A STUDY OF EMOTIONAL VULNERABILITY AND REACTIONS TO STRESS

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THE UNIVERSITY OF MANCHESTER

ABSTRACT OF THESIS

'A Study of Emotional Vulnerability and Reactions to Stress'

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The first part of the thesis explored the pattern of emotional reactivity amongst individuals with Borderline Personality Disorder (BPD). A previous review (Rosenthal, Gratz, Kosson, Cheavens, Lejuez & Lynch, 2008) claimed that a discrepancy exists in the subjective versus objective patterns of responding to emotional stimuli in those with BPD. The present review assessed the reliability of such findings by reviewing a more homogenous sample of studies that had used similar methodological procedures, in addition to a range of subjective and objective measures. It also aimed to investigate psychophysiological factors associated with this proposed divergent pattern of responding. The methodological quality of all included studies was assessed. The evidence reviewed disputes claims that BPD individuals display diminished physiological reactivity, despite equal or higher self-reported emotional reactivity than controls. Instead, the present review found that individuals with BPD react more severely (both psychologically and physiologically) to experimental stimuli, than controls, particularly when the stimuli is personally-relevant. Disruption of specific brain structures involved in the regulation of emotion within the Autonomic Nervous System (ANS) are implicated in this heightened profile of emotional reactivity. Furthermore, present state dissociation acts as a defence mechanism which appears to limit cognitive processing abilities such as problem-solving, attention and concentration in those with BPD.

The second part of the thesis described a randomised controlled study investigating the effects of an attention training technique on pain tolerance. The Attention Training Technique (ATT; Wells, 1990) is a brief technique used in metacognitive therapy to modify attentional control. The effect of ATT versus Progressive Muscular Relaxation (PMR) on pain tolerance was examined in a sample of individuals who had experienced early childhood trauma (N=57). Participants were randomly assigned to either the ATT condition (N = 29) or the PMR condition (N = 28). A laboratory stressor was included: The Cold Pressor Task (CPT) as an objective measure of pain tolerance. Results supported the hypothesis that ATT modified performance on the CPT. Individuals assigned to the ATT condition were able to persist significantly longer with the CPT than those in the PMR condition. Theoretical and clinical implications of the findings are discussed. Results provide preliminary evidence for the possible benefits of ATT within medical settings.

The third part of the thesis critically reflected on the methodological issues and dilemmas presented by the systematic review process, as well as the methodological and ethical issues raised by the research study.

Declaration

No portion of the work referred to in this thesis has been submitted in support of an application for another degree of qualification of this or any other university or institute of learning.

Copyright Statement

The Author

Qualifications:

Post-graduate Diploma in Cognitive Behavioural Psychotherapy: Pass

The University of Huddersfield (2010)

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Bachelor of Sciences (Honours) Psychology: 2:1

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Part 1: Literature Review

The discrepancy between subjective and objective reactivity in Borderline Personality Disorder: Reliability of effects and associated psychophysiological factors

This manuscript was prepared in accordance with journal guidelines for

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A copy of the author information pack is available in Appendix A.

Word count: 13,467 (including figures, tables and references)

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Abstract

Previous studies that have used either physiological *or* self-report measures of distress identified a discrepancy between objective and subjective reactivity amongst those with Borderline Personality Disorder (BPD). The present review explored the reliability of this discrepancy by synthesising findings from studies that have utilised *both* objective *and* subjective measures of distress. It also investigated associated psychophysiological factors that may explain it. Ten studies of individuals with BPD were reviewed. The methodological quality of all studies was assessed. In contrast to a previous review by Rosenthal, Gratz, Kosson, Cheavens, Lejuez and Lynch (2008), findings from the present review did not confirm a discrepancy between the psychological and physiological aspects of emotional reactivity within BPD. The present review included a more homogenous set of studies which showed that BPD individuals react more severely than healthy controls and those with common mental health problems, in response to experimentally emotive stimuli. In particular, idiographic, personally relevant stimuli (versus standardized mood induction procedures) are required for a more consistent observation of these findings. Results were represented in studies that measured both sympathetic *and* parasympathetic aspects of objective, physiological arousal, in addition to subjective, self-reported psychological reactivity. Disruption in the Hypothalamic-Pituitary-Adrenal-Axis (HPAA); a brain structure involved in the regulation of emotion (leading to a lack of concordance between parasympathetic and sympathetic aspects of Autonomic Nervous System [ANS] arousal) appears to explain this overall heightened level of emotional reactivity in BPD individuals. Moreover, when exposed to idiographic stimuli, present state dissociation appears to act as a defence mechanism which may limit cognitive processing abilities such as problem-solving, attention and concentration in those with BPD.

Keywords: *abuse, history, trauma, personality, emotion, reactivity, physiological*

Key Practitioner Message

- Individuals with BPD react more intensely to emotional stimuli than those with common mental health problems and healthy controls.

- This heightened pattern of emotional reactivity is particularly true when BPD subjects are exposed to personally-relevant stimuli and is represented in both their self-reported experience and physiological arousal levels.

- Brain structures involved in the regulation of emotion within the parasympathetic and sympathetic branches of the ANS are biased in those with BPD and this may explain their unique profile of emotional reactivity.

- During exposure to emotion-provoking, idiographic stimuli, individuals with BPD experience dissociation which limits their cognitive capacity for processing new information.

Introduction

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), Borderline Personality Disorder (BPD) is defined as an "impairment in personality *and* the presence of pathological personality traits" (American Psychological Association [APA], 2013). The disorder is characterised by impairments in identity or self-functioning, empathy or intimacy, in addition to negative affectivity, disinhibition and antagonism (APA, 2013). The domain concerning 'negative affectivity' comprises of emotional lability, anxiousness, separation insecurity and depressiveness. The term 'emotional lability' is the focus of the present review and it refers to "unstable emotional experiences…..that are easily aroused, intense and/ disproportionate to events and circumstances" (APA, 2013). For the purposes of this review this concept shall be referred to as 'emotional reactivity' which reflects the broader range of measures used for this construct.

Early literature exploring the concept of emotional reactivity within the field of BPD relied exclusively on the use of self-report measures, such as the Affective Lability Scale (ALS; Harvey, Greenberger & Serper, 1989) and the Affective Intensity Measure (AIM; Larson & Diener, 1987). As the recognition of the more objective, physiological aspects of emotional responding began to be acknowledged, several studies began to use Skin Conductance Responses (SCR's) and Heart Rate (HR) to explore the concept of emotional reactivity within a variety of clinical samples including phobias (Ohaman, Flykt & Lundqvist, 2000) and anxiety related disorders (Cuthbert, Lang, Strauss, Drobes, Patrick & Bradley, 2003). However, despite emotional reactivity being conceptualised as one of the key characteristics underpinning emotional dysregulation in BPD (Linehan, 1993), the evidence base to support such theoretical claims was sparse. The first published study exploring the psychophysiological nature of emotional reactivity within a BPD population identified a discrepancy between objective versus subjective distress (Herpertz, Kunert,

Schwenger & Sass, 1999). A previous review investigating this phenomenon collated studies that had used either physiological, behavioural or psychological measures of emotional reactivity (Rosenthal, Gratz Kosson, Cheavens, Lejuez & Lynch, 2008). Studies reviewed in Rosenthal et al.'s (2008) paper (Cowdry, Gardner, O'Leary, Leibenluft & Rubinow, 1991; Ebner-Priemer, Badeck, Beckmann, Wagner, Feige & Weiss, 2005; Herpertz et al., 1999; Schmahl, Elizinga, Ebner, Simms, Sanislow & Vermetten, 2004) generated mixed findings relating to the discrepancy. Heightened reactivity to experimental stimuli was observed subjectively, despite diminished physiological reactivity, in comparison to controls (Schmahl et al., 2004). This stood in contrast to studies using trait-based self-report measures which showed that BPD individuals respond much more intensely to negative life events than controls (Cowdry et al., 1991), despite lower levels of subjective reactivity and heightened physiological arousal in response to artificial, experimental stimuli. A further study found that BPD subjects exhibited reduced physiological responses in comparison to controls, despite equivalent levels of self-reported reactivity in relation to experimental stimuli (Herpertz et al., 1999).

Rosenthal et al. (2008) concluded that such mixed findings may be the result of studies that used a diverse range of methodological procedures. For example, some studies relied solely on the use of physiological measures (Ebner-Priemer et al., 2005), whereas others only used self-report measures. In addition, some studies used experimental paradigms to induce mood or stress (Herpertz et al., 1999), whereas others used more naturalistic, field based approaches (Cowdry et al., 1991). Of those that did use experimental mood induction procedures, some were evoked using general paradigms (e.g. exposure to white noise/ mental arithmetic tasks), whereas others used more BPD-related content to induce mood (e.g. exposure to a social rejection scenario). Finally, some studies used real time assessment methods, yet others used cross-sectional methods.

Hence, further research is required to (1) establish the reliability of findings by reviewing a more homogenous sample of studies that have used both objective and subjective measures of emotional reactivity and (2) seek to identify possible psychophysiological factors that may contribute to the observed discrepancy between the physiological versus psychological aspects of reactivity.

History of abuse and Borderline Personality Disorder (BPD)

Greater levels of psychopathology, including emotional dysregulation and sexually risky behaviours (Messman-Moore, Walsh & Dilillo, 2010) have been found amongst adult survivors of Childhood sexual abuse (CSA), emotional abuse or neglect in comparison to individuals who have not experienced such adverse life events (Cutajar, Mellen, Ogloff, Thomas, Wells & Spataro, 2010). More specific to the context of the present review, histories of early abuse and trauma are consistently found to be more prevalent in those with BPD (Golier, Yehuda, Bierer, Mitropoulou, New, Schmeidler, Silverman & Siever, 2003; Leichsenring, Leibing, Kruse, New & Leweke, 2011; Lohr, Westen & Hill, 1990). In comparison to those without a diagnosis of BPD, individuals with BPD report a significantly higher rate of exposure to childhood physical abuse (53% versus 34%) and are twice as likely to develop Post Traumatic Stress Disorder (PTSD) (Golier et al., 2003). More recent evidence has found that interpersonal trauma (sexual and physical assault or abuse) amongst those with BPD, is associated with high levels of co-morbid, Axis I disorders, including PTSD (Westphal, Olfson, Bravova, Gameroff, Gross, Wickramaratne, Pilowsky, Neugbauer, Shea, Lantigua, Weissman & Neria, 2013). In individuals with BPD, interpersonal trauma that occurred during adulthood was strongly associated with interpersonal trauma in childhood. However, 'non-interpersonal' trauma (e.g. non-invasive life adversities) was only linked to a diagnosis of BPD if the event/s had occurred in

childhood (Westphal et al., 2013), suggesting that early life exposure to trauma is perhaps a more powerful predictor of BPD, regardless of the specific type of traumatic incident. Furthermore, the interaction between temperamental personality traits and childhood emotional abuse not only increases the predisposition to developing BPD but also influences the severity of it (Martin-Blanco, Soler, Villalta, Felui-Soler, Elices, Perez, Arranz, Ferraz, Alvarez & Pascual, 2014). Some researchers have concluded that the earlier age at which the individual is exposed to trauma, the more detrimental the effect due to disruption of key neurological pathways implicated in the developmental strategies to regulate emotions (Claes, Vertommen, Smits & Bijttebier, 2009). Hence, in addition to investigating the concept of emotional reactivity, the present review was also interested in exploring the terms 'abuse' and 'trauma' since these are key constructs known to characterise the early life experiences of those with BPD (Kuo, Khoury, Metcalfe, Fitzpatrick & Goodwill, 2014).

Emotional reactivity and BPD

Inability to regulate emotions has long been considered a key feature of Borderline Personality Disorder (BPD) (Rosenthal et al., 2008). Impulsive behaviours often associated with emotional dysregulation, such as self-injurious behaviour, drug abuse, binge eating and attempts to commit suicide are commonly expressed by those with BPD, suggesting that heightened behavioural inhibition influences the expression of BPD in these individuals (Lynch, Chapman, Rosenthal, Kuo & Linehan, 2006).

According to Linehan's (1993) model of Dialectical Behaviour Therapy (DBT), the inability to regulate one's emotions involves three components; the first being an overall increased level of negative affect. Another factor is an elevated level of emotional arousal or reactivity to emotional stimuli. Finally, recovery to the emotional baseline appears to take longer for such individuals, following exposure to a negative emotional cue (Linehan, 1993;

Koenigsberg, Siever, Lee, Pizzarello, New, Goodman, Cheng, Flory & Prohovnik, 2009; Kuo & Linehan, 2009). Consistent findings support the notion that those with BPD display an elevated level of negative affect, in comparison to healthy controls (Carpenter & Trull, 2013). However, Linehan's (1993) model concerning the heightened emotional reactivity and arousal to distressing or negative stimuli of those with BPD remains controversial, with many studies producing conflicting findings. In fact, some studies have found that those with BPD showed *less* biological reactivity in comparison to controls (Ebner-Priemer et al., 2005; Limberg, Barnow, Freyberger & Hamm, 2011). Nevertheless, these studies measured objective, physiological responses of the hypothalamus-pituitary-adrenal-axis (HPAA) and Sympathetic Nervous System (SNS), as opposed to the psychological aspects of emotional reactivity. More research is warranted examining the qualitative self-reported level of emotional reactivity, instead of just relying on biological measures of emotional reactivity.

Rationale for the present review

Although a number of emerging studies recognised the importance of using *both* objective and subjective measures of emotional reactivity, a review is yet to be carried out on studies using multi-method assessments of emotional reactivity. Hence, the present review is novel because it encapsulates these two categorical definitions of emotional responding to establish whether a discrepancy in objective versus subjective reactivity is reliably found when a broader range of measures are utilised. Assuming reliability of this discrepancy is found, the review will also aim to explore possible factors associated with this divergent pattern of responding.

Aims

The aim of the current systematic review was to critically evaluate findings from studies that have used a diverse range of psychophysiological means of measuring emotional reactivity, amongst individuals diagnosed with BPD. It will:

a) review the methodological quality of all included studies.

b) establish the reliability of the finding concerning the discrepancy between objective versus subjective reactivity by reviewing a more homogenous sample of studies that have used similar methodological procedures *and* assessed both objective and subjective parameters with the sample subjects.

c) seek to identify possible psychophysiological factors that may contribute to the observed discrepancy.

Method

Search procedure

A systematic search of OVID (PsychInfo, AMED, Medline-R), EMBASE, PubMed, CINAHL Plus, SCOPUS and Web of Knowledge was conducted using the search terms: 'history of abuse', 'trauma', 'emotional reactivity', 'physiological reactivity' and 'personality'. Boolean searches were conducted using combinations of the following (and related terms): "Personality AND physio* reactivity OR emotion* reactivity" and "Trauma/ History of abuse AND physio* reactivity OR emotion* reactivity". The first combination of terms were exploded to include all relevant terms and then further refined with the second

combination of terms: "History of abuse AND personality* AND emotion* reactivity OR physiological reactivity".

Inclusion criteria

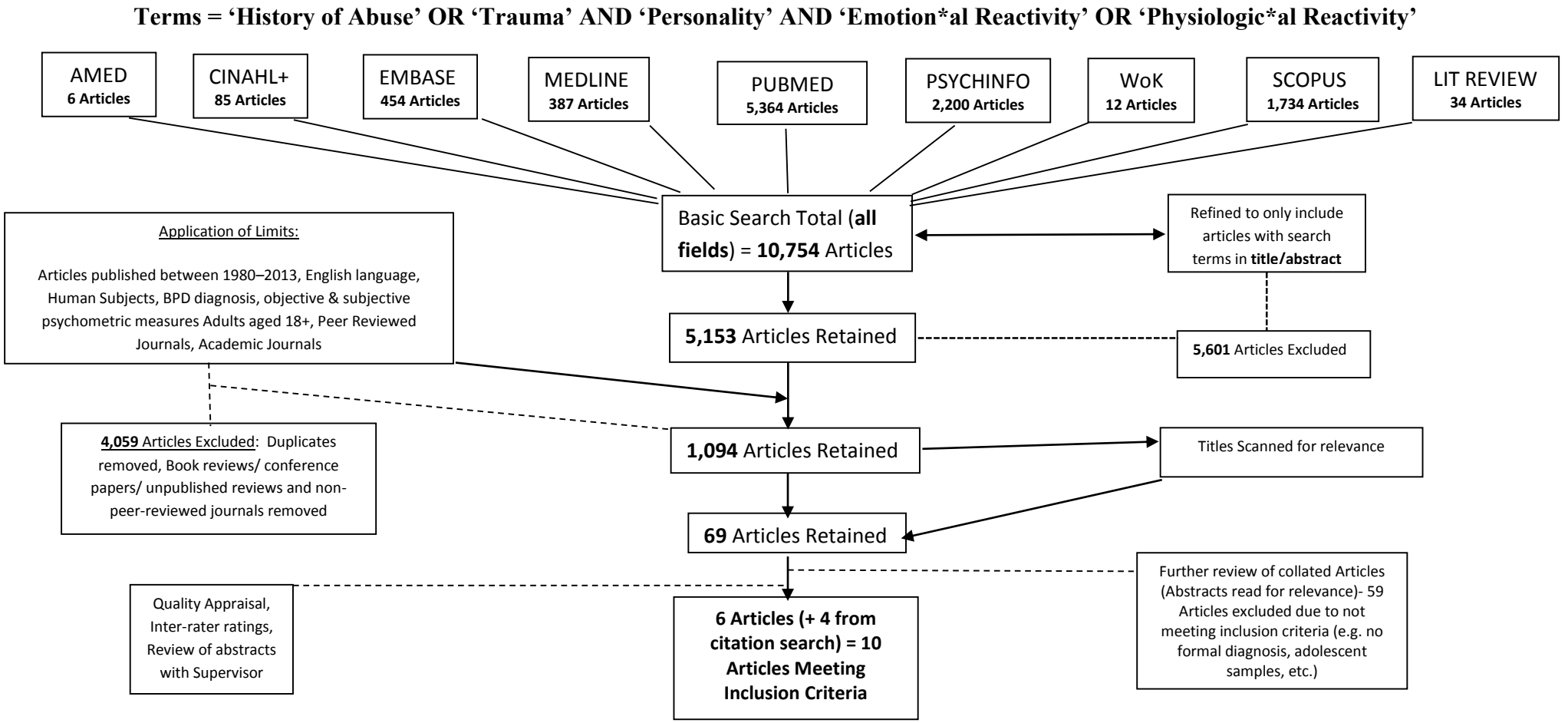
The studies that were included in this review met the following criteria: controlled/ comparative/ correlational studies, using a range of subjective and objective methods, published or 'in press' in a peer reviewed journal. All studies had to be written in English, published between 1980 and 2014 and reported on history of abuse, personality and emotional reactivity or physiological reactivity. Only studies using a quantitative design and *both* objective and subjective measures of reactivity were reviewed, whose samples included adult participants (> 18 years) meeting formal diagnostic criteria for BPD.

Exclusion criteria

Studies were excluded if they were unpublished (e.g. dissertation abstracts) or written in a language other than English. Studies that identified those with 'features' of BPD but that did not use established psychometric measures validated against diagnostic (DSM) criteria to assess these, were excluded from the review. Studies published prior to the year 1980 were excluded because this was the year in which formal diagnostic criteria for 'personality disorder' first appeared in the Diagnostic and Statistical Manual of Mental Disorders (DSM-III) (APA, 1980) as a '*bona fide*' psychiatric disorder. Studies using a qualitative design were excluded. All studies using non-human participants or children were excluded, given that disorders of personality are only diagnosable in human adults. Studies that did not measure the constructs of 'personality', 'history of abuse' and 'emotional or physiological reactivity' were also excluded.

A flow diagram of the search procedure is presented in Figure 1.

Figure 1: Flow Diagram of Systematic Literature Search



Results

The initial search, including *all fields,* returned a total of 10,754 articles (see Figure 1). These were refined to include only studies that included the search terms within their *abstract/ title*, which returned a total of 5,153 articles, prior to the application of inclusion/ exclusion criteria. Following exclusion of those articles that failed to meet the inclusion criteria, 1,094 were retained. All titles were initially scanned for relevance, which resulted in 69 articles. After reading the abstracts of these 69 papers in more detail, six articles met the inclusion criteria. Inspection of the references from these papers revealed a further four articles that were identified as suitable. Thus, a total of 10 papers were reviewed.

Overview

Eight studies looked directly at those with a clinical diagnosis of BPD, verified by diagnostic assessment tools such as the Structured Clinical interview for DSM-IV, 1994, Axis II Disorders, (SCID-II–BPD; First, Gibbon, Spitzer, Williams & Benjamin, 1997) and the Assessment DSM-IV Personality Disorders (ADP-IV; Schotte, De Donker, Van kerckhoven, Vertommen & Cosyns, 1998). Two of the studies used participants identified as having significant features of the disorder, as measured by a clinically rigorous assessment tool: the Personality Assessment Inventory – Borderline Features Scale, (PAI-BO; Morey 1991). The PAI-BOR (Morey, 1991) has shown strong convergent validity against diagnostic criteria for BPD amongst non-clinical populations (Trull, 1995; Stein, Pinsker-Aspen & Hilsenroth, 2007). Hence, studies that had used this tool to assess suitability of participation (Dixon-Gordon, Lovasz & Walters, 2011; Dixon-Gordon, Yiu & Chapman, 2013) were included in the present review. Six studies compared BPD individuals to Healthy Controls (HC's) (Austin, Riniolo & Poges, 2007; Barnow, Limberg, Stopsack, Spitzer, Grabe, Freyberger & Hamm, 2011; Elices, Soler, Fernandez, Martin-Blanco, Potella, Perez, Alvarez & Pascual,

2012; Feliu-Soler, Pascual, Soler, Sanz, Villamarin & Borras, 2013; Hazlett, Speiser, Goodman, Roy, Carrizal, Wyn, Williams, Romero, Minzenberg, Siever & New, 2007; Herpertz, Kunert, Schwenger & Sass, 1999). Two studies compared BPD individuals with individuals diagnosed with an Axis I Social Anxiety Disorder (SAD), in addition to HC's (Kuo & Linehan, 2009; Kuo Neacsiu, Fitzpatrick & MacDonald, 2014). Two further studies compared individuals with high features of BPD against individuals with medium and low features (Dixon-Gordon et al., 2011; 2013).

All 10 papers were subject to a quality assessment. Please refer to Table 1 for an overview of all included studies, which are presented in chronological order.

Study characteristics

The majority of the selected studies were American (N=5) (Austin et al., 2007; Dixon-Dixon-Gordon et al., 2013; Hazlett et al., 2007, Kuo & Linehan, 2009 and Kuo et al., 2014). One originated from Canada (N=1) (Dixon-Gordon et al., 2011). The remaining studies originated from Europe (N=4) (Barnow et al, 2011; Elices et al., 2012; Felui-Soler et al., 2013; Herpertz et al., 1999). Sample sizes ranged from 20 to 87 participants. The youngest participants were 18 years old and the oldest were 45.

All 10 studies used a quantitative design and established measures of subjective distress, such as the Hamilton Rating Scale for Depression (HRSD) (Hamilton, 1960), the State Trait Anxiety Inventory (STAI) (Speilberger, Gorssuch, Lushene, Vagg & Jacobs, 1983), the Dissociative State Scale (DSS) (Stiglymayr, Shapiro, Stieglitz, Limberger & Bohus, 2001), Visual Analogue Scales (VAS) (Haines, Williams, Brain & Wilson, 1995), the Self-Assessment Manikin (SAM) (Lang, 1980; Bradley & Lang, 1994), the Profile of Mood States (POMS) (McNair, Lorr & Droppleman, 1971) and the Positive and Negative Affect Scale (PANAS) (Watson, Clark & Tellegen, 1988).

Physiological responses were measured by Respiratory Sinus Arrhythmia (RSA), Skin Conductance Level (SCL) /Response (SCR), Salivary Cortisol, Heart Rate (HR), Electrocardiography (ECG) and Cardiac Impedance (IBI). Startle Eye-blink (SEB) responses were measured by Electromyography (EMG) activity. All studies (N=10) utilised both objective and subjective measures of reactivity and exposed participants to a laboratory emotion induction procedure, such as a Means End Problem Solving Procedure (MEPS; Dixon-Gordon et al., 2011) or white noise (Barnow et al., 2011; Hazlett et al., 2007), emotional picture viewing (neutral versus pleasant or unpleasant imagery) (Austin et al., 2007; Barnow et al., 2011; Elices et al., 2012; Feliu-Soler et al., 2013; Herpertz et al., 1999; Kuo & Linehan, 2009; Kuo et al., 2014) or a social rejection stressor such as giving a presentation and receiving feedback from a group of peers (Dixon-Gordon et al., 2011; 2013).

Synthesis of studies summarised in Table 1

The most recent study by Kuo et al. (2014) investigated emotional reactivity in BPD subjects versus SAD individuals and HC's by exploring their responses to both standardised and idiographic (personally-relevant) stimuli. They specifically targeted three distinct emotions: anger, sadness and fear. BPD participants displayed greater reactivity of sadness and anger (but *not* fear) in response to the idiographic stimuli. This was a different pattern to that exhibited by those with SAD/ HC's, who showed greater reactivity to fear imagery. BPD individuals showed greater self-reported reactivity to *all* emotions when exposed to standardised films, confirming heightened subjective reactivity compared to controls. Moreover, BPD individuals showed greater RSA than SAD's and HC's in response to standardized films in comparison to personally relevant imagery. In contrast, they displayed higher SCR in relation to personally relevant imagery but not standardized film stimuli,

confirming that greater physiological reactivity is observed overall but that the type of autonomic arousal response (RSA versus SCR) is dependent on the type of emotion induction procedure (standardized versus idiographic) utilised. Specifically, Kuo and colleagues (2014) demonstrated that standardized experimental paradigms appear to trigger reactions associated with parasympathetic physiological reactivity (RSA), whereas idiographic paradigms appear to trigger sympathetic physiological reactivity (SCR). Such patterns of differential reactivity between standardised/ idiographic stimuli were not observed amongst SAD's and HC's (Kuo et al., 2014), suggesting that the pattern of emotional responding in BPD subjects is much more complex in comparison to controls and those with common mental health problems. Thus, the use of idiographic emotion induction procedures targeting specific, personally-relevant emotions (anger and sadness) are required to investigate the unique profile of heightened emotional reactivity in those with BPD. Furthermore, the use of both standardized and idiographic experimental stimuli has allowed for a more in depth analysis of the physiological aspects of emotional reactivity in those with BPD, which is a methodological strength of the present study.

Dixon-Gordon et al. (2013) investigated psychophysiological reactivity amongst individuals with 'high', 'medium' and low features of BPD when exposed to a standardized (vanilla baseline procedure) versus idiographic (social rejection scenario) emotion induction. Interpersonal dysfunction predicted greater objective and subjective reactivity. Interpersonal dysfunction and ambivalence were both mediators of physiological (SCR) reactivity, whereas dissociation was associated with greater subjective (self-reported) reactivity. Interestingly, Dixon-Gordon et al. (2013) showed that high BPD features were associated with heightened emotional reactivity to idiographic, personally-relevant stimuli (both subjectively and objectively) but only in relation to sympathetic physiological arousal (SCR's) and not other parasympathetic indices of physiological arousal (HR, ECG, IBI), nor

the neutral emotion induction procedure. They concluded that heightened emotional reactivity in BPD is specific to the sympathetic as opposed to parasympathetic indices of physiological reactivity, in addition to the type of emotion induction paradigm. Similar to Dixon-Gordon et al.'s (2013) findings, a study by Feliu-Soler et al. (2013) also reported higher sympathetic reactivity levels but lower parasympathetic reactivity in those with BPD, compared to controls. However, in contrast to the two studies mentioned above, Felui-Soler and colleagues (2013) found no differences on self-report measures of emotional reactivity between BPD individuals and healthy controls, despite those with BPD reporting higher levels of negative emotional intensity at baseline. Hence, Felui-Soler et al. (2013) was one of only two studies in this review that found a discrepancy between psychological and physiological aspects of emotional reactivity in BPD. Although this study was rated as 'Strong' on overall methodological quality, it is worth noting that this study only exposed participants to a standardized emotion induction procedure: the International Affective Picture System (IAPS; Lang, Ohman & Vaitl, 1988). Thus, the lack of consideration for exposure to idiographic stimuli within the methodology could account for the observed discrepancy.

Similarly to Kuo et al.'s (2014) study, Elices et al. (2012) conducted an earlier study investigating emotional reactivity in relation to standardized versus idiographic film imagery, amongst those with BPD in comparison to HC's. They targeted a wider range of specific emotions: anger, sadness, fear, disgust, amusement and neutral state. Elices et al. (2014) demonstrated that BPD individuals exhibit heightened parasympathetic arousal, as measured by increases in HR variability during standardized (fear, anger and sadness) related films. This corroborates Kuo et al.'s (2014) suggestion that standardized emotion induction procedures may tap into parasympathetic aspects of physiological arousal and that they are evoked in response to specific emotional states. However, BPD individuals showed no

differences in comparison to controls on sympathetic measures of physiological arousal, which stands in contrast to findings of Dixon-Gordon et al. (2013) and Felui-Soler at al. (2013). Furthermore, personally relevant BPD imagery (sexual abuse, neglect and abandonment) revealed subjectively higher self-reported reactivity in those with BPD than controls. In sum, Elices et al. (2012) also observed heightened objective *and* subjective reactivity in those with BPD, providing further support for the lack of discrepancy. However, this was dependent on the type of emotion induction procedure utilised.

Barnow et al. (2011) exposed BPD individuals and HC's to standardized, aversive and idiographic, unpleasant imagery to investigate psychophysiological patterns of emotional reactivity. BPD individuals subjectively rated all scenes as more negative and arousing than HC's. Furthermore, BPD patients showed a greater level of SCR, confirming consistency of heightened psychophysiological reactivity across measures. Present-state dissociation was found to mediate group differences on self-reported reactivity (with BPD subjects reporting higher levels of state dissociation before and after exposure to imagery, compared to controls). This provides further support for the role of dissociation as a psychological process which may account for heightened subjective emotional reactivity in those with BPD, as also proposed by Dixon-Gordon et al. (2013).

An earlier study by Dixon-Gordon et al. (2011) found BPD individuals to display increased self-reported negative emotions during an idiographic emotion induction procedure (social rejection stressor). No differences were observed between groups on RSA (parasympathetic arousal) but those with high BPD features exhibited shorter IBI's and greater SCR's (indicating greater sympathetic arousal) during the emotion induction, than those with medium or low features of BPD. Thus, this study supports the notion that BPD individuals exhibit heightened psychological *and* physiological emotional reactivity than controls when exposed to personally-relevant emotion induction paradigms but that

idiographic experimental procedures (a social rejection scenario in this case) do tap into the more sympathetic (as opposed to parasympathetic) characteristics of physiological reactivity (Dixon-Gordon et al., 2011; Elices et al., 2012; Kuo et al., 2014).

Kuo and Linehan (2009) also explored the profile of emotional reactivity in those with BPD (compared with SAD's and HC's) by utilising a wide range of self-report and physiological measures. They exposed participants to standardized and idiographic experimental paradigms and also found evidence to dispute a discrepancy between psychological and physiological effects. However, in contrast to the majority of studies included in the present review, this study found BPD individuals to respond *equally* to both SAD and HC subjects on both objective and subjective measures, despite heightened biological and psychological vulnerability in comparison to SAD's and HC's at baseline.

A study by Austin et al. (2007) exposed BPD individuals and HC's to neutral versus conflict related film clips in order to explore emotional reactivity. BPD participants displayed lower parasympathetic reactivity (RSA) than controls. In fact, their RSA *decreased* during exposure to film clips, yet they displayed faster HR (greater sympathetic arousal). This finding stands in line with claims that heightened physiological arousal in those with BPD is largely related to sympathetic, rather than parasympathetic autonomic reactivity (Dixon-Gordon et al., 2013; Feliu-Soler et al., 2013). Furthermore, BPD subjects exhibited mobilisation behaviours associated with the fight/ flight response, whereas in contrast, controls showed a slowed HR and behaviours more consistent with social engagement (Austin et al., 2007). BPD individuals subjectively rated conflict scenes as more negative than HC's. There were no differences on self-reports of neutral scenes, again, confirming the context-specific nature of heightened emotional reactivity in BPD.

Hazlett et al. (2007) explored emotional reactivity by exposing participants (BPD's and HC's) to neutral versus unpleasant words, in addition to white noise bursts. BPD patients

showed greater sympathetic (SEB) responses than controls in relation to negative but not neutral stimuli, confirming that greater physiological arousal in those with BPD is specific to idiographic stimuli. No group differences were found for neutral word ratings but BPD individuals rated unpleasant words as *less* unpleasant than controls. In addition to greater physiological reactivity, BPD individuals showed higher self-reported emotional reactivity on items measuring affective intensity, affective lability and aggression, confirming a lack of discrepancy on objective and subjective measures of reactivity.

Finally, Herpertz et al. (1999) investigated emotional reactivity in those with BPD and reported no differences in self-reported or physiological levels of reactivity, in comparison to controls. In contrast, BPD subjects showed lower electrodermal responses than controls, suggestive of physiological *under arousal.* This discrepancy between objective and subjective reactivity in those with BPD only receives support from one other study in this review (Felui-Soler et al., 2013). It is worth noting that this study, similarly to Felui-Soler and colleagues (2013) only utilised a standardized, IAPS emotion induction paradigm. Hence, reliance on a limited methodological procedure may have contributed to the observed findings.

Quality assessment tool

The Effective Public Health Practice Project (EPHPP) tool (Thomas, Ciliska, Dobbins & Micucci, 2004) was used for the quality assessment of selected papers because it can be applied to all types of quantitative study designs. The tool has also been shown to have good content and construct validity, as established by Cohen's (1960) Kappa (Thomas et al., 2004). Items on the tool covered the following areas: Selection Bias, Study Design, Principle Confounders, Blinding, Data Collection Methods and Rates of Attrition. Ratings on each sub-category were combined to provide an overall global rating of 'Strong', 'Moderate' or

'Weak'. A dictionary is provided to aid the researcher in making a decision about which of these three categories each study should receive. For example, for questions relating to 'Confounders' the researcher is asked two questions: (1) *"Were there important differences (pertaining to race/ sex/ marital status/ age/ education/ pre intervention scores on outcome measures) between groups prior to the experiment?"* (Answer: Yes/ No/ Can't Tell) (2) *"If yes, indicate the percentage of relevant confounders that were controlled for in the design / analysis"* (Answer: 80-100%/ 60-79%, less than 60%, Can't Tell). If a study answers 'No' to Q1 or 'Yes' to Q2 and '80-100%' on Q2, it would be rated as 'Strong' for this component. If on the other hand, the answer to Q1 was 'Yes' and it had only controlled for 60-79% of confounders, it would achieve a 'Moderate' component rating. Finally, if it had controlled for less than 60% or it wasn't clear how many confounding variables were controlled for, the study would be rated as 'Weak' for this component.

In terms of the overall, global ratings, a descriptive guide is provided. A study with no 'Weak' ratings across the five components would be classified as 'Strong'. A study with one 'Weak' rating would be classified as 'Moderate' and a study with two or more 'Weak' ratings would be classified as 'Weak'. However, it is worth noting that should a study use a correlational design, it is automatically classified as a 'Weak' study overall, regardless of its methodological strength on any of the other four components. Critique of this tool is provided in the strengths and limitations section of this review.

The first author (RS) and a peer (SV), who was independent of the research team, rated a sample (60%) of the selected papers. Examination of each sub-category allowed for the relative strength of each study to be considered. For example, items measuring constructs of internal and external validity were considered to carry more weight when determining quality. Hence, studies rated higher on these areas of research methodology were considered to be stronger studies. The level of agreement using the quality assessment tool was optimal,

with 82% of the papers receiving the same quality rating. Discrepancies between ratings on the remaining papers were discussed and then re-rated to establish a final agreement of quality.

Table 1: Summary of Papers included in Systematic Review

Paper	Title	Sample	Design	Assessment Measures	Emotion Induction	Outcome Measures	Findings	Quality Rating
Papers examining individuals with a verified diagnosis/ key features of BPD (N = 10)								
1. Kuo, Neacsiu, Fitzpatrick & MacDonald (2014) In: USA	A Methodological examination of emotion inductions in Borderline Personality Disorder: A comparison of Standardized versus Idiographic stimuli.	N = 60 Females (20 BPD, 20 SAD, 20 HC's), Mean age = 23.6	Mixed model ANOVA	Screening: Structured Clinical Interview for DSM-IV Axis I (SCID-I) (First et al. 1995) & Structured Clinical Interview for DSM-IV Axis II (SCID-II) (First et al. 1996)	Exposure to either Standardized stimuli (Emotion Films) eliciting 3 target emotions (anger, fear, sadness) (Gross & Levenson, 1995) or to Idiographic stimuli (Personally-relevant imagery) evoking 3 key emotions (anger, fear, sadness) (Pitman et al. 1987)	Emotional Responding measured by the Visual Analogue Scale (VAS) (Haines et al. 1995), Dissociative State Scale (DSS) (Stiglmayr et al. 2001) Physiological Responding measured by Respiratory Sinus Arrhythmia (RSA) & Skin Conductance Response (SCR)	BPD participants displayed greater reactivity of sadness and anger (but *not* fear) in response to the idiographic stimuli. BPD's showed greater self-reported (VAS) reactivity to *all* emotions when exposed to standardised films. BPD's showed greater RSA than SAD's and HC's in response to standardized films in comparison to personally relevant imagery. In contrast, they displayed higher SCR in relation to imagery but not film stimuli. Patterns of differential reactivity between standardised/ idiographic stimuli were not observed amongst SAD's and HC's. Personally relevant emotional inductions targeting sadness and fear may be more effective than standardised mood induction procedures when investigating those with BPD.	Strong
2. Dixon-Gordon, Yiu & Chapman (2013) In: USA	Borderline personality features and emotional reactivity: The	68 Female undergraduates (23 high, 23 mid, 22 low features	Repeated measures ANOVA's	Personality Assessment Inventory – Borderline Features	Exposure to a neutral mood induction (The 'Vanilla baseline procedure') & A	Skin Conductance Responses (Sympathetic Activity) Heart Rate Variability (HRV)	BP features associated with interpersonal dysfunction & predicted greater SCR reactivity and self-reported emotional reactivity. Increase in dissociation was	Strong

Paper	Title	Sample	Design	Assessment Measures	Emotion Induction	Outcome Measures	Findings	Quality Rating
	mediating role of interpersonal vulnerabilities	of BPD) (mean age = 21.68 years)		Scale (PAI-BOR, Morey, 1991) Inventory of interpersonal Problems Personality Disorders 25 (IIP-PD-25, Kim & Pilkonis, 1999)	social rejection stressor.	(Parasympathetic Activity) Electrocardiogram (ECG) and Cardiac Impedance (IBI) Data. Positive and Negative Affect Schedule (PANAS, Watson, Clark & Tellegen, 1988) The Dissociation Tension Scale (DSS; Stiglmayr et al., 2001)	associated with self-reported negative emotional reactivity on the PANAS.Interpersonal dysfunction mediated association between BP features and physiological SCR's *but not* self-reported emotional reactivity. Interpersonal ambivalence mediated association of BP features with SCR reactivity. BP features were associated with heightened emotional reactivity to the social rejection stressor (both subjectively- self-reports and physiologically-SCR's) but not other physiological indices (HRV, ECG, IBI) and not the neutral mood induction, suggesting that physiological reactivity in BPD may not only be specific to the type of emotion induction but also specific to the sympathetic as opposed to parasympathetic indices of reactivity.	
3.Feliu-Soler, Pascual, Soler, Sanz, Villamarin & Borras (2013) In: Spain	Emotional responses to negative emotion induction procedure in Borderline Personality Disorder	N = 50 (35 with BPD, 91 % Female, 9 % Male & 15 Healthy Controls, 87% Female, 13 % Male)	Hierarchical Linear Modelling / MANOVA's	Hamilton Rating Scale for Depression (HRSD) (Hamilton, 1960) The Brief Psychiatric Rating Scale (BPRS) (Overall & Gorham, 1988) Self -Assessment Manikin (SAM) (Lang, 1980)	Exposure to pictures from IAPS (Lang, Ohman & Vaitl, 1988): Images were chosen for Negative valence, High activation and low dominance in SAM scores	Physiological measures: Salivary Cortisol (HPAA Activation) Salivary alpha-amylase (SAA) Psychological measures: Profile of Mood States (POMS) (McNair et al., 1971) Positive & Negative affect scale (PANAS)	BPD subjects showed lower cortisol levels (parasympathetic nervous system) and higher SAA (Sympathetic Nervous System) levels compared to controls. No differences were found on self-report measures between groups but BPD individuals presented with higher levels of negative emotional intensity at baseline and throughout. Overall, results disconfirm an emotional hyper-reactivity hypothesis in those with BPD.	Strong

Paper	Title	Sample	Design	Assessment Measures	Emotion Induction	Outcome Measures	Findings	Quality Rating
						(Watson, Clark & Tellegen, 1988) Perceived stress scale (PSS-10) (Cohen & Williamson, 1988)		
4.Elices, Soler, Fernandez, Martin-Blanco, Potella, Perez, Alvarez & Pascual (2012) In: Spain	Physiological and self-assessed emotional responses to films in Borderline Personality Disorder.	N = 60 females (30 BPD, 30 HC's) age range 18-45.	Cross-sectional	The Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II; Gomez-Beneyto et al.,1994) and the Revised Diagnostic Interview for Borderlines (DIB-R; Barrachina et al., 2004)	Emotion eliciting film clips to induce key emotions: anger, fear, disgust, sadness, amusement & neutral state. Exposure to BPD-relevant imagery: sexual abuse, neglect & abandonment	Spanish version of the PANAS (Sandin et al., 1999) Self-Assessment Manikin (SAM; Bradley and Lang, 1994). The Discrete Emotions Questionnaire (DEQ) Rottenberg et al. (2007). Skin Conductance Level (SCL) responses and Heart Rate (HR)	BPD individuals scored higher on negative affect and lower on positive affect on the PANAS, in comparison to controls at baseline. There were no differences between groups on physiological reactivity at baseline. In terms of reactivity to films, there was a difference for HR but not for SCL: BPD individuals showed an increase in HR compared to controls on fear, anger & sadness films. Personally relevant BPD imagery also revealed subjectively higher reactivity in those with BPD on the SAM & DEQ (than controls).	Strong
5.Barnow, Limberg, Stopsack, Spitzer, Grabe, Freyberger & Hamm (2011) In: Germany	Dissociation and emotion regulation in Borderline Personality Disorder.	N = 59 (33 females with BPD, 26 Healthy Controls).	Cross-sectional	Structured Clinical Interview for DSM-IV Axis II (SCID-II) (First et al. 1996) Borderline Personality Inventory (BPI;	Exposure to Idiographic unpleasant, Standardised aversive and neutral scripts & Acoustic startle probes of white noise.	Startle Response measured by Electromyography (EMG) Activity Skin Conductance Responses (SCR's) Self-Assessment Manikin (SAM)	BPD individuals subjectively rated all scenes as more negative and arousing than HC's. Eye-blink startle responses did not differ between patients & controls but BPD patients showed a greater level of SCR. Present-state dissociation was found to mediate this group difference (with BPD subjects reporting higher levels of state dissociation before and after	Strong

Paper	Title	Sample	Design	Assessment Measures	Emotion Induction	Outcome Measures	Findings	Quality Rating
				Leichsenring, 1999). Anxiety measured using State Trait Anxiety Inventory (STAI; Speilberger et al., 1970). Depression measured using Beck Depression Inventory (BDI; Beck et al, 1961).		Valence & Arousal Ratings Trait Dissociation measured by Dissociative Experiences Scale (DES; Berstein & Putnam, 1986). State Dissociation measured by Dissociation Tension Scale (DTS, Stiglmayr et al., 2003)	exposure to imagery, compared to controls).	
6. Dixon-Gordon, Lovasz & Walters (2011) Canada	Too upset to think: The interplay of Borderline Personality Features, negative emotions and problem solving in the laboratory	N = 87 Female undergraduates with high (N = 26), medium (N = 32) or low (N = 29) BPD features Mean age = 21.59 years	Correlational	Personality Assessment Inventory – Borderline Features Scale (PAI-BOR, Morey, 1991)	Means-Ends Problems Solving Procedure (MEPS) Measures of Dissociation: The Dissociative State Scale (DSS) (Stiglmayr et al., 2001) & Emotion: Laboratory emotions induction procedure: Imaginal emotional induction involving a social rejection scenario.	Physiological measures of emotional arousal: Skin Conductance (SC) & Respiratory Sinus Arrhythmia (RSA) Electrocardiogram (ECG) and Cardiac Impedance (IBI) Data. Psychological measures: The Positive & Negative Affect Scale (PANAS) (Watson, Clark & Tellegen, 1988)	High BPD group showed significant reductions in relevant solutions to social problems & more inappropriate solutions following negative emotion induction. Increases in self-reported negative emotions during emotion induction (social rejection stressor) mediated this relationship between high BPD features and low social problem solving performance. High BPD group also showed trait deficits on the SPSI-R. No differences were observed between groups on RSA but High BPD's exhibited shorter IBI's (indicating greater sympathetic arousal) during the emotion	Weak

Paper	Title	Sample	Design	Assessment Measures	Emotion Induction	Outcome Measures	Findings	Quality Rating
						Social Problem Solving Inventory – Revised (SPSI-R) (D'Zurilla et al., 2002) Affect Intensity Measure (AIM) (Larson & Diener, 1987) Brief Symptom Inventory (Dergogatis, 1993	induction, than medium or low BPD's. High BPD's also showed greater SCR's during emotion induction compared with baseline or following the MEPS.	
7. Kuo & Linehan (2009) In: USA	Disentangling emotion processes in borderline personality disorder: Physiological and self-reported assessment of biological vulnerability, baseline intensity and reactivity to emotionally evocative stimuli	N = 60 Females (20 BPD, Mean age = 23.55, 20 Social Anxiety Disorder, Mean age = 23.90 & 20 healthy controls, Mean age = 23.30) Overall Age range = 18 – 45	Cross-sectional	Structured Clinical Interview for Axis I DSM-IV Disorder (First et al., 1995) Structured Clinical Interview for DSM-IV Axis II Personality Disorders (First et al., 1996) to screen for Social Anxiety, Non clinical presentations & BPD respectively.	Exposure to Standardised Condition (Emotion Films) and Personally Relevant Condition (Imagery Films).	Self report measures of emotion regulation: Trait Measures: The Difficulties in Emotion Regulation Scale (DERS) (Gratz & Roemer, 2004), Acceptance & Action Questionnaire (AAQ) (Hayes et al., 2004) State-Trait Anger Inventory (STAXI) (Speilberger et al., 1988) State Measures: Visual Analogue Scale (VAS) (Haines et al., 1995) Physiological Measures: Respiratory Sinus Arrhythmia (RSA) and Skin Conductance Responses (SCR).	BPD Participants displayed heightened biological vulnerability compared with normal controls, as shown by their reduced basal RSA. BPD participants also showed a higher baseline emotional intensity, characterised by higher SCR and higher self-reported negative emotion at baseline. However, BPD individuals did not display heightened reactivity as both their self- report & physiological changes from baseline to emotion induction tasks were not greater than healthy controls or those with Social Anxiety.	Strong

Paper	Title	Sample	Design	Assessment Measures	Emotion Induction	Outcome Measures	Findings	Quality Rating
8. Austin, Riniolo & Poges (2007) In: USA	Borderline Personality Disorder and emotion reactivity: Insights from the polyvagal theory.	N = 20 females (9 BPD, 11 HC's), all aged between 18 & 45.	Cross-sectional	Structured Clinical Interview for DSM-III-R (SCID; Spitzer, Williams, Gibbon, & First, 1990, 1992) and the Diagnostic Interview for Borderlines (Gunderson, Kolb, & Austin, 1981).	Exposure to x3 10 minute film clips (2 conflict scenes, 1 neutral scene)	Likert scales to measure self-reported arousal. Respiratory Sinus Arrhythmia (RSA) Electrocardiography (ECG) recordings.	Physiological RSA measures were equal across patients & controls at baseline. BPD participants displayed lower RSA reactivity than controls. In fact, their RSA *decreased* during exposure to film clips. BPD individuals displayed a vagal withdrawal of shorter heart periods (faster heart rate – greater sympathetic arousal). In contrast controls showed an increase in vagal tone, resulting in longer heart periods (slowed heart rate). BPD's subjectively rated conflict scenes as more negative than HC's. There were no differences on self-reports of neutral scenes.	Strong
9. Hazlett, Speiser, Goodman, Roy, Carrizal, Wyn, Williams, Romero, Minzenberg, Siever & New (2007) In: USA	Exaggerated Affect-modulated startle during unpleasant stimuli in Borderline Personality Dosrder	N = 48 (27 with BPD, 18 Male, 9 Female, Mean age = 31.0), 21 HC's (11 Male, 10 Female, 28.6)	Cross-sectional	Structured Clinical Interview for DSM-IV Axis I disorders (First *et al.* 1996) and the Structured Interview for DSM-IV Personality Disorders (SIDP-IV) (Pfohl 1996).	Exposure to unpleasant versus neutral words White Noise Bursts to elicit startle reflex	Startle Eye-blink (SEB) Self-Assessment Manikin (SAM) of subjective Arousal/ Valence	BPD patients showed greater SEB responses than controls in relation to negative but not neutral stimuli. No group differences were found for neutral word ratings but BPD individuals rated unpleasant words as less unpleasant than controls. BPD individuals had higher self-reported distress on items measuring affective intensity, affective lability and aggression. There were no group differences in self-reported impulsivity.	Strong
10. Herpertz, Kunert,	Affective responsiveness in Borderline	N = 51 Females (24 with BPD &	ANOVA's / ANCOVA's	International Personality Disorder	Exposure to IAPS: Pictures containing either pleasant,	Psychological measures:	Results disconfirmed that BPD subjects have a biologically based hyper-responsiveness: No differences	Moderate

Paper	Title	Sample	Design	Assessment Measures	Emotion Induction	Outcome Measures	Findings	Quality Rating
Schwenger & Sass (1999) In: Germany	Personality Disorder: A psychophysiol ogical approach	27 healthy controls) Mean age = 28.0 years		Examination (Loranger, Susman, Oldham & Russakoff, 1993) according to DSM-III-R Criteria.	neutral or unpleasant emotional content	Self-report ratings using Likert scales of Affect & Arousal Physiological measures: Heart Rate, Skin conductance & Startle response measures	in self-reported arousal levels. In contrast, BPD subjects showed lower electrodermal responses to all 3 picture categories than controls suggestive of physiological *under arousal.*	

Table 2: Component / Global Ratings on the EPHPP Quality Assessment Tool

Paper	Selection Bias	Study Design	Confounders	Blinding	Data Collection	Withdrawals	Global Rating
1. Kuo et al. (2014)	Moderate	Moderate	Strong	Moderate	Strong	N/A	STRONG
2. Dixon- Gordon et al. (2013)	Moderate	Strong	Strong	Moderate	Strong	N/A	STRONG
3. Feliu-Soler et al. (2013)	Moderate	Moderate	Strong	Moderate	Strong	Strong	STRONG
4. Elices et al. (2012)	Moderate	Moderate	Strong	Moderate	Strong	Strong	STRONG
5. Barnow et al. (2011)	Strong	Moderate	Strong	Moderate	Strong	N/A	STRONG
6. Dixon-Gordon et al. (2011)	Moderate	Weak	Strong	Moderate	Strong	Strong	WEAK
7. Kuo & Linehan (2009)	Moderate	Moderate	Strong	Moderate	Strong	Strong	STRONG
8. Austin et al. (2007)	Moderate	Moderate	Strong	Moderate	Strong	Strong	STRONG
9. Hazlett et al. (2007)	Strong	Moderate	Strong	Moderate	Strong	N/A	STRONG
10 Herpertz et al. (1999)	Moderate	Moderate	Strong	Moderate	Weak	N/A	MODERATE

Main findings and discussion

The aims of the current review were to: a) establish the methodological quality of studies reviewed, b) examine the reliability of the reported discrepancy of objective versus subjective distress in those with BPD and c) explore underlying psychophysiological factors that might explain this discrepancy, each of which shall be discussed in turn.

Quality ratings of selected studies

Quality ratings for the included 10 studies ranged from 'Strong' to 'Weak'. The majority of studies were rated as 'Strong' (N=8). One study was classified as 'Moderate' (Herpertz et al., 1999) due to limited internal validity as identified by unreliable or invalid measures of data collection. Only one study was classified as 'Weak' (Dixon-Gordon et al., 2011) and this was due to using a correlational study design (EPHPP; Thomas et al., 2004). The quality ratings can be seen in Table 1, along with other relevant study information. For detailed, sub-category information on the quality ratings, please see Table 2.

Divergence between subjective and objective measures of reactivity

The majority of studies reviewed (N=8) did not find a discrepancy between subjective versus objective reactivity in those with BPD. All of these studies were rated as 'Strong', except for one (Dixon-Gordon et al., 2011) so we can be more confident in the reliability of this finding. As this finding stands in contrast to previous research papers, which reported differential levels of emotional versus physiological reactivity in those with BPD, the present review does not confirm this discrepancy. It is possible that this previous observation could have been the result of diverse methodologies, which have led to a mixed picture of emotional reactivity in these individuals.

Of the eight studies reporting a lack of difference in objective versus subjective emotional reactivity, seven studies found individuals with BPD to have *heightened* reactivity, both physiologically *and* psychologically in comparison to healthy controls and/ those with SAD (Austin et al., 2007; Barnow et al., 2011; Dixon-Gordon et al., 2011; Dixon-Gordon et al., 2013; Elices et al., 2012; Hazlett et al., 2007; Kuo et al., 2014). Conversely, one study (Kuo & Linehan, 2009) found that BPD individuals reacted *equally* to healthy controls and/ those with SAD, on *both* physiological and psychological measures of emotional reactivity.

Only two studies found a discrepancy between objective versus subjective distress (Feliu-Soler et al., 2013; Herpertz et al., 1999). One study reported that individuals with BPD showed no differences in self-report measures of subjective distress, yet they did show a heightened level of physiological responding in comparison to controls (Felui-Soler et al., 2013). The other study found BPD individuals to respond equally to controls on self-reported measures of reactivity, despite diminished physiological reactivity, suggestive of biological *under-arousal* (Herpertz et al., 1999). From reviewing the methodological procedures of all ten studies, two possible explanations for these findings emerged. One explanation is related

to the type of emotion induction used (including the specific emotions evoked), while another is the specific types of physiological reactivity measured; each explanation will be discussed in turn.

Standardised versus idiographic emotion induction procedures

Previous studies have confirmed that hyper-reactivity was only evoked in BPD participants when they were exposed to an experimental mood induction that contained some self-evaluative content (Gratz, Rosenthal, Tull, Lejuez & Gunderson, 2010). This was corroborated by a later study in which individuals with a BPD diagnosis showed greater sensitivity to social rejection paradigms compared to healthy controls (Staebler, Helbing, Rosenbach & Renneberg, 2011), suggesting that this is a key concept linked to emotional reactivity in those with BPD. In contrast, BPD subjects showed no differences in comparison to controls when exposed to a more general mood induction procedure involving an auditory task (Gratz et al., 2010; Jacob, Hellstern, Ower, Pillmann, Scheel, Rusch & Lieb, 2009).

In terms of the present review, Kuo et al. (2014) examined a range of affective states as potential influencers of psychobiological reactivity. They reported that heightened emotional reactivity in those with BPD was found to be dependent on the emotion in question (Kuo et al. 2014). Specifically, anger and sadness predicted greater reactivity of those with BPD but fear did not. This was in contrast to the pattern observed within control subjects who showed heightened reactivity to fear in comparison to BPD subjects, suggesting that emotional reactivity in BPD is entirely context and emotion specific and is only likely to be observed in experimental studies that contain a personally relevant task. Furthermore, Elices et al. (2012) targeted a wider range of emotions in their study, including fear, sadness, anger, disgust, amusement and neutral state. They also found anger and sadness (as well as fear) to

be key emotional reactions evoked in those with BPD, as measured by heightened parasympathetic arousal in comparison to control subjects.

All of the studies in the present review that did not identify discrepancies between psychological and physiological reactivity in BPD individuals (N=8) utilized both standardized and idiographic experimental paradigms to induce emotion in the laboratory (Austin et al., 2007; Barnow et al., 2011; Dixon-Gordon et al., 2011; Dixon-Gordon et al., 2013; Elices et al., 2012; Hazlett et al., 2007; Kuo & Linehan, 2009; Kuo et al., 2014), which could explain why a more convergent pattern of reactivity was observed. Thus, the type of emotion induction procedure used is likely to increase the reliability of findings. The specific type of personally-relevant stimuli may also contribute to a consistency amongst findings. For example, of the studies that found a consistent pattern of responding across measures, four studies exposed participants to idiographic film clips containing neglect, rejection or abandonment related content (Austin et al., 2007; Elices et al., 2012; Kuo & Linehan, 2009; Kuo et al., 2014). One study used the same idiographic theme but with words as opposed to film clips (Hazlett et al., 2007) and a further study used aversive idiographic scripts (Barnow et al., 2011). Finally, two studies specifically exposed participants to a social rejection scenario as part of their idiographic methodology (Dixon-Gordon et al., 2011; Dixon-Gordon et al., 2013). Thus, it seems that idiographic stimuli used as part of experimental emotion induction procedures must contain themes of rejection or abandonment but the means to elicit this (films, scripts, words or scenarios) is not necessarily limited to a particular form.

Parasympathetic versus sympathetic arousal involved in emotional reactivity

A further contributory factor of the findings of the present review could perhaps be explained by the fact that the majority of studies (N= 9) used a wide range of physiological measures of emotional reactivity such as; Skin Conductance Level (SCL) or Responses (SCR), Heart

Rate (HR), Startle Eye-blink (SEB), Respiratory Sinus Arrhythmia (RSA), Electrocardiography (ECG) and Cardiac Impedance (IBI). This diverse range of objective measures allows for a more detailed investigation of autonomic arousal by measuring biological markers of both the sympathetic and parasympathetic branches of the Autonomic Nervous System (ANS). Only one study in this review (Hazlett et al., 2007) measured physiological reactivity purely in relation to SEB responses, which is a measure of Sympathetic Nervous System (SNS) activity. Previous studies that have observed a discrepancy between self-reported and physiological elements of emotional reactivity (e.g. Ebner-Priemer et al., 2005; Limberg et al., 2011) have reported this largely on the basis of SNS variables such as SCL's or SCR's, rather than taking account of the parasympathetic aspects of the ANS as well.

Interestingly, the study by Felui-Soler and colleagues (2013) discovered an asymmetry between the Hypothalamic Pituitary Adrenal Axis (HPAA) and SNS amongst participants diagnosed with BPD. More specifically, they reported that BPD individuals exhibited diminished cortisol levels (controlled by the HPAA; part of the Parasympathetic Nervous System; PNS) during exposure to a standardized emotion induction, despite showing increased activation of Salivary Alpha-Amylase (sAA) (which is regulated by the SNS). This was in contrast to control participants who exhibited similar cortisol and sAA levels (Felui-Soler et al., 2013). This finding corroborates earlier research conducted with a sample of individuals who have been exposed to early life traumas (Ali & Pruessner, 2012). Since the HPAA and SNS have been implicated in returning the individual to homeostasis (Bauer, Quas & Boyce, 2002), asymmetry in the stress response could possibly contribute to emotional dysregulation in BPD individuals. Furthermore, diminished cortisol levels are highly correlated with long term stress (Fries, Hesse, Hellhammer & Hellhammer, 2005). Thus, since BPD individuals are known to have a history of traumatic life adversities

(Leichsenring et al., 2011), Felui-Soler et al. (2013) concluded that their supressed PNS activity might be due to a chronic over-activation of the HPAA over a long period of time, resulting in lower PNS reactivity in comparison to controls when exposed to artificial laboratory procedures.

Psychophysiological contributors to heightened emotional reactivity in BPD

Half of the papers (N= 5) examined specific factors implicated in the expression of emotional responding in BPD (Austin et al., 2007; Barnow et al., 2011; Dixon-Gordon et al., 2011; Dixon-Gordon et al., 2013; Felui-Soler et al., 2013). The role of specific emotions, particularly anger and sadness have been implicated in the mediation of the overall level of emotional reactivity reported by those with BPD (Elices et al., 2012; Kuo et al., 2014). Subjective levels of these negative emotions were not only higher prior to and during exposure to experimental paradigms but also afterwards, meaning that it took much longer for these individuals to recover and return to their baseline levels. This would support the hypothesis proposed by Felui-Soler and colleagues (2013), that a disruption in the biological structures of the ANS responsible for returning the individual back to homeostasis, is likely to contribute to the heightened profile of emotional reactivity in BPD individuals.

One study found deficits in problem-solving abilities to be an important contributory factor in explaining the profile of heightened emotional reactivity that is observed in those with BPD (Dixon-Gordon et al. 2011). When exposed to a problem-solving procedure, those with high features of BPD struggled to provide relevant solutions to social problems in comparison to those with medium or low features (Dixon-Gordon et al., 2011). Furthermore, they performed significantly worse on their problem-solving abilities following a negative emotion induction procedure (social rejection scenario), suggesting that their lower problem-solving abilities became further compromised once they experienced negative affect.

According to Dixon-Gordon et al. (2011), subjective self-reports of negative affect mediated the relationship between high BPD features and poor problem-solving abilities. In addition, high BPD individuals showed deficits on the Social Problem Solving Inventory–Revised (SPSI-R) (D'Zurilla, Nezu & Maydeu-Olivares, 2002), which is a trait-based measure, suggesting that findings are consistent amongst both state and trait measures. Nevertheless, this study was only a correlational analysis and thus was rated 'Weak' in terms of its methodology because the direction of causality cannot be determined. The fact that this study used a *social* problem-solving task could be the reason why those with BPD features perform poorly, given that aspects of social situations (such as evaluation by others) have been previously implicated in the presentation of those with BPD (Gratz et al., 2010). BPD individuals could have a heightened perception of being scrutinised or judged by others, leading to an elevated fear of rejection, which in turn diminishes their ability to problem-solve, rather than a deficit in problem solving abilities per se. However, this study does provide some evidence that when exposed to a social rejection scenario, the ability to problem-solve becomes compromised. This suggests that concentration and ability to process information is significantly impaired by emotional responses, perhaps indicating an overall disruption in cognitive/ attentional processes that is only observed during exposure to personally-relevant as opposed to standardised imagery.

A more recent study by Dixon-Gordon et al. (2013) investigated the specific interpersonal vulnerabilities implicated in the emotional reactivity of those with high, medium and low features of BPD. Interpersonal dysfunction mediated the relationship between BPD features and physiological reactivity (Skin Conductance Responses) *but not* self-reported emotional reactivity. This discrepancy between the mediation of objective but not subjective measures of distress would suggest that some cognitive mechanism is responsible for explaining this. In fact, Dixon-Gordon et al. (2013) confirmed that scores on

the interpersonal ambivalence subscale of 'dysfunction' predicted greater physiological reactivity.

A study by Barnow et al. (2011) found heightened emotional reactivity in BPD individuals to be mediated by present-state dissociation, with BPD subjects reporting greater levels of state dissociation before and after exposure to personally-relevant imagery, in comparison to controls. This finding was consistent across subjective (self-report) and objective (SCR) responses. However, whilst dissociation mediated physiological reactivity by increasing SCR, it reduced the magnitude of startle responses during aversive and unpleasant imagery (Barnow et al., 2011). Thus, it was concluded that dissociation acts as a defence mechanism in response to external threats by narrowing the sensory channels for cognitive processing of the stimulus, whilst the individual is still experiencing high levels of autonomic arousal (Barnow et al., 2011). However, the fact that BPD individuals do subjectively rate their self-reported level of arousal or distress higher than controls, after the exposure to idiographic stimuli, suggests that some processing takes place. Perhaps by rating their emotional reactivity retrospectively (based on their experience of extreme physiological arousal within their bodies), this could explain heightened levels of reactivity, in comparison to controls.

Finally, in their study (Austin et al., 2007) discovered that BPD individuals display physiological reactivity that is typical of the flight/ fight response when exposed to idiographic stimuli (e.g. increased HR and mobilisation behaviours). In contrast, control subjects' exhibit physiological states that support more social exchange behaviours, suggestive of a more adaptive regulation of the heart and vagal tone (Austin et al., 2007). This may indicate that that brain structures involved in regulation of emotion and physiological activity, have perhaps evolved differently in those with BPD. Nevertheless, this is a tentative suggestion and further research is required to explore this.

Summary

In summary, the present review found a lack of evidence to support a differential pattern of emotional responding (psychologically versus physiologically) amongst individuals with BPD. The overall quality of studies included in this review was of high methodological quality, based on the EPHPP quality appraisal tool. Hence, this provides some assurance that the present findings are reliable. The lack of a discrepancy in the present review is proposed to be due to the inclusion of a more homogenous sample of studies than in previous work. In particular, the use of idiographic and standardized induction procedures (in addition to a range of physiological measures that capture both parasympathetic and sympathetic measures of autonomic arousal), appears to explain the observed consistency amongst findings within the present review. One of the underlying factors that contributed to the symmetry between self-reported and physiological reactivity observed in the present review was a heightened negative affect, prior to exposure to a given laboratory stimulus. This heightened baseline intensity and slow recovery after exposure to personally-relevant experimental paradigms was explained by a disruption in the brain structures involved in the regulation of autonomic arousal. Specifically, the two systems (PNS and SNS) involved in returning the individual back to homeostasis are at odds with each other in BPD individuals. Instead of complimenting one another to diffuse emotional reactivity, (which is observed in healthy controls), the physiological systems in BPD subjects appear to be misaligned. Decreased problem-solving abilities following exposure to a social rejection scenario implicated cognitive processes pertaining to concentration and attention to be biased in those with BPD. The final factor found to contribute to the heightened profile of emotional reactivity in BPD individuals was present-state dissociation. This response to external threat (personally relevant stimuli) was thought to be caused by a slowing down of the channels

required for cognitive processing of imagery (Barnow et al., 2011). Subsequently, BPD individuals experience a high level of physiological arousal, whilst shutting off from the psychological effects of the stimuli during exposure. Perhaps it is this defensive strategy that impacts on emotional regulation in those with BPD.

Limitations

More than half of the studies reviewed (N=8) used samples of female participants only, making it difficult to know whether the findings would be applicable to males. One study that included both genders only included a small percentage of male participants (Feliu-Soler et al., 2013). Hazlett et al. (2007) was the only study that used twice as many male participants than females, making this the most generalizable study to the general population in terms of its strong external validity on constructs measuring selection bias. Two studies (Dixon-Gordon et al., 2011; Dixon-Gordon et al., 2013) utilised undergraduate students as participants, the majority of which were psychology students. Hence, although all studies blinded participants to the aims of the research, there is potential for some participants to have guessed the nature of the study in question, which could have influenced the overall findings. Finally, all 10 studies utilised a cohort-analytical, correlational or cross-sectional design meaning that all participants were only investigated at one point in time. Findings cannot therefore be generalised to levels of emotional reactivity over a longitudinal period of time.

Although the majority of studies included in the present review were rated 'Strong' (N=8) in terms of their methodological quality, increasing the reliability of present findings, the EPHPP quality rating tool has several limitations. Firstly, methodological components (e.g. selection bias/ study design) are not scored but instead are rated as 'strong', 'moderate' or 'weak', based on the subjective interpretation of answers to questions on each component.

Thus, a study can be rated as ‘Strong’ providing it has no ‘weak’ ratings. However, this does not allow the reader to distinguish between a study that, for example, has all ‘moderate’ ratings from one that has all ‘strong’ ratings. Both studies would achieve the same, global rating; ‘strong’, yet one would clearly hold more weight than the other. In an attempt to try to address this issue, the component quality ratings for each study were presented in Table 2 for the reader’s clarification. A further limitation of the tool is the fact that any study which uses a correlational design (e.g. Dixon-Gordon et al., 2013, within the present review), automatically receives a ‘weak’ global rating, regardless of whether it has been rated as ‘strong’ on other important aspects of methodological quality such as internal validity. Finally, the tool contains two categories (in addition to the five components); one on ‘intervention integrity’ and one on ‘analyses’, yet neither of these allow the researcher to rate these components in terms of the methodological quality for these categories. Thus, some important information about the quality of studies appears to be excluded from the overall, global classification. Hence, the present review could be improved by utilising a more comprehensive quality appraisal tool. Nevertheless, the fact that *all* included studies were quality rated and the majority (8/10) were rated ‘strong’ makes the conclusions of this review more concise because it allows the reader to differentiate between studies that are more methodologically robust (e.g. those rated ‘strong’) than other studies which have been identified as having methodological flaws (e.g. those rated ‘moderate or ‘weak’).

Conclusions

In summary, studies that utilised both objective and subjective measures of distress as well as accounting for baseline reactivity or intensity confirmed that BPD individuals are higher emotional reactors than those with Axis I disorders such as SAD and healthy controls. It is clear that reactivity is dependent on the nature of the experimental manipulation and the

specific affective states in question. Common findings across all papers confirm that tasks that are personally relevant to individuals with features of BPD (i.e. tasks involving abuse/ neglect imagery or the potential for rejection) are reacted to more severely than controls. This points to possible cognitive mechanisms involved in the role of increased subjective reactivity. Specifically, the Self-Regulatory Executive Function model (S-REF; Wells & Matthews, 1994; 1996) of psychological disorder proposed that disorder arises out of patterns of biased self-regulatory processing that lead to a persistence of a sense of threat to the self. Specifically, the pattern of processing is dominated by worry, rumination, threat monitoring and coping behaviours that have ironic effects on emotional and cognitive control. It is likely that evaluation and rejection are likely to be closely associated with activation of worry, rumination and monitoring for early signs of rejection. This pattern of processing is hypothesised to impair cognitive flexibility and ability to regulate emotions. In fact the influence of this processing style appears to be moderated by level of attentional control (Fergus, Bardeen & Orcutt, 2012), which may be impeded by high levels of self-focused attention in BPD. In particular, decreased concentration and thus, ability to problem solve are related to heightened emotional reactivity which may prevent cognitive processing of new corrective information. Furthermore, present state dissociation was found to be a factor which limits the psychological processing of experimental stimuli during acute periods of high physiological arousal in those with BPD. In addition to the influence of cognitive factors, findings suggest that those with BPD features exhibit disproportionate activation of PNS and SNS arousal in response to idiographic experimental paradigms and this is thought to be due to a disruption in the systems responsible for emotional regulation as a consequence of chronic over-reactivity of the HPAA over time (Feliu-Soler et al., 2013).

Clinical implications

When assessing individuals for BPD, it is important that clinicians do not rely solely on the use of self-report measures. Instead, clinicians should be utilising a multi-method approach consisting of rigorous psychological assessment tools, in addition to physiological measures of reactivity and clinical observations. Hyper-sensitivity to rejection or any situation which could be construed as indicating failure can be particularly stressful for individuals with BPD. Thus, key behavioural markers of the disorder may be exhibited during potentially shameful or embarrassing situations, when there is likely to be a heightened perception of threat. This has implications for clinicians and therapists to consider when working with these individuals. Being more aware of triggers which could potentially rupture the therapeutic alliance, will allow clinicians to consider ways of reducing such threats or simply forewarning the client of emotions they are likely to experience in advance of the situation arising so that they can be more prepared.

Directions for future research

The present findings provide further support for the importance of studies utilising both objective and subjective measures of distress as part of their methodology. When reviewing the literature on emotional responding it is apparent that it is important to define what we mean by 'reactivity' or 'responses'. Some studies refer to these concepts as the overall, baseline level of intensity, whilst others have referred to the amount that the psychological or biological concepts being measured (e.g. negative affect and blood pressure, respectively) increase during exposure to a given stimulus. Thus, clarification of definition would allow future reviews to consider the evidence pertaining to a more homogenous and thus, conclusive range of studies. It is clear that specific patterns of emotional reactivity, (a heightened profile of emotional reactivity in the context of the present review) are only

observed in relation to experimental paradigms that evoke emotions that are relevant to those with BPD (e.g. anger and sadness). Hence, in addition to a clear definition of 'reactivity', future research needs to clarify which specific emotions are being examined, rather than viewing 'emotion' as a generic concept.

In terms of continuing to measure the concept of emotional reactivity in future, more studies are required to examine the overall levels of reactivity from baseline through to exposure and recovery time, given that the majority of studies reviewed found consistent evidence that those with BPD exhibit a heightened level of negative affect to begin with. The present review has demonstrated that when all studies control for this emotional predisposition at baseline (in comparison to control subjects) this allows for a clearer picture of the extent to which those with BPD are more emotionally reactive. Future studies need to also consider the context of the experimental setting. Observation of those with BPD in more naturalistic environments would be advantageous in assessing whether reduced pressure to 'perform' improves their problem solving abilities or cognitive processing capacity. However, there are ethical implications involved with naturalistic observations so perhaps the most feasible suggestion is that future laboratory based studies use idiographic scenarios that are more transferrable to real-life situations.

Longitudinal research into the development and reorganisation of brain structures involved in the regulation and release of cortisol (e.g. HPAA) would be required to confirm the hypothesis that those with BPD develop an under-active brain structure in adulthood.

The impact of heightened emotional reactivity on cognitive and attentional based processes in those with BPD, requires further exploration. Perhaps if future studies incorporated a measure of cognitive flexibility within their methodology, this would help to establish whether or not BPD individuals could benefit from attention-based strategies such

as the Attention Training Technique (ATT; Wells, 1990). Nevertheless, this is a tentative suggestion which requires further study.

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Part 2: Empirical Study

Can attention training improve pain tolerance in individuals who have experienced childhood trauma?

This manuscript was prepared in accordance with journal guidelines for

Behaviour Research and Therapy

A copy of the author information pack is available in Appendix B.

Word count: 11,188 (including tables, figures and references)

9,480 (excluding tables, figures and references)

Abstract

The Attention Training Technique (ATT; Wells, 1990) is a component used in metacognitive therapy. It aims to modify metacognition and attention control. It reduces internal, self-focused attention and enhances cognitive flexibility so that individuals may develop more effective, helpful coping strategies and cease to utilise maladaptive cognitive strategies and threat monitoring behaviours. The present study investigated the effects of ATT on pain tolerance in a sample of 57 individuals who had been exposed to one or more early adverse life experiences. Participants were randomly assigned to either the ATT group (N = 29) or a control group (N = 28). A laboratory induced stressor: the Cold Pressor Task (CPT) was used as an objective measure of pain tolerance. Results supported the hypothesis that ATT increases pain tolerance amongst individuals who have experienced childhood trauma. Participants in the ATT condition persisted significantly longer with the CPT (mean immersion time = 122.93 seconds), than those in the PMR condition (mean immersion time = 78.0 seconds). The clinical implications for the application of ATT are discussed. ATT may be beneficial in reducing the transition from acute to chronic pain in those who are predisposed to developing psychological or physical health problems in later life.

Keywords:

Attention training, emotion, metacognition, pain tolerance, cold pressor.

Highlights:

- Attention control has a powerful impact on pain tolerance in a laboratory setting.
- ATT is beneficial for individuals who have experienced childhood trauma.
- ATT is more effective at increasing pain tolerance than distraction and relaxation.
- ATT may have useful applications within routine medical healthcare settings.
- ATT may prevent the transition from acute to chronic pain.

Introduction

The Attention Training Technique is a specific set of exercises involving auditory attention. It is aimed at reducing self-focused processing, increasing awareness of flexible control over cognition and disconnecting control from internal and external events (Wells, 1990; 2009). The technique has been evaluated as a stand-alone strategy but it is often used within the context of metacognitive therapy. Preliminary studies have shown that ATT is associated with reductions in PTSD symptoms (Callinan, 2011, Nassif & Wells, 2014), panic (Wells, 1990; Wells, White & Carter, 1997), social phobia (Wells et al. 1997), hypochondriasis (Cavanagh & Franklin, 2000; Papageorgiou & Wells, 1998) and major depression (Papageorgiou & Wells, 2000). This data suggests that ATT is a brief, yet effective treatment technique within its own right (Nassif & Wells, 2014; Wells, 2007). A recent review of various attention training methodologies, including dot probe training methods (Amir, Weber, Beard, Bomyea & Taylor, 2008; Amir, Beard, Burns & Bomyea, 2009; MacLeod, Rutherford, Campbell, Ebsworthy & Holker, 2002), visual search training methods (Dandeneau, Baldwin, Baccus, Sakeellaropoulo & Pruessner, 2007), mindfulness based stress reduction (Shapiro, Schwartz & Bonner, 1998; Shapiro, Oman, Thoresen, Plante & Flinders, 2008) and clinical auditory training (Papageorgiou & Wells, 1998, 2000; Wells, 1990; Wells et al., 1997) found the attention training paradigm to be particularly successful in improving emotion regulation outcomes of individuals with clinical disorders (Wadlinger & Isaacowitz, 2011).

Theories of attention and their links to psychopathology

Exploration of cognitive processes underlying mental health presentations has implicated attention bias as playing a key role in emotional vulnerability (Wells & Matthews, 1994). MacLeod et al. (2002) proposed that such attentional biases are largely automatic processes

that occur independently of voluntary control and are therefore unchangeable. However, Wells and Matthews (1994) argued that attentional processes involved in psychological disorder are in fact largely volitional and therefore can be modified by training individuals to process and attend to information in an alternative way, thus exerting greater control over unhelpful reactions to stressful stimuli.

In their model, Wells and Matthews (1994, 1996) propose that an unhelpful pattern of thinking called the 'Cognitive Attentional Syndrome' (CAS) has a detrimental impact on healthy psychological functioning. Maladaptive thinking styles of worry, rumination, hyper vigilance to threat and concomitant reduction in cognitive efficiency, along with a series of other coping behaviours, are all proposed to prevent the effective self-regulation of distressing cognitions and emotion. Attention training is one technique devised to enhance metacognitive control of the cognitive attentional syndrome. In fact greater attentional flexibility is conceptualised as a general-purpose resource that can moderate the intensity of the CAS and thereby increase stress tolerance. Consistent with this view, recent evidence has found that the relationship between the CAS and symptoms of emotional disorders, is moderated by attentional control (Fergus, Bardeen & Orcutt, 2012).

Although there is growing support for the role of ATT in ameliorating responses to psychological stimuli, there has been little research investigating the role of ATT in ameliorating responses to aversive physical stimuli such as pain. Sharpe, Perry, Rogers, Dear, Nicholas and Refshauge (2010) acknowledged that pain is also likely to be a potentially threatening internal experience, hence they argued that extending research into the effectiveness of ATT in the area of pain makes perfect sense. Their study offered some promising preliminary findings within this relatively novel area of research. Sharpe et al. (2010) investigated the efficacy of Wells' (1990) ATT paradigm on pain ratings, threshold

and tolerance before, during and after exposure to the Cold Pressor Task (CPT). They randomly allocated a large group (N = 103) of non-clinical undergraduate students to receive either ATT or Progressive Muscular Relaxation Training (PMR) prior to exposure to the CPT. Their findings confirmed that those assigned to receive ATT showed less hyper-vigilance to sensory pain words, in comparison to those assigned to the PMR condition. ATT was also found to be effective at reducing the degree of focus on internal sensations but not on mindfulness or disengagement from pain words. Overall, participants in receipt of ATT reported pain less quickly than participants receiving PMR. However, there were no differences between the two groups for tolerance or pain ratings during the CPT. Hence, Sharpe et al. (2010) concluded that ATT can change the cognitive processes thought to be associated with pain but that brief, introductory training in ATT may not be sufficient to affect broader change in pain tolerance. Nevertheless, they suggested that since ATT was found to disrupt cognitive processes associated with heightened pain perception and that consequently, this appears to influence how quickly pain is registered, further exploration of ATT in relation to pain is warranted (Sharpe at al., 2010).

Early trauma and reactions to pain

There are individual differences in the tolerance and experience of pain (Ellermeier & Westphal, 1995). One group of individuals who are particularly sensitive to pain and other internally threatening events are those who have lived through early traumatic learning experiences (Casey, Greenberg, Nicassio, Harpin & Hubbard, 2008). Jones, Power and Macfarlane (2009) used data from the 1958 British birth cohort study to investigate prospectively, the impact of adverse life events during early childhood, upon chronic pain in adulthood. This was a large scale study where parental reports were provided at 7 years of age and over 7,000 adults provided pain data 38 years later. Regression analyses revealed a

significant relationship between exposure to early traumatic events and chronic pain in later life. In particular, hospitalisation following a Road Traffic Collision (RTC), as well as experience of parental death or being placed in institutionalised care (e.g. children's homes/ foster care), were all associated with increased risk of developing chronic pain problems in adulthood (Jones et al., 2009). Inspection of the relative risk ratio's (RR = 1.4) confirmed that hospitalisation following an RTC during childhood increased the risk of developing Chronic Widespread Pain (CWP) in adulthood by 40% and this relationship remained after adjusting for gender, social class and psychological distress (Jones et al., 2009). In terms of parental death, there was no relationship between paternal death and CWP in adulthood. However, maternal death doubled the risk of CWP in adulthood (RR= 2.0) and residence in institutionalised care increased the risk of CWP in later life by 90% (RR=1.9). These relationships also remained after adjusting for gender, social class and psychological distress and exposure to institutionalised care fully explained the association between maternal separation and CWP (Jones et al., 2009).

Aims of the Current Study

To the author's knowledge, Sharpe et al.'s (2010) study is the only study to date that has explored the impact of Wells' (1990) ATT upon reactions to pain stimuli and its implications for the management of pain. Furthermore, despite success in the treatment of various clinical populations, the evidence base for ATT has largely focused upon its effectiveness in the reduction of a discrete set of symptoms that meet diagnostic criteria for specific disorders.

To date there is no research into the possible preventative effects of training those who are susceptible to developing low pain tolerance or psychopathological problems. Hence, the present study aimed to test the effectiveness of ATT (versus a credible, comparable control technique), offered to those identified as having experienced childhood

trauma, as a means of reducing reactions to internal threats, namely pain. Sharpe et al. (2010) highlighted that one of the main limitations of their study was that they utilised two experimental manipulations (threat and intervention). They acknowledged that this complicated design may have weakened the effect of either one or both of the interventions. They also claimed that it was important to include a 'placebo-type' control condition. However, they did not measure credibility and compliance with ATT/PMR, meaning that their findings cannot be solely attributed to the effects of the intervention alone. Finally, they were unable to determine whether or not ATT influences subjective perceptions of pain after exposure to the CPT because they only measured pain at tolerance, not afterwards.

Inclusion of a number of methodological modifications to those used by Sharpe et al. (2010) aimed to improve current research in the field: (1) Using credibility and compliance measures of both ATT and PMR as a means of controlling for non-specific factors and measuring expectancy; (2) Obtaining a subjective pain measure *after* tolerance is reached on the cold pressor task, as opposed to during the task and at tolerance; (3) Removing the threat versus no threat condition to simplify the study to purely investigate the manipulation of the intervention (ATT vs PMR). In view of these modifications, the present study tested the following primary and secondary hypotheses:

Those who receive a brief, meta-cognitive intervention technique 'attention training', in comparison to controls will:

Primary hypothesis

1. Show greater pain tolerance than those who receive PMR, as indicated by a longer immersion time on the CPT.

Secondary hypotheses

2. Report less subjective pain as indicated by lower scores on a Numeric Pain Rating Scale.

3. Show greater positive affect and/ lower negative affect than those who receive PMR, as indicated by a significant group x time interaction on the PANAS or as indicated by a significant difference between those who receive ATT and the control group as shown in the ANCOVA if time 1 differences need to be controlled for.

Design

The current study used a between-within groups, mixed model design. Participants that met the inclusion criteria and subsequently agreed to participate in the main study were randomly allocated to one of the two experimental conditions. The process of randomisation is described in the procedural section of this paper. The between-group factor was the condition that participants were assigned to; Attention Training or Progressive Muscular Relaxation. The within group factor was time, with repeated measurements taken at time 1 (before ATT/PMR) and time 2 (after ATT/PMR).

Participants and Setting

Ethical approval was granted by The University of Manchester School of Psychological Sciences Ethics Committee (No: 12372). The study was advertised on the University volunteer website, as well as poster advertisements that were placed in university buildings. In order to widen participation beyond the student population, the study was also advertised on the experimenters' Facebook page. One hundred and eighty-nine participants (N=189), including students from The University of Manchester and The University of Huddersfield,

as well as full and part time employees from the lay population, completed the online screening questionnaires. Fifty-seven (N=57) participants were recruited to the main, face to face study. Inclusion criteria were: (1) the experience of one or more traumatic events (general, physical, emotional or sexual), before the age of eighteen *and* (2) the experience of either *'intense horror, hopelessness or helplessness'* or the feeling of *'being out of one's body or as if in a dream'* at the time that the worst event occurred, as identified by the ETISR-SF (Bremmner, Vermetten & Mazure, 2000).

Those who identified themselves as currently accessing mental health services or who considered themselves to be suffering from a current mental health problem were excluded. Inspection of scores on the PHQ-9 (Kroenke, Spitzer & Williams, 2001) and GAD-7 (Spitzer, Kroenke, Williams & Lowe, 2006) at screening also helped to eliminate participants with significant symptoms of depression and anxiety (i.e. scores within the moderate to severe range: 15-27 on the PHQ-9 and 10-21 on the GAD-7), so as to only target a non-clinical sample. Pregnant women were also excluded from the study for ethical reasons.

The age of participants recruited to the main study ranged from 18 to 62. Fourteen (24.6%) were male (mean age = 31.00, SD = 10.60) and forty-three (75.4%) were female (mean age = 28.72, SD = 12.59). The ATT condition consisted of (N=6, 20.7%) males and (N=23, 79.3%) females. The PMR condition included (N=8, 28.6%) males and (N=20, 71.4%) females. The majority of participants (N=25, 43.9%) were aged between 18 and 25, seventeen participants (29.8%) were aged 26-35, nine (15.8%) were aged 36-45, five (8.8%) were aged 46-60 and one participant (1.8%) was aged above 60. With regards to their demographics, the sample recruited were 89.5% (N= 51) White-British. Of the remaining

participants (N=6), two were Italian, one was German, one was Persian, one was Chinese and one was of Black Afro-Caribbean origin. Employment status of the sample as a whole was recorded as follows: Full-time employed (N=20, 35%), part-time employed (N=1, 1%), post-graduate (N=13, 22.5%), undergraduate (N=22, 38.5%) and retired (N=2, 3%).

All participants were entered into three prize draws as an incentive for participating.

Materials

Attention Training Technique

A recorded CD (copyright Wells, 2007) presented ATT in a standardised way to participants in the experimental condition. The duration of ATT was twelve minutes, excluding the instructions given prior to the technique. The sounds included a clock, church bells, birdsong, insects, traffic and running water. A copy of the recording is available at www.mct-institute.com. A written introduction to the task was utilised so that any questions could be answered by the experimenter before the task commenced and to enable credibility ratings to be taken prior to exposure to the task.

Control Condition: Progressive Muscle Relaxation

A Progressive Muscle Relaxation CD of equal duration was presented to participants in the control condition. The CD was a recording of the Jacobson technique (Jacobson, 1938) and included instructions of how to tense and relax the major muscle groups of the body repeatedly, in order to achieve progressive relaxation. A written introduction to the task was also utilised for the same reasons outlined above. The PMR was recorded using the same person's voice as that used in the ATT recording.

Cold Pressor Apparatus

A cool box, filled with water was used to implement the Cold Pressor Task (CPT). Ice cubes were placed in the water to lower the temperature to the optimum range required to observe the 'Lewis effect' (Ahles, Blanchard & Leventhal, 1983; Lovallo, 1975), where pain is experienced by the participant due to vasoconstriction and subsequent vasodilation of blood vessels (Sharpe et al., 2010). A digital thermometer was used to maintain the water temperature at 4.5 degrees Celsius (+/- 0.4 degrees Celsius). Participants were instructed to submerse their arm in the water up to the depth of their elbow.

Measures

Screening

The Early Trauma Inventory Self-Report Short Form (ETISR-SF)

The Early Trauma Inventory Self Report – Short Form (ETISR-SF) (Bremmner et al., 2000) was used to assess for vulnerability. It comprises of 27 items, divided into four dimensions (general trauma, physical abuse, emotional abuse and sexual abuse) and is scored on a dichotomous scale (Yes/No). It has shown good validity and reliability for measuring exposure to adverse life events *before* the age of eighteen (Bremmner et al., 2000). When comparing the short-form with the psychometric properties of the full version (Bremner, Bolus & Mayer, 2007), domain scores for the short list correlated highly with the original list and showed similar internal consistency for the individual domains (α = .70 – .87 compared with α = .78 – .91), which is a high level of internal consistency (Cronbach, 1951).

The Patient Health Questionnaire (PHQ-9)

The Patient Health Questionnaire (PHQ-9) (Kroenke et al., 2001) is a 9 item depression scale asking the respondent to rate their symptoms (e.g. "trouble sleeping - difficulty falling or staying asleep") on a sliding scale of severity ranging from a score of 0 = "Not at all", to a score of 3 = "Nearly every day", with a maximum score of 27. Respondents are asked to rate their symptoms based on how they have felt over the last two weeks. It has shown good internal validity and utility for assessing depression within primary care (Cronbach's α = .85) (Spitzer, Kroenke & Williams, 1999) and was therefore thought to be suitable for administering to a non-clinical population within the present study.

The Generalized Anxiety Scale (GAD-7)

The Generalized Anxiety Scale (GAD-7) (Spitzer et al., 2006) is a 7 item anxiety scale. Symptoms such as "Not being able to stop or control worrying" are rated by the respondent on a sliding scale of severity ranging from a score of 0 = "Not at all", to a score of 3 = "Nearly every day", with a maximum score of 21. Respondents are asked to rate their symptoms based on how they have felt over the past two weeks. This scale has demonstrated good internal consistency (α = .89) (Cronbach, 1951), test re-test reliability and procedural validity (Spitzer et al., 2006) and has also been used in the general population (Löwe, Decker, Müller, Brähler, Schellberg, Herzog & Herzberg, 2008). Hence, this scale was deemed suitable for use within the present study.

The Meta-Cognitions Questionnaire (MCQ-30)

The Meta-cognitions Questionnaire (MCQ-30) (Wells & Cartwright-Hatton, 2004) is a 30 item self-report scale, measuring five factors of meta-cognition: (1) positive beliefs about worry, which measures the extent to which a person believes that perseverative thinking is

useful (e.g. “worrying helps me to avoid problems in the future”); (2) negative beliefs about worry concerning uncontrollability and danger, which assesses the extent to which a person thinks that perseverative thinking is uncontrollable and dangerous (e.g. “I could make myself sick with worrying”); (3) cognitive confidence, which assesses confidence in attention and memory (e.g. “I have little confidence in my memory for words and names”); (4) beliefs about the need to control thoughts, which assesses the extent to which a person believes that certain types of thoughts need to be suppressed (e.g. “I should be in control of my thoughts all of the time”); and (5) cognitive self-consciousness, which measures the tendency to monitor one’s own thoughts and focus attention inwards (e.g. “I am aware of how my mind works when thinking through a problem”). Six items are dedicated to each of these five factors, with each statement requiring the respondent to rate their level of agreement. Scores were rated on a sliding scale of agreement, ranging from 1 = “Do not agree” to 4 “Agree very much”, yielding a total score of 120, with a maximum sub-scale score of 24 on each of the five meta-cognitive domains. Cronbach alphas for the individual subscales ranged from $\alpha = .72$ to $\alpha = .93$ (Wells & Cartwright-Hatton, 2004) and test-retest reliability for each of the final MCQ-30 sub-scales were good (Spada, Mohiyeddini & Wells, 2008).

Primary Dependent Variable

Pain Tolerance

Pain tolerance was measured by using a stop watch to record the time that each participant had their arm submersed in the water, prior to withdrawal at tolerance or after the maximum duration limit of 3 minutes. A maximum immersion time limit was set because ethical concerns were raised regarding the possibility of nerve damage if participants’ hands and arms were immersed for a longer period of time.

Secondary Dependent Variables

Numeric Pain Rating Scale (NPRS)

The NPRS (McCaffery & Pasero, 1999) is a self-report pain rating scale consisting of a 10 point Likert scale ranging from 0 = "No pain at all" to 10 = "worst possible pain". Participants were asked to rate their perceived level of pain on this scale, following removal of their arm from the water.

The Positive and Negative Affect Schedule (PANAS)

The PANAS (Watson, Clark, & Tellegen, 1988) is a 20 item measure that comprises two mood scales, one measuring positive affect and the other measuring negative affect. Each item is rated on a 5-point Likert scale ranging from 1 = "very slightly or not at all" to 5 = "extremely" to indicate the extent to which the participant has felt the specified affective state (e.g. "Hostile") in the indicated time frame, for example "within the past week". Watson et al. (1988) reported Cronbach's alpha coefficients ranging from 0.86 to 0.80 for the Positive Affect Scale and 0.84 to 0.87 for the Negative Affect Scale. Test-retest correlations for an 8 week period ranged from 0.47 to 0.68 for the Positive Affect and 0.39 to 0.71 for negative affect. Validity of the scale is reported: Measures of general distress and dysfunction, depression and state anxiety are more highly correlated with the Negative Affect Scale (positive correlations) than the Positive Affect Scale (negative correlations).

Control Variables

The Emotional Reactivity Scale (ERS)

The ERS (Nock, Holmberg, Photos & Michel, 2007) is a 21 item self report measure designed to assess individual experiences of emotion reactivity by asking participants to rate the extent to which they agree with each statement in relation to their regular (day to day) experiences. The scale consists of 3 sub scales measuring emotional (1) intensity (7 items e.g. "when I experience emotions, I feel them very strongly/ intensely") (2) sensitivity (10 items e.g. "I tend to get emotional very easily") and (3) persistence (4 items e.g. "when something happens that upsets me, it's all I can think about for a long time"). Each item is rated on a 4 point Likert scale ranging from 0 = "Not at all like me" to 4 = "Completely like me", with total possible scores ranging from 0 to 84. Nock, Wedig, Holmberg and Hooley (2008) reported Cronbach's alpha coefficient to be .94, indicating good internal consistency. The internal consistency reliability of each of the 3 sub scales also demonstrated strong internal consistency (intensity $\alpha = .86$, sensitivity $\alpha = .88$ and persistence $\alpha = .81$), suggesting that the sub scales, as well as the overall scale are both reliable indicators of emotion reactivity.

The Pain Anxiety Symptoms Scale (PASS – 20)

The PASS-20 (McCracken & Dhingra, 2002) is a 20 item, self–report questionnaire designed to measure 4 distinct components of pain related anxiety. Hence, there are 4 subscales (each comprising of 5 items) measuring (1) cognitive anxiety (e.g. "when I feel pain, I am afraid that something terrible will happen") (2) escape/ avoidance behaviours (e.g. "I will stop any activity as soon as I sense pain coming on") (3) fearful thoughts/ consequences (e.g. "pain sensations are terrifying") and (4) physiological arousal (e.g. "I find it difficult to calm my body down after periods of pain"). Participants are asked to rate to what extent they agree

with each item on a 5 point Likert scale, ranging from 0 = "Never" to 5 = "Always". Total scores on this scale range from 0 to 100. Abrams, Carleton and Asmundson (2007) explored the psychometric properties of the PASS-20 within a non-clinical population and found both total and sub-scale scores to have correlation coefficients ranging from moderate to high (r = .42 to r = .71, average r = .57), according to Cohen's d, with other related measures, suggesting concurrent validity. The internal consistency of the sub-scale has been reported as an average alpha of .81, ranging from α = .75 to α = .87 (McCracken & Dhingra, 2002).

Credibility / compliance measures

Credibility and compliance scales were administered to measure perceived effectiveness and engagement with the task in question (either ATT or PMR) e.g. 'Before listening to the recording, please rate how likely you think this technique will help to improve your mood and quality of life?' This was rated on a Likert scale ranging from 0 – 10 (0 being 'Not likely at all', 10 being 'Extremely likely'). Levels of compliance were also measured e.g. 'Now that you have listened to the recording, please rate how engaged you were with the task', using a 0-10 point Likert scale (0 being 'Not engaged at all', 10 being 'Completely engaged').

Procedure

All participants read an information sheet, outlining the nature and details of the study online. After consent was obtained, participants then completed the screening questionnaires (ETISR-SF, PHQ-9, GAD-7 and MCQ-30) to ensure that they fulfilled the inclusion criteria for the study. Once suitability for inclusion to the study had been established, participants were randomly allocated to either the ATT or PMR condition. The process of randomisation involved the experimenter writing the unique questionnaire ID number of each suitable

participant on a randomisation grid (compiled by the statistician), in chronological order of the date of completion. The method used was simple block randomisation (with no stratification) with block sizes varying between 2 and 8. The statistician was independent of the research team, so as to reduce experimenter bias in the process of allocation to each condition. The distribution of gender across conditions was controlled for by alternating the allocation of each male between ATT and PMR (in date order of questionnaire completion), to ensure an equitable spread. Participants were then invited to meet with the experimenter to take part in the main study. They were informed that they would be required to attend two separate sessions (a week apart).

Session 1

The first session was of 20 – 25 minutes duration. At the beginning of this session, verbal consent was sought by the experimenter and written documentation of the participant's agreement to consent was obtained. The experimenter administered the subjective, self-report measures in the following order; the PANAS, the ERS and the PASS-20. A brief verbal description of each scale and how to complete each one was provided by the experimenter. Since the PANAS can be used to measure affect in two different ways, it is important to note that participants were instructed to complete the PANAS based upon their perception of affect *over the past week*, as opposed to the present moment. Once participants had completed the three questionnaires, they were seated in front of the computer in preparation for listening to the audio recording (of either ATT or PMR). Before listening to the CD, participants were asked to rate how credible they anticipated the technique to be, based upon the written description of the task alone. The experimenter then left the room for the duration of the CD (12 minutes) so that participants did not feel as if they were being observed, in an attempt to maximise engagement with the task. Upon the experimenters

return to the laboratory setting, participants were asked to rate their perceived credibility of the technique. They were also asked to rate their level of compliance with the task. These ratings were recorded. At the end of the session, an appropriate time to meet with the experimenter to complete the study was arranged (a week later, where possible). Participants were asked to listen to their CD at least once as homework practice and to record their perception of effectiveness using the credibility rating scale. They were advised to listen to the CD at a mid-point between session one and session two (e.g. 3 or 4 days after the first session where the time frame between sessions one and two was a week). They were all instructed to listen to the CD alone in a private, quiet location so as to reduce disruption during the task.

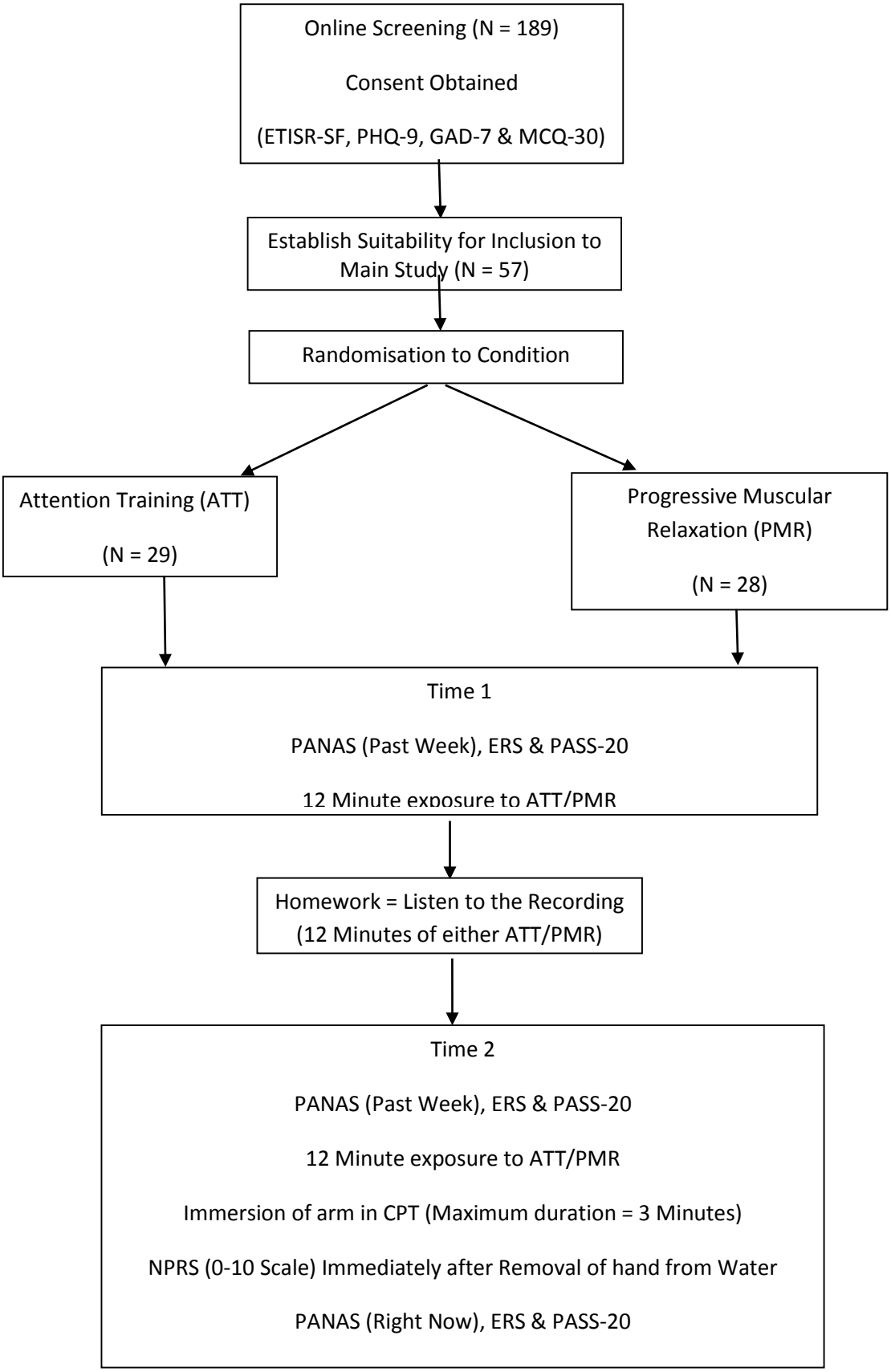
Session 2

The second session was of 40 - 45 minutes duration. The experimenter collected the 'Between session practice' diary from each participant. The experimenter then administered the same questionnaires (the PANAS, the ERS and PASS-20) in the same order as the initial session. Again, participants were asked to rate their affect on the PANAS based upon *the past week.* Once participants had completed these, they were again seated in front of the computer to listen to the audio recording. The experimenter left the room at this point. Compliance ratings were obtained after the participant had listened to the CD. Participants were then given a verbal introduction to the CPT, in which the experimenter explained the procedure for the task and how the tolerance and pain ratings would be taken. They were told that they could withdraw their arm from the water at any point but that they should try to leave their arm submersed until the sensations became intolerable. The experimenter checked that the water was at the correct temperature and recorded this information, prior to submersion. Participants then submerged their arm into the cool box, up to their elbow.

Tolerance times were recorded with a stop watch. After immediate removal of their arm from the water, participants were asked to rate their pain perception on the NPRS. The experimenter reassured each participant that there would be no lasting damage from the CPT and that the normal sensation would return to their arm shortly. Participants were then instructed to complete the PANAS and the ERS for a final time. On this occasion, participants were instructed to rate their perception of affect on the PANAS *within the present moment.* Finally, participants were thanked for their participation in the experiment and debrief information was provided.

A diagrammatic representation of the procedure is provided in Figure 1.

Figure 1: Diagrammatic representation of procedure.



Results

Preliminary Analyses

An initial screening of the key dependent variables (immersion time, PANAS positive/ negative scores and pain perception as measures by the NPRS) was conducted. These descriptive statistics are presented in Table 1.

Table 1: Descriptive statistics of key dependent variables and covariates.

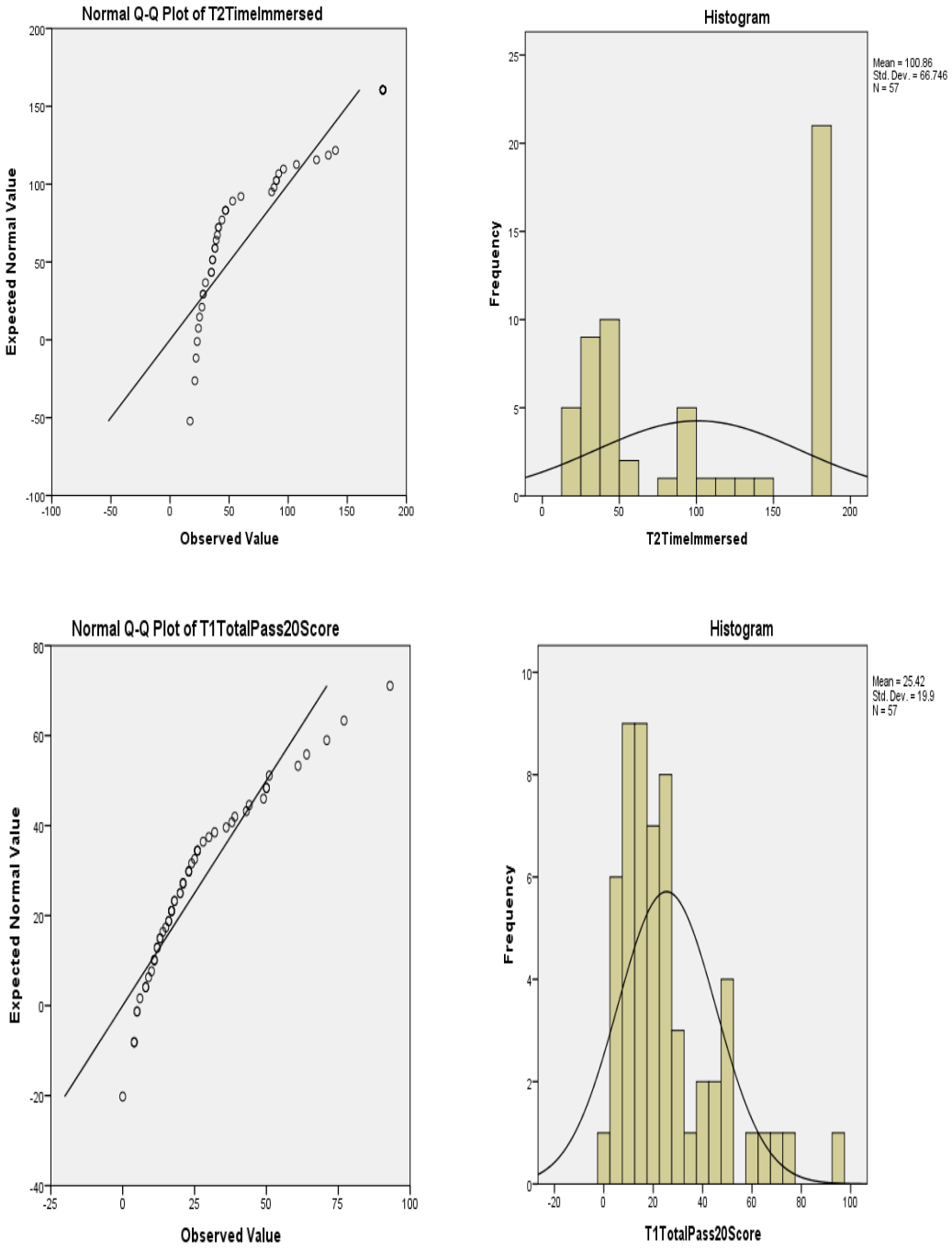
		ATT			PMR	
DV's	**Unadjusted M**	**SD**	**95% CI**	**Unadjusted M**	**SD**	**95% CI**
Immersion Time	126.6	59.40	104.01-149.17	74.21	64.33	49.27-99.16
Pain Rating (NPRS)	5.41	1.99	4.66-6.17	6.14	1.94	5.39-6.89
Time 2 PANAS +ve (After CPT)	29.28	8.00	26.25-32.30	28.32	8.46	25.04-32.30
Time 2 PANAS –ve (After CPT)	12.38	5.40	10.33-14.33	12.82	5.46	10.71-14.94
Covariates						
Time 1 ERS	27.90	18.80	20.75-35.05	38.18	14.66	32.49-43.86
Time 1 PASS-20	19.07	17.62	12.37-25.77	32.00	20.28	24.14-39.86

All variables were normally distributed except for immersion time and total PASS-20 scores at time 1. There were no missing values. One-sample Kolmogorov-Smirnoff tests and subsequent examination of associated histograms and Q-Q plots revealed a bimodal distribution for immersion time and a positively skewed distribution for total PASS-20 scores. These graphs are shown in Figure 2. The key dependent variable (time immersed) failed the one sample K-S test; Skewness = .17, p = .002. The control variable (PASS-20 Score) also failed the one sample K-S test; Skewness = 1.42, p = .032, indicating that both

variables significantly deviated from the normal distribution. A square root transformation was performed to convert the immersion time scores. This reduced the amount of Skewness to .007. However, the transformed square root variable still failed the one sample K-S test, $p = .003$.

We proceeded with parametric analyses since the sample size was large and bimodal distributions cannot be transformed. According to the Central Limit Theorem (Stein, 1972), tests based on the normal distribution are still valid for sample sizes of $N = 30$ or more, even when the data is not normally distributed (Howell, 2002). This analysis was supplemented with non-parametric follow-up testing to determine the reliability of effects.

Figure 2: Graphical representation of deviation from the normal distribution.



Pre-experimental differences

A series of independent t-tests were computed to determine whether there were any pre-existing differences between groups, prior to experimental manipulation in order to ascertain which, if any variables at time 1 should be considered as potential confounding factors and controlled as covariates. Baseline scores on the Emotional Reactivity Scale (ERS) revealed a significant difference between the experimental group (M = 27.90, SD = 18.80, 95% CI: 21.61 – 34.19) and the control group (M = 38.18, SD = 14.66, 95% CI: 31.78 – 44.58) (t (55) = 2.30, p = .03, two-tailed). The magnitude of the differences in means (mean difference = 10.28, 95% CI: 1.31 to 19.25) was moderate (partial eta squared η^2 = .09), Cohen (1988).

Baseline scores between the experimental group (M = 19.07, SD = 17.62, 95% CI: 12.01 – 26.13) and the control group (M = 32.00, SD = 20.27, 95% CI: 24.82 – 39.19) (t (55) = 2.6, p = .01, two-tailed) on the Pain Anxiety Symptoms Scale (PASS – 20) were also found to be significantly different. The magnitude of the differences in means (mean difference = 12.93, 95% CI: 2.85 to 23.00) was large (partial eta squared η^2 = .11), Cohen (1988).

There were no significant group differences between PANAS (positive/ negative scores) at time 1. Analysis of the pre-experiment screening variables (Total ETISR-SF, PHQ-9, GAD-7 and MCQ-30 scores) revealed that there were no significant group differences in terms of their exposure to trauma, symptoms of low mood and anxiety or Meta-cognitive beliefs. Descriptive statistics for the pre-experimental screening variables are presented in Table 2.

Table 2: Descriptive statistics for the screening variables.

		ATT			PMR	
DV's	**Unadjusted M**	**SD**	**95% CI**	**Unadjusted M**	**SD**	**95% CI**
ETISR-SF Score	6.31	4.43	4.71 – 7.91	6.82	4.16	5.19 – 8.45
PHQ-9 Score	5.59	5.30	3.76 – 7.41	5.89	4.48	4.03 – 7.75
GAD-7 Score	4.31	4.18	2.63 – 6.00	6.36	.86	4.64 – 8.07
MCQ-30 Score	52.07	16.97	46.27-57.87	59.82	14.03	53.92 - 65.73

Expectancy and Compliance

Examination of expectancy ratings showed that there were no significant group differences in credibility ratings before; t (55) = 0.36, p = .72, two-tailed) or after (t (55) = -.82, p = .42, two-tailed) listening to the CD (ATT/PMR) at session one. There were also no significant differences between the experimental group (M = 7.31, SD = 2.16) and the control group (M = 6.30, SD = 2.46) on compliance ratings, as indicated by the 0 – 10 scale (10 being fully compliant) after listening to the CD at baseline (t (55) = -1.7, p = .10, two-tailed). These equivalent credibility and compliance ratings provide some assurance that any differences observed are unlikely to be due to differences in expectancy or levels of compliance with the techniques.

Demands of the CPT task

There were no significant group differences between the ATT group (M = 4.60, SD = 0.24) and the PMR group (M = 4.67, SD = 0.25) in the temperature of the water at time of immersion (t (55) = 1.00, p = 0.32, two-tailed), confirming that any results obtained are unlikely to be due to variation in the demands of the task between conditions.

Main Findings

Tests of the primary hypothesis

Independent T-test

The independent t-test revealed a significant difference between the ATT group (M = 126.59, SD = 59.36) and the PMR group (M = 74.21, SD = 64.33) in the duration of immersion in the water (t (55) = -3.20, p = .002, two-tailed), confirming that the ATT group were able to tolerate pain for a longer duration than the PMR group.

Mann-Whitney U Test

Given that the dependent variable (immersion time) was shown to be non-normally distributed in the preliminary analysis, the independent t-test was followed-up with the non-parametric Mann-Whitney U Test. This test also revealed a significant difference between the ATT group (Mean Rank = 35.72) and the PMR group (MR = 22.04) in the length of immersion time (U = 211.00, p = .001). Non-parametric tests are less sensitive than parametric tests in that there is an increased chance of type II error, i.e. an increased chance of finding no significant difference between groups, when in reality, there is one (Field, 2000). Thus, in finding a significant difference on the non-parametric test, we can be more confident that there is a true difference between the two groups.

Analysis of variance (ANOVA)

The ANOVA demonstrated significant differences between the two conditions in duration of immersion times F (1, 55) = 10.21, p = .00, partial eta squared (η^2) = .16, which is a large effect size (Cohen, 1988). The observed power was 88% with alpha at 0.05. Inspection of

the unadjusted means (ATT = 126.59, SE = 11.49, PMR = 74.21, SE = 11.69) revealed that as expected, the experimental group showed longer immersion times than the control group.

Analysis of covariance (ANCOVA)

In the next step of testing the primary hypothesis, pre-existing group differences were controlled for. Total ERS and PASS-20 scores were found to be elevated in the PMR group and were both entered as covariates when testing for group differences in immersion time. The ANCOVA demonstrated significant differences between the two conditions in duration of immersion time F (1, 53) = 6.52, p = .01, partial eta squared (η^2) = .11, which is a large effect size (Cohen, 1988). The observed power was 71% with alpha at 0.05. Examination of the adjusted means (ATT = 122.93, SE = 11.93, PMR = 78.0, SE = 12.16) revealed that as hypothesised, the experimental group showed longer immersion times. In fact, those in the ATT group persisted with the CPT an average of 44.93 seconds longer than those in the PMR group, hence the null hypothesis was rejected. The unadjusted descriptive statistics are displayed in table 1. (The ANCOVA was also run on a transformed square root outcome variable for immersion time which succeeded in transforming the data to some extent but this did not alter the significance level of the result p = .007, rounded to .01).

Tests of the secondary hypotheses

Independent T-tests

An independent t-test revealed that there were no significant group differences between the ATT group (M = 5.41, SD = 1.99) and the PMR group (M = 6.14, SD = 1.94) on subjective ratings of pain (t (55) = 1.40, p = 1.7, two-tailed), as measured by ratings on the NPRS.

There were also no significant group differences between the ATT group (M = 29.28, SD = 7.95) and the PMR group (M = 28.32, SD = 8.46) on positive affect immediately after exposure to the Cold Pressor Task (t (55) = -.44, p = .66, two-tailed), as measured by the PANAS. There were no significant group differences between the ATT group (M = 12.38, SD = 5.34) and the PMR group (M = 12.82, SD = 5.46) in negative affect immediately after exposure to the CPT (t (55) = .31, p = .76, two-tailed), as measured by the PANAS. No significant group differences were found between positive or negative affect at time 2, before exposure to the CPT, either.

ANOVA

The ANOVA demonstrated that there were no significant differences between the two conditions on subjective perceptions of pain F (1, 55) = 1.96, p = 1.7, partial eta squared (η^2) = .03, which is a small effect size (Cohen, 1988). The observed power was 28% with alpha at 0.05. Inspection of the unadjusted means (ATT = 5.41, SE = .36, PMR = 6.14, SE = .37) revealed equivalent levels of subjective pain between the two groups, as measured by the NPRS. The ANOVA illustrated that there were no significant differences between the two groups on reported positive affect F (1, 55) = .19, p = .66, partial eta squared (η^2) = .00, which is a very small effect size (Cohen, 1988). The observed power was only 7% with alpha at 0.05. Examination of the unadjusted means (ATT = 29.28, SE = 1.5, PMR = 28.32, SE = 1.5) revealed equal levels of positive affect, following exposure to the CPT, as measured by the PANAS. The ANOVA also demonstrated that there were no significant differences between the two groups on reported negative affect F (1, 55) = .09, p = .76, partial eta squared (η^2) = .00, which is a very small effect size (Cohen, 1988). The observed power was 6% with alpha at 0.05. Examination of the unadjusted means (ATT = 12.38, SE = 1.0, PMR = 12.82,

SE = 1.0) showed equivalent levels of negative affect between the two groups, immediately after exposure to the CPT.

ANCOVA

Pre-existing differences (total ERS and PASS-20 scores), which were found to be elevated in the PMR group were both entered as covariates when testing for group differences in pain perception. The ANCOVA demonstrated that there were no significant differences between the two conditions on subjective perceptions of pain $F(1, 53) = 1.62$, $p = .21$, partial eta squared (η^2) = .03, which is a small effect size (Cohen, 1988). The observed power was 24% with alpha at 0.05. Examination of the adjusted means (ATT = 5.42, SE = 0.38, PMR = 6.14, SE = 0.39) revealed equivalent perceptions of pain between the groups, as measured by the NPRS. Hence, the null hypothesis was accepted. However the statistical power was low given the small sample size and small effect. The unadjusted descriptive statistics are also displayed in table 1.

Pre-existing differences (total ERS and PASS-20 scores), which were found to be elevated in the PMR group were both entered as covariates when testing for group differences in affect. The ANCOVA demonstrated that there were no significant differences between the two groups on reported positive affect $F(1, 53) = 0.20$, $p = .89$, partial eta squared (η^2) = .00 or reported negative affect $F(1, 53) = .97$, $p = .33$, partial eta squared (η^2) = .09. Examination of the adjusted means revealed equal positive affect (ATT = 28.65, SE = 1.57, PMR = 28.98, SE = 1.60) and equal negative affect (ATT = 13.27, SE = 0.95, PMR = 11.90, SE = 0.97) immediately after exposure to the CPT, as measured by the PANAS. The unadjusted descriptive statistics are displayed in table 1.

There were also no significant group differences in positive or negative affect at time 2, before exposure to the CPT, hence, the null hypothesis was retained.

The unadjusted descriptive statistics for all variables recorded at Time 2 are displayed in table 3.

Table 3: Descriptive statistics of all variables measured at Time 2.

	ATT			**PMR**		
Variable	**Unadjusted M**	**SD**	**95% CI**	**Unadjusted M**	**SD**	**95% CI**
Credibility Rating	5.97	2.28	5.10-6.83	5.29	2.49	4.32-6.25
Compliance Rating	6.48	2.40	5.57-7.40	6.14	2.34	5.24-7.05
Immersion Time	126.6	59.40	104.01-149.17	74.21	64.33	49.27-99.16
Pain Rating (NPRS)	5.41	1.99	4.66-6.17	6.14	1.94	5.39-6.89
Before CPT						
PANAS+ve	30.41	7.32	27.63-33.20	32.18	5.43	30.07-34.28
PANAS –ve	19.76	7.38	16.95-22.57	19.68	7.45	16.79-22.57
PASS-20	18.83	16.72	12.47-25.19	32.18	18.52	25.00-39.36
ERS	28.93	21.16	20.88-36.98	34.11	15.76	28.00-40.22
After CPT						
PANAS+ve	29.28	8.00	26.25-32.30	28.32	8.46	25.04-32.30
PANAS –ve	12.38	5.40	10.33-14.33	12.82	5.46	10.71-14.94
ERS	26.38	22.27	17.91-34.85	33.57	18.08	26.56-40.58

Discussion

Key findings

In support of the primary hypothesis, the main finding of this study was the large and significant difference in immersion times between the experimental group and the control group, on the CPT. Pain tolerance was significantly greater in those who received ATT in comparison to those who received PMR.

In terms of the secondary hypotheses, findings did not support the prediction that those in the ATT group would show lower perceptions of pain on the NPRS. In fact, subjective perceptions of pain were very similar in both groups, thus revealing a discrepancy between self-reported pain and behavioural tolerance of pain. In addition, findings were unsupportive of the prediction that ATT would influence affect by either reducing negative affect or increasing positive affect, following exposure to the CPT. Results confirmed that affect remained the same across groups, both prior to and after exposure to the CPT, a week after time 1 measures were obtained.

These findings partially replicate those of Sharpe et al. (2010) in demonstrating no group differences between self-reported perceptions of pain, as measured by the NPRS. However, Sharpe et al. (2010) also found no significant group differences in pain tolerance. This contrasts with the significant group differences in immersion time that were found in the present study. Hence, this new evidence would dispute claims that ATT may be insufficient to influence tolerance of pain, as previously suggested by Sharpe at al. (2010). In fact, the present findings confirm that even a brief, introductory (36 minute duration) exposure to the ATT paradigm appears to exhibit powerful effects on the behavioural and psychological aspects of pain tolerance. More specifically, the present findings extend those of Sharpe et

al.'s (2010) study by showing that ATT not only influences how quickly pain is registered, but also the duration that pain can be tolerated.

A number of reasons could explain these discrepancies in findings. Firstly, the present study utilised a sample of emotionally vulnerable individuals, as opposed to a healthy sample of undergraduates that were not identified as having been exposed to a significant traumatic event early on in life, as used in Sharpe et al.'s (2010) study. Since adverse childhood experiences have been identified as increasing susceptibility to a number of psychological problems (Mullen, Martin, Anderson, Romans & Herbison, 1993; Spertus, Yehuda, Wong, Halligan & Seremetis, 2003) and physical health difficulties in adulthood, including pain (Casey et al., 2008; Jones et al., 2009), it may be that the present study was more sensitive to detecting intervention effects. A further advantage of the present study was that it used a more heterogeneous sample in terms of both age and occupation. Sharpe at al. (2010) only targeted undergraduate students (mean age = 19.48), whereas the present study obtained a range of ages (from 18 to 62, mean age = 29.30), as well as including participants from the lay population who were either full/ part-time employed or retired. Hence, the larger diversity within the present sample may have increased the likelihood of detecting significant differences in pain tolerance.

Secondly, refinement of Sharpe et al.'s (2010) methodology by excluding the threat manipulation component, obtaining pain ratings after exposure to the CPT, as well as measuring credibility and compliance allowed the present study to examine the impact of the two interventions (ATT/PMR) in more detail. These modifications reduce the range of influences on pain-related responses and provide some control over interpretations of the findings linked to expectancy effects or differences in compliance with the interventions.

Furthermore, measurement of pain perception *after* exposure to the CPT, along with the lack of group differences in pain perception, as measured by the NPRS, may give an insight into the mechanism by which ATT works. The ATT may not act directly on the perception of pain but may increase cognitive capacity to choose alternative responses and override pain responses. In particular, following ATT the participant may not need to choose behavioural withdrawal as a means of regulating internal distressing experiences (pain) but may be better able to recruit alternative cognitive strategies.

The present study also modified the methodology of that used by Sharpe et al. (2010) by exposing participants to the intervention (ATT/PMR) for a longer duration overall (36 minutes as opposed to a one-off 12 minute exposure) and at three distinct time points (session 1, homework practice and session 2). This may have allowed a more rigorous test of the efficacy of ATT.

The findings did not support the hypothesis that ATT may influence affect by either reducing negative affect or increasing positive affect. This could be due to a number of factors. The most obvious being that although the CPT is a well known laboratory procedure for the induction of pain, it may not induce affect. Secondly, research suggests that self-report measures are less sensitive to detecting reactivity to stress (Rosenthal, Gratz Kosson, Cheavens, Lejuez & Lynch, 2008) and subjective measures of self-reported distress are often at odds with objective physiological measures of distress, particularly when used with emotionally vulnerable individuals (Felui-Soler, Pascual, Soler, Perez, Amario, Carrasco, Sanz, Villamarin & Borras, 2013; Kuo & Linehan, 2009). Hence, it may be that utilising an induction procedure such as the CPT detects physiological reactivity to stress over and above psychological reactivity to stress. Finally, despite the present study using a sample of individuals who had experienced childhood trauma, as identified by the ETISR-SF, it did

use a non-clinical population, as opposed to targeting individuals suffering from diagnostically identifiable 'disorders'. Thus, it may be that although ATT has been shown to be effective at influencing affect change within clinical populations, the efficacy is harder to detect in a sample that are not showing clinically significant symptoms of affect, as measured by the PHQ-9 and GAD-7.

Theoretical implications

These findings are consistent with the idea that reactions to stress (in this case, pain) are influenced by ATT. In MCT, such reactions are dependent on the intensity of the CAS (Wells & Matthews, 1994; 1996). Thus, it is possible that in the present study, ATT may have reduced the propensity with which the CAS was activated by diverting participant's attentional focus away from internal experiences evoked by the CPT, towards external stimuli (Wells, 1990; 2009). However, since the present study did not include a measure of the CAS, support for the theoretical basis of ATT requires further exploration by future studies.

Is ATT more than just distraction? Distraction has been investigated within the pain literature and findings suggest that altering attention as opposed to distraction influences reactivity to the CPT (Sharpe et al., 2010). Distraction is based on the idea that focusing attention towards a neutral or non-painful stimulus within the environment, alleviates the experience of pain (Elomaa, Williams & Kalso, 2009). However, distraction has shown inconclusive results for reduction of pain, across a number of research studies (Eccleston & Crombez, 1999; Goubert, Crombez, Eccleston & Devulder, 2004; McCaul and Malott, 1984; Tracey, Ploghaus, Gati, Clare, Smith & Menon, 2002). More specifically, Goubert et al. (2004) found distraction to have paradoxical effects of *increased* pain after exposure to a lifting task, in those with chronic pain. Furthermore, they found that distraction had no effect

on self-reported pain during exposure and catastrophic cognitions about the pain (causing less engagement with the distraction task), was mediated by the attentional focus on pain (Goubert et al., 2004). One of the major differences between distraction and ATT is that distraction is generally used as a coping technique during pain exposure, but in the current study ATT was tested as a procedure that might subsequently modify pain tolerance.

The practice of ATT has been shown to increase cognitive flexibility and thus, meta-cognitive control in regulating distressing cognitions and emotion (Nassif & Wells, 2014). Hence, it may be the case that prior to exposure to the painful physiological sensations brought about by the CPT, those in the ATT group had developed greater flexibility in their CAS, allowing them to subsequently focus on external stimuli in the environment (Fergus et al., 2012). This would have enabled them to persist with the task longer than those in the PMR group, who had not received any technique associated with disrupting their internal self-focused attention. Nevertheless, since the present study did not include a measure of cognitive flexibility, further research would be required to investigate these theoretical implications.

Clinical implications

The present study utilised a sample of non-clinical individuals, all of who had been exposed to a significant degree of early life trauma. Hence, these findings offer promising results for the benefits of ATT in being able to increase resilience to stressful, painful situations in those that may otherwise develop chronic psychological and or physical related problems later in life (Casey et al., 2008; Jones et al., 2009).

Findings may have implications for the use of ATT in medical settings where painful surgical or invasive procedures are routinely performed. The present study utilised a control condition (PMR), which includes a component of distraction (Sharpe et al., 2010). Thus, it

may be the case that ATT would be a more effective intervention than relaxation or distraction techniques in physical health settings. Moreover, since attention training techniques have been shown to be effective in ameliorating symptoms of PTSD (Callinan, 2011; Wells & Sembi, 2004; Wells & Colbear, 2012), the use of ATT within acute medical settings may play a preventative role in influencing the trauma sequale of medical procedures by interrupting the attentional processing biases, associated with frequent activation of the CAS. They may also have implications for the benefits of ATT in prevention of transition from acute to chronic pain (Casey et al., 2008), particularly if at risk groups (i.e. emotionally vulnerable individuals) are identified early on. Since Pain has repeatedly shown to have a detrimental effect on quality of life (Ferrell, Grant, Pedilla, Vemuri & Rhiner, 1991; Ferrell & Dean, 1995; Niv & Kreitler, 2001), ATT could be utilised as a brief, accessible self-help technique, which could potentially make a difference in mental health outcomes amongst the general population.

Limitations

Limitations of the present study are that we cannot be sure whether ATT improves tolerance or PMR reduces tolerance. Nevertheless, we can be certain that ATT is better than a comparable, equally credible intervention (PMR). Future research utilising a control group that receive no intervention would be required to determine the direction of causality. However, potential ethical issues surrounding a wait-list control condition would require careful consideration. A further consideration is the use of the CPT within the present study. Although the CPT was considered an appropriate method to use due to its extensive use as a pain induction procedure across many populations, the generalizability of the task to real-life, painful or stressful situations remains questionable. Individuals who have been exposed to adverse life events during their childhood may view laboratory procedures such as the

CPT as artificial and trivial. Thus, the CPT may not be the most rigorous test of pain tolerance amongst the sample of individuals used within the present study. The fact that a ceiling effect was observed in the ATT group due to participants being asked to remove their hand from the water at 3 minutes for ethical reasons, suggests that ATT may have more powerful effects upon pain tolerance levels than the present study was able to detect. A further criticism of the present study is that although all participants appeared to have completed their homework by returning their 'Between session practice' diary, there is no way of determining whether participants did actually listen to their ATT/ PMR CD between sessions. Those who did genuinely comply with the homework task may not have done so under laboratory conditions, which could have potentially influenced the findings. Nevertheless, participants were instructed to listen to their CD in a quiet room with minimal distractions. The monitoring of homework compliance more rigorously is a consideration for future studies. Furthermore, the short timeframe in which these findings were observed means that the long-term benefits of ATT for pain outcomes in emotionally vulnerable individuals require further exploration. The present study utilised a sample which predominantly consisted of females, therefore the benefits of ATT upon altering pain tolerance may not necessarily be applicable to the general population. Finally, the extent to which the findings are generalizable to individuals with acute or chronic pain is somewhat speculative, since the sample did not include participants who identified themselves as suffering from current pain. Further research exploring the applicability of ATT within real-life pain settings is warranted. Methodological and clinical implications, which warrant acknowledgement within the context of the present empirical study, as well as the limitations and directions for future studies, are discussed further in the critical appraisal.

Conclusions

In conclusion, ATT was found to have a powerful impact on the tolerance of pain, within a laboratory setting. This key observation may have implications for the wider application of ATT to acute medical settings and the general population. Results suggest that a range of individuals could potentially benefit from ATT. In particular, those suffering from physical health problems, as well as non-clinical groups of individuals who have been exposed to adverse early life events and who therefore may be susceptible to developing subsequent pain or psychological problems at a later point in life. Given that ATT is one component of meta-cognitive therapy, results from the present study raise important questions concerning the potential greater efficacy of ATT when presented as a component of a more complete integrated treatment package.

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Part 3: Critical Appraisal

Word count = 6,095 (including references)

5,667 (excluding references)

Overview

A reflective journal was kept throughout the research process, noting areas for consideration at key stages of the research journey, from development of the research idea, through data collection, analysis and the key findings. The first section will focus on methodological issues and dilemmas raised by the systematic literature review, including limitations. The second section will focus on the methodological and clinical implications, which warrant acknowledgement and discussion within the context of the present empirical study. This will include theoretical and clinical considerations related to the present study, as well as reflections on the process of conducting the study more generally. Finally, the limitations of the present study and directions for further research will be discussed.

Literature review

Origins of the review

I chose to conduct my literature search in the area of emotional reactivity and trauma history because this complimented the focus of my empirical study. Literature describing the links between adverse life events and increased susceptibility to developing psychological problems later in life, highlighted specific personality factors, particularly borderline personality traits, implicated in this relationship. It became clear that the majority of early research in this field had relied solely on the use of subjective, self-report measures when investigating emotional reactivity. Recognition of the importance of utilising physiological measures of distress as a more objective approach to exploring emotional reactivity was acknowledged. However, whilst a growing number of studies had begun to use a combination of both psychological and physiological measures of emotional reactivity, a gap in the research was identified for a review of such studies. The literature also highlighted a discrepancy between subjective and objective reports/ recordings of distress. Since I was

about to embark on conducting a study that utilised both objective and subjective measures myself, I was keen to explore the reasons underlying this finding in further detail.

The review process

The systematic review of the literature produced for this doctoral level thesis has been an evolving piece of work, over the last twelve months. Part of this ongoing process required extensive, systematic searches of the literature in the field of Borderline Personality Disorder (BPD), in addition to evaluation and synthesis of the research. I chose to conduct a systematic review as opposed to a meta-synthesis or a narrative review due to the strengths of utilising explicit measures to identify, extract and synthesise relevant data. Systematic reviews use objective, evidence-based procedures to enable a comprehensive review of the findings, making them more replicable and less biased than other types of review (Mulrow, 1994; NHS Centre for Reviews and Dissemination, 2001). I valued being able to use established standards to critically appraise the research in this field because it enabled me to resolve some of the controversy between conflicting findings.

As this was a completely new experience for me, it felt overwhelming initially, in terms of both devising succinct search terms and the sheer amount of articles that were generated from the searches (N = 1,094 following the application of limits), leading to the retention of N = 69 potentially suitable articles, after scanning the titles for relevance. I have learnt to appreciate the importance of adopting a clear search strategy to enable a concise, effective approach to determine which studies were the most relevant to include. I often found it challenging to maintain such strict inclusion criteria, so as to only capture studies directly related to the research question, whilst taking care not to overlook other potentially relevant articles. The review only focused on studies using participants with diagnosed BPD, as opposed to personality 'features'. The reason behind this decision was to explore the

concept of emotional reactivity within a distinct clinical population so that findings and implications would be applicable to a specific diagnostic group of individuals. Although this seemed like the most appropriate approach to take at the time, the drawbacks of using narrowly defined inclusion criteria for this review will be discussed in the limitations section. Aside from the methodological limitations, I underestimated the amount of time it would take to read through the 69 articles that were originally identified as potentially suitable, in addition to a more detailed inspection of the 10 studies that specifically met my inclusion criteria. However, by undertaking a systematic approach to my literature topic, I believe that the literature review process has allowed me to develop a skill of synthesising and summarising the key findings and implications from an initially, vast amount of data. This has definitely allowed me to feel more competent in my research skills overall. Thus, I have valued the skills I have gained, despite the challenges I have faced along the way.

Limitations of the review

The review focused rigidly on studies that had utilised participants who had received a verified diagnosis of BPD (or established, diagnostic features of the disorder). Narrowing the focus of the review to include only clinical populations allowed the implications to fit more precisely with those individuals identified as having a recognised DSM-IV (APA, 1994) diagnosis of BPD. This is likely to increase the likelihood of the implications being implemented by clinicians working with such individuals, as opposed to the reader possibly becoming confused about which individuals the findings are directly applicable to, had a broader range of studies, including personality 'traits' been included.

Nevertheless, a disadvantage of the strict inclusion criteria adopted within the present review is that it does not take account of individuals with borderline personality traits who tend to present in community settings (e.g. Primary Care Mental Health Services). Such

individuals are likely to exhibit key behavioural and emotional markers of BPD, regardless of having a diagnosis. Hence, the present review is somewhat ignorant of the move towards personality disorders being recognised as on a continuum, rather than from a clinical cut-off perspective.

Finally, the applicability of the findings to the population as a whole remains questionable given that there was a definitive lack of studies utilising male participants. Studies that did include both genders were disproportionate, with the number of females considerably outweighing the number of male participants. Nevertheless, the review was conducted on the availability of relevant research studies within the field. Thus, a direction for future studies is to expand recruitment to more males to increase ecological validity of the overall findings.

Empirical study

Development of the project

Although the topic of my research project was prescribed to a certain extent (it was required to be within the field of my supervisors' specialist area of interest and expertise), I valued being able to develop a proposal that took the project forward in a direction that I could influence. I developed an interest in the idea of prevention and felt passionate about conducting a study with a non-clinical population of individuals who were predisposed to developing psychological difficulties at some point in their lives. My interest in the trauma literature brought about the idea of narrowing the inclusion criteria to target a population of individuals who had been exposed to an early traumatic event. Since the focus of my literature review was to explore emotional reactivity amongst individuals identified as having personality issues or a significant history of abuse, it made sense for me to develop a study within an area that had some links to my review paper.

Initially, I wanted to conduct a study that would allow me to utilise and develop my clinical skills, in addition to my research skills, by taking on a dual role of delivering metacognitive therapy sessions and evaluating outcomes of the therapy. However, after further discussion with my supervisor, based upon his experience of the time and resources required to conduct such a study (e.g. the limited constraints of a ClinPsyD budget and timeframe allowed) we decided to test an implication of the metacognitive model instead. On reflection, I feel my original idea arose through my limited research experience and thus, was a rather naïve perspective to take. Hence, drawing on the knowledge of my supervisors' extensive research experience was invaluable in developing my research design and subsequent proposal. The Research Sub Committee (RSC) and University Research Ethics Committee (UREC) meetings also helped to further refine my research design and proposal to ensure methodologically rigorous and ethically approved procedures were adhered to. I now appreciate the importance of such procedures occurring within a timely manner to coincide with the early stages of getting the research study underway. However, on reflection, this was a stressful process to participate in whilst other competing demands of the course were upon me. My time management and organisational skills were definitely tested at this stage of the research process. I have learnt how to plan for such meetings and prioritise my workload accordingly and am more appreciative of the many stages of preparation that are essential when planning a piece of research.

Methodological and ethical considerations

Design

A mixed, between-within design was agreed upon for the empirical study. The advantage of this type of design is that it allows for comparison between different treatment groups, as well as within the groups, across different points in time. This type of analysis allows us to

determine whether there is a causal relationship between the independent variable, random assignment to condition (Attention Training; ATT versus Progressive Muscular Relaxation; PMR) and the intended outcomes (a difference in the tolerance or perception of pain and either a reduction of negative affect or increase in positive affect).

Recruitment

It was decided to recruit a sample of students for a number of reasons. Firstly, they are an opportunistic sample of individuals who are easy to access and are often interested in participating in research studies. Secondly, the impact of ATT as a treatment technique had only been tested in clinical samples of individuals, suffering from discrete diagnostic disorders such as panic (Wells, 1990; Wells, White & Carter, 1997), social phobia (Wells et al. 1997), hypochondriasis (Cavanagh & Franklin, 2000; Papageorgiou & Wells, 1998), major depression (Papageorgiou & Wells, 2000) and posttraumatic stress disorder (PTSD) (Callinan, 2011; Wells & Colbear, 2012; Wells & Sembi, 2004). However, more research was required to test the efficacy of ATT within populations that may have been exposed to a broad range of adverse life events and hence, are likely to experience a broader range of psychological phenomenon. Finally, students were considered an appropriate sample to target within the context of the present study because research proposes that a high proportion of them have been exposed to at least one adverse life event (Breslau, Davis, Andreski & Peterson, 1991; Smith, Hockemeyer, Heron, Wonderlich & Pennebaker, 2008) and the aim was to examine ATT as a strategy for enhancing resilience rather than treating existing problems. Time was a consideration because the study involved me meeting with participants twice, for up to an hour of contact time, within a week. Hence, the individuals selected needed to be able to give up their free time in order to participate.

The reason that I targeted students from both The University of Manchester and The University of Huddersfield (Appendix F) was because I live in Huddersfield, hence the time taken to travel back and forth to Manchester for recruitment purposes was taken into consideration. However, in hindsight, significant time was lost trying to gain access to participants at the other university. Having only a limited access to put posters (Appendix G) up in one building and no access to the student e-mail distribution list, I only ended up recruiting two students from Huddersfield. Consequently, the costs in terms of time for meetings with the head of the behavioural sciences department, outweighed the benefits in terms of numbers recruited. Nonetheless, the various barriers I encountered with regards to widening the study population beyond my own academic institution, provided me with invaluable, first-hand experience of the practicalities involved in the recruitment stages of research.

It was anticipated that a very large sample of students would be required to complete the screening, in order to gain sufficient numbers for inclusion to the main study. However, I was surprised by the limited number of individuals that were actually suitable to be included. Just over a third of all potential participants actually met the inclusion criteria; 68 out of 189 individuals to be exact. Whilst the majority of individuals had experienced one or more traumatic life events, many answered 'No' to having experienced intense horror, helplessness or hopelessness or feeling out of their body, as if they were in a dream, at the time of the event. Thus, targeting a group of individuals that were emotionally predisposed to developing PTSD, further limited the amount of individuals that satisfied the inclusion criteria. Four suitable participants (N = 4) were lost due to having left university between the time they had completed the online screening measures and the time I contacted them to offer a time to meet for the main study. Seven suitable participants (N = 7) never responded to my e-mail inviting them to take part in the main study. Another surprising finding was

that out of 498 individuals accessing the online link, only 189 actually went on to fill in the screening questionnaires. It is possible that individuals may have assumed they would be asked about their traumatic experiences as part of the main study, if they had not taken time to read the information sheet properly. Another consideration was the lack of anonymity in the online screening process. Having to provide their e-mail address so that I could contact them to arrange a time to meet for the first session could have put participants off. Also, the very nature of inputting personally sensitive information online, without the support of the researcher to answer any immediate concerns or queries, may have prevented participants from completing the screening.

All of the above issues highlighted the limitations of using an online screening in that the researcher has limited control over the recruitment process and a limited influence on engagement with the first session. On reflection, perhaps a pilot of the screening in advance would have given me a more in depth approximation of the numbers I would have recruited, allowing for dropout at each stage between opening the screening link to attending the first session. However, despite all of the above obstacles to recruitment, no significant difficulties were encountered once participants attended the main study. Recruitment slowed, as anticipated during the Summer months and early in the New Year when students were taking exams, but all participants (N = 57) completed both parts of the study. The reason that the study was opened up to the lay population was that by the end of September 2013, only 14 participants had taken part (over the previous 3 months). Hence, in order to sustain a more consistent flow of participants recruited to the study and to ensure my time was utilised effectively, it was felt necessary to expand the study beyond the student population. Doing so presented its own limitations which will be discussed in the limitations section of this paper.

Sample size

The head of medical statistics calculated that a sample size of 142 (71 per group) would be required in order to achieve 80% power to detect effect sizes of 0.5 and above. This power calculation was based on the original idea outlined in the proposal, to include measures at three separate time points (time 1, time 2 and follow-up). However, due to the various recruitment issues highlighted above, time constraints did not allow for the longitudinal element of the study to be conducted. Based upon previous studies which utilised a similar experimental design, with two separate time points, an attrition rate of 25% was estimated between session 1 and session 2. Hence, it was calculated that I would need to aim to recruit 178 participants in total. Having no previous research experience to compare these numbers with, I felt optimistic that this may be possible to begin with. Three months into the recruitment phase it became clear that I had dramatically overestimated the number of individuals that would meet my inclusion criteria. However, uptake of participation in those identified as suitable was good. Nobody recruited to the main study dropped out, which was positive and allowed me to feel confident in my engagement skills as a clinical researcher. By March 2014, I had recruited a total sample size of 57 (29 in the ATT group and 28 in the PMR group). Therefore, the decision was made to stop recruiting at this point, to allow sufficient time for conducting statistical analyses and writing up of the thesis. The statistician confirmed that a sample of this size would allow me 80% power to detect effect sizes of 0.7 and above.

Data collection

Given the large samples required to be able to achieve enough power for statistical analyses, I had to be extremely motivated and proactive in engaging participants. I was unable to access the student credit system and my research budget (after deducting costs for travel and

equipment) did not allow me to pay participants for their time. Three prize draws of Amazon Vouchers were used as an incentive for people to take part. Although I recognised that I was doing everything in my power to generate as much interest in the study as possible, I felt quite anxious that I would not achieve a sample size sufficient for a doctoral level thesis project. At this stage, I put all my time and effort into getting all suitable participants seen within a timely manner. I spent every study day available seeing participants and at the start of the new academic year, the numbers picked up considerably so I felt slightly more confident at this time. However, I misjudged the indirect aspects of conducting the research, aside from participant contact, such as time taken to cool the water to the correct temperature for each session, as well as scoring and inputting the data collected. This required a considerable amount of perseverance and determination on my part, to recruit the required numbers.

Materials and Measures

The ATT/ PMR CD

Both CD's were of equal duration in length and were recorded by my supervisor (Wells) to ensure that each group of participants were receiving a comparable intervention, except for the content of the CD.

The Cold Pressor Task

Following discussion with my supervisor and advice given at the RSC it was decided to use the cold pressor task as a means of stress induction. The inclusion of a specific task allows more control over the nature and duration of the stressor thereby reducing confounding influences on level of stress responses.

Primary dependent variable

Immersion time

It seemed important to maintain an objective measure of pain tolerance, in addition to a subjective measure of pain perception because the literature within my systematic review had drawn my attention to the discrepancy between objective and subjective distress. Furthermore, recording the time that participants were able to leave their hand immersed in the water was a replication of all other studies that have used the CPT.

Secondary dependent variables

The NPRS

The Numeric Pain Rating Scale is a widely used tool for measuring perceptions of pain on a simple, 0-10 scale. This scale is visual and therefore seemed an appropriate tool to use for taking a quick measure of pain, immediately after participants removed their arm from the water.

The PANAS

The PANAS is a well-established, easily accessible tool to use for obtaining a reasonably quick, yet effective measure of positive and negative affect, within the adult population. The measure uses a series of positive and negative words and asks participants to rate each word with a number (from the 0-5 scale). Hence, this tool seemed an appropriate tool to use that was less burdensome and time consuming for participants, than other mood measures. The tool can also be used in one of two ways, by asking participants to provide ratings based on how they have felt over *either* the past week or in the present moment. This diverse use of the tool was ideal for use within the present study where it could be used to measure both

affect change over a week long period (from session 1 to 2), as well as measuring present affect in response to the exposure to the CPT.

Control variables

The PASS-20

In place of the Quality of life Enjoyment and Satisfaction Questionnaire Short Form (Q-LES-Q-SF) (Endicott, Nee, Harrison & Blumenthal, 1993), that was originally advocated as a secondary outcome measure in the early stages of the research design, a pain measure seemed more appropriate to use in the context of the present study. Although both measures could have been used, we felt strongly about not overburdening participants with various measures and decided that measuring pain was directly relevant to the primary research hypothesis, over and above quality of life. It was essential to control for any differences in pain between the two groups, prior to experimentation. Hence, the Pain Anxiety Stress Scale was chosen because of its brief, yet broad overview of participants' views and attitudes to pain including cognitions, fears, avoidance strategies and physiological responses.

The ERS

The Emotion Reactivity Scale was also used as a way of controlling for any differences in emotional reactivity between the two groups at baseline. The questionnaire is easy for participants to relate to because it has a list of statements pertaining to various responses to a given scenario. The participant simply circles a number from the 0-4 scale based on how much the statement fits with their imagined or experienced response. The scale is divided into 3 sub categories, allowing a broader overview of individual reactivity in terms of the intensity, sensitivity and persistence of emotions.

All measures referred to are presented in Appendix C.

Analysis

Parametric tests were used to examine data related to the main hypotheses. However, given the non-normal and bimodal distributions of the data, non-parametric tests were also used to explore the data to ensure rigorous testing of the primary and secondary hypotheses. Examination of the results obtained from these tests and the overall sample size, enabled us to be confident that parametric testing was the most appropriate analysis to follow. Conducting the analysis was considerably challenging for me because I had very limited experience of using SPSS, and had only ever used much smaller datasets. Hence, I took responsibility for my own learning and development by researching various statistical methods in order to refresh my knowledge in this area. I became aware of the numerous stages involved in cleaning and screening the data, prior to analysis and have enhanced my skills in this area by familiarising myself with statistical tests and their limitations.

Ethical issues

The study was approved by The University of Manchester, Division of Clinical Psychology (Appendix D). Ethical approval was also granted by the School of Psychological Sciences Ethics Committee (Appendix E). Due to the nature of the screening questionnaires involving participants being asked to divulge whether they had experienced a traumatic life event, concern was raised at the committee meetings about participants' emotional well-being and how distress would be managed following disclosure. It was agreed that the online participant information sheet (Appendix H) would contain detailed information about the type of questions that would be asked of participants so that they could make an informed

decision regarding whether or not to consent. I liaised directly with the university counselling service (at both campuses) to seek advice with regards to signposting participants to their service, should they become distressed. It was agreed for the contact details for student counselling to be put onto the information sheet, given that I would not have any direct contact with potential participants during the screening phase of the study. Participants were also advised that they should report any concerns raised by completing the questionnaires, to their GP. Similarly, it was agreed that if a participant should become distressed during face to face testing, the experimenter would handle this with sensitivity and would use clinical judgement surrounding assessment of risk. All participants recruited to the main study completed and signed a consent form (Appendix I). They were reminded that they were free to withdraw their consent at any time during the experiment. Full debrief information (Appendix J) about the aims and objectives of the study were provided at the end of the second session. All participants completed a post-experiment debrief consent form (Appendix K). None of the participants became unduly distressed during testing and nobody withdrew their participation from the study.

A further ethical concern raised was the use of the Cold Pressor Task (CPT). The committee urged me to provide justification for the use of this procedure, prior to my study being approved. The CPT was considered an appropriate method to use within the present study due to its extensive use as a pain induction procedure, across many populations, including children, within the paediatric pain literature (Coldwell, Kaakko, Gaertner-Makihara, Williams, Milgrom, Weinstein, Ramsay, 2002; Goodman & McGrath, 2003). Due to the potential tissue/ nerve damage that could be caused by prolonged submersion, a maximum immersion time of 3 minutes was agreed upon. Hence, participants were informed that they should leave there hand in the water until the sensations became intolerable but were asked to remove their hand from the water once 3 minutes had passed. They were

informed that they could withdraw their hand from the water at any point. Although I appreciate that a sound ethical methodological procedure was vital, the use of a time limit for the CPT caused a significant negative skewness in the distribution of scores within the ATT condition, which will be discussed further in the limitations section. Despite these concerns, nobody refused to place their hand in the water and all participants reported that normal sensations had returned to their arm, prior to leaving the experimental setting.

The procedure as a whole generated some positive spontaneous feedback from participants. Several individuals stated that they had enjoyed taking part in a study which involved several different components. They valued the variety of tasks involved (questionnaires, listening to an audio recording and exposure to a laboratory stressor), perhaps indicating why there were no drop-outs.

Researcher versus therapist role

In my role as a clinical researcher, I felt confident that I adhered to ethical guidelines throughout the research process. Nonetheless, it is worth considering my ethical position as a trainee clinical psychologist. Although the study did not involve any discussion of participants' trauma history or their current emotional state, a minimal number of participants did disclose additional information during testing and at times, tried to engage me in conversation. This felt somewhat uncomfortable, as my clinical position on placements was to therapeutically engage clients so it felt unnatural to refrain from doing so. However, it was essential for me to maintain my boundaries in this case, being mindful of not shifting to a therapist position so as not to contaminate the results of the experiment. Peer supervision with fellow trainees was an invaluable for sharing similar observations of this experience amongst my peers.

Theoretical and clinical implications

Findings were consistent with the notion that ATT influences reactions to stress or more specifically, pain, an effect that is thought to be mediated by the intensity of the Cognitive Attentional Syndrome (CAS) (Wells & Matthews, 1994; 1996). In terms of pain management, results also suggested that ATT was a more effective strategy than distraction or relaxation. It is possible that increased meta-cognitive control and thus, flexibility of the CAS, allowed those in the ATT group to tolerate pain longer than those assigned to the PMR condition, but the current study was designed to demonstrate an effect rather than test the underlying mechanism. Further studies using a specific measure of cognitive flexibility are required to confirm these theoretical implications. Findings were supportive of the idea that ATT may be a useful technique for increasing resilience to painful situations, particularly amongst individuals who have been exposed to adverse childhood experiences. Clinically, the results suggest that ATT could potentially act as a brief preventative tool for reducing the likelihood of experiencing psychological and chronic pain problems later in life, within individuals who have experienced early life adversities. The findings also offered some promising preliminary data to suggest that the practical application of ATT within routine medical settings, may be useful for reducing the number of individuals that often experience the transition from acute to chronic pain, following painful, traumatic, medical procedures.

Limitations of the study and directions for future research

Several limitations of the present study have been identified and warrant further consideration. Firstly, problems highlighted in the recruitment section of this paper explain the various barriers that prevented recruitment of the original sample size specified by the statistician. However, if time and resources had allowed, a larger sample size would have enabled detection of small to medium effect sizes of the secondary variables of interest

(affect change and pain perception). Statistical analyses revealed that the observed power was low, meaning that the chances of a type 2 error were high. Thus, it may be that there was a difference between groups in positive and negative affect or pain perception but the study did not have a sufficiently large enough sample size to detect these. Fortunately, the effect size for the primary outcome of pain tolerance was a large one. Future studies need to recruit a much larger sample size in order to investigate the effects of ATT on affect and pain perception more closely.

Secondly, utilising participants from the lay population meant that the setting in which the research was carried out, varied between subjects. For example, some of the research, albeit a small amount, was carried out in participants own homes, which could have affected the findings. Participants that were accessed via home visits were not seen within a laboratory setting and therefore may have felt more relaxed and at ease. Nevertheless, randomisation should have controlled for the diversity in settings between the two groups. Moreover, recruiting beyond the student population brought about distinct advantages in terms of obtaining a more diverse sample of individuals, of a broader demographic background and age range.

The ceiling effect of immersion times observed in the ATT group in response to the CPT suggests that participants in the experimental condition may have tolerated pain for longer, had the researcher not asked them to remove their arm from the water. Future studies would need to extend the immersion time in order to test this hypothesis. However, there are significant ethical implications surrounding this which may prevent future researchers from exploring this further. It is also worth noting that two participants stated that they found the CPT "soothing". This may indicate that for some individuals, the task itself is used as a distraction from other real life stressors. For such individuals, the CPT task would have been an inappropriate stressor to use because it would not have exerted the intended effects. The

pain would have perhaps been used as a way of inflicting self harm or regulating emotions, making it possible for them tolerate pain for a longer period of time than those who experienced the CPT as aversive. This may provide support for the notion that individuals with a severe history of early traumatic life events may view laboratory stressors as artificial, trivial and less personally relevant, thus limiting their emotional and physiological arousal levels (Rosenthal et al., 2008). This raises questions about the applicability of the CPT to those with as significant history of trauma and requires careful consideration by future researchers. A further limitation is that all of the measures utilised within the present study, apart from immersion time, were subjective. Therefore, a wider range of cardiovascular measures such as heart rate and blood pressure recordings, would have increased the robustness of the present study.

Finally, methodological modifications to the present study are considered. The use of a control condition would have allowed a definitive conclusion to the proposal that ATT increases pain tolerance, as opposed to the possibility that PMR reduces it. Greater inclusion of male participants within the sample, as well as targeting individuals that are actively suffering from acute or chronic pain symptoms, would increase the generalizability of the findings and thus, enhance the applicability of the clinical implications to the pain population. A longitudinal, follow-up element to the study would have allowed for the effects of ATT to be measured over time, to see whether ATT is able to maintain its effects. Measures of cognitive flexibility and the Cognitive Attentional Syndrome (CAS) would have made the theoretical implication more clear cut in terms of being able to distinguish the underlying mechanisms responsible for the greater tolerance of pain that were observed in the ATT group.

In terms of the overall write-up of the empirical study, I was faced with a dilemma of whether or not to include the screening data as an additional component. This data was kept in reserve

as my contingency plan, had I struggled to recruit a satisfactory sample size. However, including this within the main paper would have produced statistics exploring correlations between trauma history, emotional distress and meta-cognitive beliefs, which is a less novel area of research. Although this may have yielded some interesting findings, I did not want to detract from the main study itself, hence the decision not to run statistical analyses on the screening data obtained.

Conclusions

I have found the journey of completing this thesis a demanding, yet extremely worthwhile experience. Having started clinical training with a significant amount of clinical experience, yet very little research experience, I have found the opportunity of being able to contribute to the growing body of evidence within this field, an exciting and inspirational process. I have valued being able to increase my knowledge and understanding of the research process and feel much more competent in the skills I have a gained from completing a substantial piece of research.

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Appendices Section

Appendix A: Author information pack for Clinical Psychology and Psychotherapy

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BEHAVIOUR RESEARCH AND THERAPY

AUTHOR INFORMATION PACK

TABLE OF CONTENTS

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TIFF (or JPEG): Combinations bitmapped line/half-tone (color or grayscale), keep to a minimum of 500 dpi.
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- Supply files that are optimized for screen use (e.g., GIF, BMP, PICT, WPG); these typically have a low number of pixels and limited set of colors;
- Supply files that are too low in resolution;
- Submit graphics that are disproportionately large for the content.

Tables

Number tables consecutively in accordance with their appearance in the text. Place footnotes to tables below the table body and indicate them with superscript lowercase letters. Avoid vertical rules. Be sparing in the use of tables and ensure that the data presented in tables do not duplicate results described elsewhere in the article.

References

Citation in text
Please ensure that every reference cited in the text is also present in the reference list (and vice versa). Any references cited in the abstract must be given in full. Unpublished results and personal communications are not recommended in the reference list, but may be mentioned in the text. If these references are included in the reference list they should follow the standard reference style of the journal and should include a substitution of the publication date with either 'Unpublished results' or 'Personal communication'. Citation of a reference as 'in press' implies that the item has been accepted for publication.

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Strunk, W., Jr., & White, E. B. (2000). *The elements of style.* (4th ed.). New York: Longman, (Chapter 4).
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- All references mentioned in the Reference list are cited in the text, and vice versa
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Appendix C: Measures and Scales

Screening Measures:

The Early Trauma Inventory Self-Report Short Form (ETISR-SF)

The Patient Health Questionnaire (PHQ-9)

The Generalised Anxiety Disorder Scale (GAD-7)

The Meta Cognitions Questionnaire (MCQ-30)

Main Study:

Credibility/ Compliance Measures for ATT/ PMR

The Positive and Negative Affect Schedule (PANAS)

The Emotional Reactivity Scale (ERS)

The Pain Anxiety Symptoms Scale (PASS-20)

The Numeric Pain Rating Scale (NPRS)

The Early Trauma Inventory Self-Report Short Form (ETISR-SF)

Bremmner, D. J., Vermetten, E. & Mazure, C. M. (2000). Development and preliminary psychometric properties of an instrument for the measurement of childhood trauma: The early trauma inventory. *Depression and Anxiety, 12*, 1-12.

In order to protect copyright this measure has not been electronically included in the thesis. A loose copy is available with the bound version of the thesis.

The Patient Health Questionnaire (PHQ-9)

P2 – Local Patient\t Identifier

PHQ- 9

	Over the last 2 weeks, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
1	Little interest or pleasure in doing things	0	1	2	3
2	Feeling down, depressed, or hopeless	0	1	2	3
3	Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4	Feeling tired or having little energy	0	1	2	3
5	Poor appetite or overeating	0	1	2	3
6	Feeling bad about yourself — or that you are a failure or have let yourself or your family down	0	1	2	3
7	Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8	Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9	Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

A11 – PHQ9 total score

The Generalised Anxiety Disorder Scale (GAD-7)

GAD-7

Over the last 2 weeks, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
1 Feeling nervous, anxious or on edge	0	1	2	3
2 Not being able to stop or control worrying	0	1	2	3
3 Worrying too much about different things	0	1	2	3
4 Trouble relaxing	0	1	2	3
5 Being so restless that it is hard to sit still	0	1	2	3
6 Becoming easily annoyed or irritable	0	1	2	3
7 Feeling afraid as if something awful might happen	0	1	2	3
	A12 – GAD7 total score			

The Meta Cognitions Questionnaire (MCQ-30)

META-COGNITIONS QUESTIONNAIRE 30

MCQ-30

Adrian Wells & Samantha Cartwright-Hatton (1999)

This questionnaire is concerned with beliefs people have about their thinking.
Listed below are a number of beliefs that people have expressed. Please read each item and say how much you generally agree with it by circling the appropriate number.
Please respond to all the items, there are no right or wrong answers.

		Do not agree	Agree slightly	Agree moderately	Agree very much
1.	Worrying helps me to avoid problems in the future	1	2	3	4
2.	My worrying is dangerous for me	1	2	3	4
3.	I think a lot about my thoughts	1	2	3	4
4.	I could make myself sick with worrying	1	2	3	4
5.	I am aware of the way my mind works when I am thinking through a problem	1	2	3	4
6.	If I did not control a worrying thought, and then it happened, it would be my fault	1	2	3	4
7.	I need to worry in order to remain organised	1	2	3	4
8.	I have little confidence in my memory for words and names	1	2	3	4
9.	My worrying thoughts persist, no matter how I try to stop them	1	2	3	4
10	Worrying helps me to get things sorted out in my mind	1	2	3	4
11.	I cannot ignore my worrying thoughts	1	2	3	4
12.	I monitor my thoughts	1	2	3	4
13.	I should be in control of my thoughts all of the time	1	2	3	4

(PLEASE CONTINUE ON THE REVERSE SIDE)

		Do not agree	Agree slightly	Agree moderately	Agree very much
14.	My memory can mislead me at times	1	2	3	4
15.	My worrying could make me go mad	1	2	3	4
16.	I am constantly aware of my thinking	1	2	3	4
17.	I have a poor memory	1	2	3	4
18.	I pay close attention to the way my mind works	1	2	3	4
19.	Worrying helps me cope	1	2	3	4
20.	Not being able to control my thoughts is a sign of weakness	1	2	3	4
21.	When I start worrying, I cannot stop	1	2	3	4
22.	I will be punished for not controlling certain thoughts	1	2	3	4
23.	Worrying help me to solve problems	1	2	3	4
24.	I have little confidence in my memory for places	1	2	3	4
25.	It is bad to think certain thoughts	1	2	3	4
26.	I do not trust my memory	1	2	3	4
27.	If I could not control my thoughts, I would not be able to function	1	2	3	4
28.	I need to worry, in order to work well	1	2	3	4
29.	I have little confidence in my memory for actions	1	2	3	4
30.	I constantly examine my thoughts	1	2	3	4

Please ensure that you have responded to all items - Thank You.

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Wells, A. & Cartwright-Hatton, S. (2004). A short form of the metacognitions questionnaire: Properties of the MCQ-30. *Behaviour Research and Therapy, 42(4),* 385-396.

MCQ-30 Scoring Key

www.mct-institute.com

MCQ-SCORING KEY

Enter the number given by the subject for each item in the relevant box below and then sum the scores to produce a subscale total.

POS		NEG		CC		NC		CSC	
1	_____	2	_____	8	_____	6	_____	3	_____
7	_____	4	_____	14	_____	13	_____	5	_____
10	_____	9	_____	17	_____	20	_____	12	_____
19	_____	11	_____	24	_____	22	_____	16	_____
23	_____	15	_____	26	_____	25	_____	18	_____
28	_____	21	_____	29	_____	27	_____	30	_____
Total	_____		_____		_____		_____		_____

The subscales are:

POS = positive beliefs about worry
NEG = negative beliefs about uncontrollability and danger of worry
CC = cognitive confidence
NC = need for control
CSC = cognitive self-consciousness

An overall total MCQ score can be obtained by summating the subscale totals.

Credibility/ Compliance Scales

Session 1

The Attention Training Technique involves listening to a series of sounds, all at the same time and following the instructions to switch your attention back-and-forth between them in a systematic manner. The aim is to improve mental flexibility and control over your attention. If you notice that you are distracted by your internal thoughts or feelings, or by external distractions in the room, this does not matter, just treat these as background noise and continue to be guided by the instructions.

Before engaging in this task, please rate below how likely you think this will help to improve your mood and quality of life using the scale below:

|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|

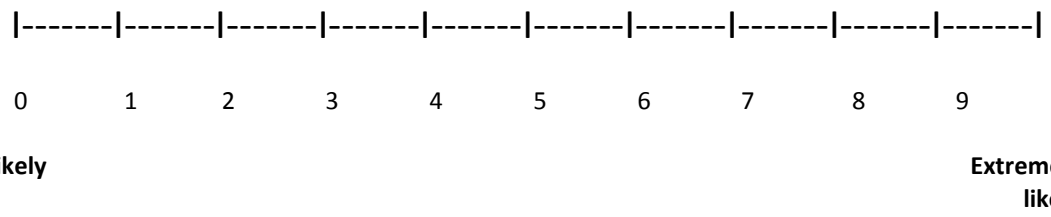
0 1 2 3 4 5 6 7 8 9 10

Not likely at all **Extremely likely**

Session 1

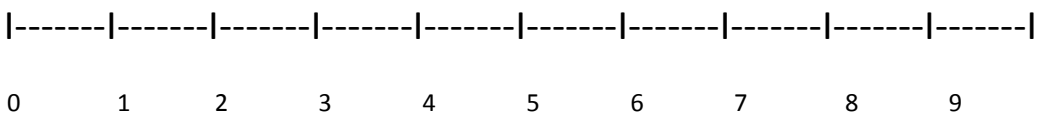
Progressive muscle relaxation is a technique that involves tensing specific muscle groups and then relaxing them to create awareness of tension and relaxation. It is termed 'progressive' because it proceeds through all major muscle groups, relaxing them one at a time, and eventually leads to total muscle relaxation. The aim is for you to listen and follow the instructions. If you notice that you are distracted by your internal thoughts or feelings, or by external distractions in the room, this does not matter, just treat these as background noise and continue to be guided by the instructions.

Before engaging in this task, please rate below how likely you think this will help to improve your mood and quality of life using the scale below:



Between Session Practice

Please keep a recording of how many times you have listened to your CD in the last week and each time, please rate on the scale below how much you were able to engage with the task. If you have practiced more than once, please just write the date next to each circled response.



Not able to engage at all

I was fully engaged with the task

Session 2

Now that you have listened to the recording, please rate below how much you felt you were able to engage with the task:

|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|

0 1 2 3 4 5 6 7 8 9 10

Not able to engage at all **I was fully engaged with the task**

How likely do you think that this task can help to improve your mood and quality of life?

|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|

0 1 2 3 4 5 6 7 8 9 10

Not likely at all **Extremely likely**

The Positive and Negative Affect Schedule (PANAS)

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54* (6), 1063-1070.

In order to protect copyright this measure has not been electronically included in the thesis. A loose copy is available with the bound version of the thesis.

The Emotional Reactivity Scale (ERS)

ERS

This questionnaire asks different questions about how you experience emotions **on a regular basis (for example, each day)**. When you are asked about being "emotional," this may refer to being angry, sad, excited, or some other emotion. Please rate the following statements.

		0 Not at all like me	1 A little like me	2 Somewhat like me	3 A lot like me	4 Completely like me
1	When something happens that upsets me, it's all I can think about it for a long time.	0	1	2	3	4
2	My feelings get hurt easily.	0	1	2	3	4
3	When I experience emotions, I feel them very strongly/intensely.	0	1	2	3	4
4	When I'm emotionally upset, my whole body gets physically upset as well.	0	1	2	3	4
5	I tend to get very emotional very easily.	0	1	2	3	4
6	I experience emotions very strongly.	0	1	2	3	4
7	I often feel extremely anxious.	0	1	2	3	4
8	When I feel emotional, it's hard for me to imagine feeling any other way.	0	1	2	3	4
9	Even the littlest things make me emotional.	0	1	2	3	4
10	If I have a disagreement with someone, it takes a long time for me to get over it.	0	1	2	3	4
11	When I am angry/upset, it takes me much longer than most people to calm down.	0	1	2	3	4
12	I get angry at people very easily.	0	1	2	3	4
13	I am often bothered by things that other people don't react to.	0	1	2	3	4
14	I am easily agitated.	0	1	2	3	4
15	My emotions go from neutral to extreme in an instant.	0	1	2	3	4
16	When something bad happens, my mood changes very quickly. People tell me I have a very short fuse.	0	1	2	3	4
17	People tell me that my emotions are often too intense for the situation.	0	1	2	3	4
18	I am a very sensitive person.	0	1	2	3	4
19	My moods are very strong and powerful.	0	1	2	3	4
20	I often get so upset it's hard for me to think straight.	0	1	2	3	4
21	Other people tell me I'm overreacting.	0	1	2	3	4

Other relevant questions/comments:

The Pain Anxiety Symptoms Scale (PASS-20)

III. PASS – 20

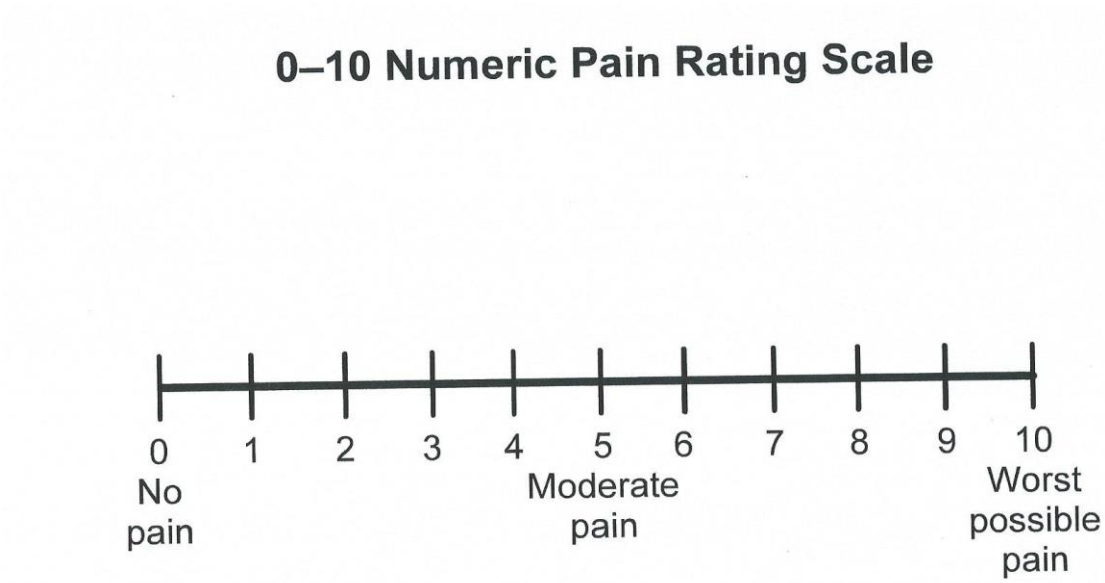
Individuals who experience pain develop different ways to respond to that pain. We would like to know what you do and what you think about when in pain. Please use the rating scale below to indicate how often you engage in each of the following thoughts or activities.

Circle one number from 0 (NEVER) to 5 (ALWAYS) for each item.

		NEVER					ALWAYS
1.	I think that if my pain gets too severe, it will never decrease.	0	1	2	3	4	5
2.	When I feel pain, I am afraid that something terrible will happen.	0	1	2	3	4	5
3.	I go immediately to bed when I feel severe pain.	0	1	2	3	4	5
4.	I begin trembling when engaged in activity that increases pain.	0	1	2	3	4	5
5.	I can't think straight when I am in pain.	0	1	2	3	4	5
6.	I will stop any activity as soon as I sense pain coming on.	0	1	2	3	4	5
7.	Pain seems to cause my heart to pound or race.	0	1	2	3	4	5
8.	As soon as pain comes on, I take medication to reduce it.	0	1	2	3	4	5
9.	When I feel pain, I think that I may be seriously ill.	0	1	2	3	4	5
10.	During painful episodes, it is difficult for me to think of anything else besides the pain.	0	1	2	3	4	5
11.	I avoid important activities when I hurt.	0	1	2	3	4	5
12.	When I sense pain I feel dizzy or faint.	0	1	2	3	4	5
13.	Pain sensations are terrifying.	0	1	2	3	4	5
14.	When I hurt I think about the pain constantly.	0	1	2	3	4	5
15.	Pain makes me nauseous (feel sick to my stomach).	0	1	2	3	4	5
16.	When pain comes on strong I think I might become paralyzed or more disabled.	0	1	2	3	4	5
17.	I find it hard to concentrate when I hurt	0	1	2	3	4	5
18.	I find it difficult to calm my body down after periods of pain.	0	1	2	3	4	5
19.	I worry when I am in pain.	0	1	2	3	4	5
20.	I try to avoid activities that cause pain.	0	1	2	3	4	5

Thank you for completing this questionnaire.
It will help us to better understand your pain problem.

The Numeric Pain Rating Scale (NPRS)



Appendix D: Letter of Project Approval from RSC

MANCHESTER 1824

of Manchester

Division of Clinical Psychology
2nd Floor Zochonis Building

School of Psychological Sciences
The University of Manchester
Oxford Road
Manchester M13 9PL

tel +44 (0)161 306 0400
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Tel: +44(0)161 306 0400
Fax: +44(0)161 306 0406
Email: emily.marner@manchester.c.uk

Rebecca Shaw
60 Burton Acres Lane
Kirkburton
Huddersfield
West Yorkshire
HD8 0QR

5th December 2012

Dear Rebecca,

Re: Feedback from Research Sub-committee - 19th November 2012

Thank you for your revised research proposal which was considered by the Research Sub-Committee Meeting on 19th November 2012. The committee were satisfied that the revisions made were appropriate and in accordance with the feedback from the meeting of 15th October 2012. You may now proceed with the research project as set out in your final proposal.

For the purposes of ethical scrutiny by relevant NHS and/or University bodies, this letter may be taken as confirmation that your research proposal has been independently reviewed and that it is considered to meet necessary scientific and methodological standards.

On behalf of the Research Subcommittee, we wish you good luck with your research work.

Yours sincerely

D. J. Hare

Dr Dougal Hare
Senior Lecturer in Clinical Psychology
Panel A Chair, Research Sub-Committee
Cc Adrian Wells and Anja Wittkowski

Appendix E: Confirmation of Ethical Approval

Ethics application 12372

Timothy Stibbs
Sent: 19 April 2013 11:23
To: Rebecca Louise Shaw
Cc: Adrian Wells; Anja Wittkowski

Dear Rebecca,

I am pleased to say that your research project has now been given ethical approval and you can go ahead with the study with immediate effect.

I will follow up with a formal letter.

Best wishes

Timothy

Dr Timothy Stibbs
Secretary to the Research Ethics Committees
University of Manchester
Oxford Road
Manchester M13 9PL
0161 275 2046

Appendix F: Letter of Approval to Recruit from The University of Huddersfield

University of
HUDDERSFIELD
Inspiring tomorrow's professionals

1.3.13

Dear Rebecca

To confirm: You have permission to approach students at the University of Huddersfield, including putting up posters and sending emails through the University contact list requesting student participation in your research within the Department of Behavioural & Social Sciences, pending ethical approval of your project.

Yours sincerely

Sarah Jane Daly

Head of Undergraduate Provision Psychology & Counselling

Queensgate Huddersfield HD1 3DH UK Telephone +44 (0) 1484 422288 Fax +44 (0) 1484 516151
Vice-Chancellor: Professor Bob Cryan BSc MBA PhD DSc

Appendix G: Poster for Recruitment

MANCHESTER 1824

The University of Manchester

Participants required to take part in a study investigating strategies to improve mood and quality of life

Be entered into 3 PRIZE DRAWS for the chance to WIN vouchers!

Volunteers Required!

An opportunity has arisen to be involved in a Psychology study that requires completion of 7 short self-report questionnaires and listening to a brief 12 minute CD.

If you decide to take part in the study then it will take place on your campus:

University of Manchester -------- the Zochonis Building or Rawnsley Building.

University of Huddersfield------- the Ramsden Building.

The study will last approximately 60 mins in total but will be conducted over two separate sessions.

This project has been approved by the University of Manchester, research ethics committee: **Reference number: (12372)**

For further details or to take part,

Please contact Rebecca Shaw

rebeccalouise.shaw@postgrad.manchester.ac.uk

Appendix H: Participant Information Sheet

Study investigating strategies to improve mood and quality of life.

Participant Information Sheet

You are being invited to take part in a research study aimed at investigating strategies to improve mood and quality of life. The study is part of a clinical psychology doctorate. Before you decide whether to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

Who will conduct the research?

Rebecca Shaw
Department of Clinical Psychology
University of Manchester
Doctorate in Clinical Psychology Programme
2nd Floor, Zochonis Building
Brunswick Street
Manchester M13 9PL

Title of the Research

Study investigating strategies to improve mood and quality of life.

What is the aim of the research?

The aim of the research is to assess the effectiveness of strategies to improve mood and quality of life.

If I am interested in taking part, what do I need to do?

If you are interested in taking part, you will need to follow the web link to the online survey. Once you have filled in your details and consented to taking part, you will be asked to complete 3 brief online questionnaires which ask about your mood, your thoughts and your personal experience of negative life events. For example, you would be asked to rate how much you agree with statements such as 'worrying helps me to avoid problems in the future.' You would also be asked whether you have experienced events such as 'the death or serious injury towards a friend', being 'touched in an intimate or private part of your body

(e.g. breast, thighs, genitals) in a way that surprised you or made you feel uncomfortable' or 'were you ever pushed or shoved?' 'were you ever put down or ridiculed?' This initial stage should take approximately 10 minutes of your time. It is possible that you may find answering these sorts of questions upsetting, however these questionnaires are often used in psychological research and do not cause any distress in the majority of cases.

Why have I been chosen?

The study is open to students based at the University of Manchester and University of Huddersfield. If you are chosen to take part in the study this will be because you have identified with a number of statements on the different questionnaires but you are not currently suffering from a mental health problem. It is hoped that a total of 142 students will take part in the research. If you are not chosen for the study, this is for one of the following reasons outlined below.

What might prevent me from being chosen?

As part of the screening process, you will be asked if you are currently accessing mental health services or if you consider yourself to be suffering from a mental health problem. You will also be asked if you are pregnant or whether there is a possibility that you may be pregnant. If you answer yes to either of these questions then you will not be asked to take part in the study for your own emotional well being. Finally, it may be that depending on the level of interest in this study you may simply not be selected due to high response rates to the online screening questionnaires.

What would I be asked to do if I was chosen to take part?

If you are eligible to take part, you will be invited to meet with the researcher (Rebecca Shaw) at your own university or college for 15-20 minutes. During this time you will be asked to complete a further set of questionnaires, some of which ask about your mood and emotional reactions to particular situations (e.g. you would be asked to rate how much you agree with statements like 'my feelings get hurt easily' 'I get angry at people easily'). You will also be asked to listen to a short 12 minute CD containing a series of sounds and instructions to help improve your mood. You would be asked to take this away to listen to once more before meeting with the experimenter for a second time.

The second session should take between 15-20 minutes and would be a repeat of the first session (questionnaires, followed by listening to a short 12 minute CD), with the addition of a brief 3 minute stress induction task, the effects of which are short lived. This technique involves placing your hand in a bucket of cold water. It has been used for many years in research and is not known to have caused any lasting effects in participants. You can stop the study at any time should you feel upset.

Following completion of the study, you will be invited to complete the same questionnaires online, approximately 6-8 weeks later.

What happens to the data collected?

The data collected from the study will be entered into a database to be analysed once the study is completed. None of this data will contain any identifiable information. Once the data is analysed the study will be written up for submission for publication in a scientific journal. Again, no identifiable information will be included in this write up.

How is confidentiality maintained?

Any data collected during the study will be kept strictly confidential. Only the research team (the experimenter and her supervisors) will have access to your data. All your data from the study will be identifiable by a personalised number only and will be kept in a securely locked filing cabinet in The University of Manchester. The anonymous data you have provided (i.e. data that does not contain any personally identifiable information) will be stored on the secure drive on University of Manchester computer. All files will be password protected.

What happens if I do not want to take part or if I change my mind?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form upon meeting with the researcher. If you decide to take part you are still free to withdraw at any time without giving a reason and without detriment to yourself. Your data can be removed from the study before analysis of the research. After this stage, data will be kept in order to complete the research study but the data you have provided will remain anonymous.

Will I be paid for participating in the research?

Choice of receiving course credits removed. Participants will be entered into 3 prize draws for the chance to win £50 worth of Amazon vouchers. If you are not selected to take part in the study following completion of the online screening questionnaires, then you will not be entered into the prize draws.

What is the duration of the research?

The total duration of the study will be approximately 1 hour.

Where will the research be conducted?

The research will be conducted in a confidential room at your own campus. If you are chosen to take part following screening, you will be informed of where to meet the researcher.

Will the outcomes of the research be published?

The findings will be submitted to a peer reviewed journal with the hope of being published. Participants with be asked if they want a copy of the findings and this will be circulated once the study has been written up.

Contact for further information

If you require any further information, please contact the researcher via email on rebeccalouise.shaw@postgrad.manchester.ac.uk.

What if something goes wrong?

If you are identified as experiencing high levels of distress during any stage of the study, this will be addressed by the researcher, following the procedure outlined in the distress

protocol. Please take time to read this protocol before proceeding to the screening questionnaires.

If you experience significant distress after taking part in the study you should contact your GP or the relevant student counselling service below:

Students from The University of Manchester should contact counsel.service@manchester.ac.uk or ring **0161 275 2864**.

Students from The University of Huddersfield should contact internalcounsel@hud.ac.uk or ring **01484 472675.**

If you decide to make a formal complaint about the conduct of the research you should contact the Head of the Research Office, Christie Building, University of Manchester, Oxford Road, Manchester, M13 9PL.

Appendix I: Consent Form

MANCHESTER 1824

The University of Manchester

Study investigating strategies to improve mood and quality of life

Chief Investigator: Rebecca Shaw

ID _____

Please initial box

1. I confirm that I understand the nature of the study proposed, having read and understood the information sheet provided. I have had opportunity to ask questions, and I am satisfied with the answers I received. ☐

2. I understand that my participation in the study is entirely voluntary and that I am free to withdraw at any time without giving a reason and without any depriment to any service/treatment. ☐

3. I agree that if I decide to withdraw from the study then the researchers can continue to use the anonymous data and information I have already given them unless I ask for this to be destroyed prior to the researcher analyzing it. ☐

4. I understand that the my anonymous data will be stored at The University for up to 5 years and may be used as part of future research, unless I ask for this to be destroyed prior to the analysis of the data I have provided. ☐

5. I agree to take part in the study. ☐

Name of participant	Date	Signature
……	… / … / ……	……
Name of person taking consent	Date	Signature
……	… / … / ……	……

NB. This consent form will be stored separately from the anonymous information you provide.

Appendix J: Debrief Information Sheet

MANCHESTER 1824

The University of Manchester

Title of Project:

Study investigating strategies to improve mood and quality of life.

Chief Investigator: Rebecca Shaw.

Factors affecting task performance

Thank you for your participation in this study.

In accordance with psychological research in this area, the main aims and hypotheses of this study were not made explicit prior to the experiment. This was done to avoid the possibility that participants may alter their behaviour whilst in the experiment. A brief background to the study and the main aims are described below.

Background and aims of the study

Research shows that negative life events can increase the chances of developing common mental health problems at some point during our lives. A technique called 'attention training' has previously been shown to reduce symptoms of anxiety and depression, in patients accessing services. To date, there has been no research exploring the possible benefits of using this technique to improve mood and quality of life in a sample of individuals from the general population.

Researchers have found that a number of brief interventions can reduce the likelihood of developing clinical symptoms of anxiety and depression and or improve mood and quality of life. Therefore, all participants were randomly allocated to either the attention training intervention or a control condition (relaxation training), with the aim of comparing data from both groups, in order to find out which strategy was most effective at doing so. In addition, the study aimed to investigate whether the group of participants that received attention training showed less reactivity to the stress induction task – the cold presser (e.g. persisted longer with the task), in comparison to the control group that received relaxation training.

The effects of stress induction

The effects of the stress induction task should have worn off immediately following the experiment. It is unlikely that you would experience any residual distress after leaving the experimental setting. If, however, you have felt distressed by any part of the study or you notice continuing distress following the experiment, I would advise you to contact your Student Counselling Service and/or your GP.

If you have any questions about this study or you would like to have a copy of the results, please contact me on the e-mail address below:

rebeccalouise.shaw@postgrad.manchester.ac.uk and I will provide you with a summary of the findings, once the data has been analysed.

Thank you again for your participation in this study.

Rebecca Shaw

Trainee Clinical Psychologist

Appendix K: Debrief Consent Form

MANCHESTER 1824

The University of Manchester

Post-experiment Consent Form

Title of Project: Study investigating strategies to improve mood and quality of life.

Chief investigator: Rebecca Shaw

ID _____

You have taken part in a study investigating strategies to improve mood and quality of life, which was carried out by Rebecca Shaw.

Have you **(please tick):**

Been fully debriefed regarding the purpose of the study?	☐
Been informed of your right to withdraw your data from the study without giving a reason and without it affecting your education?	☐
Had an opportunity to ask questions?	☐
Got satisfactory answers to your questions?	☐
Do you still agree to your data being used for the purposes of this study now that you are aware of the full aims of the experiment?	☐
Do you still agree to the possibility that your data may be used in future research studies?	☐

Name of participant	Date	Signature
……	… / … / ……	……

Name of person taking consent	Date	Signature
……	… / … / ……	……

NB. This consent form will be stored separately from the anonymous information you provide.