttraumatic stress disorder (PTSD), there is a need to better understand the role of such peri and post-traumatic social/interpersonal risk factors to inform trauma-focused interventions.

Rejection sensitivity refers to the predisposition to readily react and perceive social rejection (Downey & Feldman, 1996). Rejection sensitivity is hypothesised to develop from past repeated social rejection (Downey et al., 1997), which leads to maladaptive perception of rejection in social context such as misinterpretation of ambiguous situation. The persistent attention to rejection is a source of distress in those with high rejection sensitivity. High rejection sensitivity activates high levels of anxiety and negative mood even in a non-threatening social situation (Downey & Feldman., 1996). Constant activation of anxiety could lead to subsequent negative appraisal of the events as well as prolonged stress which can lead to altered psychophysiological responses such as hyperarousal to stressful stimuli. In fact, Bresland and colleagues found that high rejection sensitivity was associated with increased physiological arousal following a real-life social victimization (e.g. being excluded, or a target of gossip) compared to healthy controls (Breslend et al., 2018). Such heightened arousal amongst those with high rejection sensitivity in response to stressful situations can in turn induce more stress, affect appraisal of the events, and coping strategy with the situation

(e.g. avoiding and not processing the traumatic event). It can therefore be hypothesised that through a sensitised stress response, rejection sensitivity may also impact on recovery from psychological trauma.

Psychological traumas are stressful life events characterised by actual or threatened death, serious injury, or sexual violence (DSM-5; American Psychiatric Association, 2013). Such traumas can lead to PTSD (Gillespie et al., 2009). PTSD has a prevalence rates of around 70% in those who experienced lifetime trauma (Kessler et al., 2017). These prevalence rates suggest individual differences in recovery from psychological traumas, which makes it important to understand factors that contribute to the severity of posttraumatic stress (Harvey & Bryant, 1999). Whereas there are protective factors such as perceived positive changes and meaning of life that could lessen the severity of the posttraumatic stress (Steger et al., 2008), there are on the other hand vulnerability factors such as previous history of traumas that contribute to increased likelihood of posttraumatic stress (Dougall et al., 2000). One potential vulnerability factor that could contribute to the development of trauma-related stress is rejection sensitivity because of its role in sustaining level of stress and hypervigilance to social threat. This could affect how individuals process and interpret their traumatic experience. However, the role of rejection sensitivity on trauma processing is yet to be explored.

Peritraumatic Responses

The way individuals process traumatic events has been at the core of developing post-traumatic stress (Ehlers & Clark, 2000). Particular importance has been placed on the processing during and immediately after the traumatic event, the peritraumatic period, when the individual is very likely experiencing the release of stress-related neurotransmitters in ways that can affect the adaptive processing and encoding of the trauma memories leading to sensory vivid intrusive experiencing of the event in the form of flashbacks or nightmares (Maercker et al., 2013). Negative appraisals about the self, the world and self-blame during and after the trauma maintain the stress

response, lead to cognitive and emotional avoidance and thus prevent the adaptive processing of the event and reduction of intrusions (Ehlers & Clark, 2000). For ethical reasons, the study of peritraumatic processes is challenging. Therefore, Holmes et al (2004) developed the trauma film paradigm as a method that allows for an assessment of peritraumatic effects in the lab. This paradigm induces peritraumatic-like reactions by showing trauma-related, distressing contents such as road traffic accident, and dead body extractions on screen in a lab-controlled environment. The method has been useful for investigating peritraumatic effects in analogue populations in many studies. It has been found to reliably induce negative mood, distress, dissociation, and even PTSD-like symptoms (James et al., 2016). Importantly, the method also allows the investigation of physiological responses to traumatic events. It is hypothesised that during trauma individuals experience elevated physiological arousal based on the activation of the sympathetic nervous system (SNS). This activation has been indicated by increased heartrate and skin conductance as a result of fight-or-flight response (Ripley et al., 2017). Increased activation of SNS responses during trauma film was associated with increased intrusions underlying PTSD symptoms (Hilberdink et al., 2022). However, it has to be noted that the findings on physiological arousal during the trauma film are mixed with some studies finding a reduction in heartrate rather than an increase which has frequently been attributed to a freeze response (Holmes et al., 2004). To date, the role of social risk factors such as rejection sensitivity or the experience of social rejection in the peritraumatic period has not been studied.

The Role of Rejection Sensitivity During Trauma

One of the ways rejection sensitivity can affect the impact of trauma is through disruption of emotional processing during trauma. Emotional regulation difficulties often present in those with high rejection sensitivity (Ayduk et al., 2000). One important physiological marker for emotion dysregulation is resting respiratory sinus arrhythmia (RSA) or resting heartrate variability (HRV), refers to variations in beat-to-beat intervals in heart beats, and is an indicator of the activation of

parasympathetic nervous system (Thayer & Lane, 2000). In a stressful situation, RSA marks the flexibility in coping with the demand of stress in these situations. Increased parasympathetic response helps to adapt with the surrounding stress, which is why having higher RSA would indicate a good emotion regulation (Bernstein et al., 2003; Thayer & Lane, 2000). Negative affect and emotional regulation difficulties were both associated with decreased heart rate variability, suggesting that physiological responses could be an important factor for emotional control (Di Simplicio et al., 2012). However, altered HRV responses to stress, observed in those with high rejection sensitivity, could potentially indicate a poor emotional regulation. Therefore, it would not be a surprise that high rejection sensitivity, accompanied by poor emotional regulation during traumatic experiences, could later impact posttraumatic stress following the trauma. Moreover, a high heart rate variability was found to indicate a protective factor for the negative impact of rejection sensitivity by regulating emotional control (Gyurak & Ayduk, 2008). This means that having higher levels of resting heart-rate variability, as an indicator of healthy emotion regulation, could accompany an adaptive and flexible stress response during traumatic experiences. In fact, disrupted emotion regulation during trauma is important for the development of posttraumatic stress (Barlow et al., 2017). Emotional regulation difficulties, such as emotional suppression and dissociation, were found to predict posttraumatic symptoms after trauma (Bardeen et al., 2013). Thus, it is important to understand how rejection sensitivity associates with altered physiological responses, which can then affect subsequent development of posttraumatic stress. Moreover, rejection sensitivity could also interfere with post-trauma recovery during the aftermath of trauma.

Role of Social Rejection and Rejection Sensitivity After Trauma

One possible explanation of how rejection sensitivity could affect the level of posttraumatic stress could be that rejection sensitivity affects the appraisal of the trauma experienced and the coping strategies used to control the stress. Ehlers and Clark (2000) proposed that those who suffered from a persistent posttraumatic-stress disorder (PTSD) often have negative beliefs about

the traumas as well as negative beliefs about people around them. These types of negative appraisals could be more prominent in those with high rejection sensitivity. This could be because those with high rejection sensitivity tend to have negative self-beliefs and self-blame (Boldero et al., 2009), which could get entangled with the appraisal of traumas. Moreover, those with high rejection sensitivity have a negative interpretation bias, especially in social situations (Normansell & Wisco, 2017). This led them to perceive response from others, whether it was positive or negative, to be a sign of threat which can further increase posttraumatic stress.

Due to the change in cognitive appraisal of the event, rejection sensitivity could further increase the level of perceived distress after traumas. Those with high rejection sensitivity could already be 'on edge' and the attention on possible rejection or the experience of rejection itself could send the stress level into overdrive (Gaffey & Wirth, 2014; Ronen & Baldwin, 2010). Related to this, rejection sensitivity could contribute to posttraumatic stress through hyperarousal experiences as indicated by increased heartrate and elevated skin conductance (Gerber & Wheeler, 2009; Kelly et al., 2012). Physiological arousal has been higher in those with higher rejection sensitivity (Gyurak & Ayduk, 2007). Rejection could trigger physical arousal responses similar to those experienced during psychological trauma (Gerber & Wheeler, 2009), which could lead to intrusion and reexperiencing in the aftermath (Nixon & Bryant, 2005; Wald & Taylor, 2008). Furthermore, the threat of social rejection during the recovery period following trauma can amplified the stress response further. Similarly, having social support can protect individual against the stress of trauma and subsequent development of PTSD (Jittayuthd & Karl, 2022), which suggested the importance of social interactions during the recovery period. Thus, a trait such as rejection sensitivity that amplified the threat associated with potential rejection, as well as disrupting the formation of social bond following traumatic experience, could be an important factor that contribute to the development of PTSD. For example, those with high rejection sensitivity could develop intrusions after traumas because of the hyperattention to negative social stimuli and physiological hyperarousal that arises from the possibility of being rejected (Hilberdink et al., 2022). Yet, there has not been many studies

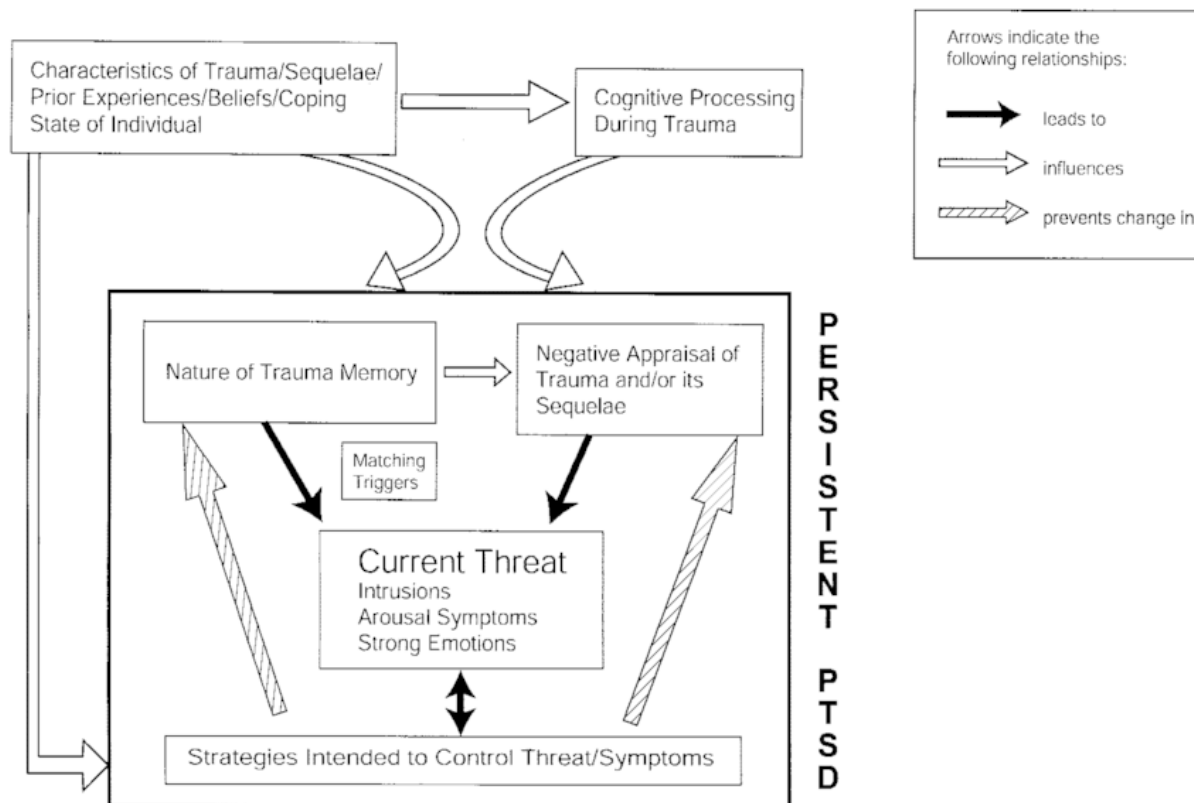
that directly investigate the effect of social rejection, and the contribution of rejection sensitivity, during the recover phrase of trauma.

Gaps in Literature and Purpose of the Study

The main objective of this paper was to test the role of rejection sensitivity and rejection experiences on the physiological responses during a laboratory trauma and later intrusions. Currently, there is limited research that directly investigates how rejection sensitivity relates to stress responses during trauma experience. Moreover, the role of rejection sensitivity for sustained distress, physiological arousal and the formation of intrusive memories following stressful events has not been previously investigated. Essentially, the study wanted to test some components of Ehlers and Clark’s (2000) cognitive model of PTSD (Figure 4.1) as follows.

Figure 4.1

Cognitive model of PTSD (Ehlers & Clark, 2000)



In the context of the cognitive model, rejection sensitivity acts as a prior experiences/belief where an individual holds a negative perception about themselves and readily expects rejection. These beliefs influence cognitive processing during trauma; where those with high rejection

sensitivity may be hyperattentive to the social aspect of the traumatic event, which increases the stress response to the trauma as well as disrupts the processing of the actual event. This can interfere with the memory of trauma where the physical sensations and stress responses became prominent. Moreover, the memory of trauma could be biased by the negative appraisal of the trauma sequelae. An example given by Ehlers and Clark (2000) was when an individual paid specific attention to poor treatments by paramedics during traumas, they displayed negative appraisal of social interactions and poor treatments by nurses after the event. Here, rejection sensitivity could contribute to the initial perception of poor treatment during trauma, and in the meantime increase physiological arousal. With arousal state, those with high rejection sensitivity are more susceptible to noticing threats. Because those with rejection sensitivity are more attentive to social threats and prone to subtle rejection cues, they are more likely to perceive threats in social situations following the traumas, applying negative appraisals to the situation, further increasing physiological stress response to the event. On the other hand, feeling helplessness and fear during trauma could also lead the individual to perceive the social situation as more negative where they felt disconnected from others or that other people could not relate to their experiences. Such cognitive process could be exacerbated by being sensitive to rejection and negative appraisals could increase physiological and stress responses, which could lead to strong emotions, arousal, and intrusions. Lastly, being sensitive to rejection could influence the coping strategies used to control strong arousal and intrusions. Those who readily expected and feared rejection could retreat and avoid contact with other people to protect themselves from potentially being rejected; thus, decreasing the level of social support they received, which could prevent changes in the feeling of fear and loneliness of losing friends and reduces adaptive processing of the event.

This study aimed to investigate the psychophysiological stress response to a social interaction that followed a virtual reality trauma film paradigm. Virtual reality was chosen over the two-dimensional, third-person perspective and non-immersive trauma film paradigm to increase its ecological validity through immersiveness and first person perspective (Cuperus et al., 2017). To

address the gaps in the literature, the experiment first investigated whether rejection sensitivity, assessed as a trait/disposition before the analogue VR trauma, is associated with physiological responses during traumatic experience (Hypothesis 1). Second, the study examined whether social rejection immediately following the VR trauma prevents recovery by increasing or sustaining physiological arousal (assessed through heartrate and skin conductance) and by reducing parasympathetic activation (assessed through high frequency high frequency heartrate variability). Moreover, the study investigated whether social rejection would lead to higher subjective distress and negative affect immediately after the social interaction. The opposite was expected for individuals experiencing social acceptance (Hypothesis 2). Fourth, because those with high rejection sensitivity could be hyperattentive to rejection cues following the trauma, their physiological arousal, and negative affect during the social interaction and the intrusions in the days following the VR trauma may be even higher during the negative social interaction (rejection) than for individuals with low levels of rejection sensitivity which the study assessed through moderation analyses (Hypothesis 3). Finally, the study examined whether social rejection following traumatic experience can have negative consequences on later development or maintenance of PTSD-like symptoms, such as intrusions related to the trauma in the seven days following the experiment (Hypothesis 4).

Methods

4.3.1: Design

The study employed a mixed within and between group experimental design with three conditions: rejected, neutral, and accepted. Participants' level of rejection sensitivity was also assessed as an independent variable. Participants' physiology (ECG and skin conductance), pre and post mood and stress, and perceived feeling of rejection were assessed as dependent variables.

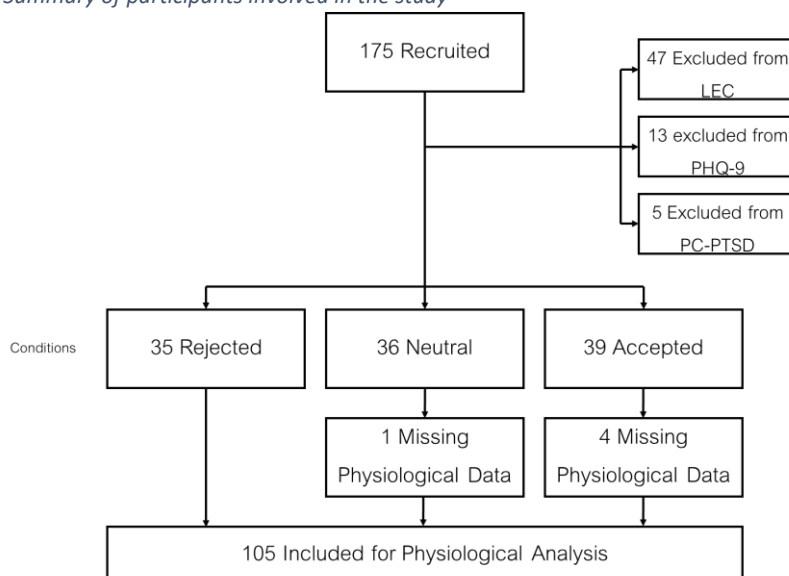
4.3.2: Participants

A total of 175 participants signed up to the study, but only 110 participants (33 male, 77 female) of aged 18-55 ($M= 21.54$, $SD= 5.42$) were included after online screening. The participants flow and numbers of participants in each condition is shown in Figure 4.2. The participants were recruited through online advertisement via social media, online recruitment database (SONA), and word of mouth. Participants were excluded from the study if they had high levels of depression (above 20), PTSD, or experienced a motor vehicle accident in the past (see Figure 4.2). This was to protect participants from excess stress caused by the experiment. Participants were randomised into the three experimental conditions (rejected, neutral, and accepted). Participants were reimbursed £10 for their time. All participants gave written informed consent, and the study was approved by The University of Exeter Ethics Committee.

Target sample size was determined by an a-priori power calculation in G*Power for repeated measure ANOVA with timepoints during the modified ostracism task as within-subject, and experimental conditions as the between-subject factor at the medium effect ($f^2= 0.15$) at a statistical power of 0.80 and an α of .05 (Faul et al., 2009). The calculation indicated that 69 participants were required for this study, and the number of data collected exceeded this target sample size.

Figure 4.2

Summary of participants involved in the study



4.3.3: Measures and Materials

Screening Tools

The Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001). This questionnaire was used as a screening tool for severe depression. It consisted of nine items, each related to symptoms of depression. Those scored above 20 out of 27, an indication of severe depression, were excluded from participating in the study.

Life Event Checklist for DSM-5 (LEC-5; Gray et al., 2004). This questionnaire assessed potential trauma experiences which could result in PTSD. It included 16 items of traumatic experiences. Participants answer whether they have directly experienced, witnessed, heard about, or experienced an incident as part of their job. Due to the nature of trauma film used in this study, participants who had experienced or witnessed item number three (Transportation accident (for example, car accident, boat accident, train wreck, plane crash)) were excluded from the study.

The Primary Care PTSD Screen (PC-PTSD; Cameron & Gusman, 2003). This is a brief four items questionnaire on the symptoms related to trauma experiences. Participants chose yes or no to each question. If they chose yes to any three items, they were excluded from taking part in the study as it indicates possible PTSD symptoms.

Rejection Sensitivity Questionnaire- Adult Version (RSQ-A; Berenson et al., 2009). This questionnaire is widely used to measure rejection sensitivity (Downey & Feldman, 1996). It consists of nine questions. Each question presented a scenario of social situations (e.g., you asked a family member for a loan, how concerned or anxious would you be over whether or not your family would want to help you?). The participants then rate how they would respond to each situation on a 7-point Likert scale. The RSQ-A has a high internal consistency ($\alpha = .89$) (Berenson et al., 2011).

Virtual Reality Equipment and Software

The virtual reality film was shown to the participant through the first-generation HTC vive headset (HTC Corporation, 2016). The headset displayed a full 360 degrees virtual environment at

2160×1200 (1080×1200 per eye) with 90Hz refresh rate. The video was run using a compatible media player on Steam software (Valve Corporation, 2020).

Virtual Reality Film (FirstCar & Leicestershire Fire and Rescue Service, 2017). The original purpose of the film was to raise the awareness of safety driving. The film started with a group of young adolescents in a car in the countryside of England. The virtual reality put the participants in the first-person view of the person sitting at on the passenger side of the car. The young driver then started driving down the road while having a conversation with two other passengers on the back seats. The driver then took his phone out and started to get distracted and lost control of the car. The screen then blinked, indicating a collision, before it went blank for a few seconds. When the screen was back on, the film showed paramedics attempting to help the injured driver and other passengers. They then lifted the roof off the car before a paramedic approached to tend to the passengers. The film ends shortly after. The film was a realistic portrayal of a motor vehicle accident, even though the actual crash was not shown. The aftermath of the accident was also realistic.

Physiological Data Acquisition. The BIOPAC MP150 system with AcqKnowledge 5.0 software (BIOPAC Systems; Goleta, CA) was used to measure electrocardiogram (ECG) and skin conductance response at the acquisition sampling rate of 2000Hz. Two electrodes were placed on the participants, one below the right collar bone and another one below the chest where the heart was. These electrodes were used for an electrography by the BIOPAC ECG100C amplifier with the sampling rate of 1kHz.

The BIOPAC SCL100C amplifier, with the sampling rate of 500Hz, was used to measure stress response through skin conductance. The system used two skin-resistant transducers (TSD203) placed on the middle phalanx of the middle and the first fingers of the participants' non-dominant hands.

Experimental tasks

Modified Online Ostracism Task (Wolf et al., 2015). The task is a modified version of the online social ostracism task by Wolf et al (2015). The task was originally designed to induce the feeling of exclusion, similar to the Cyberball task (Williams & Jarvis, 2006). Participants were told that they will be doing an online task with other participants. The task started with an instruction page detailing the task. The participants then chose one out of ten random avatars. They were instructed to write a brief description about themselves and then continue to the next page where they were encouraged to read the profiles of 11 other people. These profiles were kept the same as the original version, with varying age, gender, and race. In the original version, participants read through these profiles and were given an option to 'like' the profiles, similar to those on Facebook. In the modified version, however, there were also an option to 'dislike' a profile as well. This option was added so the participant could 'reject' someone as well as being 'rejected' by others. The original task only allowed the participants to receive likes in comparison to other people, which does not induce the feeling of being deliberately rejected by other people.

The profiles, including the participants', had 'likes' and 'dislikes' counters to show the number of likes and dislikes received by other people. When participants received a like or a dislike, they got a pop-up notification of who liked/disliked their profile in the bottom right corner. The number of likes/dislikes received were adjusted according to the conditions the participants were in. In a neutral condition, participants received 2 likes and 0 dislike. While participants were reading other people's profiles, they were able to see the number of likes and dislikes other people received as well. These number of likes and dislikes other people received were adjusted according to the condition participants were in as well. In the neutral condition, other people's profiles received a similar number of likes and dislikes to the participants. In the rejected condition; participants received 2 likes and 7 dislikes. The low number of likes were given to make it less obvious that the task was manipulated. In this rejected condition other people's profiles received much higher number of likes than dislikes to show the participants that only they were being disliked. In the accepted condition; participants received 9 likes and 2 dislikes. Low number of dislikes were given to

the participants for realism and balance of the task. In this condition, other people’s profiles received a similar number of likes and dislikes to the participants in order to induce the feeling of inclusion through having similar number of likes. After three minutes had passed, a ‘continue’ button appeared which allowed participants to continue to the next part of the study.

Figure 4.3

The modified ostracism task. Participants chosen avatar, name, descriptions, number of likes and dislikes are shown on the top left. Live information of likes and dislikes are displayed on the bottom right.

The screenshot displays a grid of user profiles in a social media-like interface. Each profile includes an avatar, a name, a short description, and a 'Like'/'Dislike' button with a count. The profiles shown are:

- Name:** Description: "Participant's descriptions with the instruction to 'Please write a paragraph in which you introduce yourself to the rest of the group. Write something you would like to tell about yourself - anything you want to share.'" Likes: 1, Dislikes: 0.
- George:** Description: "I'm a 19 year old dude from Glasgow. I love music and lately you can catch me listening to nothing but Joy Division, Echo & the bunnymen, and the smiths. Besides music I like learning languages, psychology, drawing, and writing." Likes: 0, Dislikes: 0.
- Sarah:** Description: "Let me introduce myself. I'm Sarah, married, and mother of two wonderful (grown up) children. My career has been a bit peculiar. Starting off as a graduate historian, I switched to an entirely different discipline: occupational assessor trying to help young people with disabilities to get a job. I've just retired and started spending more time on my hobbies, such as singing, reading, and playing volleyball." Likes: 1, Dislikes: 1.
- John:** Description: "Hi there, I'm 57 years old, married, with two kids. I've been a computer programmer in the states for about 30 years, but don't worry: I don't have the dusty haircut, oversized buttoned shirt and nerdie big frame glasses. Looking forward to working with you all. Cheers, John" Likes: 0, Dislikes: 1.
- Anna:** Description: "I am a Computer Science student at University of Exeter, interested in Natural Language processing. Also a lover of loose leaf tea and a Semantic Web enthusiast. I'm curious about what this task is about." Likes: 1, Dislikes: 2.
- Nick:** Description: "My life revolves around rock climbing. I started climbing when I was 12 (turning 18 soon) and usually climb 4-5 hours a day. Climbing never bores me, because each time is different – the routes, the weather, my strength and endurance. It's great!" Likes: 0, Dislikes: 0.
- Lauren:** Description: "I'm Lauren, I love to hang out with friends and go shopping. Just doing some online studies here!" Likes: 1, Dislikes: 0.
- Mary:** Description: "My name is Mary and I am 49 years old. I have a husband and 2 grown sons. My family and I lived in different countries. Our sons attended international schools wherever we went and since moving to Exeter, I found work at those schools as well. Besides roaming around the world, I like playing games. Board games, cards, black jack or poker, mah jong, or silly games on Facebook, jig saws, basically anything" Likes: 0, Dislikes: 0.
- Ky:** Description: "Hey, guys. I'm 19, native Korean. I've been in UK for about four years now. I consider myself pretty nice, though not a total angel. I just like being friendly to people I meet. In my spare time, I like making all kinds of friends, having conversations about whatever, looking" Likes: 0, Dislikes: 0.
- Arjen:** Description: "My name is Arjen, I study Artificial Intelligence" Likes: 0, Dislikes: 0.

On the right side, there is a text box: "You can click 'Like' if you have enjoyed somebody's description" and a "time left: 02:48" timer. At the bottom right, a green notification bubble says "John liked your post".

State measures

Post-Task Questionnaire. Following the adapted ostracism task, participants were asked to rate on a scale (from 0-100) whether they felt “ignored by others”, “rejected”, “as part of the

group”, or “included”. Participants were also asked if they thought they have received “under average”, “about average”, or “above average” likes, and dislikes, compared to other profiles.

Mood (Davis & Clark, 1998). Participants rated their mood states (happy, anxious, depressed, and angry), before and after the main tasks, the visual analogue scales not at all to extremely. This was to assess the change in mood by the task. The scale was also believed to correlates with intrusion after trauma film.

Perceived stress (Beekman et al., 2015). The questionnaire was used to assess level of stress before and after the main task. Self-report stress was measured with two items: “I feel stressed” and “I feel distressed.” The two scores were averaged ($r = .43$, $p < .001$). The scale has been used in previous studies to measure stress following rejection.

Memory Vividness and Emotionality (Engelhard et al., 2011). The questionnaire was used to assess memory relating to the trauma film. Participants were asked to recall the most unpleasant part of the film and visualise that in their mind for 20 seconds. They then rate vividness and emotionality of the memory on the visual analogue scales which ranged from not vivid, and not unpleasant, to extremely vivid, and extremely unpleasant. The scales have been used in previous studies to assess vividness and emotionality of real-life traumas after exposure.

Evaluation Questionnaire (Cuperus et al., 2017). This questionnaire was used in previous virtual reality studies to assess immersion with the film. The scales included four statements related to the film (“I felt personally involved”, “The events were unpredictable”, “What happened somehow seemed real”, and “I was startled by what happened”). Participants were asked to indicate how much they agreed with each statement on visual analogue scales ranging from not at all to extremely.

Diary Task (Kleim et al., 2013). The diary task was used to assess intrusion for seven days following the trauma film exposure. The method was used in the original trauma film paradigm

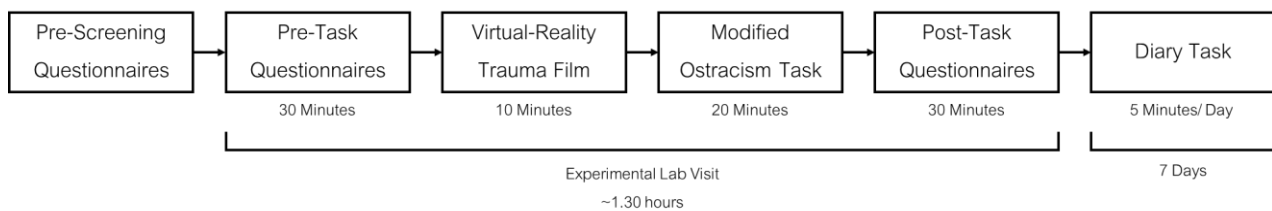
(Holmes & Bourne, 2008). The diary was adapted from Kleim et al (2013), which consisted of seven questions related to the trauma experience with an added question on social support was added for this specific study. The task was set up on Qualtrics and was send out to the participants via email each day for seven days following the lab visit.

4.3.4: Procedure

The procedure for this study is summarised in Figure 4.4. Participants were first given a link to the screening questionnaires, where they were given an online information about the study as well as a consent form. This was immediately followed by demographic questions. The participants then completed the PHQ-9, PC-PTSD, and the LEC-5. Those who passed the screening questions were invited to the lab for the main part of the experiment.

Figure 4.4

The breakdown of the procedure with experiment timeline included.



When the participants arrived at the lab, they were equipped with ECG and SCL electrodes. They then completed the RSQ-A, pre-mood, and pre-stress questionnaires. After they had completed these, they were given a virtual reality headset where they watched the film. This was immediately followed by the ostracism task. Participants were then redirected to another survey where the post-task manipulation checks, post-mood, post-stress, and memory vividness, questions were given to the participants. At the end of the lab session, they were given a link to the follow-up diary task. These were sent directly to the participants every day at 7pm for 7 days following the lab visit. After a week had passed, they were given a debrief and payment for they contribution.

4.3.5: Data Analysis

Psychophysiological Data Pre-processing

Psychophysiological data were first pre-processed through AcqKnowledge software. The QRS peaks were marked for the ECG using the software's build-in heartrate detection program. The missing and misplaced QRS peaks were added and removed manually. Heartrate was computed from these QRS peaks using the software. The mean heartrates for each minute of the experiment were then calculated. Hypothesis 1 used the absolute mean heartrate (beats per minutes; BPM) in order to investigate how rejection sensitivity associates with resting BPM. However, for Hypothesis 2 the change in heartrate was used to investigate how the modified ostracism task increased or decreased the heartrate. The change in heartrate was calculated by subtracting the BPM of minute 1 (baseline) with the BPM during each minute of the task. The SCL data were first gone through range correction by extracting the minimum and maximum values of the SCL data for each individual. The mean SCL were adjusted in proportion to the range.

High-frequency heartrate variability (HF-HRV) was extracted from the ECG data using the AcqKnowledge software's build-in HRV analysis. The R-peaks of the ECG were submitted to a fast Fourier transformation where the R-R interval variation for the frequency between 0.15Hz and 0.4Hz was calculated for each minute (Berntson et al., 1997).

Preliminary Data Analyses

All statistical analyses were conducted using SPSS version 28 (IBM, 2021). All measures appeared to be normally distributed and no assumptions were violated. Extreme outliers were data points that were significantly different from the norm in the data set, as indicated by the values below the 10th and above the 90th percentile, calculated using the SPSS software. The outliers were winsorised, where they were adjusted to the limit values of below 10 and above 90 percentiles (Field, 2017). Missing data were omitted from the analyses.

Manipulation Checks and Hypotheses Testing

Repeated measures ANOVA was conducted first to check for the effect of the virtual trauma film using the time during the film as an independent variable and physiological responses as the dependent variables. Simple contrasts were done to compare the physiological parameters at minute 1 of the film to the rest of the minutes to check for significant changes. To check that the ostracism task was effective in increasing rejection or acceptance respectively, one-way ANOVAs analyses of subjective reports of feeling ignored, rejected, included, and being part of a group, and the perceived numbers of likes and dislikes were used as dependent variables, in separate ANOVAs, and the experimental conditions were the independent variable.

To test for Hypothesis 1, a correlational analysis between rejection sensitivity and the heartrate, HRV, and skin conductance during the virtual reality film was completed. Mixed ANOVA analysis with time (each minute during the modified ostracism task) as the within subjects factor and experimental conditions (rejected, neutral, accepted) as the between subjects factor was completed for hypotheses 2 for each physiological parameter (heartrate, skin conductance, HRV). Due to violation of sphericity, Greenhouse-Geiser test was used to report the statistics for this hypothesis. For Hypotheses 3 and 4, multiple regression analyses were used to investigate the effect of the rejection manipulations on mood (Hypothesis 3) and number of intrusions (Hypothesis 4). To do this, a dummy coded variable for rejected, neutral, and accepted conditions was created, and a centred mean for rejection sensitivity was calculated. The interaction term for rejection sensitivity and each condition was created by multiplying the variables together. Rejection sensitivity and its interaction terms with each condition were then entered to investigate the moderation effect of rejection sensitivity (Stone-Romero & Anderson, 1994).

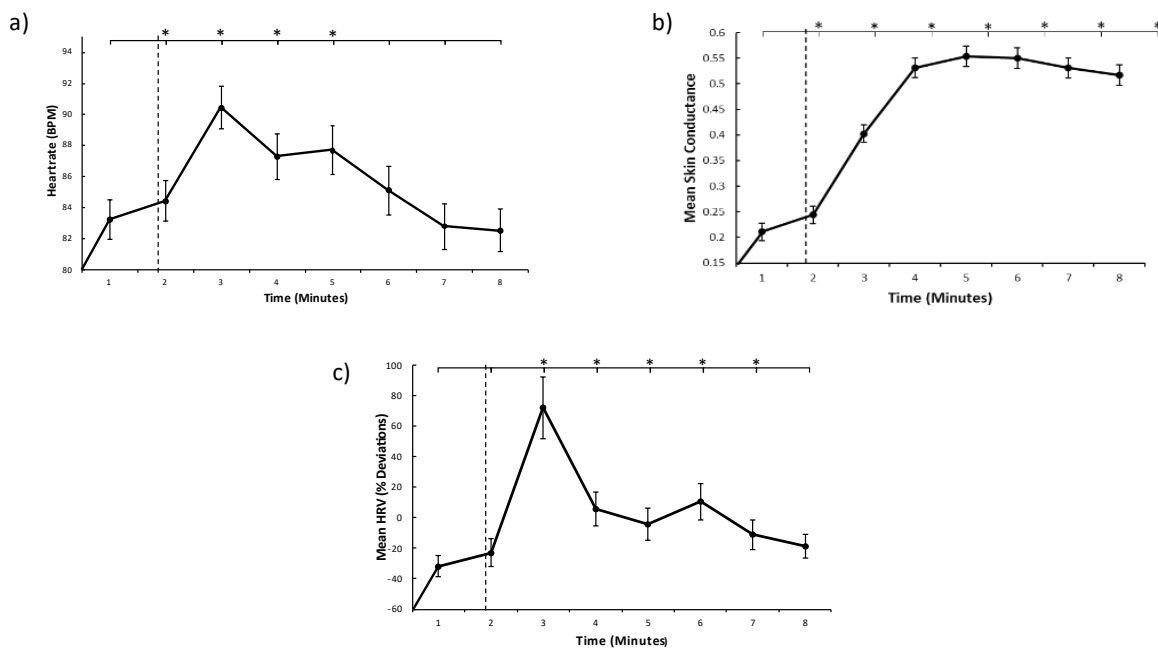
Results

4.4.1: Physiological Arousal and Parasympathetic Activity During the VR Trauma Paradigm – Manipulation Check

In order to examine whether the VR trauma elicited a physiological stress response and reduced parasympathetic activation, main effects of time for all physiological parameters were determined. Figure 4.5 shows the response curves where the asterisks indicated the significant differences simple contrast with minute 1.

Figure 4.5

Changes in physiological responses across 8-minutes during the trauma film. a) heartrate, b) skin conductance, c) percentage deviation of heartrate variability. The dotted lines indicate onset of the virtual accident. () indicates significant differences.*



Physiological Arousal (Heartrate)

A mean heartrate plot for each minute from a minute before the film started to minute 8 is shown in Figure 4.5a. Figure 4.5a shows that the heartrate increased and spiked during the accident. The heartrate then restored to the baseline slowly each minute after the accident. A repeated measures ANOVA revealed a significant difference in heartrate between times during the virtual reality film and the baseline, $F(4.32, 436.75) = 24.22$, $p < .001$, $\eta_p^2 = 0.19$.

Physiological Arousal (Skin Conductance)

A within-subjects ANOVA revealed a significant difference in the skin conductance responses across the 8 timepoints during the film, $F(2.02, 204.18) = 85.85$, $p < .001$, $\eta_p^2 = 0.46$. Skin conductance

gradually increased and then spiked around the accident, and then remained stable afterwards. The graph summary of this trend is shown in Figure 4.5b.

Heartrate Variability

A similar pattern to heartrate arousal was found for heartrate variability, which is shown in Figure 4.5c. There was a significant main effect of time in percentage deviation in HRV, $F(2.28, 230.25) = 11.45, p < .001, \eta_p^2 = 0.10$.

4.4.2: Physiological Response During Trauma (Hypothesis 1)

To test for Hypothesis 1 which stated that rejection sensitivity would predict higher physiological response during trauma, a zero-order correlation was done first to check for the relationship between rejection sensitivity and all physiological responses during the virtual accident. However, there were no significant relationships between rejection sensitivity and any of the physiological responses (see Table 4.1), therefore regression analyses were not completed for this hypothesis.

Table 4.1

Pearson's Correlations between Rejection Sensitivity and Physiological Responses During the Film

	Minutes	<i>r</i>
HR	1	.045
	2	.026
	3	.099
	4	.112
	5	.051
	6	-.019
	7	.057
	8	.065

HRV	1	.069
	2	.060
	3	-.006
	4	.004
	5	.025
	6	.010
	7	-.201
	8	.075
SCL	1	.052
	2	.023
	3	.067
	4	.176
	5	.148
	6	.092
	7	.098
	8	.100

4.4.3: Physiological Responses to the Modified Ostracism Task (Hypothesis 2a-c)

Hypotheses 2a-c investigated whether those in the rejected condition would have increased physiological stress responses and reduced parasympathetic activation compared to those in the accepted and neutral conditions following virtual trauma. Figure 4.6 shows the changes in the physiological responses during the modified ostracism task for each condition.

Effects of the Modified Ostracism Task Conditions on the Experience of Rejection, Acceptance, and Perceived Likes and Dislikes - Manipulation Check

The effect of the modified ostracism task on subjective reports of feeling ignored, rejected, included, and being part of a group, and the perceived numbers of likes and dislikes was analysed to check that the manipulation had been successful.

One-way ANOVAs revealed that there were no significant group effects in the feeling of being ignored, $F(2, 107) = 2.74, p = .07, \eta_p^2 = 0.05$, being part of the group, $F(2, 107) = 2.11, p = .13, \eta_p^2 = 0.04$, or being included, $F(2, 107) = 1.64, p = .20, \eta_p^2 = 0.03$. However, there was a significant group effect in feeling rejected following the ostracism task, *Welch's* $F(2, 64.51) = 6.20, p = .003, \eta_p^2 = 0.12$. Bonferroni-corrected post hoc tests revealed that participants felt more rejected in the rejected condition than in the accepted conditions ($M = 14.39, MSE = 5.16, p = .02$), and in the neutral condition ($M = 19.50, MSE = 5.26, p < .001$). This indicates that the task was effective for inducing higher rejection in those in the rejection condition but surprisingly it appeared not to show higher acceptance in those who were in the acceptance condition.

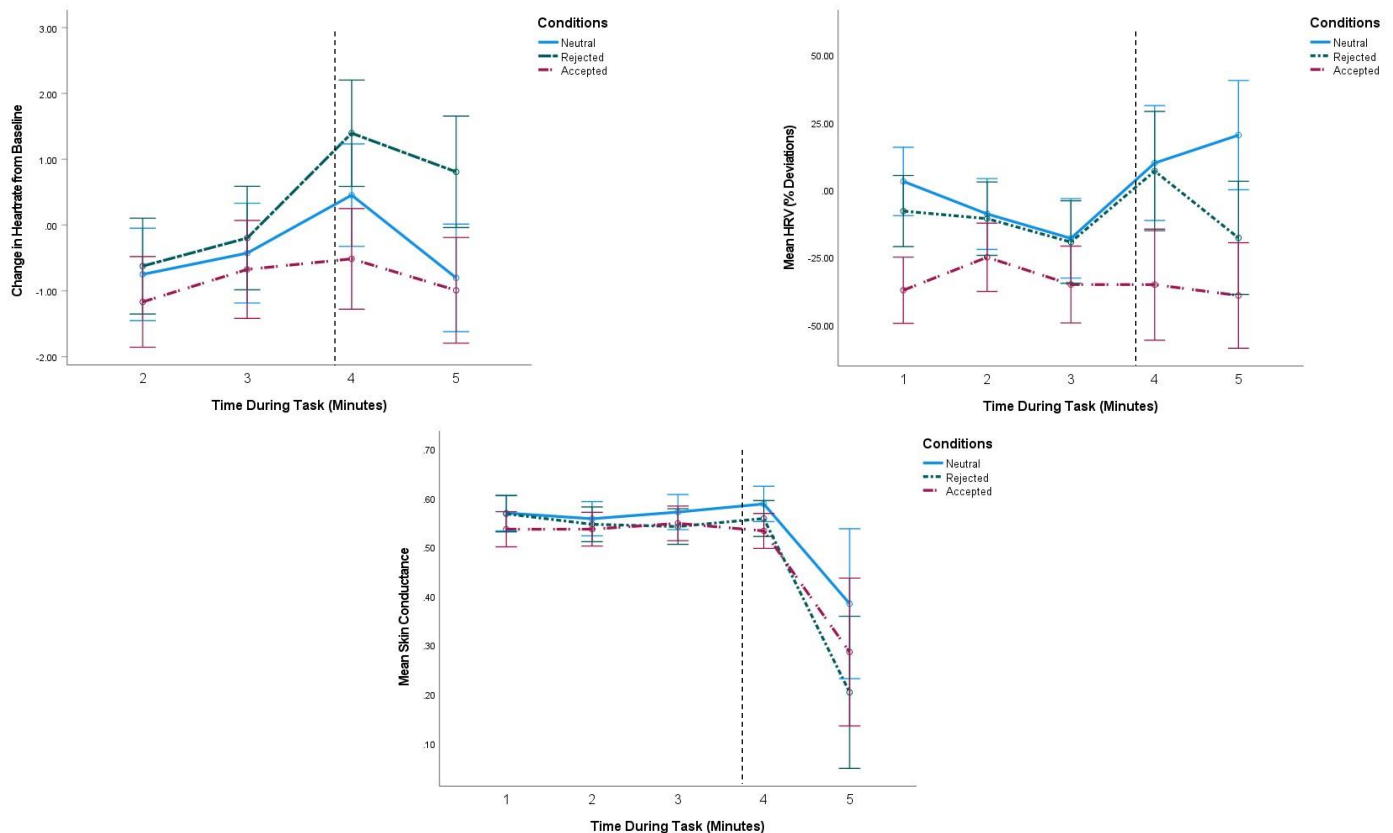
For the perceived numbers of likes the participants received, one-way ANOVAs revealed no significant group effect, *Welch's* $F(2, 70.65) = 2.12, p = .13, \eta_p^2 = 0.04$. However, there was a significant group effect for the perceived number of dislikes received, *Welch's* $F(2, 67.39) = 9.02, p < .001, \eta_p^2 = 0.18$. Bonferroni-corrected post hoc analyses revealed that individuals in the rejected conditions perceived more dislikes compared to the accepted ($M = .61, MSE = .18, p = .002$), and neutral condition ($M = .84, MSE = .18, p < .001$).

Heartrate Response to the Modified Ostracism Task (Hypothesis 2a)

A mixed ANOVA for the change in heartrate during modified ostracism task revealed only a significant main effect of time, $F(2.22, 177.30) = 3.75, p = .02, \eta_p^2 = 0.05$, but there was no main effect of condition, $F(2, 80) = 0.84, p = .44, \eta_p^2 = 0.02$, and no interaction between time and condition, $F(4.43, 253.55) = .85, p = .51, \eta_p^2 = 0.02$. The within-subjects contrast showed a significant quadratic trend across time, $F(1, 80) = 7.57, p = .007, \eta_p^2 = 0.09$. The plot for this trend is shown in Figure 4.6a, which indicated no differences between conditions, and therefore did not support the hypothesis.

Figure 4.6

Physiological changes during ostracism task between the three conditions. a) change in heartrate, b) skin conductance, c) percentage deviation in heartrate variability. The dotted lines indicate an approximate start of the condition manipulation



Skin Conductance Response to the Modified Ostracism Task (Hypothesis 2b)

A similar response was found for the skin conductance during the task period (see Figure 4.6b), where there was a significant main effect of time, $F(1.04, 133.22) = 8.59, p = .004, \eta_p^2 = 0.12$, but no condition effect, $F(2.09, 103.22) = .29, p = .76, \eta_p^2 = 0.01$, and no significant interaction, $F(2.09, 103.22) = 0.29, p = .76, \eta_p^2 = 0.01$. This again did not support the hypothesis as there were no significant differences between conditions.

Heartrate Variability Response to the Modified Ostracism Task (Hypothesis 2c)

There was no significant main effect of time for HRV, $F(3.13, 253.55) = .67, p = .65, \eta_p^2 = 0.03$, and also no significant interaction, $F(4.6.26, 253.55) = .55, p = .78, \eta_p^2 = 0.03$. However, the between-subjects effect was significant, $F(2, 81) = 3.32, p = .04, \eta_p^2 = 0.08$. Bonferroni-corrected post hoc tests revealed that there were significantly lower HRV responses in the accepted as compared to the neutral condition (see Figure 4.6c) with a mean difference of -35.57 ($MSE = 14.17, p = .04$). HRV response of those in the rejected condition was neither significantly different from neutral ($M = -11.02, MSE = 14.69, p = .73$) nor accepted conditions ($M = 24.55, MSE = 14.45, p = .21$) thus not supporting Hypothesis 2c.

4.4.4: Emotional Responses to Virtual Trauma and Subsequent Rejection Conditions (Hypothesis 3)

Hypothesis 3 investigated whether being rejected right after virtual trauma would increase negative affect and reduce positive affect (Hypothesis 3a), and whether rejection sensitivity interacted with being rejected to explain the observed change in mood (Hypothesis 3b).

Table 4.2 shows the results of multiple linear regressions with post mood states as the outcome variables and conditions, pre mood states and rejection sensitivity as predictors, including interaction terms added in step 2.

Table 4.2

Summary of moderation analyses for moods following modified ostracism task

Mood	Step	$\Delta F (p)$	ΔR^2		b	SE b	β	p
Happy	1	13.379 ($< .001$)	.338	Constant	8.643	9.659		.373
				Rejected	-3.616	2.289	-.147	.117
				Accepted	-3.274	2.207	-.137	.141
				Pre Happy	.692	.105	.539	$< .001$
				RSQ	-.522	.397	-.108	.191
	2	1.316 (.27)	.017	Constant	14.168	10.229		.169

			Rejected	-3.550	2.295	-.145	.125
			Accepted	-3.512	2.208	-.147	.115
			Pre Happy	.692	.105	.539	<.001
			RSQ	-1.004	.495	-.208	.045
			Rejected x RSQ	-.800	.505	-.165	.116
			Accepted x RSQ	-.479	.448	-.099	.288
1	13.379	.338	Constant	11.917	9.496		.212
							(< .001)
			Rejected	-.342	2.225	-.014	.878
			Neutral	3.274	2.207	.134	.141
			Pre Happy	.692	.105	.539	<.001
			RSQ	-.522	.397	-.108	.191
2	1.316	.017	Constant	12.474	10.328		.230
							(.273)
			Rejected	-.038	2.231	-.002	.987
			Neutral	3.512	2.208	.144	.115
			Pre Happy	.692	.105	.539	<.001
			RSQ	-.525	.517	-.109	.312
			Rejected x RSQ	-.321	.487	-.066	.511
			Neutral x RSQ	.479	.448	.099	.288
1	13.379	.338	Constant	12.260	9.312		.191
							(< .001)
			Accepted	.342	2.225	.014	.878
			Neutral	3.616	2.289	.149	.117
			Pre Happy	.692	.105	.539	<.001
			RSQ	-.522	.397	-.108	.191
2	1.316	.017	Constant	9.024	9.535		.346
							(.273)
			Accepted	.038	2.231	.002	.987
			Neutral	3.550	2.295	.146	.125
			Pre Happy	.692	.105	.539	<.001

				RSQ	-.204	.456	-.042	.656
				Accepted x RSQ	.321	.487	.066	.511
				Neutral x RSQ	.800	.505	.165	.116
Anxious	1	14.155	.350	Constant	9.081	4.333		.039
			(< .001)					
				Rejected	-3.535	1.991	-.163	.079
				Accepted	1.887	1.925	.089	.329
				Pre Anxious	.469	.073	.517	<.001
				RSQ	.393	.348	.092	.260
	2	1.900	.023	Constant	7.645	5.295		.152
			(.155)					
				Rejected	-3.889	1.982	-.180	.052
				Accepted	1.783	1.915	.085	.354
				Pre Anxious	.492	.074	.542	<.001
				RSQ	.441	.426	.103	.303
				Rejected x RSQ	.333	.444	.078	.455
				Accepted x RSQ	-.478	.390	-.112	.223
	1	14.155	.350	Constant	7.194	4.290		.097
			(< .001)					
				Rejected	-5.422	1.945	-.250	.006
				Neutral	-1.887	1.925	-.088	.329
				Pre Anxious	.469	.073	.517	<.001
				RSQ	.393	.348	.092	.260
	2	1.900	.023	Constant	.664	5.416		.903
			(.155)					
				Rejected	-5.672	1.938	-.262	.004
				Neutral	-1.783	1.915	-.083	.354
				Pre Anxious	.492	.074	.542	<.001
				RSQ	.919	.441	.216	.040
				Rejected x RSQ	.811	.429	.189	.062
				Neutral x RSQ	.478	.390	.112	.223

	1	14.155	.350	Constant	12.616	4.160		.003
		(< .001)						
				Accepted	5.422	1.945	.257	.006
				Neutral	3.535	1.991	.164	.079
				Pre Anxious	.469	.073	.517	<.001
				RSQ	.393	.348	.092	.260
	2	1.900	.023	Constant	15.152	4.558		.001
		(.155)						
				Accepted	5.672	1.938	.269	.004
				Neutral	3.889	1.982	.181	.052
				Pre Anxious	.492	.074	.542	<.001
				RSQ	.108	.407	.025	.791
				Accepted x RSQ	-.811	.429	-.190	.062
				Neutral x RSQ	-.333	.444	-.078	.455
Depressed	1	96.386	.786	Constant	-.055	1.278		.966
		(< .001)						
				Rejected	-.453	.605	-.040	.456
				Accepted	.529	.583	.048	.366
				Pre Depressed	.610	.033	.866	<.001
				RSQ	.141	.104	.063	.179
	2	.213 (.808)	.001	Constant	-.372	1.574		.814
				Rejected	-.427	.612	-.038	.487
				Accepted	.555	.589	.050	.348
				Pre Depressed	.609	.033	.865	<.001
				RSQ	.172	.131	.077	.193
				Rejected x RSQ	.032	.135	.014	.814
				Accepted x RSQ	.077	.119	.034	.519
	1	96.386	.786	Constant	-.584	1.263		.645
		(< .001)						
				Rejected	-.982	.586	-.086	.097
				Neutral	-.529	.583	-.047	.366

				Pre Depressed	.610	.033	.866	<.001
				RSQ	.141	.104	.063	.179
2	.213 (.808)	.001		Constant	-.087	1.605		.957
				Rejected	-.982	.594	-.086	.101
				Neutral	-.555	.589	-.049	.348
				Pre Depressed	.609	.033	.865	<.001
				RSQ	.095	.135	.042	.487
				Rejected x RSQ	-.045	.130	-.020	.727
				Neutral x RSQ	-.077	.119	-.034	.519
1	96.386	.786		Constant	.398	1.218		.744
								(< .001)
				Accepted	.982	.586	.089	.097
				Neutral	.453	.605	.040	.456
				Pre Depressed	.610	.033	.866	<.001
				RSQ	.141	.104	.063	.179
2	.213 (.808)	.001		Constant	.400	1.382		.773
				Accepted	.982	.594	.089	.101
				Neutral	.427	.612	.038	.487
				Pre Depressed	.609	.033	.865	<.001
				RSQ	.140	.123	.063	.256
				Accepted x RSQ	.045	.130	.020	.727
				Neutral x RSQ	-.032	.135	-.014	.814
Angry	1	4.609	.149	Constant	3.561	2.187		.106
								(.002)
				Rejected	.752	1.026	.077	.465
				Accepted	.580	.991	.061	.560
				Pre Angry	.466	.113	.379	<.001
				RSQ	-.042	.176	-.022	.812
2	2.545	.040		Constant	2.430	2.635		.359
								(.083)
				Rejected	.493	1.018	.051	.629

			Accepted	.535	.980	.056	.586
			Pre Angry	.511	.113	.416	<.001
			RSQ	.025	.218	.013	.911
			Rejected x RSQ	.252	.225	.131	.265
			Accepted x RSQ	-.240	.201	-.125	.235
1	4.609	.149	Constant	2.982	2.162		.171
	(.002)						
			Rejected	.172	1.004	.018	.864
			Neutral	-.580	.991	-.060	.560
			Pre Angry	.466	.113	.379	<.001
			RSQ	-.042	.176	-.022	.812
2	2.545	.040	Constant	-.717	2.711		.792
	(.083)						
			Rejected	-.042	.996	-.004	.966
			Neutral	-.535	.980	-.055	.586
			Pre Angry	.511	.113	.416	<.001
			RSQ	.265	.225	.138	.241
			Rejected x RSQ	.493	.220	.255	.027
			Neutral x RSQ	.240	.201	.125	.235
1	4.609	.149	Constant	2.810	2.080		.180
	(.002)						
			Accepted	-.172	1.004	-.018	.864
			Neutral	-.752	1.026	-.078	.465
			Pre Angry	.466	.113	.379	<.001
			RSQ	-.042	.176	-.022	.812
2	2.545	.040	Constant	4.679	2.312		.046
	(.083)						
			Accepted	.042	.996	.004	.966
			Neutral	-.493	1.018	-.051	.629
			Pre Angry	.511	.113	.416	<.001
			RSQ	-.228	.203	-.119	.266

				Accepted x RSQ	-.493	.220	-.257	.027
				Neutral x RSQ	-.252	.225	-.131	.265
Stressed	1	12.160	.317	Constant	10.277	4.110		.014
			(< .001)					
				Rejected	-3.307	1.891	-.165	.083
				Accepted	1.473	1.831	.075	.423
				Pre Stressed	.333	.336	.084	.323
				RSQ	.397	.068	.494	<.001
	2	1.984	.025	Constant	12.027	5.007		.018
			(.143)					
				Rejected	-3.609	1.882	-.180	.058
				Accepted	1.258	1.820	.064	.491
				Pre Stressed	.128	.408	.032	.755
				RSQ	.408	.068	.508	<.001
				Rejected x RSQ	-.123	.420	-.031	.771
				Accepted x RSQ	-.692	.370	-.175	.064
	1	12.160	.317	Constant	8.804	4.082		.033
			(< .001)					
				Rejected	-4.780	1.846	-.238	.011
				Neutral	-1.473	1.831	-.074	.423
				Pre Stressed	.333	.336	.084	.323
				RSQ	.397	.068	.494	<.001
	2	1.984	.025	Constant	3.242	5.137		.529
			(.143)					
				Rejected	-4.866	1.839	-.243	.009
				Neutral	-1.258	1.820	-.063	.491
				Pre Stressed	.820	.422	.208	.054
				RSQ	.408	.068	.508	<.001
				Rejected x RSQ	.570	.406	.144	.164
				Neutral x RSQ	.692	.370	.175	.064

1	12.160	.317	Constant	13.584	3.945		<.001
	(< .001)						
			Accepted	4.780	1.846	.245	.011
			Neutral	3.307	1.891	.166	.083
			Pre Stressed	.333	.336	.084	.323
			RSQ	.397	.068	.494	<.001
2	1.984	.025	Constant	14.303	4.328		.001
	(.143)						
			Accepted	4.866	1.839	.249	.009
			Neutral	3.609	1.882	.181	.058
			Pre Stressed	.250	.392	.063	.524
			RSQ	.408	.068	.508	<.001
			Accepted x RSQ	-.570	.406	-.144	.164
			Neutral x RSQ	.123	.420	.031	.771

4.4.5: Diary Task Analyses

46 participants reported at least one intrusion over the seven days. The mean total number of intrusions reported in the after virtual trauma was 2.54 (2.91). Individuals in the rejected condition reported overall 2.36 (2.34) intrusions, those in the accepted condition reported 2.54 (2.93) and those in the neutral condition reported 2.74 (3.54).

Intrusions (Hypothesis 4)

Hypothesis 4 investigated the effect of rejection on the number of virtual trauma related intrusions over 7 days after the experiment. The total number of intrusions was not correlated with other variables, except percentage deviation HRV during the third minute of the task ($r(58) = -.27$, $p = .04$) and the skin conductance at minute two of the film ($r(58) = .40$, $p = .002$).

Multiple linear regression analyses revealed that the between groups conditions did not make a significant contribution to the number of intrusions following the experiment, as well as

there being no moderation effect of rejection sensitivity. The summary of the analysis is shown in

Table 4.3.

Table 4.3

Summary of moderation analyses for number of intrusions throughout the 7 days

	Step	$\Delta F (p)$	ΔR^2		b	SE b	β	p
Number of Intrusions	1	1.99 (.896)	.010	Constant	1.856	1.004		.069
				Rejected	-.247	.473	-.081	.603
				Accepted	-.122	.456	-.041	.790
				RSQ	.053	.080	.086	.511
	2	.142 (.868)	.005	Constant	1.776	1.218		.150
				Rejected	-.282	.485	-.093	.563
				Accepted	-.134	.470	-.045	.777
				RSQ	.057	.100	.092	.570
				Rejected x RSQ	.025	.104	.039	.814
				Accepted x RSQ	-.028	.097	-.046	.773
1	1	1.99 (.896)	.010	Constant	1.978	.983		.049
				Rejected	-.125	.440	-.041	.777
				Neutral	.122	.456	.039	.790
				RSQ	.053	.080	.086	.511
	2	.142 (.868)	.005	Constant	1.604	1.230		.197
				Rejected	-.149	.451	-.049	.743
				Neutral	.134	.470	.042	.777
				RSQ	.085	.104	.138	.418
				Rejected x RSQ	.053	.100	.084	.599
				Neutral x RSQ	.028	.097	.045	.773

1	1.99	.010	Constant	2.103	.931		.027
	(.896)						
			Accepted	.125	.440	.042	.777
			Neutral	.247	.473	.078	.603
			RSQ	.053	.080	.086	.511
2	.142	.005	Constant	2.325	1.084		.036
	(.868)						
			Accepted	.149	.451	.050	.743
			Neutral	.282	.485	.089	.563
			RSQ	.032	.097	.052	.741
			Accepted x RSQ	-.053	.100	-.085	.599
			Neutral x RSQ	-.025	.104	-.039	.814

Discussion

The study was set out to extend our understanding of how the experience of social rejection and individual differences in rejection sensitivity are associated with recovery from a laboratory-induced virtual trauma experience. The study revealed first that although the new virtual reality trauma scenario induced physiological stress responses as indicated by increased SCL and heartrates, rejection sensitivity was not associated with these physiological responses. Second, even though the novel ostracism task increased subjective feelings of rejection, there was no effect of experimentally-induced rejection on physiological responses. The expected effects of feeling more anxious and distressed after being socially rejected was also not confirmed. Interestingly, rather than interacting with the social interaction condition, high rejection sensitivity made an independent contribution to high post-ostracism task stress. Finally, neither social rejection nor rejection sensitivity were associated with number of intrusions throughout the week after the experiment.

4.5.1: Rejection sensitivity and the response to VR trauma

The absence of an association between rejection sensitivity and physiological responses to the virtual reality trauma was surprising given that previous research suggested that higher levels of general emotional dysregulation in those with higher rejection sensitivity would produce higher general levels of stress (Tull et al., 2018). It had been suggested that through individuals' constant hypervigilance and physiological arousal to rejection threat physiological responses to traumatic events could be higher than in those with low level of rejection sensitivity (Bernstein et al., 2003; Thayer & Lane, 2000). There are several possible explanations why no correlations between rejection sensitivity and variations in physiological responses during the trauma film were found. One possibility is that the study participants were a non-clinical sample that reported relatively low levels of rejection sensitivity. Without the constant activation of fight-or-flight response associated with rejection sensitivity, the effect of altered physiological responses may not have been observed. Another possible explanation could be the ecological validity of the VR trauma scenario used in this study. One aspect concerns the trauma type. Rather than including an interpersonal trauma, the VR trauma was a traffic accident scenario for which rejection sensitivity could be less important for the peritraumatic processing. Rejection sensitivity, such as the fear of the possibility of being rejected following traumatic experiences, may only be associated with the interpersonal nature of a trauma that activates the cognitive-emotional processes. The VR trauma was chosen for practical and ethical reasons. The virtual reality films related interpersonal trauma have yet to be developed as they may generate too much stress for the participants. The chosen VR film has been used to promote safe driving in young people, and so is considered ethically appropriate for the participants.

An additional validity issue with the trauma film paradigm concerns the intensity of the trauma exposure, which for ethical reasons will not be as extreme as with real life trauma. As has been criticised in previous trauma film paradigm research (Holmes & Bourne, 2008) the VR trauma may not be effective in inducing a physiological stress response in this fairly healthy sample. However, even amongst those with low rejection sensitivity the VR trauma significantly increased the heartrate and skin conductance suggesting a temporary stress response. Interestingly, our

results of increased physiological arousal to the VR trauma contradicted the generally observed heartrate reduction following the classic trauma film paradigm (Holmes et al, 2004; Karl et al., 2021). Such a reduction in heartrate has been attributed to a freezing response by some authors but given that this paradigm is mainly applied to non-traumatised, healthy individuals, this interpretation is less likely. Instead, it can be argued that a heartrate reduction towards trauma films in a non-clinical sample signifies interest and engagement with complex visual stimuli which have been shown to elicit heartrate deceleration (Campbell et al., 1997). The advantage of the VR scenario used in this study as compared with the classic trauma-film paradigm lies in the similarity of the immersiveness and visual complexity of the baseline phase (normal driving) and trauma exposure (sudden accident in the same virtual space). In other words, in the trauma film paradigm, the onset of the trauma exposure is accompanied also by an increase in stimulus complexity whereas by experiencing first neutral driving then the accident in the same VR space, the possible confounding role of stimulus complexity is better controlled.

4.5.2: The role of social rejection for recovery from the VR trauma

Previously, there were no studies that investigated the effect of experiencing social rejection immediately following VR-trauma. A meta-analysis on the experimental effect of rejection have shown that being rejected alone can still produce stress responses (Gerber & Wheeler, 2009). Yet, the finding from this study that rejection neither increased physiological arousal nor state anxiety and stress was unexpected and is in contrast with previous research. There are several explanations why the findings of this study differed from these previous studies (Gerber & Wheeler, 2009; Kelly et al., 2012). First, it is possible that being rejected in an anonymised online task immediately after a vivid, immersive VR stressor may not be enough to induce an additional fight-or-flight response. Second, and related to the first point, in previous studies (Gerber & Wheeler, 2009) real-life confederates to induce rejection were used; thus, the absence of a confederate, or the use of 'virtual strangers' in the modified ostracism task, could have contributed to the lack of physiological arousal

by reducing the task adversity or credibility. Furthermore, credibility could also have been reduced by amending an existing social ostracism task. This task was originally designed to study social exclusion by manipulating participants number of likes in proportion to the number of likes other people in the session received, e.g. those in exclusion condition would receive low number of likes while the others received a lot of likes (Wolf et al., 2015). Given the theorised conceptual difference between social exclusion and rejection (Lutz & Schneider, 2021), this study attempted to add an ecologically valid rejection element (dislikes) that allows an investigation of real-life rejection through a social media platform, which is a common channel for social interaction in the present days. Moreover, participants could have realised that the 'likes' and 'dislikes' they received were manipulated as the task was done on a computer in the lab. Yet, to make sure that the task seemed realistic, the numbers of 'likes' and 'dislikes' were adjusted to make sure that none of the participants received either only likes or dislikes.

In addition to an absence of the expected effect for social rejection, there was also not the expected beneficial effect of participants who were in the acceptance condition. Surprisingly, the accepted condition contributed to more stress and anxiety than the neutral condition even though individuals in the accepted condition received seven likes and those in the neutral condition only two. However, those in the accepted condition also received two dislikes whereas in the neutral condition no dislikes were given. It is therefore possible that the neutral condition was perceived as being 'accepted'. The reasons for these numbers was to keep the neutral condition at low likes and dislikes to ensure the condition was credible and to reflect real-life online behaviours (Duradoni et al., 2021; Eftekhar et al., 2014). An alternative explanation could be that those in accepted condition may not have expected to receive a dislike, which led them to become focused on the negative feedback they received and ignore the positive likes. It is possible that one negative comment amongst many positive could have exaggerated negative state affects in individuals (Abado et al., 2020; Veerapa et al., 2020).

One of the most unexpected findings from this study was that those in rejected condition showed a significantly less subjective stress and anxiety compared to those in neutral condition. This is counterintuitive as individuals in the rejection condition received 7 dislikes and only 2 likes, which clearly indicated rejection compared to 0 dislike and 2 likes in the neutral conditions. Moreover, the manipulation check revealed that the task did induce the highest subjective feeling of being rejected in the rejection condition. An explanation could again be the credibility of the condition; those who received overwhelming numbers of rejection could have realised that these numbers were manipulated as it did not make sense why strangers would give them so many 'dislikes' in the first place. On the other hand, the neutral condition could have appeared to be less obviously manipulated as it could have reflected a more realistic real-life online behaviour of giving 'likes' to strangers.

Moreover, rejection sensitivity had no effect on mood or emotion regulation as indicated by no change in HRV following rejection. Such findings contradict previous research (Di Simplicio et al., 2012; Gyurak & Ayduk, 2008) that expect those with high rejection sensitivity to have low heartrate variability due to lack of emotion control. The lack of effect of rejection sensitivity also goes against what was predicted from Ehlers and Clark's (2000) model which expected those with high rejection sensitivity to be more attentive the likes and dislikes, which then amplified negative affects following rejection.

The final finding showed that the rejection following virtual trauma did not have an effect on the number of intrusions during the recovery. In line with Ehlers and Clark's (2000) model, it was proposed that individual differences, such as rejection sensitivity, that influence the appraisal of trauma could lead to the maintenance of PTSD symptoms including intrusions. The limited numbers of participants with high rejection sensitivity could explain why there were no observed effects on the number of intrusions following the experiment. Further, because the social manipulation failed to produce variation in physiological responses, this could explain why those in the rejected

condition did not show increased intrusions as predicted. The reason for this is that without a strong physiological response or matching triggers, there was no activation of arousal that could lead to the activation of intrusion and the reexperiencing of trauma as suggested by previous studies (Nixon & Bryant, 2005; Wald & Taylor, 2008).

4.5.3: Strengths and Limitations

The present study does have a number of limitations. The power calculation was made for the main effect not for the interaction effect. The sample required for the interaction effect to be observed will be higher than the sample size of this study. The most notable limitation was that the sample did not represent the clinical samples, or those with high rejection sensitivity. This is because the participants were screened out if they had experienced a previous traumatic event, or reported a high level of depression, which are common in those with high rejection sensitivity. These participants were excluded for ethical requirements due to the stressful nature of the trauma film, which could potentially induce negative mood and distress in vulnerable participants. Another limitation was that other variables, which could have confounded the findings, were not measured in this study. Individual differences such as gaming experiences and social media usage could have contributed to the lack of differences in physiological responses between the three conditions by desensitising physiological responses to familiar stimuli. Moreover, participants were not assessed on whether or not they believed that they were being evaluated by real people during the ostracism task, which could affect their reaction to being rejected or accepted. However, the manipulation checks on subjective feelings of rejection and the perception of the number of likes and dislikes received were measured and showed significant differences between conditions. Lastly, the task used computerised 'strangers' rather than people closely related to participants. This again could affect how participants reacted to being rejected as the evaluations by strangers may not be enough to induce a strong reaction. Yet, the ostracism task was made to reflect online social media that allows opinions of strangers to be received.

The strengths of this study come from the use of virtual reality which increased the immersiveness of the trauma film paradigm (Cuperus et al., 2017). The film introduced a safe virtual environment of traumatic experience which provided subjective feelings of realism and vividness to the participants. While subjective reports of startled responses and unpredictability of the film were low, the physiological stress responses suggested that the film was able to induce arousal during virtual accident. Moreover, the virtual reality environment provided a good insight into the physiological responses to experimentally induced trauma without being interfered by novel stimuli which elicits an orienting response often accompanied by heartrate deceleration (Sokolov, 1960). This means that the increased physiological arousal observed during the film accident may reflect the response to a real-life accident compared to the classic trauma film paradigm which includes a resting baseline followed by a sequence of complex videos where a decrease physiological response was observed due to the introduction of a novel stimuli (Holms et al., 2004).

Another strength of this study is the use of the adapted ecologically valid ostracism task. The addition of the 'dislike' option in this study provided a subjective feeling of being rejected, shown in the manipulation check, rather than the feeling of being 'ignored', which induced different responses where rejection produced more negative effect on individual's need for belonging and elicit social withdrawal (Lutz & Schneider, 2021). Such a method can be a powerful tool that can be used to investigate the effect of negative online criticism and not just passive lack of inclusion. The ostracism task might be novel to the participants, but the use of 'like' button was similar to mainstream social media such as Twitter, Facebook, and Instagram. While mainstream social media does not usually offer a 'dislike' button, except for YouTube, similar negative responses can be found on social media such as 'angry react' on Facebook, and 'Down vote' button on Reddit. The addition of a negative response helps provide a more accurate representation of social media.

4.5.4: Conclusions and Future Directions

To validate the findings of this study there are some improvements that can be applied to the task. To account for confounding variables, future studies should aim to measure individual differences factors that could potentially affect the results. The ostracism task can also be improved further by adapting the mainstream social media interfaces such as manipulating likes and dislike through the use of mainstream social media. This will further increase the ecological validity of the task and add a sense of reality to the task. In order to understand rejection sensitivity further, clinical populations with high rejection sensitivity should be included in future studies. While the risk of stress might be high, using a clinical sample would widen the understanding of how rejection sensitivity associates with physiological response during trauma as well as the aftermath. Other measures can be implemented to further the understanding of the role of rejection sensitivity during trauma. This includes a measure of emotion regulation, which is thought to be associated with heartrate variability during trauma. Moreover, a qualitative assessment can be a powerful tool to help understand observed physiological responses during and after the virtual film. One participant mentioned feeling ignored by the paramedics at the end of the film while they waited for the paramedics to treat other people. A qualitative assessment of such comments would give insights into the how rejection sensitivity acts on the appraisal and attention in virtual trauma, which then affects post-traumatic stress and physiological responses.

The hypotheses may not have been supported by the findings; however, the study still showed the effectiveness of using virtual reality to induce physiological arousal. Such findings could be a building block for the use of the virtual trauma film paradigm to study the effect of trauma in an experimentally controlled setting. Moreover, the adaptive ostracism task can be used to study the effect of negative online social interactions and online rejection. The task offers insights beyond social exclusion as well as an easy, cost-effective way of inducing rejection without the need for real-life confederates. Above all, the film and the task can be used in experimental settings to expand our knowledge of the relating field, such as online social rejection and peritraumatic experiences.

Chapter 5:

Declaration Concerned the Article Entitled	
The Effect of Rejection Sensitivity on Physiological Responses After Lab-Induced Rejection	
Publication Status	Draft for Publication
References	N/A
Copyright Status	I hold the copyright for this material.
Author's Contribution	<p>The formulation and data collection of the research ideas for the current paper was undertaken by the original researchers (Carlyle et al., 2021), with author's addition of a few measures.</p> <p>The analysis and interpretation of the data were conducted by the author under supervision of supervisors.</p> <p>The paper was predominantly written by the author with some collaborative contribution from the original researchers.</p>
Author's Statement	This paper reports on the data collected for another study.

Increased Rejection Sensitivity Following Childhood Emotional Neglect Increases Subjective Wanting for Opioids.

Sila Jittayuthd¹, Molly Carlyle^{1,2,3}, Celia J. A. Morgan^{1,2}, and Anke Karl¹

¹Mood Disorder Centre, College of Life and Environmental Sciences, University of Exeter, Exeter, UK

²Psychopharmacology and Addiction Research Centre, University of Exeter, Exeter, UK

³Lives Lived Well research group, School of Psychology, Faculty of Health and Behavioural Sciences,
University of Queensland, Brisbane, Australia

Abstract

Rejection sensitivity, the predisposition to readily perceive and react strongly to rejection, is hypothesised to be a result of early parental rejection and has previously been associated with childhood trauma and psychological maladjustments. Early trauma could lead to poor emotional regulation, as observed in individuals with high rejection sensitivity, making them more vulnerable to mental health problems and for engaging in maladaptive coping strategies such as substance abuse. However, research into the role of rejection sensitivity in explaining mental health and substance use is still limited. This study aimed to investigate the relationship between rejection sensitivity, childhood traumas, mental health, and substance use behaviours. Using data from 52 participants obtained in a double-blind study (Carlyle et al. 2021) which administered morphine and assessed subjective feelings towards the drug, along with childhood trauma, rejection sensitivity, and mental health, we tested whether there were associations between these variables. Childhood trauma was associated with rejection sensitivity, where emotional neglect was a significant predictor. Rejection sensitivity was also positively correlated with regular drug use and self-reported levels of depression and stress. Furthermore, rejection sensitivity mediated the relationship between childhood traumas, the desire for morphine, and levels of depression and stress. Exploratory analysis also revealed associations between rejection sensitivity, childhood traumas, loneliness, and perceived social support. The findings highlight the impact of childhood trauma on substance use and mental health, specifically through rejection sensitivity. Future interventions for substance use disorders should focus on the importance of early experiences, in particular emotional neglect and rejection sensitivity.

Keywords: Childhood Trauma, Rejection Sensitivity, Morphine, Substance Uses, Mental Health.

Rejection sensitivity is defined as a predisposition to readily expect, perceive, and overreact to social rejection (Downey & Feldman, 1996). It is theorised to develop as a consequence of adverse childhood experiences, particularly by experiences of parental rejection (Downey et al., 1997). Parental rejection is considered a form of emotional abuse, where this form of childhood trauma could be a precursor of rejection sensitivity (Rohner & Rohner, 1980). Rejection sensitivity is highly correlated with all types of childhood trauma (Erozkan, 2015). Childhood trauma, the experience of maltreatment such as abuse and neglect as a child or adolescent (Fink et al., 1995), has multiple dimensions including physical and emotional abuse or neglect or sexual abuse. Childhood traumas may also be characterised by lack of minimisation and denial, where an individual perceived their childhood traumas as unpleasant. This minimisation and denial was often elated in healthy individuals compared to those with childhood traumas or depressed individuals, where the negative experiences were minimised or ignored (Church et al., 2017).

The detrimental impact of childhood trauma on adult mental health such as depression and anxiety is well acknowledged (Schneider et al., 2020). A higher prevalence of childhood trauma is observed in patients with severe mental illness, such as depression (Álvarez et al., 2011). Such adverse early experiences have been proposed to lead to emotion dysregulation (Haselgruber et al., 2021) and interpersonal problems, such as insecure adult attachments (Browne & Winkelman, 2007). Increased rejection sensitivity as a result of childhood traumas may exacerbate these psychological difficulties by increasing fear of intimacy due to concerns over being rejected (Rohner et al., 2019; Downey et al., 1998), in addition to negatively impacting an individual's perceived social support – a factor known to protect against mental health problems (Barros, 2016; Watson & Nesdale, 2012) and stress (Jittayuthd & Karl, 2022). Rejection sensitivity is also associated with elevated levels of depression and stress (Liu et al., 2014). More specifically, affect dysregulation and rejection fears have been shown to mediate the relationship between childhood trauma and later mental illness (van Dijke et al., 2018). Greater rejection sensitivity arising from childhood traumas may thus be an important consideration for the development of mental health problems and for

engaging in maladaptive behaviours to cope. Substance abuse behaviour may be one such coping mechanism, however little research has explored links between childhood trauma, rejection sensitivity, and substance abuse.

Rejection Sensitivity and Substance Abuse

Referred to as substance use disorder in the DSM-5 (American Psychiatric Association, 2013); the term describes four behaviours related to substance use that include impaired control, social impairment, risky use, and tolerance and withdrawal of addictive substances. An estimate of one in 11 adults had taken drugs in 2020 (Office for National Statistic, 2020). Such high prevalence is concerning as substance use can easily lead to substance abuse which has many negative impacts such as cognitive impairment (Bruijnen et al., 2019), and impaired behavioural control (Smith et al., 2014). Studies review have shown that adverse childhood experiences are strongly correlated with the development of substance use disorder (LeTendre & Reed, 2017). Different types of adverse childhood experiences, such as sexual abuse, physical abuse, emotional neglect, and exposure to domestic violence are all significant predictors of substance abuse disorders (Choi et al., 2021; Fuller-Thomson et al., 2016). Family history of alcohol and drug use is also a contributing factor for the development of substance abuse disorder (Taplin et al., 2014). One theoretical explanation for the associations between childhood trauma and substance abuse suggests that increased drug use can resemble the attempt to reduce symptoms of posttraumatic stress (Ehlers & Clark, 2000); or negative affect associated with childhood trauma, and to increase positive affect (Hovdestad et al., 2011). Early life stress-related alterations of the biological stress regulation system, the hypothalamic–pituitary–adrenal axis, may help reinforce the effect of drugs and increase reinforcing effects of the substances at the biological level. For instance, early stressful experiences can alter the functioning of the mesolimbic dopamine and opioidergic pathways that are associated with behavioural and subjective response to rewards, in turn sensitising one to the rewarding effect of

drug use (Carlyle et al., 2021; Moustafa et al., 2018). Hence, childhood trauma may drive an individual to initiate and maintain drug use.

Given that rejection sensitivity is a consequence of childhood trauma, it is likely a feature of substance use disorders. Substance abuse may also be related to rejection sensitivity in the following ways. First, there may be a reduction in impulse control in those with high rejection sensitivity. Studies have shown that rejection sensitivity is associated with emotional dysregulation, such as engaging in risky behaviours in response to anticipated rejection, in order to manage and control the experience of rejection (Peters et al., 2014; Selby et al., 2010). This impulsivity could then lead an individual to initiate substance use (Kozak et al., 2019; Verdejo-García et al., 2008). Impulsivity has also been demonstrated as an important link between childhood traumas and substance use (Morris et al., 2017). Another possible explanation for substance uses among people high in rejection sensitivity is to help manage feelings of fear of being rejected itself. Those with high rejection sensitivity tend to exhibit more submissive behaviours and validation seeking from their social group (Flett et al., 2014; Pearson et al., 2011). The fear of rejection combined with assurance-seeking behaviours could predispose an individual to engage in risky behaviours, including substance use, in order to feel accepted (Wang & Pachankis, 2016; Woerner et al., 2016). Lastly, it is possible that those with high rejection sensitivity engage in substance abuse because these substances can help to reduce the emotional pain of rejection. Research has shown that emotional responses such as anger following social rejection is dampened by acute substance use in long-term opioid users (Carlyle et al., 2020; Kroll et al., 2019), via similar neural pathways responsible for alleviating physical pain (Kross et al., 2011), such as the endogenous opioid system. For this reason, an individual who experiences a heightened sense of rejection may want to use illicit drugs to cope with the pain (Palamar, 2012).

A range of opioidergic drugs activate this neurobiological system. Morphine is one such substance, which is an opioid agonist. It induces analgesia and can become highly addictive to an

individual (Pathan & Williams, 2012). Social rejection, being a form of 'emotional pain', can be soothed through the use of opioids which may also reduce the perception of social rejection as well as improving social interactions (Bershad et al., 2018; Carlyle et al., 2020; Kroll et al., 2019; Nobile et al., 2020), where those with high rejection sensitivity could be more motivated to turn to substances that help reduce the unpleasantness of social rejection (Frye et al., 2014). One study showed that a reduction of grey matter in the insular was associated with high subjective exclusion and higher rejection sensitivity, which in turn contributed to subsequent relapse in opioids addiction (Bach et al., 2019). The fear of rejection may result in loneliness, which then motivates an individual to self-medicate (Rokach & Orzeck, 2003). Taken together, the evidence from previous research suggests that substance abuse is a coping mechanism, not only for alleviating the emotional pain of rejection but also possible consequences such as loneliness or lack of social support (Yarcheski et al., 1998). However, there is still limited research that directly examines the relationship between rejection sensitivity, substance use behaviour and mental health.

Emerging evidence supports the link between childhood traumas and substance use, yet the role of rejection sensitivity in this relationship is not fully understood. Moreover, it is also unclear whether particular types of childhood traumas, whether physical, emotional, neglect, or abuse, are more important for explaining rejection sensitivity. Theories have indicated that rejection sensitivity could be related to substance use in many ways, yet no studies have directly examined the relationship between rejection sensitivity and substance use. The present study aimed to address this by evaluating relationships between rejection sensitivity, substance uses, childhood traumas and mental health. To address the current gaps in the existent literature, five hypotheses are examined: 1) individuals with childhood trauma would have higher rejection sensitivity, 2) rejection sensitivity and childhood traumas are associated with higher levels of substance use, 3) rejection sensitivity and childhood traumas are positively associated with the enjoyment of morphine, and 4) the want for morphine, 5) high rejection sensitivity is associated with poor mental health. Different types of childhood traumas were also explored alongside the composited score of childhood trauma to

explore which subtypes are significant contributors for the observed outcome. Erozkán (2015) expected that all types of childhood trauma would be associated with rejection sensitivity, however, as the rejection sensitivity predominately related to rejection, is it possible that certain childhood traumas, such as emotional neglect or abuse, would be more important factors for rejection sensitivity. Exploratory analysis was conducted to investigate how rejection sensitivity and childhood traumas were associated with loneliness and social support. Moreover, the present study also explored the effect of experimentally induced social rejection in those with high rejection sensitivity.

Methods

5.3.1: Design

This report is a secondary data analysis of a cross-over, placebo-controlled, double-blind study which has been previously published elsewhere (Carlyle et al., 2021). The study involved the administration of morphine. This report uses continuous measures of trauma type (physical abuse/neglect, emotional abuse/neglect, or sexual abuse), and rejection sensitivity. Specifically, for Hypothesis 1, the main dependent variable was rejection sensitivity and individual differences in experience of childhood trauma were the predictors.

For Hypothesis 2, correlations between self-reported regular drug use, drug experienced, rejection sensitivity, and childhood traumas were investigated. In the analysis for Hypothesis 3, rejection sensitivity and childhood traumas were the predictors and the extent of liking the experimentally-induced morphine effect was used as an outcome.

For Hypothesis 4, emotional responses to experimentally induced social exclusion and acceptance (such as negative affect, feeling excluded or accepted, anger) were the outcome variables and childhood traumas and rejection sensitivity were the predictors.

For Hypothesis 5, the correlation analyses were done between rejection sensitivity and the three mental health measures (Depression, Anxiety and Stress). Further inspection on the

contribution of rejection sensitivity on the mental health was done using mediation analysis where childhood trauma was the predictor, rejection sensitivity was the mediator, and mental health was the outcome.

5.3.2: Participants

All 52 participants of the Carlyle et al. (2021) study were included in this data analysis. This sample had been recruited as followed: In total, 280 participants were screened for the study and 52 of participants (35 females, 17 males) aged between 18-65 ($M= 30.91$, $SD= 14.89$) were included in the study. Table 5.1 shows the demographic and clinical characteristics of the sample. Details for screening and recruitment for the original study are provided in the publication and supplementary material.

Participants attended two sessions where they received a high dose of morphine (0.15mg/kg) and a low dose control (0.01mg/kg) (the full dosing procedure is available in the supplementary material). Participants received morphine through intramuscular injection to the antero-lateral thigh muscle. All participants had given written informed consent and the study protocol was approved by the ethics committee of the School of Psychology at the University of Exeter and the NHS Research Ethics Committee.

Power analysis/determination of the target sample size

The target sample was determined by Carlyle et al. (2021) and is provided in the supplementary materials. An overall sensitivity analysis for an independent t-test with an alpha level of .05 and a statistical power of 0.8 suggested that medium-to-large effects (Cohen's $d = .70$) were required to detect a significant group effect in this sample (Faul et al., 2009). Similarly, for a regression with seven predictors, an alpha level of .05 and a statistical power of 0.8, sensitivity analysis suggested that large effects ($f^2 = .30$) were required in our study to detect an overall significant model (Faul et al., 2009).

Table 5.1*The means and standard deviations for the measures used in the analyses*

	<i>M (Range)</i>	<i>SD</i>
<i>Childhood Traumas</i>		
Emotional Abuse	11.42 (5-25)	6.33
Physical Abuse	8.44 (5-22)	5.09
Sexual Abuse	7.54 (5-19)	4.82
Emotional Neglect	11.90 (5-25)	5.91
Physical Neglect	7.67 (5-21)	3.58
Minimisation/ Denial	8.63 (3-15)	4.00
Total Childhood Trauma	46.98 (25-100)	20.74
<i>Traits Self-Report</i>		
Rejection Sensitivity	9.61 (2.11-23.11)	4.51
Loneliness	44.00 (28-65)	10.61
Perceived Social Support	2.95 (0-4.50)	1.24
<i>Subjective Drugs Report</i>		
Number of Drugs Used	4.31 (1-9)	1.94
Number of Regularly Used	1.40 (0-9)	2.27
<i>Drugs</i>		
Preference of Morphine Effect	31.13 (0-97.71)	23.27
<i>Across Timepoint</i>		
Wanting more Morphine	21.06 (0-71.25)	3.37
<i>Across Timepoint</i>		
<i>Subjective Mental Health</i>		
Depression	10.00 (7-24)	0.59
Anxiety	9.18 (7-18)	0.43

Stress	10.92 (7-23)	0.61
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5.3.3: Materials

Rejection Sensitivity Questionnaire- Adult Version (RSQ-A; Berenson et al, 2009)

This questionnaire was used to assess for the level of rejection sensitivity in participants. It was adapted from the original rejection sensitivity questionnaire (Downey & Feldman, 1996). The questionnaire contained 9 scenarios related to different social situations (e.g. financial discussion with family). Participants rated their expectations and what they would do in these situations on a 7-point scale. The questionnaire is widely used to assess rejection sensitivity in adults, and it has high internal consistency (Cronbach alpha = 0.74) and test-retest reliability ($\alpha = .83$) (Berenson et al., 2011). A higher score indicates higher rejection sensitivity.

Childhood Trauma Questionnaire- Short Form (CTQ; Bernstein et al., 2003)

This was used to assess five types of childhood traumas (emotional abuse, physical abuse, sexual abuse, emotional neglect, physical neglect). This questionnaire contains 28 questions related to participants experiences when they were growing up, and these were rated on a 5-point scale (1 – Never True; 5 – Very Often True). The questionnaire also includes 3 items (“there was nothing I wanted to change about my family”, “I had the perfect childhood”, and “I had the best family in the world”) which assess minimisation/denial of the trauma experiences. The measure has high internal reliability for the total score (Cronbach alpha = 0.92) as well as significant discriminant validity (Stoltenborgh et al., 2015). The Sexual Abuse ($\alpha=.93-.95$), Emotional Neglect ($\alpha=.88-.92$), Emotional Abuse ($\alpha=.84-.89$), and Physical Abuse ($\alpha=.81-.86$) subscales also showed high internal consistency (Bernstein & Fink, 1997).

Depression, Anxiety, and Stress Scale (DASS; Lovibond & Lovibond, 1995)

This scale is widely used to assess state depression, anxiety, and stress. The measure contains 21 questions (short version) and three sub-factors of depression, anxiety, and stress over the past two weeks using a 4-point scale (0 – doesn't apply to me at all, 3 – applied to me very much/most of the time). While depression, anxiety, and stress are closely related constructs, the author of the measure confirmed that the items can be factored into each of the subscales. Thus, the measure can be separated into the three variables. The measure has high internal reliability ($\alpha=.88$ to $.90$) as well as convergent and discriminant validity (Henry & Crawford, 2005).

The UCLA Loneliness Scale (Peplau & Cutrona, 1980)

This is a questionnaire used to assess perceived feelings of loneliness and social isolation. Twenty items and were rated on a 4-point scale (1 - Never, 4 - Often). The measure has high internal consistency (Cronbach alpha =.89 to .94) and test-retest reliability ($r = .73$). It also has high convergent and construct validity (Russell, 1996).

Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet & Farley, 1988)

This was used to assess participants' perception of social support in their life. The questions were divided into three categories of social support (from friends, family, significant other). Participants rated each item on 7-points scale (1 – Very strongly disagree, 7 – Very strongly agree). The questionnaire showed high reliability on all categories (family= .90, friends= .94, significant other= .90) with high validity shown in number of studies (Zimet et al, 1990).

Self-Report Drug Experience Interview (Carlyle et al., 2021)

To assess previous drug sampled and regular drug use behaviours, participants were asked to report if they had taken each drug in the past and if they were regularly using the drugs in the past month. The drugs included were painkillers, ecstasy, alcohol, tobacco, cannabis, amphetamine, benzodiazepine, cocaine, ketamine, lysergic acid diethylamide, and heroin.

Drug Effect Questionnaire (DEQ; Morean et al., 2013)

The questionnaire used to assess subjective drug effects at different time points post drug administration (baseline, 15, 30, 45, 60, 90, 120, 150 minutes). The items include subjective feeling of the effect, liking and disliking, feeling high, and wanting more of the administered drug. These were rated on a visual analogue scale ranging from “Not at all” to “Extremely”. For this paper, we calculated mean scores across all time points (see Table 5.1).

Cyberball Task (Williams & Jarvis, 2006)

A computerised game aimed to promote the feeling of social exclusion. The objective of the game was to pass the ball to the other two players. Participants were told that they were playing against real people over a virtual network, however, the other two players were computers programmed to behave according to the conditions the participants were in. In an inclusion condition, participants received one-third of the ball toss to them, and only one-sixth in the exclusion condition. The conditions were counterbalanced, and each participant went through a block of each condition. The task lasted approximately 15 minutes.

Post-Cyberball Questionnaire (William et al., 2002).

A questionnaire given to the participants after each game of Cyberball to assess positive and negative moods, self-esteem- sense of belonging, meaningful existence, control, hurt, anger. An estimated percentage of balls toss to the participant was also assessed as a manipulation check.

Other Assessments

The study included other tasks and assessments reported elsewhere (Carlyle et al., 2021) and are detailed in the supplementary material.

5.3.4: Procedure

Participants were screened for initial eligibility on the telephone and then given a written consent form before completing the CTQ to assess the history of childhood trauma. After checking for eligibility, if the participants were deemed eligible, they were invited to the study centre for a

brief medical screening and the main experiment. Participants were asked to visit for two sessions of the experiment, each with seven \pm 1 days apart. In the first session, participants were given a medical screening. If they were fit to take part, they would be asked to give some demographic information and a detailed interview about their substance use history. This was followed by the Cyberball task. Participants were then cannulated for blood samples and administered a morphine dose (0.15mg/kg or 0.01mg/kg). They were then asked to complete additional tasks (reported in Carlyle et al., 2021) and the rest of the questionnaires over the period of approximately three hours. The second session followed the same procedure without the screening, demographics questions, drug use interview, and the Cyberball task. Both sessions lasted approximately 4 hours before the participants were discharged.

5.3.5: Statistical analysis

Assumptions of parametric tests including normality of data, homogeneity of variance, and outliers were checked. An independent sample t-test was first done to test Hypothesis 1. To further test the hypothesis, all types of childhood traumas were then entered into a regression as predictors, where rejection sensitivity was a dependent variable, using a stepwise method. To test for Hypothesis 2, the number of drugs the participants had used were combined into one variable, the number of drugs participants were regularly using were combined into another variable. The zero-order correlations were computed on these variables alongside the CTQ and rejection sensitivity (see Table 5.2). For hypotheses 3 and 4, childhood traumas and rejection sensitivity were entered into two different regression models, one for liking morphine, and the other one for wanting morphine. Lastly, to test hypothesis 5, three different regressions were done on the DASS subsets (depression, anxiety, and stress) using a stepwise method where rejection sensitivity and childhood traumas were the predictors (Table 5.3).

Results

5.4.1: Childhood Trauma and Rejection Sensitivity (Hypotheses 1a and b)

Participants who reported a history of childhood traumas had significantly higher subjective rejection sensitivity ($M= 11.29$, $SD= 4.97$) compared to the control group ($M= 7.80$, $SD= 3.15$), $t(50)= 3.00$, $p= .004$, $d = 0.84$. Pearson's correlation analysis revealed that higher levels of rejection sensitivity were significantly correlated with higher levels of emotional abuse, emotional neglect, physical neglect, and minimisation or denial (Table 5.2).

The regression analyses showed that the overall model was significant, $F(1, 50) = 9.96$, $p = .003$, and explained 16% of variance but only emotional neglect was a significant predictor for rejection sensitivity ($\beta= .41$, $t(50)= 3.16$, $p= .003$).

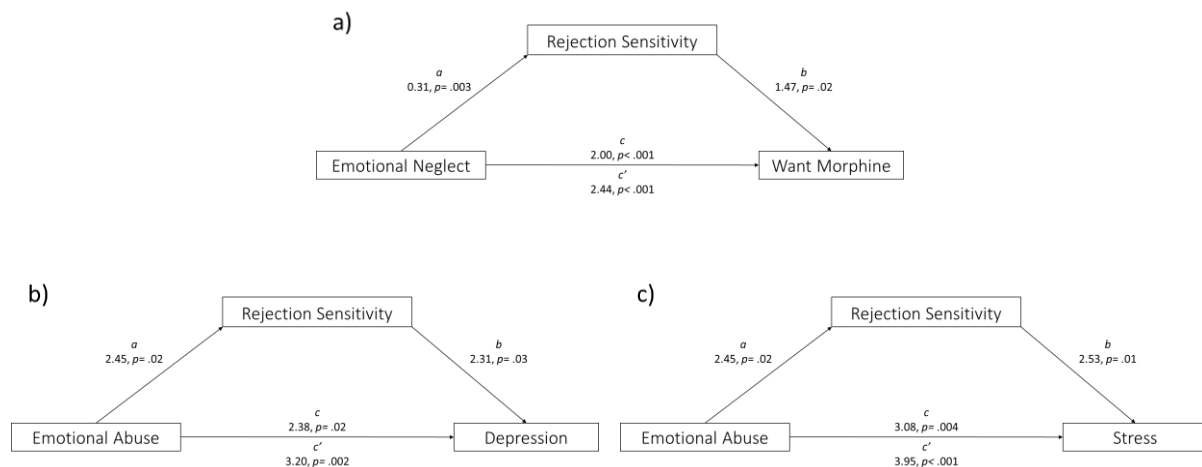
5.4.2: Substance Use (Hypothesis 2, 3, and 4)

Substance use experiences, including the number of drugs tried and number of regular drugs used are reported in the correlations table (Table 5.2) where it shows that rejection sensitivity positively correlated with regular drug uses. For Hypothesis 3, zero order correlations are reported in Table 5.2 and reveal that emotional abuse, emotional neglect, physical neglect, minimisation/denial, and rejection sensitivity were associated with morphine liking. The regression with childhood traumas and rejection sensitivity as a predictor and how much participants liked the effect of morphine as an outcome variable; using stepwise method, revealed a significant model, $F(1, 50) = 9.83$ which explained 17% of the variance. However, the only significant predictor included in this model was emotional neglect ($\beta= .41$, $t(50)= 3.14$, $p= .003$).

For Hypothesis 4, zero order correlations revealed that rejection sensitivity and all the childhood trauma measures, except sexual abuse, are associated with morphine wanting (Table 5.2). Similarly, another multiple regression where childhood traumas and rejection sensitivity were predictors and the mean want for more morphine was the outcome was done using a stepwise method. In Step 1, emotional neglect made a significant contribution ($\beta = .60$, $t(50) = 5.26$, $p < .001$) and the overall model was significant ($F(1, 50) = 27.63$, $R^2 = .36$). When rejection sensitivity ($\beta = .28$, $t(50) = 2.32$, $p = .03$) was added in Step 2, the change to the model was also significant; $F(1, 50) = 17.74$, $p < .001$, which explained 43% of the variance.

Figure 5.1

Summary model of the mediation analysis for a) wanting more morphine b) depression c) stress



A mediation analysis was done where the predictor was emotional neglect, the mean preference for the effect of morphine as an outcome, and the mediator was rejection sensitivity. It was found that there was no indirect effect from emotional neglect to the like of morphine via rejection sensitivity Bootstrapped Confident Interval (BaCI) 95% [-.21, .77], only the direct effect of emotional neglect on morphine preference was found BaCI 95% [.23, 2.48]. A similar mediation analysis was done where the want for morphine was the outcome variable. It was found that there was a significant indirect effect from emotional neglect to the want for morphine via rejection sensitivity (BaCI 95% [.09, 1.03]) where the direct effect was retained (Figure 5.1a).

Table 5.2*Zero order correlations between rejection sensitivity and childhood trauma subcategories along with drugs use behaviour, loneliness, and social support*

	Ever Used Drugs	Regularly Using Drugs	Like Morphine	Want Morphine	Loneliness	Social Support	Rejection Sensitivity	Emotional Abuse	Physical Abuse	Sexual Abuse	Emotional Neglect	Physical Neglect	Minimisation/Denial	Depression	Anxiety
Rejection Sensitivity	.07	.30*	.30*	.48**	.60**	-.61**									
Emotional Abuse	.47**	.14	.33*	.45**	.53*	-.52**	.35*								
Physical Abuse	.34*	.08	.25	.32*	.39*	-.23	.04	.71**							
Sexual Abuse	.22	-.05	.003	.11	.36*	-.22	-.10	.39**	.50**						
Emotional Neglect	.41**	.36**	.41**	.60**	.56**	-.67**	.41*	.86**	.52**	.74**					
Physical Neglect	.46**	.48**	.38**	.52**	.50**	-.55**	.35*	.70**	.51**	.30*	.74**				
Minimisation/Denial	-.40**	-.30*	-.31*	-.50**	-.61**	.57**	-.39*	-.83**	-.55**	-.27*	-.88**	-.72**			
Depression	.12	.26	.18	.46*	.55**	-.63**	.41*	.42**	.37**	.25	.42*	.30*	-.45**		
Anxiety	.10	-.06	.21	.25	.51**	-.43**	.33*	.45**	.35*	.31*	.35*	.29*	-.41*	.69**	
Stress	.19	.06	.46**	.52**	.53**	-.58**	.45*	.50**	.35*	.21	.47**	.42**	-.50**	.75**	.81**

Note: $p < .05^$, $p < .001^{**}$*

5.4.3: Effect of rejection sensitivity on mental health (Hypothesis 5)

It was found that only emotional abuse was a significant predictor for all three DASS subsets in step one. The model improved significantly when rejection sensitivity was added, but only for depression and stress. A summary of this analysis is shown in Table 5.3. Three mediation analyses were done for the depression, anxiety, and stress; where emotional abuse was a predictor and rejection sensitivity a mediator. The analyses revealed significant mediation effect for depression [BaCI .002, .15] and stress [BaCI .01, .14].

Table 5.3

The summary of regression analyses on loneliness, perceived social support, and DASS with rejection and childhood traumas as predictors

		<i>F</i>	<i>R</i> ²	<i>β</i>	<i>t</i>	<i>p</i>
Loneliness	Step 1	27.56	.36			< .001
	Constant				10.79	< .001
	Rejection Sensitivity			.60	5.25	< .001
	Step 2	28.23	.54			< .001
	Constant				7.37	< .001
	Rejection Sensitivity			.64	6.53	< .001
	Sexual Abuse			.43	4.36	< .001
	Step 3	22.94	.59			< .001
	Constant				6.87	< .001
	Rejection Sensitivity			.52	5.05	< .001
Sexual abuse			.36	3.66	< .001	
Emotional Neglect			.27	2.51	.02	
Social Support	Step 1	40.91	.45			< .001
	Constant				15.84	< .001

	Emotional Neglect			-67	-6.40	< .001
	Step 2	34.48	.59			< .001
	Constant				17.35	< .001
	Emotional Neglect			-.51	-5.03	< .001
	Rejection Sensitivity			-.40	-3.99	< .001
Depression	Step 1	10.26	.16			.002
	Constant				6.00	< .001
	Emotional Abuse			.42	3.20	.002
	Step 2	8.25	.23			<.001
	Constant				3.42	.001
	Emotional Abuse			.32	2.38	.021
	Rejection Sensitivity			.31	2.31	.026
Anxiety	Step 1	11.90	.20			.001
	Constant				8.28	< .001
	Emotional Abuse			.45	3.45	.001
Stress	Step 1	15.57	.25			< .001
	Constant				6.22	< .001
	Emotional Abuse			.50	3.95	< .001
	Step 2	11.87	.34			< .001
	Constant				3.54	< .001
	Emotional Abuse			.39	3.08	.003
	Rejection Sensitivity			.32	2.53	.015

5.4.4: Exploratory Analyses

The zero-order correlations between childhood traumas, rejection sensitivity, loneliness, and perceived social support were also reported in Table 5.2.

Rejection sensitivity and childhood traumas were then entered into a regression model as a predictor for loneliness. The analysis showed three significant model where rejection sensitivity, sexual abuse, and emotional neglect were significant predictors for loneliness. The regression summary was reported in Table 5.3.

Similarly, to investigate the effect of rejection sensitivity and childhood traumas on social support, a regression analysis was done. In this model, only emotional neglect and rejection sensitivity were significant predictors for perceived social support (Table 5.3).

Zero order correlations between rejection sensitivity and response to the Cyberball tasks are reported in Table 5.4. They revealed that rejection sensitivity was negatively associated with positive mood at both exclusion and inclusion, and self-esteem at inclusion.

Table 5.4*Zero-order correlations between Cyberball measures, rejection sensitivity, and the DASS measures*

		<i>Rejection</i>	<i>Depression</i>	<i>Anxiety</i>	<i>Stress</i>
		<i>Sensitivity</i>			
Positive Mood	Inclusion	-.36**	-.32*	-.16	-.20
	Exclusion	-.42***	-.24	-.26	-.29*
Negative Mood	Inclusion	.16	.05	.16	.18
	Exclusion	.07	.17	-.06	.05
Sense of Belonging	Inclusion	.07	.31*	.06	.24
	Exclusion	-.002	.16	.14	.45
Self-Esteem	Inclusion	-.12	-.33*	-.06	-.11
	Exclusion	-.28*	-.28	-.20	-.18
Meaningful Existence	Inclusion	.09	.16	-.06	.04
	Exclusion	-.15	-.02	.06	.03
Hurt	Inclusion	.06	.22	.15	.16
	Exclusion	.18	.09	.12	.09
Anger	Inclusion	-.17	-.02	-.05	-.03
	Exclusion	.06	.03	.13	.02
Control	Inclusion	.05	-.10	-.04	.06
	Exclusion	-.24	-.14	-.12	-.11

Note: $p < .05^$, $p < .001^{**}$, $p < .001$ after Bonferroni correction****

Discussion

The objective of this work was to investigate the associations between rejection sensitivity and substance use, and mental health, as well as their relationship with childhood traumas. The study employed an experimental approach following intramuscular administration of the opioid morphine, and a social exclusion manipulation (Cyberball) in healthy volunteers with and without histories of childhood trauma. A series of self-report measures examined whether rejection sensitivity and childhood trauma were associated with greater negative response to social exclusion, lower positive response to social inclusion and a preference for morphine, higher habitual drug use, and higher levels of stress and depression.

In line with our hypothesis, individuals with childhood traumas reported higher levels of rejection sensitivity. However, only emotional neglect made a significant contribution to the level of rejection sensitivity. Thus, although we found that our hypotheses were partially supported, i.e., that rejection sensitivity is associated with emotional neglect childhood traumas, this is at odds with existing findings by Erozkán (2015) who found that rejection sensitivity is related to multiple types of childhood traumas. Our findings additionally suggested that early rejection might largely be a result of emotional neglect, rather than emotional abuse, as proposed by Rohner and Rohner (1980).

Rejection sensitivity was also found to be a significant predictor, alongside emotional neglect, for how much participants wanted more morphine following an acute dose during the experiment. In contrast, only emotional neglect but not rejection sensitivity significantly predicted how much participants liked the effect of morphine, suggesting that some form of emotional neglect, not related to rejection, could enhance the perceived pleasantness of morphine. Rejection sensitivity was associated with the wanting for more morphine, but not with the liking of morphine. The distinction between 'liking' and 'wanting' is a common dissociation in understanding reward and vulnerability to addiction (Drummond, 2001; Robinson & Berridge, 2001). 'Liking' can reflect the hedonistic affect (i.e., pleasure) towards a reward, while 'wanting' can reflect the motivational

salience (i.e., desire to repeat the experience) of the reward. Whereas 'liking' and 'wanting' often co-occur, both are independent processes of reward that are governed by different neurobiological systems; primarily, the μ -opioid receptor system in liking, and the dopaminergic system for wanting (Peciña, 2008). These findings imply a stronger relationship between rejection sensitivity with the motivational wanting of drug reward, in absence of greater liking. It is thus possible that those with high rejection sensitivity might not necessarily experience more pleasure as a consequence of the drug effects, but the attenuating effect on the perception and sensitivity to social rejection and reduction of social pain (Frye et al., 2014; Pathan & Williams, 2012) may underlie the motivation for more morphine (Persson et al., 2019).

The number of drugs participants had tried was also correlated positively with emotional and physical abuse, and with emotional neglect, implying that childhood trauma might lead to experimenting with different drugs, consistent with a large number of studies in the literature (e.g. Leza et al., 2021 for a review). Similarly, regular drug use was positively associated with emotional and physical neglect. This partly supported our hypotheses of an association between drug use and childhood trauma. Mediation analysis revealed that rejection sensitivity partially mediated the relationship between emotional neglect and the want for morphine, extending our knowledge of the association between childhood traumas and substance use. Whereas rejection sensitivity was not related to numbers of drugs participants had tried, it was correlated with regular drug use. This supports work indicating that substance use is driven by different motivations, the predominant one being a coping mechanism to manage negative affect, which maintain the use of drugs individual have tried. Individuals with high rejection sensitivity may use drugs as a way to regulate their emotions, rather than to just experience the effect of different drugs (Wang & Pachankis, 2016; Woerner et al., 2016). In which case, people high in rejection sensitivity find a coping mechanism and continue to use the same strategy, while the use of different types of drugs may indicate a more 'hedonistic' approach. However, those with high rejection sensitivity, who readily expect rejection, may not be interested in progression into other drugs but instead continue the use of substances

they tried as a coping mechanism in response to anticipated social rejection (Ayduk, Mendoza-Denton, Walter Mischel, et al., 2000; Peters et al., 2014; Selby et al., 2010).

Rejection sensitivity was also associated with depression and stress along with emotional abuse, whereas only emotional abuse was associated with anxiety levels. These results supported our hypotheses that rejection sensitivity would be associated with poor mental health and extend the understanding of the relationship between childhood traumas and mental health through the association with rejection sensitivity. The finding supports previous results by Liu et al. (2014) demonstrating that rejection sensitivity was associated with greater depression. More importantly, in our study, rejection sensitivity mediated the relationship between emotional abuse and depression, and stress. This suggests that rejection sensitivity and some childhood traumas might impact psychological adjustments (Álvarez et al., 2011; Downey, Lebolt, et al., 1998; Schneider et al., 2020) which later results in poor mental health. Specifically, the finding supports the idea that rejection sensitivity could be one link between childhood trauma and mental health outcome (van Dijke et al., 2018). Further, such prolonged stress could contribute to reinforcement of drug use through allostatic mechanisms: stress combined with the rewarding effect of drugs may influence the brains attempt to maintain stability. Such a response could lead to negative affect, which in turn reinforces the use of drugs (Koob & Schulkin, 2019). This could help explain the link between rejection sensitivity and the want for drugs via stress. Moreover, exploratory analysis suggested that rejection sensitivity could link to loneliness and lack of social support which could associate with poor mental health (Barros, 2016; Watson & Nesdale, 2012; Jittayuthd & Karl, 2022).

Correlational analyses on the associations between rejection sensitivity and experimentally induced rejection and acceptance using the Cyberball task revealed that rejection sensitivity was negatively correlated with positive mood post-inclusion and exclusion, and self-esteem post-exclusion. However, after Bonferroni corrections, only positive mood post-exclusion was correlated with rejection sensitivity. This was surprising, as rejection sensitivity was predicted to be highly

associated with negative mood (Luterek et al., 2004) and anger (Zimmer-Gembeck et al., 2014). It is possible that this was due to a smaller sample size than in previous research and should be explored in a larger sample.

Lastly, loneliness was found to be positively correlated with both rejection sensitivity and childhood traumas. Rejection sensitivity, sexual abuse, and emotional neglect were all significant predictors of loneliness. Conversely, social support was negatively correlated with rejection sensitivity and most childhood traumas, except physical and sexual abuse. Only rejection sensitivity and emotional neglect were significant predictors of social support. In addition, as expected, both loneliness and lack of social support were highly correlated mental health outcomes.

5.5.1: Strengths and Limitations

The current analysis had several strengths and limitations. The use of a double-blind, placebo-controlled administration design provided a unique opportunity to measure the causal effects of opioids in people with childhood trauma. A potential limitation was that the data were potentially underpowered for these specific analyses, given that the power calculations were based on other study. Another limitation came from the substance use interview. The interview was unstandardised and relied on participants' self-reported drug use which might be subject to social desirability. However, the main aim of the interview was to screen out those with a history of morphine use in order to examine the effect of morphine experiences in those with no significant substance use problems. The scores were the combined number of drugs reported which might not be the most valid method for assessing drug use as other variables, such as frequency of using each drug, could affect the findings. Thus, the results for number of drugs tried and regular drug used were based on one item assessment, and the findings should be interpreted with cautions. Furthermore, participants who had a history of drug use disorder were excluded from the study. Therefore, the score was based on participants' perception of what 'regular' use of drugs were. A very low dose of morphine was used as a placebo to control for expectancy effects which may still

affect the reported preference and want for the drug, especially in people with childhood trauma who rated higher in wanting for low dose compared to the control group. However, the analysis showed clear differences in morphine want and like between the two groups (Carlyle et al., 2021).

5.5.2: Theoretical and Clinical Implications

The findings from this study have many implications. Firstly, it brought to attention the importance of emotional neglect and rejection sensitivity as potential risk factors for habitual drug use, higher morphine wanting and higher levels of stress and depression. Though, it is still unclear if early rejection was truly a form of emotional neglect that contributed to rejection sensitivity. Therefore, future studies may wish to investigate which childhood traumas contributed to rejection sensitivity as well as implementing a longitudinal design to verify the order of the relationship between childhood traumas and rejection sensitivity. Moreover, this study suggested an important clue to a link between childhood traumas and mental health. Emotional abuse and rejection sensitivity could be a focus of therapy in order to improve mental health and reduce stress. Finally, this study showed the role of rejection sensitivity on the drug use, especially morphine. Rejection sensitivity could be assessed and used as an indicator for drug use or potential opioid addiction. Further studies into rejection sensitivity in people with opioid use disorder could provide more insights into the relationship between rejection sensitivity and opioid use, specifically a qualitative analysis on the reasons people take them.

5.5.3: Conclusion

This paper investigated the relationships between childhood traumas, rejection sensitivity, and morphine. The link between rejection sensitivity and childhood traumas was confirmed, specifically emotional neglect being the main predictor for rejection sensitivity. Rejection sensitivity was also a mediator for the relationship between emotional neglect and wanting more morphine following an acute dose. Moreover, rejection sensitivity was also found to mediate the relationship between emotional abuse and depression, and stress. These findings brought to light the

importance of the link between childhood traumas and rejection sensitivity and subsequent mental health adjustments.

Chapter 6:

General discussion

This thesis set to expand our current understanding of the role of rejection sensitivity and the experience of social rejection for mental health following psychological trauma. The studies conducted throughout my PhD aimed to investigate how rejection sensitivity is associated with other vulnerability factors for stress-related disorders such as vulnerable attachment (Study 1), childhood trauma (Study 4), experiencing social rejection immediately after a laboratory traumatic stressor (Studies 2 and 3) and loneliness (Study 4), the propensity to substance use, a frequent emotion regulation strategy in trauma survivors with PTSD, and the response to the pharmacological activation of the endogenous opiate system via morphine (Study 4), as a biological system involved in regulation of physical and emotional pain and commonly hypothesised to be involved in soothing painful social-emotional experiences. The PhD also investigated how rejection sensitivity is associated with protective factors such as social support (Studies 1 and 4) and experiencing social acceptance immediately post a laboratory traumatic stressor (Studies 2 and 3). In addition to a cross-sectional survey design (Study 1), I employed an experimental approach to observe stress and physiological response to social rejection using a novel experimental task in order to understand how the experience of rejection affects the individual's momentary state and how this is associated with dispositional rejection sensitivity (Study 2). To understand how the experience of rejection and dispositional rejection sensitivity are associated with response to a trauma-related laboratory stressor, I used a virtual reality car accident scenario and assessed psychophysiological responses to lab trauma and subsequent experience of social rejection or acceptance (Study 3). In study 4, I used an experimental approach to investigate the association between rejection sensitivity and the subjective responses to opiate administration. Substance abuse behaviours, stress, loneliness, depression and anxiety were also investigated in relation to rejection sensitivity.

In this chapter, I will first summarise the main findings for these studies. These findings will then be discussed in relation to theoretical standpoints and applied to the model proposed for this

thesis. Further discussion on strengths and limitations, as well as clinical implications, and future directions will be included.

6.1: Findings Summary

6.1.1: Factors Relating to Rejection Sensitivity and their Associations with PTSD (Study 1)

In this cross-sectional survey study in 141 trauma survivors with and without PTSD, four main factors were investigated including vulnerable attachment, rejection sensitivity, social support, and PTSD symptoms. The aim for this study was to find out whether there are any associations between these measures and how are they related. As hypothesised, rejection sensitivity, vulnerable attachment dimensions, and PTSD symptoms were all positively associated. Social support, however, was negatively correlated with these measures. Mediation analyses revealed a significant indirect effect from vulnerable attachment dimension to PTSD symptoms via both rejection sensitivity and social support. Interestingly, a significant sequential pathway that suggested that vulnerable attachment could exert its effect on PTSD symptoms via higher levels of rejection sensitivity and subsequent lower perceived social support was identified. Although a replication in a larger sample and using a longitudinal design is required, from these findings a model pathway for PTSD was proposed and shown in Figure 1.4.

6.1.2: Association between Rejection Sensitivity and Physiological Responses to Rejection (Study 2)

Study 2 aimed to observe psychophysiological stress responses to a social evaluation, specifically in the context of rejection. Using a biosketch essay task, 90 healthy individuals were recruited and randomly assigned into three conditions (rejected, accepted, no feedback). Rejection sensitivity, perceived stress, and physiological responses throughout the task were measured. The results indicated that rejection sensitivity only correlated with baseline skin conductance but not the baseline heartrate, heartrate variability, and perceived stress level. Moreover, rejection conditions did not have an effect on both stress level and change in physiological responses. However, the

biosketch task did produce decreased heartrate, and increased heartrate variability and skin conductance, regardless of the conditions. Another main significant finding from this study was that rejection sensitivity was associated with higher subjective stress levels after the biosketch task.

6.1.3: The Role of Rejection Sensitivity and Experimental Rejection Following Virtual-Reality Trauma (Study 3)

The aim for Study 3 was to investigate the associations between rejection sensitivity and physiological response during a simulated virtual trauma, as well as the effect of social stressor following the virtual trauma. A virtual-reality trauma film paradigm was used to induce traumatic stress. Immediately followed was a modified ostracism task, aimed to introduce stressful social situation following the virtual trauma, where 110 participants were randomly assigned into rejected, accepted, or neutral conditions. Level of rejection sensitivity, subjective stress and moods, intrusions, and physiological stress responses throughout the study were measured. Similar to the findings of study 2, rejection sensitivity was not associated with baseline heartrate, heartrate variability, or stress. The results did show significant increase in physiological stress response during both virtual trauma and rejection task. However, there were also no significant physiological changes in response to different rejection conditions. Surprisingly, those in the accepted condition showed significant increase, while those in rejected condition showed significant decrease, in stress and anxiety compared to neutral conditions. Finally, neither rejection sensitivity nor rejection conditions were associated with number of intrusions from the virtual trauma film.

6.1.4: Rejection Sensitivity Following Childhood Traumas and Associations to Wanting Opioids (Study 4)

Study 4 was set out to run a secondary data analysis to investigate the relationship between childhood traumas and rejection sensitivity. In addition, the associations between rejection sensitivity and mental health were also investigated. In the final study, several aims were established. First, the association between rejection sensitivity and childhood trauma as a

vulnerability factor for stress-related disorders, and for substance use as a maladaptive emotion regulation factor in trauma survivors was investigated. Second, I examined the association between rejection sensitivity and propensity to use drugs, levels of stress and depression in a sample of 52 participants, 27 with history of childhood trauma and 25 healthy controls, who participated in an experimental opiate induction study. Subjective experiences of opiate administration were also investigated in relation to rejection sensitivity and childhood trauma. Third, it was investigated whether rejection sensitivity and the experience of being socially excluded through an ostracism task were associated with the changes in negative and positive emotions.

Results indicated that emotional neglect, emotional abuse, and physical neglect were all positively correlated with rejection sensitivity. For mental health, rejection sensitivity was positively correlated with depression, anxiety, and stress. Furthermore, rejection sensitivity mediated the associations between emotional abuse and depression and stress, as well as emotional neglect and anxiety. In addition, rejection sensitivity was associated with higher level of loneliness and lower social support, which in turn significantly correlated with poor mental health. In term of drug use, rejection sensitivity predicted subjective habitual drug uses as well as the want for morphine after high dose administration. The correlations between rejection sensitivity, numbers of drug tried, and liking for morphine were not significant. More interestingly, rejection sensitivity was found to mediate the relationship between emotional neglect and want for morphine during session. Finally, the results indicated that rejection sensitivity was associated with lowering positive mood after Cyberball task and lower self-esteem after being excluded.

6.2: Applications to the Theoretical Backgrounds

The results from my PhD studies addressed the research questions proposed in the introduction Chapter 1. The following section will synthesise the findings and integrate them with key theoretical background and attempt extend the foundation for the proposed model of rejection sensitivity (Figure 1.4). Firstly, the role of early vulnerability factors for understanding rejection

sensitivity was discussed. The findings regarding the association between rejection sensitivity and the components of the hot-cross bun will be explained. This was followed by the discussion on the impact of rejection sensitivity on social interactions. Lastly, the findings on rejection sensitivity and mental health, specifically stress related disorders, is explored.

6.2.1: Precursor to the Development of Rejection Sensitivity

Feldman and Downey (1994) suggested that rejection sensitivity came from early parental rejection. The introduction of IPART theory (Rohner, 2016) helps explain the mechanism into how early rejection can contribute to rejection sensitivity by raising the importance of interpersonal relationships. They believed that early rejection gets internalised into negative perception of self as well as social interaction around them. In their theory rejection was seen as form of cold, hostile, negligence types of behaviours of parents which is similar to those of childhood traumas. Erozkan (2015) supported this view with a finding that rejection sensitivity was associated with all domains of childhood traumas. The finding from study 4 that there was a significant relationship between rejection sensitivity and childhood trauma lends the idea that the two factors may be related. In contrast to my hypothesis, however, only emotional neglect but not emotional abuse and physical neglect was associated with the level of rejection sensitivity. This suggests that perhaps emotional neglect is a form of rejection that made the most contribution to the development of rejection sensitivity later in life. One theory for the relationship between emotional neglect and rejection sensitivity is that childhood emotional neglect disrupted the development of psychological, cognitive, and physical functioning. When a child is emotionally neglected, many aspects of their lives is affected, including stress regulations, distorted perceptions of relationships and self (Rees, 2008). The consequences of these neglects are strongly grounded in those with high rejection sensitivity such as hypersensitivity to stress (see section 6.2.5), excessive fear of social disapproval (Downey & Feldman, 1996), and poor emotion regulation (Gardner & Zimmer-Gembeck, 2018). It is important to point out that the reason for the lack of relationship between rejection sensitivity and

other subscales of childhood trauma could be down to the lack of sample size in study 4, therefore the findings should be taken with cautions when applying to the larger sample. However, based on the current finding, rejection sensitivity could be integrated into the IPART theory to help understand how different types of rejections can produce different results, for example, those who were rejected and neglected would be more likely to develop symptoms similar to those of high rejection sensitivity compared to rejected aggression. The IPART theory also draws upon the attachment theory (Bowlby, 1958) that the early experience with attachment figures can shape an individual's perception of interpersonal relationship in adulthood. This theory aligned with the finding observed in Study 1 where vulnerable attachment dimensions (both anxious and avoidant) predicts high level of rejection sensitivity. While there are not many studies that directly measures rejection sensitivity and attachment dimensions, those that are available came into a consensus that rejection sensitivity is related to attachment security (Boldero et al., 2009; Downey, Freitas, et al., 1998; Ronen & Baldwin, 2010). Such finding is not surprising as both IPART and rejection sensitivity theories were grounding in attachment theory (Feldman & Downey, 1994). What the finding from Study 1 extend was that the severity of vulnerable attachment dimension is an important correlates of rejection sensitivity rather than just secure versus insecure attachment types.

Thus, from the findings two factors were confirmed as correlates and hence potential vulnerability factors of rejection sensitivity, which are childhood trauma and vulnerable attachment. Traumatic childhood experiences could damage the bond between parent and child, which lead to insecure attachment. Through internal working model, the child internalised the traumatic experience in a form of rejection sensitivity which sensitise the child to potential rejection that interfere with later formation of interpersonal relationship later in life; consistent with the theory posited by Downey and Feldman (1994).

6.2.2: Rejection Sensitivity on Mood and Behaviour

Even though the studies found no correlation between rejection sensitivity and heartrate variability, an indicator of emotion regulation (Beauchine,2015), rejection sensitivity was associated with negative affect. The results from Study 3 showed that rejection sensitivity was associated with lower feeling of happiness, but higher feeling of depression and anxiety. This finding was consistent with previous research which suggested that rejection sensitivity may have an impact on mood (Gardner & Zimmer-Gembeck, 2018; Watson & Nesdale, 2012). However, rejection sensitivity was not associated with anger, even after being rejected. This finding was not as expected by previous literature that found a link between rejection sensitivity and anger following rejection (Eisenberger et al., 2007; Sijtsema et al., 2011). An explanation for this could be the result of relatively high heartrate variability in the healthy samples of the study. As mentioned, low levels of heartrate variability could be an indication of poor emotion regulation (Bernstein et al., 2003; Thayer & Lane, 2000). Emotion regulation is especially important for anger as poor RSA was found to be associated with hostility during conflict (Gyurak & Ayduk, 2008). This suggested that the healthy participants in the Study 3 might be able to better regulate their emotion, compared to those with much higher rejection sensitivity, in order to control their anger which is why no effect was observed. Moreover, study on the effect of rejection sensitivity on anger often focused on real-life rejection of intimate relationship. Thus, an online rejection by strangers used in Study 3 might not be enough to induce anger in participants. Regardless, those with higher rejection sensitivity still showed increased negative mood. Moreover, negative mood may also increase drug use as a coping mechanism (Ricketts & Macaskill, 2003). The relationship between mood and coping behaviours can be explained in the context of Ehlers and Clark's (2000) model, where strong emotions as the result of traumas can lead to dysfunctional behavioural strategies used to control these negative affects (see section 6.2.5). The finding from Study 4 showed that those with high rejection sensitivity have increased desire for morphine after the administration. This finding is in line with Nobile et al (2020) in that opiate can be used to ease social pain, therefore, those with high rejection sensitivity who often experience such pain would want more morphine to cope with such stress. Moreover, studies

showed that rejection sensitivity can increase engagement with risky behaviour due to demand for approval or avoid rejection (Butler et al., 2007; Peters et al., 2014; Purdie & Downey, 2000). The result from Study 4 indicated that those with high rejection sensitivity had sampled a wider range of drugs. While the reason behind trying different drugs was not assessed, it is possible to imply from previous studies that those with high rejection sensitivity would engage and tried more drugs in order to comply with the demand of wanting to fit in.

6.2.3: Physiology Indicators of Rejection Sensitivity

In the theory chapter, the importance of attention bias towards potential rejection cues was introduced in relation to how it contributes to physiological changes in those with high rejection sensitivity. While cognitive functions were not assessed in my studies, physiological responses as an indicator of threat system activation and stress response were investigated. Physiological responses were measured because rejection sensitivity is accompanied by a constant response to stress, which in turn can alter one's physiological responses, specifically hyperarousal, to stressful stimuli. However, the findings from the studies appear partially conflicted with the existing literature. Firstly, in both Study 2 and 3 where rejection condition was introduced to the participants, they did not show higher heart rates compared to individuals in the accepted, and neutral conditions; even though they reported higher subjective feeling of rejection in both studies. These findings are at odds with Gyurak and Ayduk (2007) who found increased physiological startle response following rejection. It is worth noting that Gyurak and Ayduk (2007) study measured startled eye-blinking response, which was different from measuring heart rate; they also used rejection and accepted paintings as stimuli to induce rejection, which did not include the element of social interaction for the participants; and the startle response could simply be the result of defensive response to novel stimuli (Porges, 2007). However, both Study 2 and 3 found increased heart rate and skin conductance in all participants when they completed the social task, independent of rejection, acceptance, and neutral condition, supporting Gerber and Wheeler's (2009) meta-analysis findings that even the

threats of social rejection, especially those that uses ostracism paradigms, can produce strong physiological arousal. Secondly, rejection sensitivity was not found to be associated with physiological stress responses in Study 2 and 3. Breslend et al (2018) also failed to find rejection sensitivity to be correlated with increased in sympathetic nervous system activation (SNS). The findings support the evidence as rejection sensitivity was not associated with change in physiological response throughout the experiment. However, Breslend et al (2018) did find positive associations between relational victimisation and rejection sensitivity in those who exhibited SNS activation and parasympathetic nervous system (PNS) withdrawal. The finding suggested that perhaps there is an interaction effect between SNS and PNS within those who scored higher in rejection sensitivity, and so investigating them individually, as in Study 2 and 3, may not yield the same results. Moreover, it is possible that the observed physiological change was specific to relation victimisation, involving behaviours that damage relationships or one's social reputation (Crick & Grotpeter, 1996), and not in the paradigm used in Study 2 and 3. Lastly, Bernstein et al (2003) suggested that those with poor emotional regulation, such as those with high rejection sensitivity, would have lower RSA as it was found to be an indicator of emotion regulation (Thayer & Lane, 2000). While emotion regulation was not measured in Study 2 and 3, heartrate variability as indicator of healthy emotion regulation was investigated. Contrary to previous research, rejection sensitivity was not correlated with lower heartrate variability. It may not be possible to conclude that those with rejection sensitivity have poorer emotional control, the findings did suggest that rejection sensitivity is not associated with physiological changes.

6.2.4: Social Impacts of Rejection Sensitivity

The findings have indicated a range of negative impact of rejection sensitivity on mood and coping behaviour, as well as trouble with vulnerable attachment and childhood trauma. Such problems can in turn be detrimental to one's social life. As seen in Study 1 and 4, rejection sensitivity was significantly associated with diminished social support. Additionally, Study 1 and 4 extended

previous research on romantic relationships by assessing perceived social support from family and friends as well. Such finding is important because it shows the importance of any types of social support to be beneficial for an individual to have (Taylor, 2011). Moreover, perceiving support within family could help prevent perpetuate the feeling of rejection associated with rejection sensitivity and poor mental health (Rohner, 2021). These results were as expected by previous research (Ibrahim et al., 2015; Ayduk et al., 2001; Purdie & Downey, 2000) where perceived social support was negatively associated with poor mental health, suggesting a possible protective effect of social support. Moreover, Study 4 also showed that rejection sensitivity highly associated with the level of loneliness, which support London et al (2007) study. More interestingly, Study 1 showed that rejection sensitivity mediates the relationship between vulnerable attachment and lack of social support, consistent with Milkulincer et al (2009) idea that insecure attachment may lead to poor social adjustment. While the mechanism that drives those with rejection sensitivity to have lower social support was not investigated, previous research and findings presented indicate that rejection sensitivity and its impacts can greatly influence the level of social support people perceived. Furthermore, the relationship between rejection sensitivity and perceived social support can help explain the impact of rejection sensitivity on mental health.

6.2.5: Rejection Sensitivity on Stress-Related Mental Health

6.2.5.1: Posttraumatic Stress Disorder (PTSD). The main aim of the current thesis is to address the scarcity in the literature surrounding the role of rejection sensitivity on PTSD. Using Ehlers and Clark's (2000) model, rejection sensitivity and its components were expected to associate with PTSD symptoms. This idea was supported through the findings in Study 1 that rejection sensitivity to be a significantly associated with PTSD symptoms. Moreover, the results showed that rejection sensitivity was associated with PTSD via lack of social support, as well as acting as a mediator for the relationship between vulnerable attachment dimension and PTSD symptoms. This is in line with the cognitive model of PTSD and extends it by suggesting that vulnerable attachment

as formed early in life could increase levels of rejection sensitivity thus contributing to habitual negative appraisals of the self and the world which will affect the processing of traumatic and highly stressful events (Halligan et al., 2013; Rohner, 2016). Rejection sensitivity and its impact could then influence the strategies for controlling the symptoms associated with traumas such as recreational drug use and seeking social support, thus lead to the maintenance of PTSD symptoms. While Study 1 generally supported the model, further experimental investigation in Study 3 provided contradicting findings. More specifically, rejection sensitivity was not associated with any increase in intrusions following virtual traumatic experiences. However, it is important to note that the trauma presented in Study 3 was done through virtual reality in the lab where participants were safe, which may not be enough to induce intrusions, yet the use of virtual reality was found to be at least as effective as the original trauma film paradigm (Cuperus et al., 2017). The cognitive model of PTSD also proposed the importance of subsequent social interaction, and the appraisal of such interaction following the traumatic experience. That is, the negative social interaction following trauma will affect the nature of trauma memory, subsequently influencing the appraisal of trauma sequelae, which then led to symptoms of PTSD. The theory was investigated in Study 3 where rejection and acceptance were experienced by the participants following virtual trauma. The findings did not support the theory as negative or positive social interaction did not increase intrusions and physiological arousals. However, this could mean that there is a moderation effect of rejection sensitivity, as high rejection sensitivity accentuate the negative appraisal of social interaction (Rohner, 2016) as well as associated with hyper arousal to stress due to constant threat system activation (Bremner & Vermetten, 2001; see Section 6.2.3). The theory was tested in Study 3 as well, yet no moderation effect of rejection sensitivity was found on both intrusions and physiological arousals. One possible explanation being that because rejection sensitivity operates on cognitive processing and appraisal of trauma, which were not assessed in Study 3, the sample may not have negative appraisal of trauma as expected due to a relatively low level of rejection sensitivity in the sample. Moreover, emotion dysregulation, which is a key component of maintaining PTSD (Sheperd & Wild, 2014; Weiss

et al., 2012), was not directly assessed in the participants, and was only assumed through heart rate variability in the sample with relatively low rejection sensitivity. Thus, the lack of emotion dysregulation could also be the explanation for the discrepancies between the findings of study 3 and the model of PTSD, i.e. that the sample in Study 3 had good emotional regulation strategies which allowed them to avoid the negative effect of trauma and rejection on subsequent intrusions and physiological arousals. Generally, the findings from my study on PTSD symptoms only partially supported the proposed model for this thesis (Figure 1.4) that suggests the importance of early childhood experience in the development of rejection sensitivity. Rejection sensitivity then associated with negative strategy for controlling PTSD symptoms, including substance use and lack of social support, which then associated with general increased in PTSD severity. However, the negative effect of rejection sensitivity specifically on intrusions and physiological arousal was not supported, especially not after rejection following traumatic experience. Thus, suggested that there might be a more complex interplay between cognitive appraisals and traumas than just the appraisal of the subsequent social interaction.

6.2.5.2: Stress-Related Mental Health. While rejection sensitivity was not specifically associated with specific symptoms of PTSD, it is no surprise that rejection sensitivity would predict poor mental health. Study 1 showed that rejection sensitive significantly associated with PTSD severity in general. The results from Study 4 provided support for previous literatures that rejection sensitivity predicts higher level of mental health issues, specifically depression, anxiety, and stress (Anderson et al., 2008; Fenn & Byrne, 2013). Further inspection revealed that the lack of social support fully mediated the relationship between rejection sensitivity and reported level of depression, and anxiety. This provides an insight into how rejection sensitivity impacts mental health by diminishing the level of social support, which is congruent with previous body of research on social support and mental health issues (Harandi et al., 2017; Boyd, 2002). Eisenberger et al. (2007) showed that having positive social support can reduce the level of stress hormones which then act as a protective factor against poor mental health. The level of stress hormones was not measured,

however the result from Study 4 revealed that lack of perceived social support predicted higher level of subjective stress. In fact, social support fully mediated the relationship between rejection sensitivity and stress, providing support for the idea that rejection sensitivity may have operated on mental health by dampening social support received. Taken together, findings suggested that rejection sensitivity is associated with stress-related mental health disorders as expected by previous literatures. Study 1 and 4 then suggested the impacts of rejection sensitivity may mediate the level of social support, which acted as a protective factor for mental health issues. Although the studies might not provide much support for the altered physiology, emotion dysregulations, and cognitive biases, the reason for the lack of findings in these areas might be down to the limitation of the studies.

6.3: Limitations and Strengths

The studies conducted have their own strengths and limitations which were discussed in their respective chapters. The summary of the overall strengths and limitations for the thesis will be discussed in this section.

One of the biggest limitations for Study 2 and 3 was the lack of representative samples of those with high rejection sensitivity. Due to the stressful nature of the experiment, including virtual reality traumas and rejection task, participants with history of traumas and high level of depression were excluded from the study to protect them from excessive stress. Due to the fact that rejection sensitivity often correlates with depression and traumas, the results from these studies came from those with low rejection sensitivity. Thus, the findings may not reflect real-life samples, which could explain the lack of significant findings. While it could be argued that the level of rejection sensitivity can be measured on a scale, some had used the measure in dichotomy terms (low vs high). Almost all the participants in study 2 and 3 fell into the 'low' group and so the physiological data from these studies only representative of those with low rejection sensitivity. On the other hand, study 1 and 4 did not have limited inclusion criteria and the significant findings from these studies reflected those

of general population with wide range of rejection sensitivity. Moreover, the measure used to assess rejection sensitivity was developed in 1996, two decades ago and in need of an update with new scenarios that apply to the new generation in order to accurately rejection sensitivity in young people. The content of the measure cannot assess situations that could be anxiety provoking for the modern society, such as not getting a reply from a friend after the message was read. However, the situations presented in the questionnaire still apply to the modern society as they represent common social interactions for any generations.

Another limitation is associated with the experimental task used in study 2, 3, and 4. Firstly, the 'rejection tasks' used in these studies were all different with their own limitations. The task in study 2 and 3 were similar in that they require participants to describe themselves to other people and then received a feedback whether they were accepted or rejected based on their self-description. In study 2 the rejection was explicit and was shown after the participants had described themselves. The rejection in study 3 was slightly different as it was in a form of 'dislike' which pop up on the screen throughout the task a number of times after participants were submit their description. These two may have produced slightly different effect as the intensity of rejection were either at one specific or across period of time. In addition, study 4 used a Cyberball task that captured the feeling of ostracism or being excluded rather than being rejected. These two terms often used interchangeably in social research (Learly, 2006). However, they can be slightly different as 'rejection' was referred to being actively expelled from groups (DeWall & Bushman, 2011 while social ostracism refers to when a person is being passively ignored or neglect (Williams & Nida, 2011). It is important to keep these in mind when interpreting the findings as they may expected different effect on the dependent variables. Using the same tasks or determining the effect of the tasks would be useful in comparing data from these experiments. Moreover, these tasks were completed online, and the feedbacks received were came from a computer confederate 'strangers'. Participants' belief in the genuineness of the task being was not assessed, meaning that it was unclear whether or not the task produced genuine feeling or rejection. This combined with the fact

that the participants were judged by complete strangers they have never met means that the task might have enough power to actually induce the effect of being rejected. However, subjective feeling of rejection and inclusion was measure, but these are subjected to desirability effect. One strength of the task used in study 3 though was that it represents modern online platforms. The task may look different from mainstream social media, but the introduction of 'like' and 'dislike' button reflected the social evaluations on social media of modern society.

Another important factor to be considered is that most of the observable results, especially for Study 1 and 4, are non-causal results. This suggests that the findings from these studies could be biased as there was no evidence for a clear causal relationship and that confounding variables could interfere with the results. For example, in Study 1, factors such as repeated trauma exposure could be an important variable that contributed to the development of PTSD, which was not assessed in the participants. Furthermore, due to the nature of cross-sectional design, it is possible that there could be a reverse causation of the findings. The findings from Study 1 were based on the theoretical model and the assumption that the model is accurate. However, there is still a possibility that the observable results could be the other way around, i.e. PTSD contributed to individual being more sensitive to rejection. Without an experimental design where the independent variables are manipulated, it is not possible to conclude a causal relationship between the observed factors. Thus, the finding should be interpreted with caution. It is also important to note that the main analyses for study 1 and 4 were mediation analyses. This again were correlational relations rather causation, thus the direction of the mediation model can be called into question. In order to remedy this problem, a longitudinal study should be conducted. By conducting a study over a long period of time, the symptoms the development and related factors can be observed, which can give insights into the order of development as well as the direction of mediation model.

Extending from the previous paragraph, the last group of limitations are from the confounding variables not assessed in these studies. This was done to keep the experiment short

and simple for participants and to make sure that they are not exhausted especially after the stress inducing task. However, assessing confounding variables would be valuable for the interpretation of the results by exploring factors that could contribute to the observable results. For instance, Study 4 had shown the importance of childhood traumas and drug use behaviours relating to rejection sensitivity. However, these factors were not assessed in the first study, only attachment as a proxy for childhood trauma was assessed, and these factors may be the main contributors of the observed effect on PTSD symptoms. Therefore, confounding variables should be considered in future studies for a more reliable result.

Finally, qualitative feedback can be employed to understand the underlying mechanism of the observed data as well as potentially explain the significant, or lack thereof, in the results. For instance, to help understand the cognitive model of PTSD, the negative appraisal of the virtual trauma in study could be assessed. This will give insights into how the trauma was perceived and process during the task and see how they relate to observed physiological responses and subsequent rejection.

Overall strengths came from the use of physiological measures. Study 2 and 3 measures heart rate as well as skin conductance to measure stress responses to the experiment. Physiological measures represent objective state of the participants as they are not commonly being controlled. Thus, using skin conductance as a marker of stress and heart rate variability as a marker of emotion regulation help understand the effect of the experiment in a non-bias way. The measure can also be used to compare with the subjective report of stress in order to understand the importance of perceived stress vs physiological stress in response to the experimental tasks. Moreover, the introduction of new technologies through the use of virtual reality can be a powerful tool to induce a lab-controlled trauma. Using virtual reality can increase immersion and engagement with the trauma film paradigm, meaning that it is one step closer to the investigation of the effect of real-life trauma.

6.4: Future Directions and Implications

The findings from the studies in this thesis can be used as a foundation for future research on the importance of rejection sensitivity. Possible research can aim to cover some of the limitations of the studies. Investigating the physiological responses in those with a high level of rejection sensitivity may produce comparable data to the insignificant findings from study 2 and 3. Moreover, assessment on cognitive appraisal and subjective emotion regulation can potentially provide valuable findings that bridge the gaps between rejection sensitivity and PTSD.

Future studies may also aim to develop an updated version of rejection sensitivity questionnaire. With the introduction of social media and new technologies, the anxiety of the possibility of rejection through these means must be taken into account. Moreover, online dating has become increasingly common, and the negative impact of rejection sensitivity can be an important factor that determines the effect online dating has on an individual.

The new adaptation of rejection task used in study 3 allows for a possibility of extending research on the impact of online social rejection in the lab setting. Moreover, future studies can aim to validate the method and compare to real-life social media rejection in order to make sure the task represents actual rejection and not just stress. Similarly, virtual-reality trauma film can be used in future studies as an avenue to investigate the consequences of lab-induced trauma and stress without posing actual physical harm to the participants.

The findings suggest the importance of rejection sensitivity in interfering with forming social support and subsequent mental health. Future studies can use this information as a basis of introducing rejection sensitivity as a risk factor for loneliness and PTSD as well as the contribution rejection sensitivity has on the development of PTSD following trauma.

With these findings and data from potential future research, a development of a cost-effective treatment for PTSD can be useful for someone like Kevin. By assessing rejection sensitivity as an early sign for potential psychological maladjustment, it is possible to develop an intervention that aims to build resilience to rejection for Kevin to prevent the detrimental impact of subsequent

rejection. Moreover, rejection sensitivity may be used as an indicator of potential development of PTSD following trauma. This will help professionals identify those at risk of developing PTSD amongst trauma survivor and intervene before seeing the symptoms of PTSD. After traumatic experience, Kevin could be introduced to a support group that build the level of social support he has. Combine with introducing skills for managing social relationship, Kevin would be able to form meaningful relationships with those around him. These relationships can then prevent loneliness and social isolations, which then reduce the need for substance abuse and promote better mental health.

Appendices

Appendix A

Ethical Approval and Materials for Study 1



CLES – Psychology
Psychology
College of Life and Environmental Sciences
University of Exeter
Washington Singer Building
Perry Road
Exeter
EX4 4QG
Web: www.exeter.ac.uk

CLES – Psychology Ethics Committee

Dear Bom Jittayuthd

Ethics application - eCLESPsy000535

Relationship Between Rejection Sensitivity and PTSD: Exploration of Their Relating Factors

Your project has been reviewed by the CLES – Psychology Ethics Committee and has received a Favourable opinion.

The Committee has made the following comments about your application:

Heather O Mahen commented, This is a very thorough ethical application. The informed consent meets GDPR standards. One comment - is the sample size large enough for interactions?

- Please view your application at <https://eethics.exeter.ac.uk/CLESPsy/> to see comments in full.

If you have received a Favourable with conditions, Provisional or unfavourable outcome you are required to re-submit for full review and/or confirm that committee comments have been addressed before you begin your research.

If you have any further queries, please contact your Ethics Officer.

Yours sincerely

Date: 11/04/2022

CLES – Psychology Ethics Committee



PARTICIPANT INFORMATION SHEET

RELATIONSHIP BETWEEN SOCIAL RELATIONSHIP AND EXTREME STRESS

My name is Sila Jittayuthd and thank you for your interest in taking part in my PhD research study. Before you participate, it is important for you to understand what it will involve. Please take time to read the following information carefully before you decide whether or not you wish to take part.

WHAT IS THE PURPOSE OF THE STUDY?

This study is designed to learn more about the role of social relationships for individuals who have experienced extreme stress and/or psychological trauma such as assaults, severe accidents or natural disasters, war or combat.

WHY HAVE I BEEN INVITED TO PARTICIPATE?

You have been invited to participate because you either responded to a flyer or signed up via social media.

DO I HAVE TO TAKE PART?

Participation is voluntary and participants may withdraw from the research for any or no reason, and at any time, without penalty. Your decision as to whether you take part in the study or not is entirely up to you and will not have any impact on you.

WHAT WILL HAPPEN TO ME IF I TAKE PART?

The questionnaire takes about 30 minutes to complete.

This study consisted of five sets of questionnaires. These questionnaires will ask you about your stressful experiences and your social relationships.

WHAT ARE THE POSSIBLE DISADVANTAGES AND RISKS OF TAKING PART?

There is a time cost (20-30 minutes) associated with the study. In our experience participants who answer the questionnaire may experience different feelings. Answering questions about your stressful experiences may temporarily increase negative feelings. Others have reported that they feel relieved if a bit tired afterwards. In the unlikely event that

extreme negative feelings or distress occur or continue until after your participation we advise you to contact your GP or make use of the helplines number listed below. Please note that you can discontinue participation at any time without giving reasons.

Wellbeing Service - Talking Therapies and Mental Health Team

Reed Hall - Hailey Wing

University of Exeter

Streatham Drive

Exeter

EX4 4QR

We also offer limited appointments at **St Lukes Campus**

Phone: 01392 724381

Email: wellbeing@exeter.ac.uk

Samaritans

Samaritans provides confidential emotional support, 24 hours a day, for people who are experiencing feelings of distress or despair. Samaritans are there if you're worried about something, feel upset or confused, or just want to talk to someone.

Telephone (24 hours): 08457 90 90 90

E-mail: jo@samaritans.org

Website: <http://www.samaritans.org>

Address: Chris, P.O. Box 9090, Stirling, FK8 2SA

Depression Alliance

Depression Alliance is a charity which aims to assist people who are affected by depression. Depression Alliance offer information, a range of publications, self-help and support groups for people with depression.

Telephone (to request an information pack): 0845 123 23 20

E-mail: information@depressionalliance.org

Website: <http://www.depressionalliance.org>

Address: Depression Alliance, 20 Great Dover Street, London, SE1 4LX

SANEline

SANeline is a national out-of-hours telephone helpline, offering emotional support and information for people affected by mental health problems. They also offer e-mail support through SANEmail, their e-mail service.

Telephone (6pm – 11pm, daily): 0845 767 8000

E-mail: visit <http://www.sane.org.uk/SANEmail>

Website: <http://www.sane.org.uk/SANeline>

Address: 1st Floor Cityside House, 40 Adler Street, London E1 1EE

Other useful websites for information about depression:

NHS choices:

<http://www.nhs.uk/Conditions/Depression/Pages/Introduction.aspx>

Mind:

http://www.mind.org.uk/help/diagnoses_and_conditions/depression

Depression Alliance:

<http://www.depressionalliance.org/>

University of Exeter:

<http://www.exeter.ac.uk/mooddisorders/>

WHAT ARE THE POSSIBLE BENEFITS OF TAKING PART?

There are no direct benefits to you of participating, but it is hoped the results will increase our understanding of the studied subject. There will also be a prize draw of £50, £20, and £5.

WILL MY INFORMATION IN THIS STUDY BE KEPT CONFIDENTIAL?

Confidentiality will be maintained in all aspects of data dissemination. Only unique numeric ID will be assigned for each participant. Names and IDs will not be matched. However, email address is required to enter the prize draw. The emails will not be matched with names. Whether you want to be entered into the prize draw or not is entirely up to you and will not have an impact on you or the study. Electronic records will be stored on password-protected computers. All data will be stored for a minimum of 1 year after collection. Data is typically

retained for 5 years after publication of the study with electronic data will be destroyed by deletion. Participants have the option of reviewing and / or removing all of their data from the study, if the request is made immediately after the study. The anonymous data may be published in scientific journals – individual participants will not be identified.

WHAT SHOULD I DO IF I WANT TO TAKE PART?

If you would like to participate, please click below to continue.

WHAT WILL HAPPEN TO THE RESULTS OF THE RESEARCH STUDY?

The data collected will be used as a part of PhD thesis.

WHO IS ORGANISING AND FUNDING THE RESEARCH?

This research study is being conducted by (Bom) Sila Jittayuthd (sj423@exeter.ac.uk) Postgraduate research student, University of Exeter.

WHO HAS APPROVED THIS STUDY?

This research has been approved by the School of Psychology Ethics Committee, University of Exeter.

CONTACT FOR FURTHER INFORMATION

For any questions or information about this study please contact (Bom) Sila Jittayuthd: sj423@exeter.ac.uk or my supervisor Dr. Anke Karl: a.karl@exeter.ac.uk. If you have any concerns about the way in which the study has been conducted, you can contact the School of Psychology Ethics Committee, University of Exeter: l.a.leaver@exeter.ac.uk (Lisa Leaver). The University of Exeter has insurance in place to cover its legal liabilities in respect of this study.

THANK YOU FOR TAKING THE TIME TO READ THIS INFORMATION SHEET

DATE

02/02/2018



CONSENT FORM

STUDY TITLE: RELATIONSHIP BETWEEN SOCIAL RELATIONSHIP AND EXTREME STRESS

Project Approval Reference:

I agree to take part in the above University of Exeter research project. I have read and understood the Information Sheet page. I understand that agreeing to take part means that I am willing to:

- Offer information regarding age, gender, and ethnicity
- Complete questionnaires regarding my traumatic experience, post-traumatic stress symptoms, interpersonal relationship, support from others, and experience of rejection.

I understand that any information I provide is confidential, and that no information that I disclose will lead to the identification of any individual in the reports on the project, either by the researcher or by any other party.

I understand that my participation is voluntary, that I can choose not to participate in part or all of the project, and that I can withdraw at any stage of the project up until the point at which data collection has commenced without being penalised or disadvantaged in any way.

I consent to the processing of my personal information for the purposes of this research study. I understand that such information will be treated as strictly confidential and handled in accordance with the Data Protection Act 1998.

I consent to the use of my data for future related research studies which have research governance approval, as long as my identity is not included in the dataset.

Appendix B

Ethical Approval and Materials for Study 2



CLES – Psychology
Psychology
College of Life and Environmental Sciences
University of Exeter
Washington Singer Building
Perry Road
Exeter
EX4 4QG
Web: www.exeter.ac.uk

CLES – Psychology Ethics Committee

Dear Bom Jittayuthd

Ethics application - eCLESPsy000536

Investigating the effect of rejection sensitivity on physiological responses to rejection

Your project has been reviewed by the CLES – Psychology Ethics Committee and has received a Favourable with conditions opinion.

The Committee has made the following comments about your application:

Fine, but please make sure that you orally debrief participants about the deception at the end (as well as give them the written debriefing information).

- Please view your application at <https://eethics.exeter.ac.uk/CLESPsy/> to see comments in full.

If you have received a Favourable with conditions, Provisional or unfavourable outcome you are required to re-submit for full review and/or confirm that committee comments have been addressed before you begin your research.

If you have any further queries, please contact your Ethics Officer.

Yours sincerely

Date: 11/04/2022

CLES – Psychology Ethics Committee



PARTICIPANT INFORMATION SHEET

PSYCHOPHYSIOLOGICAL RESPONSES TO SOCIAL INTERACTION

My name is Sila Jittayuthd and thank you for your interest in taking part in my PhD research study. Before you participate, it is important for you to understand what it will involve. Please take time to read the following information carefully before you decide whether or not you wish to take part.

WHAT IS THE PURPOSE OF THE STUDY?

This study is designed to learn more about the role of self-reflection and social interaction on mood and bodily responses. The social interaction may invoke an increase in psychophysiological responses to these situations.

WHY HAVE I BEEN INVITED TO PARTICIPATE?

You have been invited to participate because you either responded to a flyer or signed up via social media.

DO I HAVE TO TAKE PART?

Participation is voluntary and participants may withdraw from the research for any or no reason, and at any time, without negative consequences. Your decision as to whether you take part in the study or not is entirely up to you and will not have any impact on you.

WHAT WILL HAPPEN TO ME IF I TAKE PART?

The overall experiment takes about an hour to complete.

This study consisted of three stages. First, we will ask you to answer a few questions online to make sure you are eligible to participate in this study and to answer a few general questions about yourself. If you meet our inclusion criteria, we will invite you to complete an experimental task, which involves writing about yourself before engaging in a social interaction task. Throughout this session, we will assess your mood and bodily responses (electrocardiogram and galvanic skin response). For this we will attach a few leads to your chest and non-dominant hand. The leads will be filled with a salty gel. They can be removed in less than a minute and the gel can be wiped off easily. At the end of the laboratory session, we will ask you to complete a questionnaire relating to the task and to watch a pleasant short video.

WHAT ARE THE POSSIBLE DISADVANTAGES AND RISKS OF TAKING PART?

There is a time cost (45 minutes-1 hour) associated with the study. Reflecting about yourself and completing a social interaction task may be temporarily unpleasant for some individuals whereas others may enjoy it or feel neither negative or positive about it. Participation in the study is not recommended if you are currently very distressed or feeling low mood. In the unlikely event that extreme negative feelings or distress occur or continue until after your participation we advise you to contact your GP or make use of the helplines number listed below. Please note that you can discontinue participation at any time without giving reasons.

WHAT ARE THE POSSIBLE BENEFITS OF TAKING PART?

There are no direct benefits to you of participating, but it is hoped that the results will increase our understanding of the studied subject. As a thank you and reimbursement for your time we will give you 1 course credit or £5.

WILL MY INFORMATION IN THIS STUDY BE KEPT CONFIDENTIAL?

Confidentiality will be maintained in all aspects of data dissemination. Only unique numeric ID will be assigned for each participant. Names and IDs will not be matched. Electronic records will be stored on password-protected computers. All data will be stored for a minimum of 1 year after collection. Data is typically retained for 5 years after publication of the study with electronic data will be destroyed by deletion. Participants have the option of reviewing and / or removing all of their data from the study, if the request is made immediately after the study. The anonymous data may be published in scientific journals – individual participants will not be identified.

WHAT SHOULD I DO IF I WANT TO TAKE PART?

If you would like to participate, please follow the instructions, and complete the informed consent form.

WHAT WILL HAPPEN TO THE RESULTS OF THE RESEARCH STUDY?

The data collected will be used as a part of PhD thesis, will be submitted for publication in a peer-reviewed journal and presented at scientific conferences.

WHO IS ORGANISING AND FUNDING THE RESEARCH?

This research study is being conducted by (Bom) Sila Jittayuthd (sj423@exeter.ac.uk) Postgraduate research student, University of Exeter.

WHO HAS APPROVED THIS STUDY?

This research has been approved by the School of Psychology Ethics Committee, University of Exeter.

CONTACT FOR FURTHER INFORMATION

For any questions or information about this study please contact (Bom) Sila Jittayuthd: sj423@exeter.ac.uk or my supervisor Dr. Anke Karl: a.karl@exeter.ac.uk. If you have any concerns about the way in which the study has been conducted, you can contact the Chair of Exeter University's Ethics Committee Dr. Nick Moberly, (n.j.moberly@ex.ac.uk). The University of Exeter has insurance in place to cover its legal liabilities in respect of this study.

THANK YOU FOR TAKING THE TIME TO READ THIS INFORMATION SHEET

Wellbeing Service - Talking Therapies and Mental Health Team

Reed Hall - Hailey Wing
University of Exeter
Streatham Drive
Exeter
EX4 4QR

We also offer limited appointments at **St Lukes Campus**

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Email: wellbeing@exeter.ac.uk

Samaritans

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E-mail: jo@samaritans.org

Website: <http://www.samaritans.org>

Address: Chris, P.O. Box 9090, Stirling, FK8 2SA

Depression Alliance

Depression Alliance is a charity which aims to assist people who are affected by depression. Depression Alliance offer information, a range of publications, self-help and support groups for people with depression.

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E-mail: information@depressionalliance.org

Website: <http://www.depressionalliance.org>

Address: Depression Alliance, 20 Great Dover Street, London, SE1 4LX

SANeline

SANeline is a national out-of-hours telephone helpline, offering emotional support and information for people affected by mental health problems. They also offer e-mail support through SANemail, their e-mail service.

Telephone (6pm – 11pm, daily): 0845 767 8000

E-mail: visit <http://www.sane.org.uk/SANEmail>

Website: <http://www.sane.org.uk/SANeline>

Address: 1st Floor Cityside House, 40 Adler Street, London E1 1EE

Other useful websites for information about depression:

NHS choices:

<http://www.nhs.uk/Conditions/Depression/Pages/Introduction.aspx>

Mind:

http://www.mind.org.uk/help/diagnoses_and_conditions/depression

Depression Alliance:

<http://www.depressionalliance.org/>

University of Exeter:

<http://www.exeter.ac.uk/mooddisorders/>

DATE

02/08/2018



CONSENT FORM

STUDY TITLE: PHYSIOLOGICAL RESPONSES TO AND EXTREME STRESS

Project Approval Reference:

I agree to take part in the above University of Exeter research project. I have read and understood the Information Sheet page. I understand that agreeing to take part means that I am willing to:

- Offer information regarding age, gender, and ethnicity.
- Participates in an essay writing task.
- Complete questionnaires regarding my experience of the task interpersonal relationship, and experience of rejection.

I understand that any information I provide is confidential, and that no information that I disclose will lead to the identification of any individual in the reports on the project, either by the researcher or by any other party.

I understand that my participation is voluntary, that I can choose not to participate in part or all of the project, and that I can withdraw at any stage of the project up until the point at which data collection has commenced without being penalised or disadvantaged in any way.

I consent to the processing of my personal information for the purposes of this research study. I understand that such information will be treated as strictly confidential and handled in accordance with the Data Protection Act 1998.
--

I consent to the use of my data for future related research studies which have research governance approval, as long as my identity is not included in the dataset.

Appendix C

Ethical Approval and Materials for Study 3



CLES – Psychology
Psychology
College of Life and Environmental Sciences
University of Exeter
Washington Singer Building
Perry Road
Exeter
EX4 4QG
Web: www.exeter.ac.uk

CLES – Psychology Ethics Committee

Dear Bom Jittayuthd

Ethics application - eCLESPsy000977

USING VR TO INVESTIGATE ITS EFFECT ON OUR PSYCHOPHYSIOLOGICAL RESPONSES

Your project has been reviewed by the CLES – Psychology Ethics Committee and has received a Favourable opinion.

The Committee has made the following comments about your application:

Nick Moberly commented, Amendment approved via Chair's action.

- Please view your application at <https://eethics.exeter.ac.uk/CLESPsy/> to see comments in full.

If you have received a Favourable with conditions, Provisional or unfavourable outcome you are required to re-submit for full review and/or confirm that committee comments have been addressed before you begin your research.

If you have any further queries, please contact your Ethics Officer.

Yours sincerely

Date: 11/04/2022

CLES – Psychology Ethics Committee



PARTICIPANT INFORMATION SHEET

USING VR TO INVESTIGATE ITS EFFECT ON OUR PSYCHOPHYSIOLOGICAL RESPONSES

My name is Sila Jittayuthd, and I thank you for your interest in taking part in my PhD research study. Before you participate, it is important for you to understand what it will involve. Please take time to read the following information carefully before you decide whether or not you wish to take part.

WHAT IS THE PURPOSE OF THE STUDY?

This study is designed to learn more about the effect of a virtual reality stressor on immediate mood and bodily responses and on their responses within a week after experiencing the stressor in order to understand how individuals manage stress in specific situations over time. This will help us understand factors that prevent or facilitate helpful management of stress.

WHY HAVE I BEEN INVITED TO PARTICIPATE?

You have been invited to participate because you either responded to a flyer or signed up via social media.

DO I HAVE TO TAKE PART?

Participation is voluntary and participants may withdraw from the research for any or no reason, and at any time, without negative consequences. Your decision as to whether you take part in the study or not is entirely up to you and will not have any impact on you.

WHAT WILL HAPPEN TO ME IF I TAKE PART?

This study consisted of three stages. First, in order to take part in this study you will be asked to complete a screening questionnaire that will be sent to you by email. ***If you are currently experiencing excessive levels of distress in your daily life or if you have a history of psychological trauma or posttraumatic stress disorder, we advise you not to participate in this research.***

Participants who are excluded from the study will not receive the payment or course credits, however, there are many more opportunities to participate in other research within the department that provide the same benefits. We apologise for the inconvenience, and we would like to thank you for your interest.

If you meet our inclusion criteria, we will invite you to complete an experimental task, which involves completing series of questionnaires, this is then follow by watching a virtual reality (VR) film **that is set in a car. The film will be a little more traumatic than watching a distressing news but will not be more distressing than A12 (or PG13) films.** Throughout this session, we will assess your bodily responses (electrocardiogram and galvanic skin response). For this we will attach a few electrodes to your chest and non-dominant hand. The leads will be filled with a salty gel. They can be removed in less than a minute and the gel can be wiped of easily. At the end of the laboratory session, we will ask you to complete a few questionnaires relating to your experience and to watch a pleasant short video.

The third part of the experiment involves writing down your thoughts and feelings about the films that may occurs within a week after your visit to the lab. The note can be accessed on your phone/ computer and a reminder will be sent to you once a day to make sure that you have completed the diary.

WHAT ARE THE POSSIBLE DISADVANTAGES AND RISKS OF TAKING PART?

There is a time cost associated with the study. Watching the VR film may be temporarily unpleasant for some individuals whereas others may enjoy it or feel neither negative or positive about it. Participation in the study is not recommended if you are currently very distressed or feeling low mood. In the unlikely event that extreme negative feelings or distress occur or continue until after your participation we advise you to contact your GP or make use of the helplines number listed below. **There is a low chance that you might experience a slight motion sickness while watching the VR film. If this happens, please let the experimenter knows immediately and we will pause the experiment.** Please note that you can discontinue participation at any time without giving reasons. **You may still receive the remuneration even if you decided to discontinue the participation.**

WHAT ARE THE POSSIBLE BENEFITS OF TAKING PART?

There are no direct benefits to you of participating, but it is hoped that the results will increase our understanding of the studied subject. As a thank you and reimbursement for your time we will give you 4 course credit or £10.

WILL MY INFORMATION IN THIS STUDY BE KEPT CONFIDENTIAL?

Confidentiality will be maintained in all aspects of data dissemination. Only unique numeric ID will be assigned for each participant. Names and IDs will not be matched. Electronic records will be stored on password-protected computers. All data will be stored for a minimum of 1 year after collection. Data is typically retained for 5 years after publication of the study with electronic data will be destroyed by deletion. Participants have the option of reviewing and / or removing all of their data from the study, if the request is made immediately after the study. The anonymous data may be published in scientific journals – individual participants will not be identified. Any emails provided will be used to contact you to arrange the lab session only and will not be retain in the system.

The University of Exeter processes personal data for the purposes of carrying out research in the public interest. The University will endeavour to be transparent about its processing of your personal data and this information sheet should provide a clear explanation of this. If you do have any queries about the University's processing of your personal data that cannot be resolved by the research team, further information may be obtained from the University's

Data Protection Officer by emailing dataprotection@exeter.ac.uk or at www.exeter.ac.uk/dataprotection

The information and data provided by you in this experiment will be used for statistical research and research administration purposes only. The data you provide in response to our questions are anonymised and will be retained and stored in electronic format indefinitely. The data will be stored on the secure (EU-based) Qualtrics server, or as files on password-protected computers used by the research team. Contact detail (i.e., your email and phone number) will be retained upon your sign-up for this study via SONA system. Personal information (including your name and student number, which are required for processing participant payment through T1 financial system) will be collected via emails upon completion of the study and will not be associated with your response to the online survey, which ensures your data in this study remain anonymous. Both contact and personal information you provide in this study are deemed as 'personal data' under the General Data Protection Regulation and will be stored securely on the Exeter University network space which is password protected. This information will only be accessed by the researchers of this study and will be immediately deleted upon completion of the study.

If you decide to leave the study before completion, then your data will be withdrawn from the Qualtrics survey. Your contact detail will be deleted permanently and no personal information (i.e., your name and student number) will be collected.

At the end of the study, your anonymised data will be made "Open Access". This means that data are made available, free of charge, to anyone interested in the research, or who wishes to conduct their own analysis of the data. We will therefore have no control over how these data are used. No data or responses will be published in which you can be identified individually. Open access of research data and findings is considered best scientific practice and is a requirement of many funding bodies and scientific journals. Sharing data helps to maximise the impact of investment through wider use and encourages new avenues of research.

WHAT SHOULD I DO IF I WANT TO TAKE PART?

If you would like to participate, please follow the instructions and complete the informed consent form.

WHAT WILL HAPPEN TO THE RESULTS OF THE RESEARCH STUDY?

The data collected will be used as a part of PhD thesis, will be submitted for publication in a peer-reviewed journal and presented at scientific conferences.

WHO IS ORGANISING AND FUNDING THE RESEARCH?

This research study is being conducted by (Bom) Sila Jittayuthd (sj423@exeter.ac.uk) Postgraduate research student, University of Exeter.

WHO HAS APPROVED THIS STUDY?

THIS PROJECT HAS BEEN REVIEWED BY THE CLES PSYCHOLOGY ETHICS COMMITTEE AT THE UNIVERSITY OF EXETER.

CONTACT FOR FURTHER INFORMATION

For any questions or information about this study please contact (Bom) Sila Jittayuthd: sj423@exeter.ac.uk or my supervisor Dr. Anke Karl: a.karl@exeter.ac.uk. If you have any concerns about the way in which the study has been conducted, you can contact the Chair of Exeter University's Ethics Committee Dr. Nick Moberly, (n.j.moberly@ex.ac.uk) or Gail

Seymour, Research Ethics and Governance Manager (g.m.seymour@exeter.ac.uk, 01392 726621).

THANK YOU FOR TAKING THE TIME TO READ THIS INFORMATION SHEET

Wellbeing Service - Talking Therapies and Mental Health Team

Reed Hall - Hailey Wing
University of Exeter
Streatham Drive
Exeter
EX4 4QR

We also offer limited appointments at **St Lukes Campus**

Phone: 01392 724381

Email: wellbeing@exeter.ac.uk

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Samaritans provides confidential emotional support, 24 hours a day, for people who are experiencing feelings of distress or despair. Samaritans are there if you're worried about something, feel upset or confused, or just want to talk to someone.

Telephone (24 hours): 08457 90 90 90

E-mail: jo@samaritans.org

Website: <http://www.samaritans.org>

Address: Chris, P.O. Box 9090, Stirling, FK8 2SA

Depression Alliance

Depression Alliance is a charity which aims to assist people who are affected by depression. Depression Alliance offer information, a range of publications, self-help and support groups for people with depression.

Telephone (to request an information pack): 0845 123 23 20

E-mail: information@depressionalliance.org

Website: <http://www.depressionalliance.org>

Address: Depression Alliance, 20 Great Dover Street, London, SE1 4LX

SANEline

SANEline is a national out-of-hours telephone helpline, offering emotional support and information for people affected by mental health problems. They also offer e-mail support through SANEmail, their e-mail service.

Telephone (6pm – 11pm, daily): 0845 767 8000

E-mail: visit <http://www.sane.org.uk/SANEmail>

Website: <http://www.sane.org.uk/SANEline>

Address: 1st Floor Cityside House, 40 Adler Street, London E1 1EE

Other useful websites for information about depression:

NHS choices:

<http://www.nhs.uk/Conditions/Depression/Pages/Introduction.aspx>

Mind:

http://www.mind.org.uk/help/diagnoses_and_conditions/depression

Depression Alliance:

<http://www.depressionalliance.org/>

University of Exeter:

<http://www.exeter.ac.uk/mooddisorders/>

DATE

18/04/2019

CONSENT FORM

STUDY TITLE: USING VR TO INVESTIGATE ITS EFFECT ON OUR PSYCHOPHYSIOLOGICAL RESPONSES

Project Approval Reference:

I agree to take part in the above University of Exeter research project. I have read and understood the Information Sheet. I understand that agreeing to take part means that I am willing to:

- Participates in VR film watching task.
- Complete questionnaires and diary regarding my experience of the task.
- agree to the audio-recording of the interview

I understand that any information I provide is confidential, and that no information that I disclose will lead to the identification of any individual in the reports on the project, either by the researcher or by any other party.

I understand that my participation is voluntary, that I can choose not to participate in part or all of the project, and that I can withdraw at any stage of the project up until the point at which data collection has commenced without being penalised or disadvantaged in any way.

I consent to the processing of my personal information for the purposes of this research study. I understand that such information will be treated as strictly confidential and handled in accordance with the Data Protection Act 2018 and GDPR.

I understand that anonymised data will be registered and archived at the University of Exeter's ORE repository in order to make them available to other researchers in line with current data sharing practices.

I understand that relevant sections of the data collected during the study, may be looked at by members of the research team, individuals from the University of Exeter, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records.

I understand that taking part involves anonymised questionnaire responses and behavioural responses in the tasks to be used for the propose of measuring in an archive for a period of up to 5 years

I consent to the use of my data for future related research studies which have research governance approval, as long as my identity is not included in the dataset.

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