COMPASSION FOR THE SELF AND WELL-BEING: PSYCHOLOGICAL AND BIOLOGICAL CORRELATES OF A NEW CONCEPT

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I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or another University.

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Abstract

This thesis applied a triangulation of behavioural and physiological methods to explore potential psychological and biological correlates accompanying the short-term cultivation of self-compassion in both healthy and clinical samples. Drawing on theory and previous research on self-compassion, the aim of this thesis was to investigate if the cultivation of self-compassion enhances positive affiliative affect and a greater tendency to prefer positively valenced information about the self. It was hypothesised that increased positive affiliative affect would be accompanied by the activation of the soothing and contentment system, a system characterised by the dynamic balancing of the sympathetic and parasympathetic nervous systems. A series of four experimental psychophysiological studies in healthy individuals and those with a history of recurrent depression was conducted. The results of these broadly supported this hypothesis. Detailed exploration of the results indicated that the proposed protective effects of self-compassion via the stimulation of the soothing and contentment affect system and access to a more positive perception of the self may rely on important individual differences in levels of self-criticism, insecure attachment, and history of childhood adversity and might be made more challenging when there is an underlying psychopathology such as recurrent depression. In this context, the results of this thesis indicate that more indirect approaches to cultivate self-compassion like the compassionate body-scan or mindfulness-based cognitive therapy (MBCT) might enable these individuals to access and activate the soothing and contentment system. Taken together, this research suggests that the cultivation of self-compassion might contribute to resilience in the face of negative thoughts,

memories, feelings and depressive symptoms, because it is accompanied by psychophysiological response patterns that are suggested to be associated with adaptive emotion regulation and self-soothing in times of distress.

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LIST OF ABBREVIATIONS

aBIC	adjusted Bayesian Information Criterion
AIC	Akaike Information Criterion
ANOVA	Analysis of Variances
BDI-II	Beck Depression Inventory-II
BS	Body Scan
CBT	Cognitive behavioural therapy
CFA	Confirmatory factor analysis
CFI	Comparative fit index
CFI	Compassion-focussed imagery
CM	Compassion meditation
CMT	Compassionate Mind Training
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders (4th Edition)
ECG	Electrocardiography
EEG	Electroencephalogram
ERP	Event-related brain potentials
FSCRS	Forms of Self-Criticising/Attacking & Self-Reassuring Scale
GCM	Growth Curve Modelling
HF	High Frequency
HPA	Hypothalamic-Pituitary-Adrenal
HR	Heart-Rate

HRV	Heart Rate Variability
IPD	Individual Patient Data
J–N technique	Johnson–Neymann technique
LGCM	Latent growth curve modelling
LKM	Loving-Kindness Meditation
LPP	Late Positive Potentials
MBCT	Mindfulness-Based Cognitive Therapy
MBSR	Mindfulness-Based Stress Reduction
MDD	Major Depressive Disorder
MLR	Maximum likelihood estimation with robust standard errors
MOPS	Measure of Parental Style
MSC	Mindful Self-Compassion
PHQ-9	Patient Health Questionnaire for depression
PTSD	Post Traumatic stress disorder
RCT	Randomized Control Trail
RMSEA	Root mean squared error of approximation
RSQ	Relationships Structures Questionnaire
RT	Reaction Time
SAAM	State adult attachment measure
SAP	Secure attachment priming
SC	Skin conductance
SCID	Structured Clinical Interview for Diagnosis
SCL	Skin-Conductance-Level

SCS	Self-Compassion Scale
SRMR	Standardized root mean square residual
SRP	Self-referential processes
SSRI	Selective serotonin reuptake inhibitors
TLI	Tucker-Lewis Index
VAS	Visual Analogue Scales

1 INTRODUCTION

Understanding processes and mechanisms that facilitate wellbeing and prevent mental health problems (such as depression) is of great importance, particularly as mental health problems are highly prevalent in the general population and are associated with negative consequences for an individual's social life and well-being, as well as for society and the economy (Wittchen et al., 2011). Recent research has pointed out that the cultivation of self-compassion may be one of these protective mechanisms (e.g. Galante, Galante, Bekkers, & Gallacher, 2014; Gilbert, 2014; Kuyken et al., 2010; MacBeth & Gumley, 2012; Zessin, Dickhauser, & Garbade, 2015). However, self-compassion is quite a new construct in psychology research and its cognitive and psychophysiological correlates are not well understood. In particular, the majority of studies on self-compassion have been correlational and there is a deficit in the current literature examining mechanisms underlying self-compassion and their impact on its beneficial effects.

This thesis wishes to address this gap by applying experimental and psychophysiological methods to investigate potential psychological and biological mechanisms underlying the cultivation of self-compassion in both healthy and clinical samples. Within the theoretical background of this thesis I will explore the current conceptualisation of self-compassion and review research on its potential benefits. Identified gaps in the current literature will be addressed with four empirical studies.

2 THEORETICAL BACKGROUND

2.1 What is Self-Compassion?

Current definitions of self-compassion are primarily informed by Buddhist philosophy and proposed by practitioners and teachers of compassion meditation (see Feldman & Kuyken, 2011; Neff, 2003a; Salzberg, 1995). In the classical teachings of the Buddhist tradition, compassion refers to the heart that trembles in the face of suffering. Compassion is seen as a response to suffering and the acknowledgment that not all pain can be 'fixed' or 'solved' but all suffering is made more approachable in a landscape of compassion (Feldman & Kuyken, 2011). In line with this, the Dalai Lama (1995) sees compassion as an openness to the suffering of others with a commitment to relieve it. While Buddhist concepts of compassion have a lineage extending more than 2500 years, recent years have seen an overwhelming growth of research into compassion and its role in psychopathology and wellbeing in western psychology. Possibly due to the complex multidimensional nature of compassion, there is considerable divergence in how western psychologists define compassion and specifically the relatively new construct self-compassion. Therefore, the goal of this chapter is to provide an overview of the current conceptualisation of self-compassion and differentiate it from other related constructs. There are three major components to this chapter: (i) a review of the different definitions of self-compassion; (ii) an elaboration of the support for the definition of self-compassion by discussing psychometric evidence of the assessment of self-compassion currently used in research; and (iii) a brief consideration of how self-compassion is distinct yet related to other constructs such as compassion, attachment, self-esteem, and self-pity.

Definitions of Self-compassion

The most frequently cited definition of self-compassion in the psychology literature was introduced by Kirsten Neff (2003b; 2015), a pioneer in studying self-compassion over the last decade. She conceptualises self-compassion as compassion that is turned inward and refers to how we relate to ourselves in times of perceived failure, suffering or distress. She proposes three components of self-compassion, each of which has a positive and negative pole presenting compassionate vs. uncompassionate behaviour: self-kindness vs. self-judgment, common humanity vs. isolation, and mindfulness vs. over-identification. She describes self-kindness as a tendency to treat ourselves with kindness, care, understanding and support rather than being self-critical or harshly judging oneself in times of personal failure. Moreover, self-kindness involves actively soothing and comforting oneself in times of distress. Neff's understanding of common humanity is that we see our own experience of imperfection as part of the larger human experience and acknowledge that everyone suffers rather than feeling isolated by our imperfection. Finally, she describes mindfulness as a balanced state of awareness whereby one is not suppressing or avoiding painful thoughts or feelings, nor getting carried away by them. Neff argues that these qualities are intrinsic to a healthy sense of self that, taken together, represent a self-compassionate frame of mind enabling us to manage our emotions in the face of difficulties.

Paul Gilbert (2009) sees self-compassion in the context of compassion as an evolved psychological capacity that is part of human beings' care-giving system. He defines compassion broadly, and includes dimensions of care, soothing, sympathy, empathy, tolerance, and non-judgment. He advocates that these compassionate feelings can flow in different directions, therefore we can have compassionate feelings for others, experience compassion from others, and can have compassion for ourselves (i.e. self-compassion), especially in times of personal distress (Gilbert, 2009; Gilbert, McEwan, Matos, & Rivis, 2010). Implicit to his understanding is a theory that integrates the biological underpinnings of human behaviour, evolution and human attachment. Gilbert's work on compassion was informed by his work on depression, and the integral role, as he saw it, of self-criticism, shame and powerlessness in depression (Gilbert, 1984, 2000). Gilbert's focus therefore seems to be on self-compassion as the antithesis to self-criticism and blame, describing how this is related to emotion regulation systems. Gilbert defines this as a process of self-to-self relating where tolerance, kindness and sympathy towards one's distress are developed. He suggests that this way of relating has tempering effects on self-criticism and blame through the process of self-reassurance and self-soothing (Gilbert and Proctor, 2006).

Another definition of self-compassion is offered by Christina Feldman and Willem Kuyken (2011). Similar to Neff (2003), their conceptualisation of self-compassion is drawn from Buddhist philosophy as well as from their clinical work on depression. They offer the following definition: "Compassion is an orientation of mind that recognises pain and the universality of pain in human experience and the capacity to meet that pain with kindness, empathy, equanimity and patience. While self-compassion orientates to our own experience, compassion extends this orientation to others' experience" (Feldman & Kuyken, 2011, p. 143).

The common denominator of the definitions above is the acknowledgement that self-compassion is multi-dimensional, including feelings of care, kindness, empathy, equanimity and patience towards ourselves in times of personal distress or suffering.

Moreover, self-compassion is seen as a healthy sense of self that facilitates adaptive emotion regulation in face of difficulties via active self-soothing processes. Disagreement exists regarding the interplay of the different facets of self-compassion. While Kirstin Neff advocates that self-compassion represents the relative balance of the compassionate (self-kindness, common humanity, and mindfulness) and uncompassionate (self-judgment, isolation, and over-identification) responses to personal suffering, and thus the lack of self-compassion is as important to the definition as the presence of it, Paul Gilbert conceptualises self-compassion as distinct from self-criticism. Exploring the psychometric support of the self-report measurement of self-compassion may help to shed light on this debate.

Assessment of Self-Compassion

Most frequently, self-compassion is assessed by the Self-Compassion Scale (SCS; Neff, 2003a), as this is currently the only available self-report measurement of self-compassion. The SCS was developed to measure various components of self-compassion as defined by Neff (2003b). The 26-item questionnaire measures how often people respond to feelings of inadequacy or suffering with self-kindness, self-judgment, common humanity, isolation, mindfulness, and over-identification. Responses are given on a 5-point scale ranging from “Almost Never” to “Almost Always”. Using confirmatory factor analysis (CFA), Neff (2003a) identified a hierarchical six factorstructure (i.e. the six facets of self-compassion as described previously) and one higher order factor of self-compassion. To calculate the overall self-compassion score, items representing uncompassionate responses to suffering are reverse-coded. Then, means are calculated for each subscale, and a grand mean is calculated that represents the overall self-compassion score. Most researchers use this total score as an indicator for trait self-compassion. Neff (2003a) developed the SCS using an undergraduate sample and found good reliability and validity, including high associations with positive mental health outcomes.

Recently, researchers called the generalisability of the hierarchical six-factor factor structure of the SCS into question (e.g. Lopez et al., 2015; Williams, Dalgleish, Karl, & Kuyken, 2014). Most of the studies examined the factor structure of the SCS by CFA in the context of validating translations of the SCS. The majority of these studies yield support for the correlated six-factor structure of the SCS, while there have been mixed findings regarding the higher order factor. Support for a higher order factor was found in a Chinese student sample and Portuguese clinical and community samples (Chen, Yan, & Zhou, 2011; Costa, Marôco, Pinto-Gouveia, Ferreira, & Castilho, 2015). In contrast, no support was found in samples composed of German students, an Italian student and community sample, and a Dutch community sample (Hupfield & Ruffieux, 2011; Lopez et al., 2015; Petrocchi, Ottaviani, & Couyoumdjian, 2013). In a recent article Neff (2015) highlighted that these findings should be interpreted with caution as translations of the original scale may be biased by cultural factors or by the quality of the translation. Critically, a study examining the factor structure of the original English SCS using community, meditator, and clinical samples via CFAs yielded no support for a higher order factor and concluded that the SCS is better suited to measure the six components of self-compassion separately (Williams et al., 2014). Adding to this debate, Lopez et al. (2015) proposed a two-factor model for the SCS. Using exploratory factor analysis to explore the factor structure of the SCS in a Dutch community sample, they argue that the three positive subscales of the SCS (self-kindness, common humanity, and mindfulness) should be subsumed under a single “self-compassion” factor, while the negative subscales (self-judgment, isolation, and over-identification) should be subsumed under a “self-criticism” factor, as these two factors are measuring two different processes. They find theoretical support for their argument from Gilbert et al. (2010), who advocates that self-compassion is distinct from self-criticism as it relates to different affective and physiological systems (see chapter 1.2.1), and therefore should not be measured as one concept. In a recent article, Neff (2015) responded to this debate. In this article she presents a different statistical approach to explore the factor structure of the SCS (i.e. bi-factor modelling (Reise, Moore, & Haviland, 2010)) within five different populations. She concluded that the bi-factor model yields an acceptable fit for the majority of the samples tested, whereby the overall self-compassion factor accounted for at least 90 % of the reliable variance in all populations examined. Moreover, she advocates that the self-compassionate state of mind is best conceptualised as involving more compassionate and fewer uncompassionate responses to suffering as self-compassion interventions impact both simultaneously (Neff & Gremer, 2013).

This debate about the definition and psychometric characteristics of self-compassion underlines the fact that there is currently not a coherent conceptualisation of self-compassion. Moreover, it highlights the demand for a reliable and valid way of measuring self-compassion. Exploring the physiological underpinnings and underlying mechanisms of the cultivation of self-compassion may contribute to a better understanding of the construct. I will revisit this in chapter 2.2.1. At the moment there is support for both conceptualisations of compassion, e.g. self-compassion as a multidimensional construct without a single overarching compassion construct (e.g. Williams et al., 2014) versus self-compassion as a higher order construct consisting of different aspects (e.g. Neff, 2015). Within this thesis, I conceptualise self-compassion in line with Neff (2003a, 2003b) as the relative balance of the compassionate (self-kindness, common humanity, and mindfulness) and uncompassionate (self-judgment, isolation, and over-identification) responses to personal suffering. Hence, it will be defined as one higher order construct.

Self-Compassion and other related constructs

In defining self-compassion it is important to consider how it is distinct to other self-related constructs, especially because it is considered quite a new concept in western psychology. In the following section, I will therefore discuss similarities and distinctions between self-compassion and related constructs. In particular, I will consider the relation of self-compassion to compassion and attachment, as well as its relation to other self-related constructs like self-esteem and self-pity.

Self-compassion and compassion

When considering self-compassion, it is important to outline its relation to and difference from the wider and scientifically older concept of compassion. This was partially already raised in the section on the different definitions of self-compassion (Feldman & Kuyken, 2011; Gilbert, 2009) but a more explicit review is necessary because there is evidence that while these constructs share certain similarities they are also distinct from each other.

Compassion involves a motivation to care and having feelings of warmth, understanding, and kindness towards the suffering of others (for a recent review on the conceptualisation of compassion see Goetz, Keltner, & Simon-Thomas, 2010). Researchers agree that self-compassion can be referred to as compassion that is turned towards our own suffering and difficulties (Feldman & Kuyken, 2011; Gilbert, 2009; Neff, 2003b), although there is some divergence on the specific conceptualisation of self-compassion in relation to compassion for others, as discussed previously (Feldman & Kuyken, 2011; Gilbert, 2009; Neff, 2003b). Whereas the two concepts are related, individuals can differ in the way they have compassion and self-compassion. Supporting this argument, there is evidence that for some individuals (in particular clinical populations), it may be easier to give support and compassion to others rather than receiving support and being compassionate to oneself (e.g. Brown, Nesse, Vinokur, & Smith, 2003). In line with this idea, Pauley and McPherson (2010) looked at the meaning and value that compassion and self-compassion had in a depressed group. They found that participants valued both constructs. Participants reported that performing acts of kindness and actively caring for others was very important in their lives. However, whilst participants viewed self-compassion as potentially very helpful to them, they also saw it as being very difficult to develop, particularly if they are feeling very depressed. Correlational studies in healthy community samples have found that self-compassionate individuals are equally compassionate towards themselves and others. However, people low in self-compassion tend to be more compassionate to others than towards themselves (Neff & Pommier, 2013). This suggests that compassion and self-compassion are related (i.e. for individuals with a healthy self) yet distinct (i.e. for people who lack self-compassion). Supporting the relationship between compassion and self-compassion, several researchers have posited that both capacities are rooted in— and developed by— the attachment system and the relationship with primary caregivers (Gilbert, 2009; Gillath, Shaver, & Mikulincer, 2005; Neff & McGehee, 2010). In addition compassion, both for the self and others, is argued to be linked to the soothing and contentment positive affect system and its underlying physiology (Gilbert, 2009; see also Chapter 2.2.1). Given the important role of attachment for self-compassion, I will explore the relation between these two concepts in the next section.

Self-compassion and attachment

Attachment refers to the affectional bond that is formed between an infant and caregiver during the early years of life. The sensitivity and responsiveness an infant experiences from caregivers shapes individual differences in attachment patterns and is proposed to be influential for emotion regulation in times of distress. It has also been posited as influential in establishing internal working models of the self and others in adulthood (Bartholomew & Horowitz, 1991; Bowlby, 1979; Mikulincer & Shaver, 2007). Adult attachment is commonly conceptualised along two dimensions of attachment avoidance (discomfort with closeness and interdependence) and anxiety (fear of rejection and abandonment) (Fraley, Waller, & Brennan, 2000; Mikulincer & Shaver, 2007).

Researchers argue that the quality of parenting plays an important role in fostering the capacity to relate to oneself with compassion in times of distress, and the ability to self-soothe to relieve this distress. Neff (2011) suggests that sensitive and responsive parenting is associated with higher levels of self-compassion. In contrast, individuals who experienced cold, inconsistent, or rejecting caregiving are less likely to be self-compassionate and more likely to respond to distressing events with greater self-criticism (Gilbert & Procter, 2006). Thus, attachment theory may be a useful framework to understand the origins of self-compassion and the development of individual differences in self-compassion.

Individuals high in attachment related anxiety are likely to have received overprotective but inconsistent parental care. This attachment style is characterised by the fear of rejection and abandonment, concern about intimate relationships, and negative feelings about the self (feeling unworthy/ unloved) and others (Bartholomew & Horowitz, 1991). As a result of these experiences and feelings, attachment anxiety triggers the use of a hyperactivating emotion-regulation strategy, i.e. individuals are hypervigilant to social threat and attachment-related information in their environment (Mikulincer & Shaver, 2007).

The experience of neglect, rejection, or punishment during childhood has been associated with attachment avoidance. According to Bartholomew and Horowitz (1991) attachment related avoidance breaks down into two subtypes depending on an individual's internal working model of the self and others: dismissive avoidance (associated with a positive view of the self and a negative view of others), and fearful avoidance (associated with a negative view of the self and others). Avoidantly attached individuals are excessively self-reliant, and tend to not engage in efforts to enhance intimacy (Mikulincer & Shaver, 2007). This disposition leads them to turn attention away from threat- and attachment-related information in order to avoid feeling negative affect (hypoactivating) (Mikulincer & Shaver, 2007).

Particularly relevant for this thesis, attachment-related security is conceptualised as a state of low attachment-related anxiety and avoidance (Mikulincer & Shaver, 2007).

Caring and supportive interactions with caregivers (whereby an infant's bids for proximity and comfort when stressed are met with sensitivity and responsiveness) contribute towards attachment-related security (Mikulincer & Shaver, 2007) and positive internal working models of the self (e.g. feeling worthy/ loved) and others (caring/attuned/reliable) (Bartholomew & Horowitz, 1991). This disposition fosters the ability to self-soothe and regulate emotions adaptively in times of distress (Mikulincer & Shaver, 2007).

Investigating the link between attachment styles and self-compassion, Neff and McGehee (2010) found that attachment security was significantly related to higher levels of self-compassion. There is also evidence that attachment related anxiety is associated with lower levels of self-compassion (Wei, Liao, Ku, & Shaffer, 2011). There are mixed findings with regard to the relationship between self-compassion and attachment avoidance. Neff and McGehee (2010) found no relationship between self-compassion and attachment related avoidance, while Raque-Bogdan, Ericson, Jackson, Martin, and Bryan (2011) found a negative correlation. Theoretically, it might be possible that attachment-related avoidance is related to lower levels of self-compassion, as individuals high in attachment-related avoidance have less capacity to accept personal failure with compassion and instead engage in efforts to deny their shortcomings (Mikulincer & Shaver, 2007). I will discuss the relationship between attachment style, self-compassion, and emotional regulation in more detail in chapter 2.2.1 (p. 18 -19). Taken together, there is good evidence that the capacity for self-compassion is rooted in the development of a secure attachment style.

Self-compassion and self-esteem

Another important construct to consider is self-esteem, as both self-compassion and self-esteem are linked to positive emotions about the self. Self-esteem refers to how we evaluate ourselves positively, and is often based on comparisons with others (Harter, 1999). Similarly, self-compassion generates positive emotions about the self, but in contrast to self-esteem, it does not do this by judging the self (Neff, 2003b) or engaging in social comparisons (Gilbert, 2009). Self-compassion rather represents a healthy way of positively relating towards the self. Supporting this argument there is evidence that self-esteem and self-compassion can be empirically differentiated. In a student sample, Neff and Vonk (2009) demonstrated that self-compassion and self-esteem are moderately correlated and are equal predictors of happiness, optimism, and positive affect. Critically however, self-compassion was a stronger negative predictor of social comparison and stronger predictor of stable self-worth than self-esteem. Moreover, unlike self-esteem, self-compassion was not significantly correlated with narcissism. In the light of these results, Neff and Vonk (2009) argued that self-compassion may be a useful alternative to positively relate to the self (especially in times of personal failure) as, unlike self-esteem, it does not rely on self-judgement or social comparison.

Self-compassion and self-pity or self-centeredness

Informed by their work with patients, researchers report that their clients worry that in becoming more self-compassionate they may also become more self-pitying or self-centered (Gilbert & Irons, 2004). Neff (2003b) states that the common humanity and mindfulness components of self-compassion are thought to separate self-pity and self-centeredness from self-compassion. In contrast, it is suggested that self-pity is associated with being engrossed in one's own suffering to the point of exaggerating it (Barnard & Curry, 2011). This self-absorption is thought to be broken by self-compassion as it relates one's own suffering to others', holding painful thoughts in a balanced awareness (Neff, 2003b). Similarly, self-compassion is thought to prevent individuals from being overly self-centered as it fosters social connectedness. Supporting this argument, Neff (2003a) found that self-compassion was significantly associated with self-reported social-connectedness.

This chapter summarised the major theoretical conceptualisations of self-compassion in western psychology, and in particular the research literature, and demonstrated existing divergence in defining and measuring this construct. Exploring the physiological underpinnings and underlying mechanisms of self-compassion may contribute to a better understanding of the construct and will be explored in the next chapter.

2.2 What are the correlates of self-compassion that could be potential facilitators of beneficial change?

There is an increasing body of literature suggesting that self-compassion helps people to suffer less under the challenges of everyday life (e.g. Arch et al., 2014; Barnard & Curry, 2011; MacBeth & Gumley, 2012; Wei et al., 2011). So far the majority of studies focusing on self-compassion have been correlational, using the Self-Compassion Scale (SCS; Neff, 2003a) to determine the association between trait self-compassion and psychological health. As discussed in section 1.1, research also suggests that self-compassion is negatively related to self-criticism, i.e., a tendency for negative individual self-talk concentrating on failures, minimising successes, and putting the self down (Gilbert et al., 2004). Higher levels of trait self-compassion have been associated with higher well-being and quality of life (Wei et al., 2011; Zessin et al., 2015). In contrast, lower levels were associated with mental health problems such as post traumatic stress disorders (PTSD) (Thompson & Waltz, 2008) and depression (Kuyken et al., 2010). Supporting this argument, a recent meta-analysis found a large effect size when examining the link between self-compassion and psychopathology across 20 studies (MacBeth & Gumley, 2012).

Summarising the literature, one of the most consistent findings is that greater self-compassion is linked to lower levels of anxiety and depression and greater well-being. However, there is a deficit in the current literature examining mechanisms underlying self-compassion and their impact on its beneficial effects. A better understanding of potential mechanisms of self-compassion may be accomplished by looking into the possible cognitive-affective and physiological processes associated with it. In the following section, I will discuss two potential mechanisms via which self-compassion might exert its beneficial effect, a) the stimulation of physiological systems associated with affiliation and wellbeing, and b) the possible impact of self-compassion on self-referential processes.

2.2.1 Psychophysiology and Self-Compassion

Evidence is increasing that self-compassion might exert its protective effects by stimulating physiological systems associated with affiliation and wellbeing. Theoretical support for this argument comes from Paul Gilbert (2009). Drawing on a review of positive and affiliative emotions (Depue & Morrone-Strupinsky, 2005), the social engagement system (Porges, 2007), and studies of threat based emotions (LeDoux, 1998), Gilbert positions compassion (for self and others) in the context of a soothing and contentment system accompanied by a specific physiological activation pattern (see below) that enables the individual to respond adaptively to emotional challenges and to relate to other individuals. In contrast to this system, he describes the threat-protection and drive and excitement system and he also describes how the activation of these systems is a dynamic process (see Figure 2.1).

The threat-protection system

This system provides the ability to detect and respond to threat (LeDoux, 1998). The threat detection system can become activated if we feel in danger or unsafe and leads to active threat behaviour (i.e. flight and fight response), or to threat behaviours of deactivation, such as defeat, helplessness or despair. This system is linked to the activation of two major physiological systems: the sympathetic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis. Hence, the activation of the threat system is accompanied by specific body responses. Enhanced activation of the sympathetic nervous system results in increased sweat secretion in areas such as the palms of the hands (i.e. increased skin conductions) and general higher physiological arousal that gives raise to heart rate (Sokolov, 1963). Enhanced HPA axis activity gives rise to the release of the stress hormone cortisol (Sapolsky, Krey, & McEwen, 1986). Humans find social threats an especially powerful stimulus for stress, which elicits a cortisol response (Dickerson & Kemeny, 2004).

The drive and excitement system

The drive and excitement system is associated with feelings of excitement, wanting, and pleasure. This system motivates and encourages people to seek out the things they need to survive and prosper (Depue & Morrone-Strupinsky, 2005). It is an achievement-drive and social comparison- focused system that becomes activated if we achieve something great like winning the lottery or a competition. The drive and excitement system is linked to the sympathetic nervous system and physiological arousal. Hence, it is an activating, dopaminergic and "go getting" system (Gilbert, 2009).

The soothing and contentment system

This system is associated with feelings of secure attachment, peacefulness, safety, and the oxytocin-opiate system (Carter, 1998). The system becomes activated if we are happy with the way things are, feeling safe and not wanting or striving and is linked to the activation of the parasympathetic nervous system. The soothing/calming system is developed in an individual during childhood, through a secure attachment to a caregiver who adopts a compassionate stance towards the individual, so that the individual's distress is repeatedly and appropriately calmed and soothed (see self-compassion and attachment section). As a result, this fosters the development of self-soothing behaviour, a healthy tolerance for distress, and a motivation to care for themselves and for others (Gilbert, 2009; Gillath et al., 2005). Porges' Polyvagal theory (2007) describes the physiological underpinnings of the soothing and contentment system and affiliation. He advocates that a specific part of the autonomic nervous system —the myelinated vagus nerve— promotes interpersonal approach behaviours that enable social affiliations. The myelinated vagus nerve evolved with mammalian attachment strategies for survival and the ability for infants to be calmed and soothed by their caregiver. This part of the autonomic nervous system can dampen sympathetically driven threat-defensive behaviours and HPA axis activity (e.g. stress responses), and promote a calm physiological state that is conducive to interpersonal approach and social affiliation (Depue & Morrone-Strupinsky, 2005). This calm physiological state is associated with enhanced parasympathetic activity that gives rise to the beat-to-beat variability in heart rate known as heart rate variability (HRV). This has been linked to flexible attention deployment and adaptive emotion regulation to threat contexts (Thayer & Lane, 2000).

Within this model, Gilbert (2014) discusses a possible link between self-compassion, anxiety, depression and well-being. He argues that psychological difficulties may arise from difficulties in early attachment experiences. As discussed previously, early attachment experiences shape internal working models of self and others (Bartholomew & Horowitz, 1991) and lead to the development of the emotion regulation strategies used in times of distress (Mikulincer & Shaver, 2007). For example, an individual who has either not experienced compassion or experienced excessive negativity from significant caregivers when the soothing/calming system is developing in childhood and adolescence may develop attachment-related anxiety, which is often accompanied by high levels of self-criticism and negative views about the self and others. These individuals are hypervigilant to threat and attachment-related information in their environment (Mikulincer & Shaver, 2007). Physiologically, this is accompanied by an over-activation of the threat protection system characterised by increased sympathetic arousal (higher skin conductance and heart rate), higher HPA axis activity, and lower measures of HRV (i.e. dampened parasympathetic activation), which has been associated with both mental and physical ill health (Appelhans & Luecken, 2006; Thayer & Lane, 2007). Avoidantly attached individuals are excessively self-reliant, and tend to not engage in efforts to enhance intimacy (Mikulincer & Shaver, 2007). This disposition leads them to turn attention away from threat and attachment-related information in order to avoid negative affect (hypoactivating) (Mikulincer & Shaver, 2007). Physiologically, this is accompanied by an over-activation of the social comparison or social rank component of the drive and excitement system, which is characterised by increased sympathetic arousal and dampened parasympathetic activation (Depue & Morrone-Strupinsky, 2005). In summary, difficult attachment experiences frequently lead to the development of maladaptive emotional regulation strategies and preclude individuals from accessing the soothing and contentment system in times of distress. This is in contrast to individuals high in attachment-related security.

Gilbert (2014) suggests that the cultivation of self-compassion enhances well-being because it may stimulate the safety and contentment affect system and thus helps individuals who have difficulties accessing this system in times of distress. The cultivation of self-compassion may have specific effects on the three emotion regulation systems (see Figure 2.1). Self-compassion can have a down-regulating effect on the threat protection system (i.e. sympathetic arousal and HPA axis activity) and the drive and excitement system (i.e. sympathetic/physiological arousal). Moreover, a self-compassionate mind frame facilitates the activation or access to the soothing and contentment system (i.e., parasympathetic activation). This can promote a calm physiological state, characterised by reduced sympathetic activation (i.e. reduced skin conductance and heart rate) and enhanced parasympathetic activity that gives rise to HRV. This dynamic balancing of the sympathetic and parasympathetic nervous systems is conducive to interpersonal approach and social affiliation (Porges, 2007); it has been linked to flexible attention deployment and adaptive emotion regulation in times of distress (Appelhans & Luecken, 2006; Thayer & Lane, 2000), and is suggestive of the ability to self-soothe when stressed (Porges, 2007).

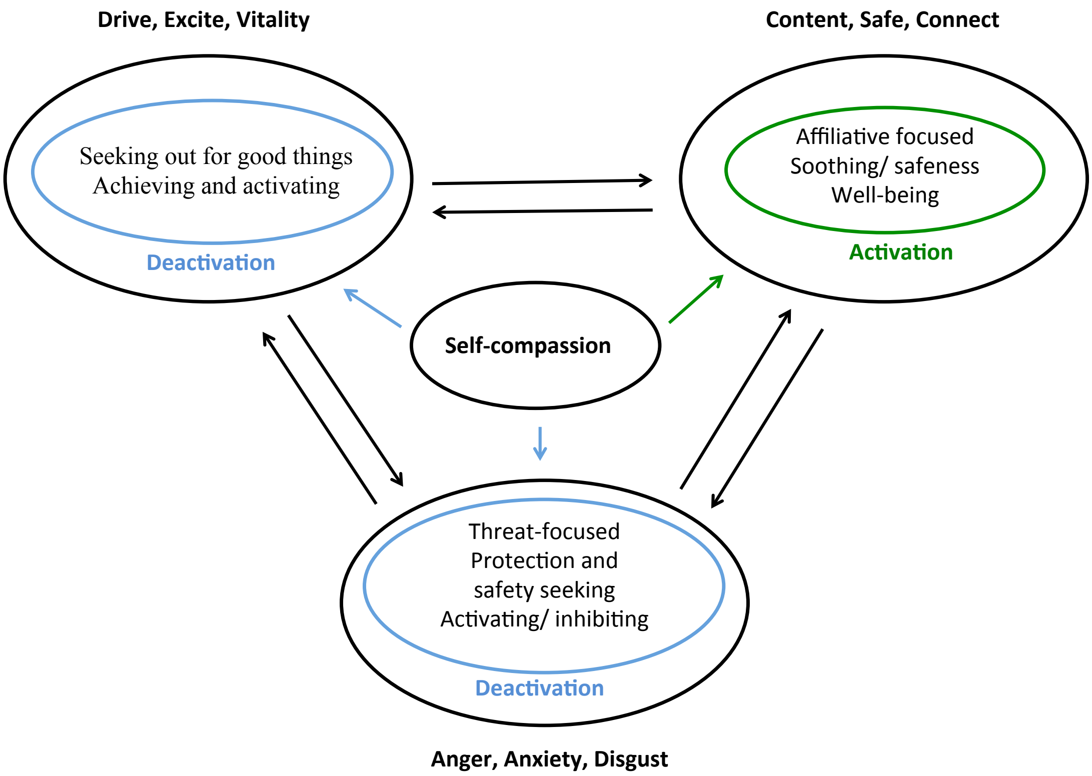

Figure 2.1 The interaction between the three major emotion-regulation systems adopted from Gilbert (2009) and the potential role of self-compassion within this model.

In support of this argument, mindfulness meditation or compassion-focused imagery[1] have *induced parasympathetic activation* indicated by higher HRV (e.g. Rockliff,

[1] This involves generating a visual image of an ideally compassionate figure sending oneself unconditional love an acceptance. It is comparable in nature to secure attachment priming (SAP) that has been widely used in experimental research (Mikulincer & Shaver, 2007) with the fundamental

Gilbert, McEwan, Lightman, & Glover, 2008; Wu & Lo, 2008). In addition, there is evidence that mindfulness meditation or compassion-focused imagery have *reduced sympathetic activity* indicated by reduced skin conductance (Ortner, Kilner, & Zelazo, 2007; Tang et al., 2009) and lower salivary alpha amylase[2] responses (Duarte, McEwan, Barnes, Gilbert, & Maratos, 2015). Moreover, these interventions have shown *reduced HPA axis activity* indicated by reduced cortisol (Rockliff et al., 2008; Vandana, Vaidyanathan, Saraswathy, Sundaram, & Kumar, 2011) and improved immune functioning (Davidson et al., 2003; Fan, Tang, Ma, & Posner, 2010).

Critically, none of the above-mentioned experimental inductions were specifically designed to cultivate self-compassion. They were either based on Buddhist meditative practices incorporating mindfulness and general compassion, or using compassion-focused imagery, whereby participants generate a visual image of an ideal compassionate figure sending oneself unconditional love and acceptance.

Although these interventions are likely to translate into greater levels of self-compassion (e.g. Kuyken et al., 2010) this has to date not been tested explicitly. Surprisingly, none of the studies mentioned above examined state the effects of their intervention on self-compassion. Moreover, most of the experimental studies have

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difference that SAP invites recall of a real event where the secure attachment figure gave unconditional love, compassion and support whereas in CFI a fictitious attachment figure is imagined and an ideal imagery is created. The latter is a way to overcome the fact that some individuals may find it really hard to recall real events of perceived attachment security.

[2] Lower salivary alpha amylase responses are interpreted as dampened sympathetic activation (Rohleder, Nater, Wolf, Ehlert, & Kirschbaum, 2004).

used manipulations that have not been designed and conducted by practitioners with appropriate competencies, even though there is an emerging consensus that teaching mindfulness requires a set of competencies (Crane et al., 2012). I will revisit the discussion about the short-term increase-ability of self-compassion in chapter 2.3.1.

What can we make of the theorised and evidenced psychophysiology underling self-compassion? There is theoretical and experimental support that one possible protective effect of self-compassion lies in the activation of the positive affiliative affect system, characterised by a content and calm state of mind with a disposition for kindness, care and social connectedness. However, there are three current gaps in the literature: (1) a lack of existing experimental/one-off self-compassion interventions, (2) a lack of studies that measure state changes in self-compassion, and (3) a lack of triangulation studies applying self-reporting and bio-behavioural measurements. These gaps need to be addressed to test the hypothesised effects of self-compassion on the positive affiliative affect system.

2.2.2 Self-Referential Processes and Self-Compassion

Another potential protective mechanism underlying self-compassion might be positive self-referential processes (SRP) and their neural circuitries. SRP refers to evaluations made concerning whether a stimulus is self-referent or not, and thus offers insights into a person's self-perception (Northoff et al., 2006). Negative cognitions about the self and high levels of self-criticism have been associated with PTSD (e.g. Karl, Rabe, Zöllner, Maercker, & Stopa, 2009) and depression (Gilbert et al., 2004). Mezulis et al. (2004) found in a meta-analysis that, compared to healthy populations, patients suffering from depression and anxiety show a reduced tendency to prefer positively valenced information about the self when they were asked to rate the self-relevance of positive and negative personality adjectives. In a recent review Cili and Stopa (2015) highlighted the importance of this increased accessibility of a negative self in the maintenance of psychological disorders. It is not yet well understood if the facilitation of self-compassion reduces negative self-referential processing and reduces the accessibility of a negative self, thus contributing to wellbeing. To date there are no published studies available investigating the effects of the cultivation of self-compassion on SRP, but given that self-compassion is negatively associated with self-criticism and depression (e.g. Gilbert, Baldwin, Irons, Baccus, & Palmer, 2006; MacBeth & Gumley, 2012) this might be a fruitful avenue to shed light on a potential mechanism via which self-compassion exerts its protective effects.

SRP is typically measured by a self-referential task (Markus, 1977) in which positive and negative personality adjectives are presented and participants indicate whether each word describes them or not. Within this task, self-perception is operationalised by the number of negative and positive words declared as “me” and the reaction time to negative and positive words, with shorter time indicating more automatic, self-congruent word endorsement. This offers a way to understand individuals’ self-perceptions at any one time. Recently, researchers utilised event-related brain potentials (ERP’s) to gain insights into automatic and effortful encoding processes associated with SRP in healthy vs. depressed individuals (Auerbach, Stanton, Proudfit, & Pizzagalli, 2015; Shestyuk & Deldin, 2010). ERP’s are the averaged neural activity in response to specific events derived from the raw electroencephalogram (EEG[3]) that allows a better understanding of the dynamic nature of cognitive processing with high temporal precision. Thus, ERP's are particularly suited to examine early, automatic and late, effortful affective-cognitive processes. Early ERP components such as the P1 and the P2 are thought to reflect automatic processing of emotional stimuli (e.g. Flor, Knost, & Birbaumer, 1997; West & Holcomb, 2000), whereas late positive potentials (LPP) index more effortful elaboration and sustained engagement to emotional stimuli (e.g. Huang & Luo, 2006). Using a self-referential task, Shestyuk and Deldin (2010) found greater ERP component amplitudes to negative relative to positive words during automatic stimuli processing (indexed by the P2 component) for current and remitted depressed individuals while the opposite pattern was found for the healthy compassion group. Similarly, Auerbach et al. (2015) reported that compared with healthy female adolescents, depressed adolescents exhibited greater ERP component amplitudes during automatic stimuli processing following negative words (indexed by the P1 component). Critically, this effect was associated with a more maladaptive self-view and self-criticism. In addition, both studies found evidence that depressed individuals showed greater ERP activity representing effortful evaluation and sustain engagement towards negative words as compared to positive words (indexed by the LLP component), whereas healthy individuals demonstrated the opposite pattern. Interestingly, Shestyuk and Deldin (2010) found that remitted depressed individuals did not demonstrate a negativity bias towards negative words during effortful word processing. They concluded that effortful processing biases towards negative self-referent information in the context of depression might be mood-dependent whereas

[3] EEG allows for the recording of the electrical potentials of brain neurons close to the brain surface via placement of electrical sensors across the scalp and forehead (Tortora & Derrickson, 2006).

the automatic processing bias towards negative information about the self might be mood-independent.

Taken together, these findings suggest that currently depressed individuals may have a biased self-referential processing towards negative information about the self, i.e. they have easier, automatic access to negative self-relevant information and sustained engagement to this information. This bias may over time contribute to the maintenance of depressive symptoms (Beck, 1996; Cili & Stopa, 2015; Williams, Healy, Teasdale, White, & Paykel, 1990). Interestingly, the effortful elaboration on negative information about the self in the context of depression is likely to be mood-dependent, e.g. remitted depressed individuals who are currently not feeling depressed do not demonstrate this bias (Shestyuk & Deldin, 2010). Indeed, there is evidence that the LPP (e.g. effortful elaboration of emotionally stimuli) may be sensitive to change in emotional stimuli processing. For example in a healthy student sample Hajcak, Moser, and Simmons (2006) demonstrated that cognitive reappraisal can reduce the LPP following emotional pictures. Therefore, ERPs may be sensitive in picking up subtle changes in cognitive or affective processing and thus lend itself particularly well to understand state changes in self-referential processing.

In this context, adopting a more self-compassionate stance may result in increased access to more positive self-representations. This might be accompanied by adaptive alterations in brain responses towards positive and negative information about the self. However, research is needed to test this hypothetical protective effect of self-compassion as to date, there is no research evidence supporting this argument available. This highlights the need for valid and reliable inductions of self-compassion. I have already identified this as a gap in the current self-compassion literature. In the next chapter, I will discuss different approaches of how to cultivate self-compassion.

2.3 The Dynamic Nature Of Self-Compassion

While it is acknowledged that self-compassion has pre-existing trait level qualities that have their origins, at least in part, in early childhood experiences (e.g. Gilbert, 2009, 2014), there is increasing evidence that skills of self-compassion can also be acquired and taught in adulthood (Shonin, Van Gordon, Compare, Zangeneh, & Griffiths, 2014). This raises two questions: First, how can skills of self-compassion be best cultivated and second, are individual differences influencing the capacity to acquire self-compassion? In the following I will discuss different approaches of how to teach self-compassion and explore the current evidence about how individual differences might moderate one's capacity to use these approaches.

2.3.1 Different Approaches To Cultivate Self-Compassion

There is increasing evidence that self-compassion can be acquired and increased, both in short laboratory inductions, 8-week programs and more intensive retreats (e.g. Arch et al., 2014; Breines & Chen, 2012; Galante et al., 2014; Hofmann, Grossman, & Hinton, 2011; Kuyken et al., 2010; Neff & Germer, 2013; Shonin et al., 2014). A review of the existing literature investigating the cultivation of self-compassion suggest four different approaches: (a) kindness-based meditations; (b) compassionate letter writing; (c) compassionate mind training; (d) the mindful self-compassion program, and (e) Mindfulness based cognitive therapy.

Kindness-based meditations

Recently, Galante et al. (2014) provided a meta-analysis on the effects of loving-kindness meditation (LKM) and compassion meditation (CM), exercises oriented toward enhancing unconditional, positive emotional states of kindness and compassion towards the self and others. In this review, twenty-two studies were included. The studies examined ranged from a single-dose exposure to LKM or CM up to eight-week interventions. They concluded that, compared to passive control conditions, LKM and CM are moderately effective in decreasing self-reported depression and increasing mindfulness, compassion, and self-compassion. Critically, they noted that the results suffer from imprecision due to wide confidence intervals deriving from small studies and variations of LKM and CM in regard to teachings styles and abilities of the teachers. In addition, there are two published reviews on the effects of LKM and CM informing their effects on psychopathology and wellbeing (Hofmann et al., 2011; Shonin et al., 2014). Both reviews included similar studies as in Galante et al. (2014) with the exception that Shonin et al. (2014) excluded studies that only used a single dose-exposure to LKM or CM and Hofmann et al. (2011) did not include studies published since 2011. In sum, both reviews concluded that kindness-based meditations demonstrated improvements in positive and negative affect as well as psychological distress. Both reviews also highlight the problem of the variation in LKM and CM styles used in the studies examined. In addition the common denominator of the three reviews is that they noticed that the objectives of the studies examined tend to be mixed and exploratory. Hence, while these results encourage using kindness-based meditations in order to cultivate self-compassion, this research is still in its infancy. Standardised interventions are urgently needed as well as valid measures to assess outcomes.

Compassionate letter writing

A few studies used compassionate letter writing to cultivate self-compassion in student samples. Leary, Tate, Adams, Allen, and Hancock (2007) asked participants to write about a negative experience in their life in a self-compassionate manner, i.e. prompting the common humanity aspect of the negative event, expressing understanding and kindness for themselves in the same way they would express concern to a friend who had undergone the experience, and to describe their feelings about the event in an objective and unemotional fashion (see Neff, 2003b). Compared to a writing control and self-esteem condition (e.g. prompting positive self-evaluation), they found that the self-compassion induction led participants to acknowledge their role in negative events and lower negative affect as compared to the control conditions. Using the same approach, Breines and Chen (2012) found that writing about personal failure in a self-compassionate vs. self-validating manner made participants more motivated to improve themselves[4]. Shapira and Mongrain (2010) asked participants to write one self-compassionate letter a day for a week addressing a difficulty they experienced that day. This self-compassion induction significantly increased happiness and decreased self-reported depression. Surprisingly however, none of these studies assessed state effects of their intervention on self-compassion. While the results of these self-compassionate manipulations are promising, little is known about the direct effect of these interventions on self-compassion.

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[4] In order to measure the motivation to change, after the manipulation, participants were asked to spent 5 min responding in writing to two prompts: (1) whether they have done anything to change their weakness and (2) where they think the failure comes from. These statements have then been analysed as to the degree they contained evidence of incremental beliefs or the belief that their weakness was malleable and could be changed.

Compassionate Mind Training (CMT)

CMT is a group-based therapy intervention for clinical populations developed by Paul Gilbert (for a detailed description of CMT see Gilbert, 2014). CMT is designed to help people develop skills of self-compassion, by encouraging clients to be self-soothing and caring towards themselves when they are feeling anxiety, anger, and disgust. This is accomplished using a variety of exercises including visualisation of compassionate imagery, and by engaging in self-compassionate behaviours and habits such as self-soothing exercises in times of distress. In a pilot study of CMT involving hospital day patients with intense shame and self-criticism, significant decreases in depression, self-attacking, shame, and feelings of inferiority were reported after participation in the CMT program as well as increases of individuals' ability to be self-soothing and provide reassurance for the self (Gilbert & Procter, 2006). In another study using CMT, individuals who met criteria for schizophrenia showed reductions in depression and increases self-reassurance (Mayhew & Gilbert, 2008). Whereas these results are encouraging of the idea that self-compassion can be cultivated, the results should be interpreted with caution due to small sample sizes and high drop-out rates.

Mindful Self-Compassion (MSC)

Chris Germer and Kristin Neff have developed a training program designed to teach self-compassion skills to the general population called Mindful Self-Compassion (MSC; Neff & Germer, 2013). The structure of MSC is modelled on Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1982), with participants meeting for two and a half hours once a week over the course of eight weeks, and also meeting for a half-day "mini retreat." The program includes a mix of formal meditation practices and practices directly focused to generate self-compassion (similar to LKM), e.g. calling to mind an emotionally difficult situation in one's life and repeating phrases such as "May I feel safe, may I feel peaceful, may I be kind to myself, may I accept myself as I am". In addition MSC includes informal practices such as placing one's hands on one's heart in times of stress (e.g. self-soothing exercises). In a randomised controlled study including 54 participants of the MSC program, Neff and Germer (2012) found that compared to controls, MSC participants demonstrated a significant increase in their levels of self-compassion and decrease in self reported depressive symptoms. Again, these results suggest that self-compassion can be cultivated and taught. However, this study used a passive control group, meaning that other factors could have been responsible for the results. In addition, the participants in this study consisted only of highly educated, middle-aged females with prior meditation experience. Hence it is difficult to generalise these results.

Mindfulness based cognitive therapy (MBCT)

MBCT, an eight-week psychosocial program particularly designed for the treatment of depressive relapse (Segal, Teasdale, & Williams, 2002), uses meditation techniques such as the body scan and breath awareness to teach mindfulness skills (for a more detailed description of MBCT see chapter 2.4.1). Although self-compassion is not an explicit skill taught in MBCT, MBCT teachers often convey implicit messages in the exercises and discussion about the importance of being kind and gentle with oneself (Segal, Williams, & Teasdale, 2013). There is evidence that participation in MBCT increases levels of self-compassion (Kuyken et al., 2010). However the amount of studies investigating the effect of MBCT on self-compassion is very limited and more research is needed to generalise these effects.

In sum, the reviewed literature suggests that self-compassion can be cultivated using more direct approaches such as kindness based meditations, MSC, compassionate letter writing and CMT, or via a more indirect approach like MBCT. However, research into increasing self-compassion is still in its infancy. Enhancing the effects on self-compassion of more complex interventions like CMT or MSC appear to be more convincing. However, these interventions apply various approaches to cultivate self-compassion, making interpretations of which elements of the intervention caused these reported increases very difficult. As discussed previously, there is a need for experimental/one-off self-compassion interventions to test the hypothesised mechanisms via which self-compassion exerts its protective effects. There is a particular gap in the literature investigating how to increase self-compassion in the short term. Based on the reviewed literature, LKM directed towards the self and others appears to be a promising approach not only in cultivating self-compassion but also in improving mental and physical health (Galante et al., 2014; Shonin et al., 2014). However, there are several limitations about the generalisability of the current LKM findings in regard to their application to increase self-compassion. First, there was variation in the competencies of the teachers applying LKM (Galante et al., 2014). Given that teaching mediation requires a set of competencies (Crane et al., 2012), there is a need to control for these possible biases. Second, LKM in its traditional format is designed to foster general feelings of kindness and goodwill towards the self and others. Hence, although cultivating these loving mind-sets is likely to translate into greater self-compassion, it is not its primary purpose. Third, there is a lack of a validated measure to assess state changes in self-compassion. Fourth, there was a number of studies that showed no significant overall improvements in self-reported depression symptoms or wellbeing after LKM, but found, through a qualitative component, that at least some individuals benefited from the intervention (see Galante et al., 2014).

Considering the above-mentioned limitations, one direction for further research might be the development of a standardised LKM with a particular focus on the cultivation of self-compassion that is suitable for experimental research, recorded by and incorporating clinical experiences from an experienced MBCT therapist and trainer. In addition, there is an urgent need to develop a state measure of self-compassion to assess the impact of self-compassion manipulations on adopting a more self-compassionate stance. Finally, there is a need to explore possible individual differences that might impact the ability to adopt a more self-compassionate stance. The next chapter is concerned with reviewing the current understanding of individual differences in cultivating self-compassion.

2.3.2 How do individuals differ in their ability to cultivate self-compassion?

There might be important individual differences influencing how people experience self-compassion and thus affect their ability to cultivate warm and compassionate feelings towards themselves in times of personal distress (Gilbert et al., 2010). That is to say that someone who has experienced adversity and has not experienced secure and warm relationships with caregivers but was exposed to neglect or abuse (emotional and physical) may have a reduced capacity to generate self-compassion as their experience precluded them from being exposed to this positive learning opportunity (Gilbert et al., 2010; Mikulincer & Shaver, 2007). Typically, these individuals are also very self-critical and even imagining compassion for themselves can be difficult or frightening (Gilbert & Procter, 2006). Support for this argument comes from a physiological study by Rockliff et al. (2008), who found decreases in HRV and a lack of significant cortisol reductions in response to CFI for a subgroup of individuals with high levels of self-criticism and an insecure attachment style, while the other participants demonstrated increases in HRV and significant cortisol decreases. They concluded that CFI can stimulate the soothing and contentment system and attenuate the HPA axis in some individuals but those who are very self-critical and insecurely attached may have difficulties benefiting from this intervention. They argue that these individuals might have experienced an under-stimulation of the soothing and contentment system throughout their life, leading to difficulties or anxiety engaging with this system. Supporting this argument, Longe et al. (2010) found that participants scoring higher in self-criticism showed increased amygdala activation when attempting to engage in self-reassurance thinking and conclude that this suggests that self-critical individuals experience difficulties with interventions aimed at positive thinking/self-compassion because the amygdala is implicated in responding to threat (Adolphs, 2002).

To date, there are no psychophysiological studies directly investigating the effect individual differences have on a person's ability to cultivate self-compassion. But in light of the above-mentioned findings (and referring back to the discussion about the relationship between attachment experiences and self-compassion) it is hypothesised that individual differences in experienced childhood adversity, attachment style, trait self-compassion, and self-criticism moderate a person's ability to adopt a self-compassionate stance.

Self-criticism has been proposed to play a key role in the development and maintenance of depression (e.g. P. Gilbert & Irons, 2004; Rector, Bagby, Segal, Joffe, & Levitt, 2000). Given that very self-critical individuals are suggested to have particular difficulties activating the soothing and contentment systems via direct approaches like CFI or self-compassion inductions (e.g. Gilbert et al., 2006; Rockliff et al., 2008), utilising more indirect approaches that have been shown to cultivate self-compassion like MBCT might be particularly beneficial for these individuals (Kuyken et al., 2010). The next chapter is concerned with exploring the potential of self-compassion in preventing relapses of depression in the context of MBCT.

2.4 Self-compassion and its role in relapse prevention for individuals at high risk of depression

Major depressive disorder (MDD), which has a life prevalence rate of around 16 %, is associated with significant impairment and suffering and often has a recurrent and/or chronic course (Kessler et al., 2009; Wittchen et al., 2011). Diagnosis of MDD requires a presence of a number of symptoms for a period of two weeks, with at least one of the symptoms being depressed mood or loss of interest or pleasure (Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision, American Psychiatric Association, 2000). Other symptoms include changes in sleeping patterns and weight, psychomotor agitation or retardation, fatigue, feelings of guilt and worthlessness, difficulties with concentration and suicidal ideation. The symptoms also represent a significant shift from previous levels, causing distress and impairment in daily functioning. Recurrent depression is diagnosed after an occurrence of two or more episodes of MDD, with at least two consecutive symptom-free months separating them. MDD is a particular burden because it typically runs a recurrent course, with rates of recurrence/relapse greater than 50% for those who have their first episode and 90% for those who have had three or more episodes (Kessing et al., 2004). Hence, there is a great demand for developing and optimising treatments that can prevent depressive recurrence.

Mindfulness based cognitive therapy (MBCT), an eight week psychosocial program, is an efficacious intervention for recurrent depression and has recently emerged to reduce rates of relapse (e.g. Kuyken et al., 2015; Kuyken et al., in press; Piet & Hougaard, 2011). Critically, researchers only recently started to investigate through which mechanisms MBCT helps prevent people vulnerable to depression from falling back into a depressive episode. Interestingly for this thesis, evidence is increasing that self-compassion might be one of the mechanisms of change in MBCT (Holzel et al., 2011; Kuyken et al., 2010; van der Velden et al., 2015). Before moving on to discussing how self-compassion might be particularly beneficial for relapse prevention within MBCT, a brief consideration is given to MBCT's theoretical premise and nature.

2.4.1 Mindfulness-based cognitive therapy (MBCT)

MBCT's theoretical foundation is a model of cognitive vulnerability to depressive relapse and recurrence (Segal et al., 2013). The model proposes that when people at risk for depressive relapse experience sad moods, they are at high risk of depressive relapse/recurrence because their sad mood has become associated with specific maladaptive cognitions, like negative beliefs about the self and a tendency to ruminate or catastrophising. These maladaptive thought processes maintain low mood and potentially escalate into a depressive episode (Beck & Haigh, 2014; Teasdale & Barnard, 1993). In those at risk for depression these maladaptive thought processes have become automatic and once activated people find it difficult to disengage from them (Teasdale & Barnard, 1993). This (re) activation of dysfunctional thinking styles triggered by dysphoric states is suggested to be a key mechanism for depressive relapse/recurrence (Segal et al., 2006). MBCT was developed to target this cognitive reactivation (Segal et al., 2013).

MBCT is a manualised skill-based treatment delivered in a class format for eight weekly two-hour group sessions with 8 to 12 participants per group. Mindfulness practices within MBCT draw extensively from mindfulness-based stress reduction (MBSR) programmes (Kabat-Zinn, 2013). The core skill is to learn to disengage from unhelpful thinking patterns before these spirals lead into depression. Recognition of the emergence of unhelpful thoughts, feelings and sensations is achieved through mindfulness meditation training such as the body scan, mindful movement and mindfulness of the breath, which cultivates attitudes of acceptance and non-judgment (Kabat-Zinn, 1994). In addition, MBCT includes cognitive components from cognitive behavioural therapy (CBT). CBT elements in MBCT include psychoeducation about the importance of cognitions in depression. The role of maladaptive cognitions, rumination and avoidance in inducing and maintaining depressive systems are explored and plans are drawn up for identifying and managing warning signs of relapse.

In general, MBCT has an explicit focus in developing the capacity to recognise, orient towards and allow the contents of the mind rather than trying to avoid or change these (Segal et al., 2013). In addition, the development of self-compassion is implicitly interwoven into meditation instructions, and MBCT leaders embody mindfulness and compassion in response to participants' questions and comments throughout the course. The self-compassion element in MBCT involves meeting distressing thoughts and feelings with kindness, empathy, equanimity and patience, and is thought to be a crucial change process (Feldman & Kuyken, 2011). Through a combination of practices cultivating mindfulness skills, implicit learning of the principles of self-compassion and CBT elements, participants are thought to learn to recognise automatic maladaptive thought processes and step out of habitual unhelpful thinking patterns (Segal et al., 2013).

The effectiveness of MBCT in reducing depressive relapse or recurrence has been evaluated in a meta-analyses by Piet and Hougaard (2011). Their findings suggest that MBCT significantly reduced rates of depressive relapse and recurrence compared with usual care or placebo. In addition, there is evidence that MBCT with support to taper or discontinue antidepressant treatment was as effective for prevention of depressive relapse or recurrence as maintenance of antidepressants (Kuyken et al., 2015; Kuyken et al., in press). Despite the increasing evidence of the effectiveness of MBCT and its empirically founded theoretical rationale, researchers have only recently started to investigate how and why MBCT works. Among others, evidence is increasing that self-compassion might be one of the mechanisms of change in MBCT (Holzel et al., 2011; Kuyken et al., 2010; van der Velden et al., 2015). The next section reviews evidence for this argument and aims to explain how increased self-compassion might be a key mechanism by which MBCT improves depressive outcomes.

2.4.2 Self-compassion as a potential mechanism of change within MBCT

Researchers have proposed that increased self-compassion associated with MBCT may be a key mechanism by which MBCT improves well-being and prevents relapse into depression (Holzel et al., 2011; Kuyken et al., 2010; van der Velden et al., 2015). In a key study, Kuyken et al. (2010) examined the link between MBCT treatment, cognitive reactivity, self-compassion, and relapse in depression in a randomised control trail (RCT). They found that MBCT was associated with significantly greater improvements in self-compassion as compared to pharmacotherapy. In this study cognitive reactivity was operationalised as a change in depressive thinking during a sad mood induction resulting in MBCT participants demonstrating greater cognitive reactivity post-treatment as compared to pharmacotherapy. Interestingly, the authors found that MBCT reduced the link between cognitive reactivity and depressive relapse, whereas higher cognitive reactivity predicted relapse in the pharmacotherapy control group. Further, the authors found that changes in self-compassion in the MBCT group significantly moderated the relationship between cognitive reactivity and depressive symptoms at 15-monthfollow-up. These findings suggest that the decoupling of cognitive reactivity and depressive symptoms at follow up appears to be linked to the cultivation of self-compassion during MBCT. The authors concluded that, in line with the theoretical premise of MBCT, self-compassion may reduce problematic cognitive reactivity to negative mood in people at high risk of depression and might be a key mechanism via which MBCT works.

The suggestion of a key role of self-compassion as an adaptive emotion-regulation strategy is consistent with correlational research. For example, Karl and Kuyken (2010) found a significant negative association between trait self-compassion and self-reported cognitive-behavioural avoidance and rumination in a sample of trauma survivors with a history of depression. They argue based on cross-sectional data that self-compassion may be protective because it prevents people from engaging in maladaptive thought processes that take up individuals' attentional resources, serve as avoidance strategies and thus prevent adaptive processing and memory update. More recently, Diedrich, Grant, Hofmann, Hiller, and Berking (2014) compared self-compassion with a range of other emotion-regulation strategies (e.g. reappraisal of the situation, or accepting the negative emotions) in mood repair following a sad mood induction in a clinically depressed sample. They found that employing self-compassion to regulate depressed mood after the sad mood induction was associated with greater reductions in depressive mood, as compared to the waiting control condition. No differences in depressive mood reductions were found between self-compassion, acceptance, or reappraisal condition. However, the authors found that the comparative effectiveness of self-compassion and reappraisal was moderated by a participant's baseline depressive mood, indicating that self-compassion was more effective than reappraisal for individuals with high self-reported depressive mood at baseline. Diedrich et al. (2014) concluded that self-compassion might be an adaptive emotion-regulation strategy, particularly for individuals with high levels of depressed mood.

However, the question of how self-compassion supports adaptive emotion regulation in individuals at great risk of depression is still understudied and there are several limitations in the current literature. Specifically, there is an over-reliance on self-report measures, which can introduce social desirability and/ or deliberate over- or under-reporting of subjective mood changes. In addition, there are currently no studies investigating the physiological underpinnings of the change in self-compassion pre/post-MBCT. As stated previously, the triangulation of self-report and physiological measures might be particularly fruitful to investigate if self-compassion is a potential mechanism in MBCT and via which processes it exerts its protective effect.

As hypothesised previously, one of the protective effects of self-compassion might be the improved access and activation of the soothing and contentment system. Hence, improvements in self-compassion through MBCT might be accompanied by increased activation of the calm and content affect system. This is characterised by increased HRV, an indicator of parasympathetic activity and effective emotion regulation (Thayer & Lane, 2000), suggestive of the ability to self-soothe when stressed (Porges, 2007). This thesis is concerned with testing this hypothesis and therefore addressing a current gap in the literature.

Interestingly, there is evidence that MBCT is particularly beneficial for individuals reporting childhood adversity (Williams et al., 2014). As stated earlier in this thesis (see section 2.2.1 and 2.3.2), these people might have particular difficulties being self-compassionate, because their experience precluded them from being exposed to self-compassion and positive affiliative affect (Gilbert et al., 2010; Mikulincer & Shaver, 2007). A recent individual patient data (IPD) meta-analysis suggests that those most at risk of depressive relapse benefit the greatest amount from MBCT compared with control conditions (Kuyken et al., in press). MBCT might be particularly beneficial for them, because it helps them to develop skills to access and activate the under-stimulated soothing and contentment system in the face of negative thoughts, memories, feelings and depressive symptoms.

3 Synopsis of the theoretical background: How can self-compassion build up resilience and lead to increased wellbeing?

3.1 Synopsis and study rationale

In summary, despite the growing evidence that self-compassion is associated with wellbeing and lower levels of mental health problems (e.g. Hofmann et al., 2011; Kuyken et al., 2010; MacBeth & Gumley, 2012; Wei et al., 2011; Zessin et al., 2015), it is not well understood how the cultivation of self-compassion increases resilience; i.e. the ability to respond to and recover from challenging events and the capacity to endure and continue in the face of adversity. Integrating the above mentioned findings and hypotheses on the correlates of self-compassion within the broaden-and-build-up framework of resilience by Fredrickson, Cohn, Coffey, Pek, and Finkel (2008) may help a better understanding of the issues, and is the theoretical framework for the proposed empirical studies within this thesis.

In line with this framework, it is suggested that regularly practiced self-compassion has a facilitative effect on building-up of resources (resilience) via two basic processes: (a) *broadening* an individual's momentary emotional processing and thinking which enables them to draw on higher-level and novel connections and ideas and (b) these broadened mindsets help to *build* new personal resources. In particular, it is proposed that cultivating self-compassion over time will initiate two fundamental processes:

(1) The cultivation of self-compassion by meditative techniques will enhance positive affiliative affect (e.g., love, care, feeling securely attached) and a greater tendency to prefer positively valenced information about the self. This state should be reflected in activation of the soothing and contentment system which is characterised by the dynamic balancing of the sympathetic and parasympathetic nervous systems and a greater ability to self-soothe when stressed (Broaden; see Figure 3.1 A).

(2) In line with Kuyken et al. (2010), who established that self-compassion attenuated the toxic effects of reactivity during a sad mood induction in individuals with a history of recurrent depression, we suggest that self-compassion reduces problematic reactivity to negative stimuli (initiates a building-up of resilience) which in turn leads to reduced symptoms of depression and increased wellbeing (see Figure 3.1 B).

Reviewing the existing literature of self-compassion identified a lack of adequate experimental/one-off self-compassion interventions. To test the proposed broaden hypothesis and to address this current gap in the literature, the self-compassion inductions used in this thesis have been recorded by and incorporated clinical experiences from an experienced mindfulness therapist and trainer. In addition, manipulation checks have been used to ensure the paradigm is fit for the purpose to cultivate self-compassion. Furthermore, the triangulation of self-report and physiological measures within this framework addresses the current debate on the measurement issues of self-compassion. This is because it facilitates the examination of possible physiological underpinnings of self-compassion and thus contributes to a better understanding of the construct and might offer a more objective way to measure self-compassion.

Utilising this experimental approach, Figure 3.1 suggests a series of empirical studies within the broaden-and-build framework to test the above-mentioned hypotheses. To test the suggested broaden hypothesis, S*tudy I* will investigate if meditative techniques designed to cultivate self-compassion will increase positive affiliative affect in a healthy student sample. In addition this study will investigate if these changes are accompanied by increased parasympathetic and decreased sympathetic activation (e.g. activation of the soothing and contentment system). *Study II* will investigate the hypothesised increased access to a more positive self-attitude when self-compassion is cultivated. In *Study III* we will explore if individuals at high risk for depression show a reduced capacity to activate the proposed broaden mechanisms when self-compassion is cultivated as compared to the healthy controls.

To test the suggested building-up hypothesis, *Study IV* is built on the study by Kuyken et al. (2010) and will explore to what extent the suggested improvements in self-compassion following MBCT are accompanied by altered physiological responses (increased activation of the soothing and contentment system) if a self-compassionate stance is adopted.

Figure 3.1 accounts further for a moderator role of individual differences in trait self-compassion, self-criticism, attachment style and childhood adversity in a person's capacity to cultivate self-compassion. As discussed in section 2.3.2, someone who has experienced adversity and has not experienced secure and warm relationships with caregivers but was exposed to neglect or abuse (emotional and physical) may have a reduced capacity to generate compassion for themselves and others as their experience precluded them from being exposed to this positive learning opportunity (e.g. Gilbert et al., 2010).

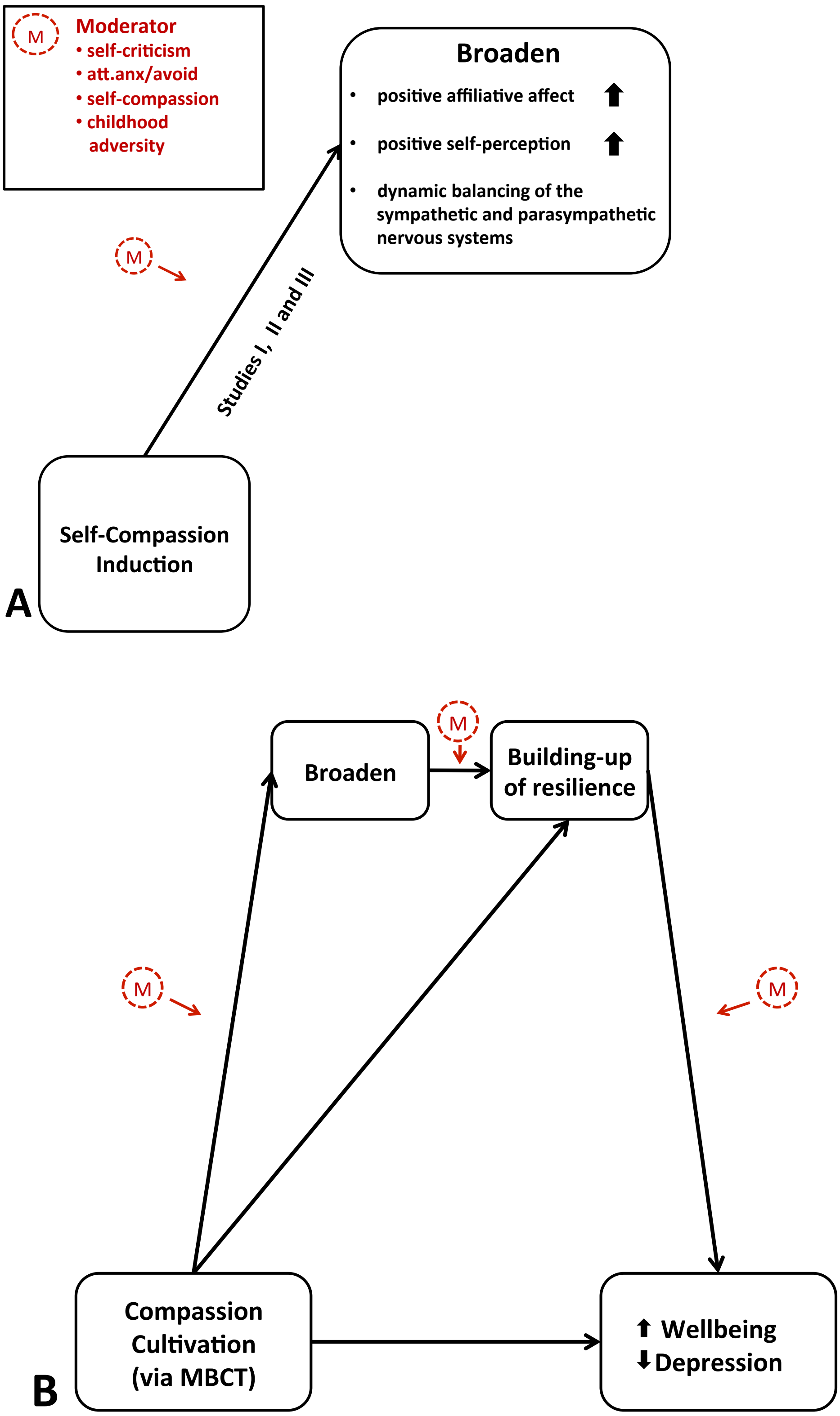

Figure 3.1 A: Suggested associations between self-compassion, broaden-and-building-up mechanisms of resilience for the study of short-term psychological and physiological effects. B: Suggested associations with wellbeing and depression as outcome variable.

3.2 Research questions

The proposed studies attempt to address the following research questions:

1. Will meditative techniques designed to cultivate self-compassion increase positive affiliative affect and access to a more positive self-attitude? (Study I and Study II)
2. Will increased positive affiliative affect be accompanied by increased parasympathetic and decreased sympathetic activation of the autonomic nervous system? (Study I)
3. Will a more positive self-perception be accompanied by enhanced automatic and elaborate processing of positive information about the self, as evidenced by early and late components of the ERP? (Study II)
4. Are there differences between healthy individuals and individuals at risk for depression in cultivating a self-compassionate stance? (Study III)
5. Will individual differences in trait self-compassion, self-criticism, attachment style and adverse childhood moderate a person's capacity to cultivate self-compassion? (Study I, II, and III)
6. Will the participation in MBCT alter an individual's psychophysiological responses to a self-compassion induction? (Study IV)

3.3 Thesis structure

In the following, the research questions will be addressed by four stand-alone manuscripts (Study I, II, III, and IV). A publication-based approach for the empirical chapters has been chosen to facilitate efficient publication of the papers after the submission of the thesis. Preliminary data of Study I has been presented at the 53rd Annual Society for Psychophysiological Research (SPR) Meeting, October 2-6, 2013, Florence, Italy (Kirschner, Kuyken, & Karl, 2013).

4 STUDY I: Psychophysiological correlates of and individual differences in self-compassion in healthy individuals

4.1 Abstract

There is consensus that the cultivation of self-compassion has beneficial effects on mental health and wellbeing but the underlying processes and mechanisms via which it exerts its protective effects are not yet well understood. We therefore studied psychophysiological correlates of two meditation exercises designed to cultivate state self-compassion as compared to a rumination, control and positive excitement condition. Heart-Rate (HR), Heart-Rate-Variability (HRV), and Skin-Conductance-Level (SCL) during the guided audio exercises were recorded in 135 participants. In addition changes in positive affiliative affect, self-compassion and self-criticism were assessed. Both self-compassion meditation and the positive excitement condition increased state self-compassion and affiliative affect and decreased self-criticism whereas the rumination condition triggered the opposite pattern. Affect changes in the self-compassion conditions were accompanied by the expected psychophysiological response patterns (i.e., a significantly lower HR, SCL and higher HRV). The results indicate that one possible protective effect of self-compassion lies in the activation of the soothing and affiliative affect system. Further explorations of these findings suggested that responses to the self-compassion induction were moderated by participants' tendencies to self-criticise, trait levels of self-compassion and attachment related anxiety. Individuals high in self-criticism, low in self-compassion and with an anxious attachment style tended to respond to the indirect self-compassion induction with higher activation of the soothing and affiliative system but not in the direct self-compassion induction. Implications of the findings are discussed.

Keywords: self-compassion, psychophysiology, individual differences, positive affiliative affect

4.2 Introduction

There is growing evidence that the cultivation of self-compassion has beneficial effects on mental health and wellbeing (Galante et al., 2014; Gilbert, 2014; Hofmann et al., 2011; MacBeth & Gumley, 2012; Neff & Germer, 2013) but the underlying processes and mechanisms via which it exerts its protective effects are not yet well understood. Self-compassion has been defined as being kind to one's self (Neff, 2003b) and being able to use self-reassurance and soothing rooted in a secure attachment style (Gilbert, 2009) in times of adversity (Gilbert, 2009; Neff, 2003b). Further, it includes being non-judgmental about one's self (Gilbert, 2009; Neff, 2003b) and recognising one's experience as part of the human condition (Neff, 2003b) and being able to care for and affiliate with others (Gilbert, 2009). It is a state where a sense of safety can be activated and distress alleviated. This is in contrast to self-criticism characterised by maladaptive emotion-regulation strategies such as being harsh and judgmental to one's self (Gilbert, 2009; Neff, 2003b), feeling isolated (Neff, 2003b) and being in flight or fight or social rank mode (Gilbert, 2009). Self-criticism therefore exacerbates a sense of threat in difficult times (Gilbert, 2009).

The majority of studies investigating self-compassion have been correlational, using the Self-Compassion Scale (Neff, 2003a) to determine the association between trait self-compassion, emotion regulation, and psychological health. Research suggests that self-compassion is negatively related to self-criticism, i.e. a tendency for negative individual self-talk by concentrating on failures, minimising successes, and putting the self down (Gilbert, Clarke, Hempel, Miles, & Irons, 2004). Higher levels of trait self-compassion have been associated with wellbeing, quality of life, and health behaviours like exercise, body image, and more caring and supportive relationship behaviour (Neff, 2003a; Neff, Rude & Kirkpatrick, 2007; Wei et al., 2011; Zessin et al., 2015). In contrast, lower levels were associated with mental health problems such as PTSD, rumination and depression (Kuyken et al., 2010; Neff, 2003a; Thompson & Waltz, 2008). There is a current gap in the literature regarding studies that examine mechanisms underlying self-compassion and their impact on its beneficial effects.

Evidence is increasing that self-compassion might exert its protective effects by stimulating physiological systems associated with affiliation and wellbeing. Drawing on a review of positive and affiliative emotions (Depue & Morrone-Strupinsky, 2005), the social engagement system (Porges, 2007), and studies of threat based emotions (LeDoux, 1998), Gilbert (2009) proposes a tripartite affective system, which consists of one negative 'threat-focused' affect system and two positive affect systems. One of the two positive systems is focused upon stimulation and excitement, while the other is associated with feeling safe, securely attached, affiliated with others, and with the ability to self-soothe when stressed. Gilbert (2009) positions compassion (for self and others) in the context of the soothing and contentment system. This system is suggested to promote a calm physiological state that is conducive to interpersonal approach and social affiliation (Depue & Morrone-Strupinsky, 2005). This calm physiological state is associated with enhanced parasympathetic activity that gives rise to the beat-to-beat variability in heart rate known as heart rate variability (HRV), which has been linked to flexible attention deployment and adaptive emotion regulation to threat contexts (Thayer & Lane, 2000) and is suggestive of the ability to self-soothe when stressed (Porges, 2007). Furthermore, the soothing and contentment system is proposed to be important in down-regulating the negative sympathetic threat-seeking system (Depue & Morrone-Strupinsky, 2005; Gilbert, 2014).

In support of this proposition, compassion meditation or compassion-focused imagery has been shown to induce higher HRV (e.g. Arch et al., 2014; Rockliff et al., 2008; Tang et al., 2009) and down-regulate sympathetic activity indicated by reduced skin conductance (Ortner et al., 2007; Tang et al., 2009) and lower salivary alpha amylase responses (Duarte et al., 2015). Moreover, these interventions have been shown to reduce stress responses indicated by reduced cortisol (Rockliff et al., 2008; Vandana et al., 2011) and improved immune functioning (Davidson et al., 2003; Fan et al., 2010).

These findings considered together suggest that one possible protective effect of self-compassion lies in the activation of the positive affiliative affect system which is characterised by a content and calm state of mind with a disposition for kindness, care and social connectedness and is accompanied by a specific physiological response pattern associated with adaptive emotion regulation in times of distress. Critically, none of the above mentioned experimental inductions were specifically designed to cultivate self-compassion. They were either based on Buddhist meditative practices incorporating mindfulness and general compassion, or using compassion-focused imagery, whereby participants generate a visual image of an ideally compassionate figure sending oneself unconditional love and acceptance. Although these inductions are likely to translate into greater levels of self-compassion (e.g. Kuyken et al., 2010) this has to date not been tested explicitly.

Evidence is increasing that although self-compassion has trait-like properties, it can be cultivated and can lead to increased positive emotions and wellbeing (Galante et al., 2014; Hofmann et al., 2011; Shonin et al., 2014). For example, kindness-based meditations drawing from Buddhists traditions, such as loving-kindness meditation (i.e. an exercise orientated to toward enhancing unconditional kindness towards oneself and others) have been found to induce self-compassion, increase positive affect, and decrease negative affect (Galante et al., 2014; Hofmann et al., 2011; Hutcherson, Seppala, & Gross, 2008). In addition, Mindfulness based cognitive therapy (MBCT), an eight-week psychosocial program particularly designed for the treatment of depressive relapse (Segal, Teasedale, & Williams, 2002), has been shown to increase self-compassion and these changes in self-compassion predicted wellbeing 15 months later (Kuyken et al., 2010). MBCT uses meditation techniques such as the body scan and breath awareness to teach mindfulness skills. Interestingly, even though it is not an explicit skill taught in MBCT, self-compassion is implicitly interwoven into meditation instructions. For example, reminders include in the focused attention meditation include: "Whenever you notice that the mind has wandered off, bring it back with gentleness and kindness." Evidence that MBCT increases self-compassion suggests that self-compassion can also be cultivated more indirectly.

However, most of the experimental work on self-compassion relies heavily upon self-reporting, which may be biased by demand characteristics. In addition, there is a lack of adequate experimental/one-off self-compassion interventions in the current literature (Galante et al., 2014; Hofmann et al., 2011). Therefore, building up on experimental approaches investigating the cultivation of self-compassion and using a triangulation of self-report and physiological measures may improve our understanding of its underlying mechanisms and thus address a current gap in the literature.

Individual differences may affect the ability to cultivate self-compassion and to activate the soothing and contentment system. Support for this argument comes from a physiological study by Rockliff et al. (2008), who found decreases in HRV and a lack of significant cortisol reductions in response to CFI for a subgroup of individuals with high levels of self-criticism and an insecure attachment style, while the other participants demonstrated increases in HRV and significant cortisol decreases. They concluded that CFI can stimulate the soothing and contentment system and attenuate the HPA axis in some individuals but those who are very self-critical and insecurely attached may have difficulties benefiting from this intervention. They argue that experienced childhood adversity might be a reason for this as well as problematic attachment experiences. These experiences may lead to difficulties or anxiety in stimulating this system. Supporting this argument, Longe et al. (2010) found that participants scoring higher in self-criticism showed increased amygdala activation when attempting to engage in self-reassurance thinking and conclude that this suggests that self-critical individuals experience difficulties with interventions aimed at positive thinking/self-compassion because the amygdala is implicated in responding to threat (Adolphs, 2002). In the light of more aversive and avoidant responses to direct self-compassion interventions in those individuals with high levels of self-criticism and difficult attachment experiences, the question arises if these individuals find it easier to cultivate self-compassion via more indirect interventions.

Integrating the above-mentioned considerations, the aim of this study was to build on experimental approaches suggestive to cultivate self-compassion to investigate psychophysiological underpinnings of self-compassion. To maximise the integrity of the experimental manipulations used in this study, the inductions were developed and recorded together with mindfulness teachers with extensive experience. In total, this study had five conditions. A Loving Kindness Meditation (LKM) with a specific focus on the cultivation of self-compassion (adopted from Neff

& Germer, 2013) was used as a direct technique to cultivate state self-compassion. In addition, we used a compassionate body scan (directing kind and compassionate attention to one's own body sensations) as a more indirect approach to cultivate self-compassion (based on Neff & Germer, 2013). To stimulate the drive and excitement affect system (Gilbert, 2009), a positive-excitement condition was designed. Having manipulations designed to stimulate the two different types of positive affect systems enables exploration on the specificity effects of positive affect on physiological responses. Moreover, we included a rumination condition designed to stimulate the threat system (adopted from Roberts, Watkins, & Wills, 2013), as well as a neutral control condition. Based on previous research on compassion, we hypothesised that techniques designed to cultivate self-compassion (as compared to the control conditions) increase affiliative positive affect (i.e., love, care, feeling securely attached). It was further expected that increased positive affiliative affect is accompanied by reduced skin conductance and heart rate (inferring increased sympathetic activation) and increased heart rate variability (inferring increased parasympathetic activation). Individual differences in trait self-compassion, self-criticism, attachment style, and experienced childhood adversity were expected to moderate the effects. For example, people who have experienced childhood adversity, attachment difficulties, and are very self-critical might find it difficult to activate the affiliative affect system/self-soothing system, particularly in the more direct condition.

4.3 Methods

4.3.1 Participants

A total of 135 students were recruited from the University of Exeter (27 per experimental condition; see Figure 4.1 for the participant flow diagram). Participants were native English speakers, right handed, with normal or corrected to normal vision and hearing. Exclusion criteria included current depression, currently taking psychopharmacological medication, epilepsy, cardiac problems and a history of brain surgery. All participants provided written informed consent and received course credits or £10 for participation. The study protocol was approved by the School of Psychology, University of Exeter' ethics Committee[5].

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5 Ethics-Approval-Number: 2011/579

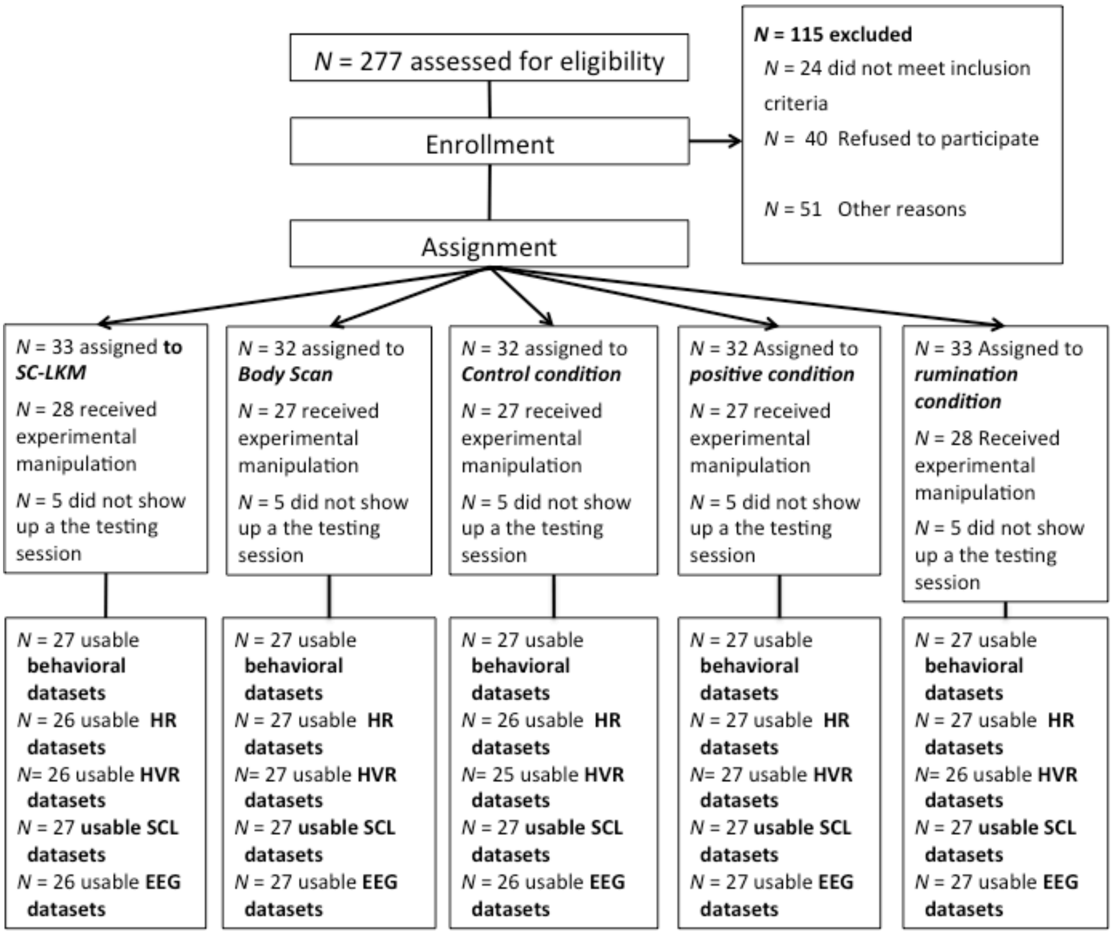

Figure 4.1 Participant flow diagram of study I. *Note:* Reasons for exclusion of physiological dataset were poor data quality. In addition one participant in the LKM and one in the rumination condition could not follow the instructions of the audio-exercises. They have been excluded from subsequent analyses.

4.3.2 Materials

Self-report measurements. To establish study eligibility all participants underwent a depression screening using the Patient Health Questionnaire PHQ-9 for depression (PHQ-9; http://www.depression-primarycare.org/organizations/). The PHQ-9 is a standardised questionnaire often used to assess depressive symptoms in primary mental health settings. The PHQ-9 has excellent reliability (internal α=.89; test re-test α=.84) and is a valid measure for discriminating depression, with ROC analysis showing the area under the curve for diagnosing depression in PHQ-9 being

0.95 (Solomon et al., 2000). Questions are scored from "0" (not at all) to "3" (nearly every day), with higher total scores indicating increased current depressive state. Although it is not a diagnostic tool, standardised cut-off scores can be used to conclude a tentative diagnosis. Individuals with score $\geq$ 10 have been shown to have a depression diagnosis with 88% sensitivity and 88% specificity (Kroenke, Spitzer, & Williams, 2001). For use as an assessment tool a score $\geq$ 2 on either question one (little interest of pleasure in doing things) or question two (feeling down, depressed, or hopeless) must also be present to make a tentative depression diagnosis. Within this study the assessment tool diagnostic cut off from the PHQ-9 was used as a screening tool for study exclusion.

To assess individual difference variables hypothesised to moderate the impact of our experimental inductions we assessed trait levels of self-criticism, attachment style, experienced childhood adversity and trait levels of self-compassion.

To assess levels of self-criticism we used the *Forms of Self-Criticising/Attacking & Self-Reassuring Scale* (FSCRS; Gilbert et al., 2004). It is a 22-item scale, which measures different ways people think and feel about themselves when things go wrong for them. The items make up three components. There are two forms of self-criticalness: inadequate self and hated self, and one form of self-reassure: reassure self. The responses are given on a 5-point Likert scale (ranging from 0 = not at all like me, to 4 = extremely like me). Findings suggest good reliability (α = .90 for inadequate-self and α = .85 for both the hated-self and the reassured-self) and validity (e.g. Baiao, Gilbert, McEwan, & Carvalho, 2015). Recent research confirmed the original three-factor structure of the FSCRS in both clinical and non-clinical samples suggesting that self-criticism should not be seen as a single dimension (e.g. Baiao et al., 2015; Castilho, Pinto-Gouveia, & Duarte, 2015). Both forms of self-criticism have been positively linked depression and anxiety whereby the self-hating domain was more associated with self-harm and borderline phenomenology (Gilbert et al., 2004; Gilbert et al., 2010). In contrast, greater self-reassurance has been shown to be related to mental health and well-being (Gilbert et al., 2004). Cronbach's alpha in this sample was .73 for the inadequate self, .76 for the hated self, and .77 for the reassure self.

Attachment style was assessed via the *Relationships Structures Questionnaire* (RSQ; Fraley, Niedenthal, Marks, Brumbaugh, & Vicary, 2006). The RSQ measures attachment dimensions of anxiety (Cronbach's α = .87 in this sample) and avoidance (Cronbach's α = .73 in this sample). This is a self-report designed to assess attachment patterns in a variety of close relationships. The same 10 items are used to assess attachment styles with respect to four targets (i.e., mother, father, romantic partner, and best friend). The responses are given on a 7-point Likert scale (ranging from 1 = strongly disagree, to 7 = strongly agree). Psychometric properties of the RSQ are adequate. Research has shown that the individual scales demonstrated a good retest-reliability over 30 days (r = .88 for the avoidance scores and r = .92 for the anxiety scores) and that the scales are meaningfully related to different outcomes (e.g. relationship satisfaction and depressive symptoms) (see Fraley, Heffernan, Vicary, & Brumbaugh, 2011; Fraley, Hudson, Heffernan, & Segal, 2015).

To assess experienced childhood adversity we used *the Measure of Parental Style* (MOPS; Parker et al., 1997). The MOPS is a self-assessment tool to measure perceived parenting styles across three measures (Indifference, Abuse, Overcontrol). The responses are given on a 4-point Likert scale (ranging from 0 = not true at all, to 3 = extremely true). The three subscales of the MOPS have shown good reliability across 4 weeks testing period (r = .93 for parental indifference, r = .92 for parental abuse, and r = .87 for parental over-control (Picardi et al., 2013)), and good internal consistency (α = .93 for parental indifference, α = .82 for parental over-control, and α = .87 for parental abuse (Parker et al., 1997)). Higher scores on the three parental domains of the MOPS have been associated with mental health problems such as depression and anxiety disorders (Kuyken et al., 2015; Parker et al., 1997). It had a good reliability (Cronbach's α = .93 for indifference, .88 for abuse, and .79 for over control) in this sample).

Trait levels of self-compassion were assessed via *the Self-Compassion Scale* (SCS; Neff, 2003a). This is a 26 item self-report scale, which measures six dimensions of self-compassion: mindfulness (Cronbach's α = .73 in this sample), over-identification (Cronbach's α = .66 in this sample), self-kindness (Cronbach's α = .85 in this sample), self-judgement (Cronbach's α = .76 in this sample), isolation (Cronbach's α = .75 in this sample), and common humanity (Cronbach's α = .38 in this sample). Each item is rated on a five-point scale, ranging from 1 ("almost never") to 5 ("almost always"). In this study I obtained the total of this scale (sum of the six self-compassion dimensions, with the negative dimensions – over-identification, self-judgment, and isolation — reversely coded) as measure of trait self-compassion. Research demonstrated that the SCS has shown good test-retest reliability (r = .93) and convergent and discriminant validity (Neff, 2003; Neff, 2015; Neff, Kirkpatrick, & Rude, 2007; Neff, Rude, & Kirkpatrick, 2007). A more detailed description on the psychometric properties of the SCS can be found in chapter 2.1, pp. 5 – 8.

Visual Analogue Scales. To assess the effectiveness of the experimental inductions on participant's mood, self-compassion, positive affiliative affect and self-criticism a series of questions using Visual Analogue Scales (ranging from 0 to 100) have been used throughout the experiment. Four questions asked participants about their state affiliative affect (i.e., feeling securely attached, safe, loved and connected; Cronbach's α = .66 in this sample) based on the state adult attachment measure (SAAM; Gillath, Noftle, & Stockdale, 2009). Three asked about participant's state self-compassion (Cronbach's α = .73 in this sample) adopted from the Self-Compassion Scale (SCS; Neff, 2003a), and one about their state self-criticism (based on the Forms of Self-Criticising/Attacking & Self-Reassuring Scale (FSCRS; Gilbert et al., 2004). See appendix I for the exact wording of the questions.

Experimental inductions. The induction tapes for the five different conditions were developed and recorded together with an experienced MBCT therapist from the ACCEPT clinic, an NHS commissioned depression service that is part of the University of Exeter Mood Disorders Centre. The tapes were matched in terms of word density (610 – 630 words) and length (11.5 minutes). For the exact wording of the manipulations see appendix II. In the Compassionate Body Scan (BS) participants are guided to direct kind and compassionate attention to their body sensations. In the Self-Compassion Loving Kindness Meditation (LKM) condition participants are guided to direct loving/friendly feelings toward themselves and others. In the rumination condition participants are asked dwell on a sad/negative memory or current problem. In the control condition participants are guided through a routine supermarket-shopping scenario. In the positive excitement condition participants were asked to think about certain aspects of a positive event or situation where they were working through or achieving something great. Feedback on the final audio exercises was gathered from experienced mindfulness and meditation practitioners as well as staff within our clinical department to ensure ecological validity.

4.3.3 Psychophysiological Recording and Data Pre-processing

The autonomic nervous system measures described below were recorded using a BIOPAC™ MP150 system connected to a computer running the commercially available software AcqKnowledge 4.2 (BIOPAC Systems; Goleta, CA), with acquisition sampling rate of 2000Hz. These data were filtered and corrected offline using specialised analysis programmes within the AcqKnowledge 4.2 software; as described in the respective sections below.

Heart rate (HR). The heart rate was acquired as an indicator of physiological arousal and in particular as a measure that distinguishes between physiological orientation (i.e., an organism's allocation of attention towards novel stimuli and response inhibition to familiar or insignificant stimuli (Jung et al., 2000) and defence response (i.e., an organism's protective reflex from aversive stimuli (Sokolov, 1963) HR determination in beats per minute was based on a semi-automatic R-wave detection algorithm implemented in the software AcqKnowledge (Version 4.2., BIOPAC Systems Inc., Goleta, CA). Raw ECG data were filtered applying a FIR bandpass filter between 0.5 and 35 Hz and 8000 coefficients. Artefact detection (i.e., noisy, missing or ectopic beats) and removal was performed using a template correlation and interpolation from the adjacent R-peaks based on Berntson and colleagues (Berntson, Quigley, Jang, & Boysen, 1990; Berntson & Stowell, 1998) and Solem, Laguna, and Sornmo (2006). The interpolation procedure was used for less than 5% of the ECG data. Mean HR in beats per minute was then extracted from the R-waves for each data section. For the different experimental conditions, mean HR values were determined for the duration of the 11 minutes of the exercise in one-minute segments. A minute prior to the meditation start was used as a baseline.

Heart rate variability (HF HRV). High frequency heart rate variability as an indicator of parasympathetic activation and adaptive physiological regulation capacity (Thayer & Lane, 2000) was determined from the artefact-free ECG (see above) by calculating a time series from the R-peaks and submitting it to a fast Fourier transformation that calculates the power spectrum of the R-R interval variation in a given time window (Berntson et al., 1997; Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996). Of particular interest was the frequency range between 0.15 Hz and 0.4 Hz (high frequency, HF). This high frequency band of HRV is generally considered a marker of parasympathetic input. Mean HF HRV were then extracted for each data section similar to the heart rate. HRV values were log-transformed using the natural log to normalise data.

Skin conductance level (SCL). Skin conductance (SC) was applied as a measure of sympathetic activation and physiological defence response (Sokolov, 1963). SC was recorded from bipolar Ag/AgCl reusable strap electrodes on the medial phalanx of the middle and ring finger of the non-dominate hand, at a sampling rate of 125Hz. No filters were run on SC data; however the data was manually screened for recording or movement artefacts, of which none were found within data portions of interest. Mean SCL, Maximum SCL values and minimum SCL values were extracted for the same time windows and a range correction (Lykken, Rose, Luther, & Maley, 1966) was applied to each data section for each participant to give a mean SCL corrected for individual differences. The formula for this was: Corrected SCL = (SCLmean – SCL min) / (SCL max-SCL min).

To obtain measures of HR, HRV and SCL change throughout the audio exercise and in order to control for individual differences we calculated participants' change values for each minute of the experimental condition. These change values were calculated by subtracting values for each minute of the audio exercise from the averaged baseline values of the participant.

4.3.4 Procedure

Participants were screened for the exclusion criteria and asked to complete a few questionnaires (SCS: Neff, 2003, FSCRS: Gilbert et al., 2004, RSQ: Fraley et al., 2006 MOPS: Parker et al., 1997) using an online survey. Eligible participant were invited to the laboratory session. Following informed consent, participants completed a self-referential task. The data of the self-referential task are not presented here. After this, participants completed an 8-minute baseline period (divided into eight one minutes blocks, four with their eyes open 4 with their eyes closed) where participants were invited to relax. Following the baseline, participants listened to one of the five induction tapes and finally were asked to complete a one-minute baseline period with their eyes closed. Before and after the first baseline and following the induction tape participants completed a manipulation check. For this we used visual analogue scales (ranging from 0 to 100) to answer 11 questions about state affiliative affect. Finally, participants completed another self-referential task. During the whole experimental procedure psychophysiological measurements (ECG, SCL) were recorded.

Randomisation. Eligible participants were randomly assigned to one of the five experimental conditions. This was achieved using a random number-generator to create a sort key. The participant numbers have than been sorted according to the random sort key and hence randomly assigned to one of the five experimental blocks.

4.3.5 Statistical data analysis

Data were analysed using statistical software SPSS version 21 (SPSS Inc., Chicago, Illinois), R (http://www.r-project.org) and Mplus version 7.3 (Muthén & Muthén, 2014) The data distribution was explored using the Shapiro-Wilks test of normality and by visual inspection. Where required we checked for multivariate normality using the Mardia test of multivariate non-normality (Mardia, 1970). Boxplots were used to identify outliers with regard to each of the outcome parameters. Cases were deemed as outliers if they were over 3 standard deviations away from the mean and didn't represent a meaningful observation. Outliers were assigned "a raw score on the offending variable that is one unit larger (or smaller) than the next most extreme score in the distribution" (Tabachnick & Fidell, 2001, p. 77)

Manipulation checks. For testing the effectiveness of the experimental inductions on participant's mood, self-compassion, positive affiliative affect and self-criticism, a series of repeated measures ANOVAs with time (pre vs. post manipulation) as the within-subjects factor and condition as the between-subjects factor were conducted.

Moderation analyses. To answer the research question about the effect of individual differences on the association between self-report change in self-compassion, positive affiliative affect and self-criticism in response to the direct and indirect meditation condition, a series of simple moderation analyses were performed following suggestions and using the SPSS script provided by Hayes (2012). We used residualised gain scores in the self-report measures as outcome in the moderation models. Residualised gain scores, as validated index of pre-post change that controls for variance in initial pre-scores, were calculated by regression of post-score on pre-score on the relevant manipulation check scores (Mintz, Luborsky, & Christoph, 1979; Speckens, Ehlers, Hackmann, & Clark, 2006; Williams, Zimmerman, Rich, & Steed, 1984). Moderation analyses were performed using mean-centred continuous predictors (individual difference variables hypothesised to moderate the impact of our experimental inductions) and interaction terms of condition (self-compassion manipulations vs. control condition) and trait predictors. In order to further characterise the nature of significant interactions we used the Johnson–Neymann (J–N) technique (Johnson & Neyman, 1936; Potthoff, 1964). The J–N technique allows one to directly identify points in the range of the moderator variable where the effect of the predictor on the outcome transitions from being statistically significant to not significant by finding the value of the moderator variable for which the ratio of the conditional effect to its standard error is equal to the critical t score.

Latent growth curve modelling (LGCM). To investigate if (a) the different experimental inductions were associated with different body responses throughout the task and if (b) individual differences in trait self-compassion, self-criticism, attachment style and experienced childhood adversity have an effect on the correlation between the experimental condition and expected change in physiology, a LGCM approach was applied using the software MPlus, version 7.2 (Muthen & Muthen, 2012). LGCM is a novel statistical approach for longitudinal/repeated measures data that combines and extends features of repeated measures ANOVA and structural equation modelling (Duncan, Duncan & Strycker, 2011) and allows to capture the average trend or pattern of change over time and between-person differences around the average trend (Browne, 1993; Meredith & Tisak, 1990; B. O. Muthen & Curran, 1997; Willett & Sayer, 1994).

Within LGCM, the basic growth model is fit as a restricted common factor model (Meredith & Tisak, 1990). Specifically, repeated measures of a variable represent indicators of continuous latent variables, growth factors, that represent different aspects of change and capture individual differences in a trajectory. Typically, these are the intercept (i.e., mean starting value) and the linear (i.e., rate of growth) and quadratic (i.e., levelling off, or coming down) slopes. LGCM can be calculated by statistical software package such as Mplus (Muthén & Muthén, 2014).

There are a number of advantages of this statistical approach. First, LGCM can model aspects of change as random effects; i.e., the means, variances, and covariances of individual differences in intercepts and slopes can be estimated. Second, LGCM can handle missing data easily if they are missing at random. Third, the antecedents and sequelae of change can be examined. Fourth, LGCM allows to include time-varying covariates. Last but not least, within LGCM, the goodness of fit of the model to data can be estimated. In this study, common overall fit indices such as the root mean squared error of approximation (RMSEA), comparative fit index (CFI), the Tucker-Lewis index (TLI), and the standardized root mean square residual (SRMR) have been used to establish adequate fit of the models (see Schermelleh-Engel, Moosbrugger, & Mueller, 2003). Comparisons between the different models within each outcome variable have been made informal by using indices such as the sample size adjusted Bayesian Information Criterion (aBIC; whereby smaller values indicate a better model fit), the Akaike Information Criterion (AIC), and formal by using the Chi-Square Test (for multivariate normal outcome variables) or the Satorra-Bentler Scaled Chi-Square Test (for non-normal outcomes) (Bryant & Satorra, 2012; Satorra & Bentler, 2001).

There are also some disadvantages to LGCM. First, they require multinormally distributed variables. However, recently, procedures have been introduced that allow computing LGCM with multivariately non-normal data. For example, within Mplus there is the robust maximum likelihood estimation (MLR, Muthen & Kaplan, 1985; Muthén & Muthén, 2014). Second, there is the SEM-inherent requirement for relatively large samples. However, it has been shown that basic LGMs perform well with small total numbers (Muthen & Muthen, 2002).

4.3.6 Sample size determination and justification

Sample size was determinated using a priori sample size calculations (Faul, Erdfelder, Lang, & Buchner, 2007).

The sample size was determined for a 5 (group) x 11 (time) mixed ANOVA, assuming a statistical power of .80, a = .05 and a medium effect size (f = .25). Based on this calculation, it was found that a minimum of 120 participants were required for this study to detect an effect of group on the outcome variables (first hypotheses).

The sample size for testing the moderation hypothesis was based on regression models that involved three predictors (group, individual differences variable, group X individual difference interaction term). To detect a medium effect size for the interaction term (f^2= .15) a minimum of 120 participants would be required.

Post data collection I decided to use a growth curve modeling approach (GCM) instead of repeated measures ANOVAs to analyze the physiological outcome variables. This was because the GCM approach has the advantage of taking temporal dynamics into account (see chapter 4.3.5 page 65 for a detailed description of the LGCM approach). The literature suggests that the sample size of the present study is a sufficient for GCM (Curran, Obeidat, & Losardo, 2010; Muthen & Muthen, 2002). Moreover, this study was comparably powered to previous published findings in the compassion and psychophysiological literature (e.g. Rockliff, Gilbert, McEwan, Lightman, & Glover, 2008; Rockliff et al., 2011).

4.4 Results

4.4.1 Sample Characteristics

Sample characteristics are depicted in Table 4.1. The average age of the sample was 19.34 years (*SD* = 2.06). The sample of this study can be described as relatively self-compassionate (*M* = 19.51 out of 30, *SD* = 4.46, range = 8.60 – 28.90) and as being relatively low in self-criticism ('inadequate self' subscale of the FSCRS: *M* = 12.97 out of 36, *SD* = 7.27, range = 0.00 – 33.00). In addition, participants reported relatively low attachment related avoidance (*M* = 1.78 out of 7, *SD* = .90, range = .33 - 4.38) and attachment related anxiety (*M* = 1.85 out of 7, *SD* = .79, range = .06 – 5.08). Moreover, this sample indicated to have perceived positive parenting characteristics with low scores of experienced abuse (*M* = .70 out of 15, *SD* = 1.28, range = .00 – 7.00), indifference (*M* = .88 out of 18, *SD* = 1.82, range = .00 – 9.5) and over-control (*M* = 2.50 out of 12, *SD* = 1.79, range = .00 - 8.5).

As can be seen in Table 4.1, there were no significant differences between the groups in age, attachment style (Relationship Structure Questionnaire), levels of self-compassion (Self Compassion Scale), levels of self-criticism (FSCRS), and childhood adversity (MOPS).

Table 4.1:

Means, Standard Deviations, and Significance Tests for the sample characteristics of the different experimental groups

Characteristic	Group: LKM	Body Scan	Rumination	Positive Condition	Neutral Condition	Test	*p*	η^2_p
n	27	27	27	27	27			
gender								
male/female: n	7/20	7/20	7/20	7/20	7/20			
Age in Years: *M(SD)*	18.81(1.36)	19.81(2.83)	19.60(2.30)	18.93 (1.41)	19.50 (1.88)	$F(4, 134) = 1.35$	0.254	0.04
Relationship Structure Questionnaire								
Total avoidance: *M(SD)*	1.68(0.87)	1.53(0.64)	1.90(0.99)	1.95(1.07)	1.93(0.91)	$F(4, 134) = 1.11$	0.353	0.03
Total anxiety*: M(SD)*	1.96(1.27)	1.86(0.72)	1.74(0.53)	1.89(0.73)	2.11(0.99)	$F(4, 134) = 0.63$	0.639	0.02
Self Compassion Scale								
Total sum: *M(SD)*	19.75(5.11)	20.16(4.84)	18.61(3.62)	19.83(4.23)	19.19(4.51)	$F(4, 134) = 0.58$	0.673	0.02
FSCRS								
Reassure Self: *M(SD)*	21.25(5.53)	21.70(5.11)	19.85(5.66)	20.96(5.94)	19.44(5.53)	$F(4, 134) = 0.79$	0.528	0.02
Inadequate Self: *M(SD)*	13.05(7.27)	11.70(6.86)	14.48(8.17)	12.41(6.63)	13.22(7.26)	$F(4, 134) = 0.56$	0.692	0.01
Hated Self : *M(SD)*	1.59(3.24)	1.26(1.74)	1.88(2.66)	1.22(1.50)	2.77(3.26)	$F(4, 134) = 1.63$	0.171	0.04
MOPS								
Indifference: *M(SD)*	0.92(2.18)	1.01(2.21)	0.65(1.63)	0.94(1.66)	0.81(1.46)	$F(4, 134) = 0.16$	0.957	0.02
Abuse: *M(SD)*	0.44(0.81)	0.65(0.99)	0.68(1.43)	0.98(1.53)	0.65(1.43)	$F(4, 134) = 0.61$	0.653	0.02
Over control: *M(SD)*	2.17(1.70)	2.87(1.75)	2.37(1.81)	2.50(1.77)	2.68(1.99)	$F(4, 134) = 0.61$	0.654	0.01

Note. Trait self-compassion has been assessed via the SCS (Neff, 2003). The possible range of this scale is 0 – 30, with higher scores indicating higher trail levels of self-compassion. Attachment related avoidance and anxiety have been measured via the RSQ (Johnson & Neyman, 1936; Potthoff, 1964). The possible range of the two subscales is 0 – 7, with higher scores indicating higher attachment related anxiety or avoidance. The Forms of Self-Criticising/Attacking & Self-Reassuring Scale (Fraley et al., 2006) was used to assess trait level of self-criticism. The scale measures two forms of self-criticalness; inadequate self (possible range 0 – 33), and hated self (possible range 0 – 20), and one form of self-reassure, reassure self (possible range 0 -32). Experienced childhood adversity (i.e. experienced indifference: range 0 -18; experienced abuse: range 0 – 15; experienced over-control: range 0 -12) was assessed via the Measure of Parental Style (MOPS; Parker et al., 1997).

4.4.2 Manipulation Checks

To confirm that the experimental inductions were effective in leading to the expected changes in mood, self-compassion, positive affiliative affect and self-criticism we carried out a number of manipulation checks.

Changes in state Self-Compassion. The scores for the state self-compassion ratings are depicted in Figure 4.2. The Group X Time ANOVA did not yield a main effect of Group, $F(4, 130) = 1.59$, $p > .05$, $\eta^2_p = .04$. However, in line with our hypothesis, there was a significant Group X Time interaction, $F(6.96, 226.29) = 9.83$, $p < .001$, $\eta^2_p = .23$. Simple contrasts revealed that there was a significant increase in self-compassion in the *body scan condition* with higher scores at after the body scan as compared to pre body scan, $F(1, 26) = 26.31$, $p < .001$, $\eta^2_p = .50$, 95% CI [6.65, 15.55]. Similar patterns could be found for the *positive condition,* $F(1, 26) = 14.01$, $p = .001$, $\eta^2_p = .52$, 95% CI [3.30, 11.34], and for the *loving kindness condition,* $F(1, 26) = 22.93$, $p < .001$, $\eta^2_p = .47$, 95% CI [5.38, 13.47]. In contrast, a significant decrease in self-compassion could be found in the *rumination condition* after the indication as compared to before, $F(1, 26) = 7.98$, $p = .009$, $\eta^2_p = .23$, 95% CI [-12.82, -2.02].There was no pre/ post difference in the *control condition,* $F(1, 26) = .27$, $p = .607$, $\eta^2_p = .01$, 95% CI [-4.39, 2.61].

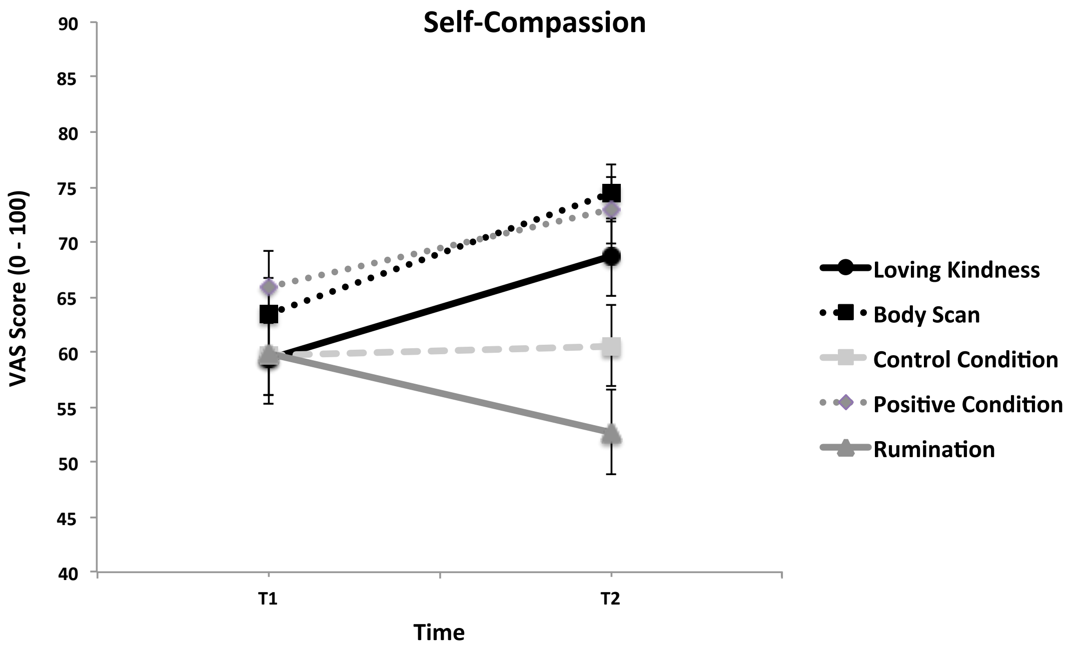

Figure 4.2 Graphs display group mean changes in self-reported state self-compassion ± 1 standard errors. *Note:* T1 = pre experimental manipulation; T2 post experimental manipulation. VAS Sample items included: "*Right now: I feel like not being kind and understanding towards myself (0) – I feel like being very kind and understanding towards myself (100)*".

Changes in self-criticism. Similar to the state self-compassion findings, the Group X Time ANOVA examine changes in state self-criticism did not yield a main effect of Group, $F(4,130) = 1.88$, $p > .05$, $\eta^2_p = .05$**.** Critically, and as hypothesised, there was a significant time by group interaction indicating, that the ratings for the different time points did differ between the groups, $F(7.75, 251.92) = 5.69$, $p < .001$, $\eta^2_p = .15$. The self-criticism ratings are depicted in Figure 4.2. Simple contrasts revealed that there was a significant decrease in self-critical ratings in the *Body scan group* with lower ratings after the body scan exercise as compared to before, $F(1, 26) = 8.55$, $p < .007$, $\eta^2_p = .25$, 95% CI [-17.34, -3.02]. A similar pattern was found in the *positive condition*, $F(1, 26) = 7.54$, $p = .011$, $\eta^2_p = .23$, 95% CI [-15.63, -2.24, and for the Loving kindness condition, $F(1, 26) = 7.00$, $p = .014$, $\eta^2_p = .21$, 95% CI [-7.69, -

0.97]. In contrast, there was a significant increase in self-critical ratings with higher ratings after the induction as compared to before in the *rumination condition*, $F(1, 26) = 22.73$, $p < .001$, $\eta^2_p = .47$, 95% CI [8.94, 22.49]. No pre/ post manipulation difference emerged for the control condition, $F(1, 26) = .03$, $p = .857$, $\eta^2_p > .00$, 95% CI [-4.96, 5.93].

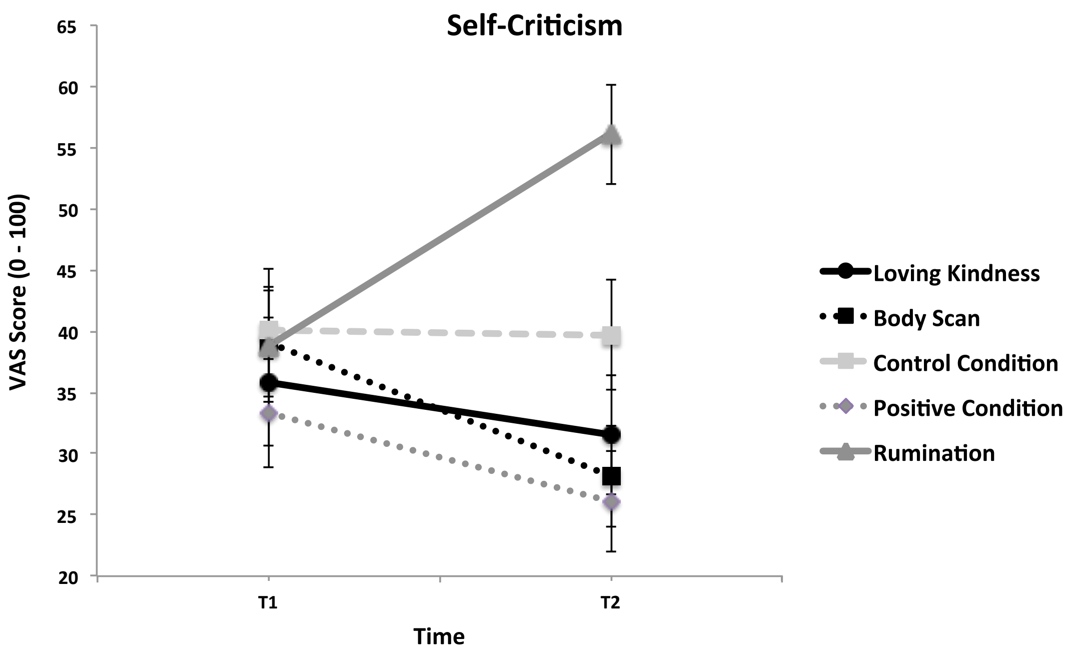

Figure 4.3 Graphs display group mean changes in self-reported state self-criticism ± 1 standard errors. *Note:* T1: pre experimental manipulation; T2: post experimental Manipulation. VAS sample included: "*Right now: I don't feel at all self-critical (0) – I feel very self-critical (100)*".

Changes in state positive affiliative affect. The scores for the positive affiliative affect ratings are depicted in Figure 4.4. The two-way ANOVA revealed no significant main effect of group, $F(4,130) = .25$, $p > .05$, $\eta^2_p = .01$. However, the Time X Group interaction yielded significance, $F(2, 260) = 17.40$, $p < .001$, $\eta^2_p = .35$. Simple contrasts revealed that there was a significant increase in positive affiliative affect in the *body scan condition* with higher scores at T2 as compared to T1, $F(1, 26)$

$= 13.11$, $p = .001$, $\eta^2_p = .33$, 95% CI [2.55, 9.25]. An increase in positive affect post manipulation could also be found for the *positive condition,* $F(1, 26) = 11.15$, $p = .003$, $\eta^2_p = .30$, 95% CI [2.11, 8.90], and for the *loving kindness condition,* $F(1, 26) = 35.43$, $p < .001$, $\eta^2_p = .58$, 95% CI [6.11, 12.55]. In the *rumination condition* there was a significant decrease in positive affiliative affect after the manipulation, $F(1, 26) = 39.10$, $p < .001$, $\eta^2_p = .60$, 95% CI [-18.75, -9.47], whereas no pre/ post manipulation difference emerged for the *control condition*, $F(1, 26) = .49$, $p = 486$, $\eta^2_p = .01$, 95% CI [-.33, 4.77].

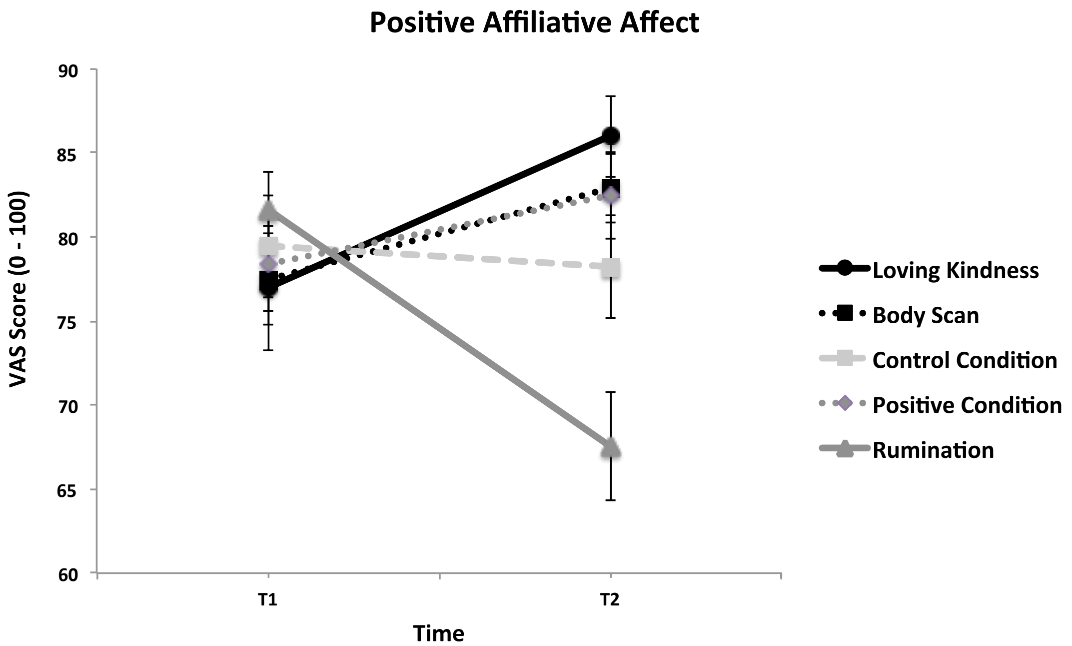

Figure 4.4 Graphs display group mean changes in self-reported state positive affiliative affect ± 1 standard errors. *Note:* T1 = pre experimental manipulation; T3 = post experimental manipulation. VAS sample included: *"right now: I don't feel loved and safe at all (0) – I feel very loved and safe (100).*

Summary of the manipulation check findings. The results of the manipulation checks indicate that the different conditions showed the expected effects. The manipulations designed to cultivate self-compassion (the Loving Kindness Meditation as direct method and the Body Scan as indirect method) increased levels of state self-compassion and positive affiliative affect and decreased state levels of self-criticism. Similar patterns could be found for the positive condition. The opposite patterns have been found for the rumination condition. Finally, the control condition did not affect participant's ratings.

4.4.3 Associations between individual differences and changes in self-compassion, positive affiliative affect and self-criticism during the two self-compassion manipulations

To determine if individual differences in trait self-compassion, trait self-criticism, anxious attachment style or experienced childhood adversity predict change in state self-compassion, positive affiliative affect and self-criticism, a series of simple moderation analyses were run (following suggestions and using the PROCESS procedure for SPSS provided by Hayes (2012)) with residualised gain score of the relevant dimension pre-post meditation as outcome/dependent variable and condition (LKM/ Body Scan vs. control condition) as predictor, and trait levels of self-compassion, self-criticism, anxious attachment style or experienced childhood adversity as moderator variable.

4.4.3.1 Loving kindness meditation.

Self-compassion change. The model including trait self-compassion as the moderator was significant in predicting state self-compassion change, $F(3, 50) = 5.31$, $p = .003$, $R^2 = .28$. The significant effect of condition, $b = .67$, $t(50) = 3.38$, $p = .001$, confirmed the manipulation check findings, indicating that the LKM was associated with higher relative increases in state self-compassion as compared to the control condition. Critically, the interaction yield significance, $b = .09$, $t(50) = 2.17$, $p = .034$. The Johnson-Neyman (J-N) technique revealed that the conditional effect of trait self-compassion on state self-compassion change transitioned in significance at a SCS sum-score of 22.51 out of 27.85 in this sample, $b = .41$, $SE = .20$, $t(50) = 2.01$ $p = .05$, 95% CI [.00, .81], with the relation between state self-compassion change and condition significant at SCS sum-scores below this threshold (66.67 % in this sample) and non-significant at SCS sum-scores above this threshold (33.33 %). This indicates that participants with lower levels of trait self-compassion, below a score of 21.51 out of 27.85 in this sample, showed a relative increase in state self-compassion after the loving kindness meditation. Moreover, the model including trait self-criticism as moderator was significant in predicting state self-compassion change, $F(3, 50) = 6.03$, $p = .001$, $R^2 = .25$. Condition remained as a significant predictor, $b = .69$, $t(50) = 3.43$, $p = .001$. In addition, the self-criticism moderator made a significant contribution, $b = .05$, $t(50) = 2.25$, $p = .029$. Based on the Johnson-Neyman (J-N) technique it was yielded that the conditional effect of trait self-criticism on state self-compassion change transitioned in significance at a FSCRS inadequate self sum-score of 8.42 out of how 13.03 in this sample, $b = .44$, $SE = .22$, $t(50) = 2.01$ $p = .05$, 95% CI [.00, .89], with the relation between state self-compassion change and condition significant at trait self-criticism scores above this threshold (70.37 % in this sample) and non-significant at SCS sum-scores below this threshold (29.63 %). This indicates that in particular participants with higher levels of trait self-criticism showed an relative increase in state self-compassion during the LKM. No other significant moderation effects were identified.

Self-criticism change. In contrast to the state self-compassion change findings, no model including condition and the different moderators reached significance in predicting state self-criticism change. This suggests that there was no difference in state self-criticism change between the LKM and the control condition. In addition, individual differences did not moderate the relationship between self-criticism change and condition.

Positive affiliative affect change. The model including trait self-compassion as the moderator was significant in predicting change in positive affiliative affect, $F(3, 50) = 9.00$, $p < .001$, $R^2 = .40$. Only condition ($b = .81$, $t(50) = 4.90$, $p < .001$) and the interaction ($b = .01$, $t(50) = 2.24$, $p = .027$) made a significant contribution. This indicates that the LKM was associated with higher relative increases in positive affiliative affect as compared to the control condition. To further characterise the nature of the moderation we used the Johnson-Neyman (J-N) technique. The conditional effect of trait self-compassion on positive affiliative affect change transitioned in significance at a SCS sum-score of 24.32 out of 27.85 in this sample, $b = .41$, $SE = .20$, $t(50) = 2.01$ $p = .05$, 95% CI [.00, .08], with the relation between positive affiliative affect change and condition significant at SCS sum-scores below this threshold (79.62 % in this sample) and non-significant at SCS sum-scores above this threshold (20.38 %). Similar to the self-compassion change findings, this indicates that in particular participants with lower levels of self-compassion, below a score of 24.32, showed a relative increase in positive affiliative affect after the LKM. No other significant moderation effects were identified.

4.4.3.2 Body Scan.

Self-compassion change. Similar to the LKM findings, the model including trait self-compassion as the moderator was significant in predicting state self-compassion change, $F(3, 50) = 10.11$, $p < .001$, $R^2 = .44$. The model revealed a significant effect of condition, $b = .67$, $t(50) = 3.38$, $p < .001$, confirming the manipulation check findings, whereby the body scan was associated with higher relative increases in state self-compassion as compared to the control condition. Critically, the interaction yield significance, $b = .15$, $t(50) = 3.58$, $p < .001$. The Johnson-Neyman (J-N) technique revealed that the conditional effect of trait self-compassion on state self-compassion change transitioned in significance at a SCS sum-score of 22.89 out of 28.90 in this sample, $b = .42$, $SE = .21$, $t(50) = 2.01$ $p = .05$, 95% CI [.00, .85], with the relation between state self-compassion change and condition significant at SCS sum-scores below this threshold (70.37 % in this sample) and non-significant at SCS sum-scores above this threshold (29.63 %). Moreover, the model including the trait self-criticism moderator was significant in predicting state self-compassion change, $F(3, 50) = 12.02$, $p < .001$, $R^2 = .39$. Again, condition, $b = .92$, $t(50) = 4.66$, $p < .001$, and the interaction, $b = .08$, $t(50) = 3.85$, $p < .001$, made a significant contribution. Based on the Johnson-Neyman (J-N) technique it was yielded that the conditional effect of trait self-criticism on state self-compassion change transitioned in significance at a FSCRS inadequate self sum-score of 6.96 out of 11.70, $b = .45$, $SE = .23$, $t(50) = 2.01$ $p = .05$, 95% CI [.00, .91], with the relation between state self-compassion change and condition significant at trait self-criticism scores above this threshold (75.92 % in our sample) and non-significant at SCS sum-scores below this threshold (24.08 %). This indicates that in particular participants with low levels of self-compassion and higher levels of trait self-criticism showed a relative increase in state self-compassion after the compassionate body scan. No other significant moderation effects were identified.

Self-criticism change. In contrast to the state self-compassion change finds, no individual differences had a significant effect on the relationship between state self-criticism change and condition (control condition vs. body scan), all $p > .05$. Only condition, $b = -.58$, $t(50) = 2.49$, $p = .016$, made a significant contribution within the model predicting change in state self-criticism change, $F(3, 50) = 3.04$, $p = .037$, $R^2 = .15$, indicating that the body scan was associated with higher relative decreases in self-criticism as compared to the control condition.

Positive affiliative affect change. The model including trait self-compassion as the moderator was significant in predicting change in positive affiliative affect, $F(3, 50) = 3.44$, $p = .024$, $R^2 = .23$. Only condition, $b = .49$, $t(50) = 2.61$, $p = .012$, made a significant contribution. This confirmed the findings from the manipulation checks, whereby the body scan was associated with higher relative increases in positive affiliative affect as compared to the control condition. No individual differences had a significant effect on the relationship between state positive affiliative affect change and condition, all $p > .05$.

Summary of the moderation findings. The results of the moderation analyses confirmed the findings from the manipulation checks; whereby the self-compassion manipulations (LKM and Body scan) led to a higher relative increase in state positive affect, state self-compassion, and a greater relative decrease in state self-criticism. Critically, the results indicate that trait levels of self-criticism and self-compassion facilitate these changes in state self-compassion and positive affiliative affect. In particular, participants low in self-compassion and high in self-criticism seem to benefit most from the self-compassion manipulations.

4.4.4 Effects of the self-compassion and control manipulations on brain and body responses

4.4.4.1 Heart rate effects.

Did the self-compassion and control manipulations trigger different heart rate trajectories?

Figure 4.5 shows the pattern of change in heart rate for the different experimental conditions. The outcome variables were multivariate normally distributed. The model with continuous latent variables of slope, quadratic growth and intercept of heart rate change at 11 time points as outcome and the five experimental conditions as independent variables revealed a good fit with $\chi^2(89) = 164.66$, $p < .001$; CFI = .968; TLI = .965; SRMR = .03; RMSEA = .08, 90% CI [0.06, 0.09]; AIC = 6648.53; aBIC = 6639.80. It indicated that the Body Scan (b = -3.66, SE = .99, $p < .001$), Rumination (b = 2.32, SE = 1.00, p = .020), and Loving Kindness Meditation (b = -4.54, SE = .99, $p < .001$) were significantly influencing the intercept. This suggests that these groups differed in their starting values in heart rate change (i.e., in the first minute of the audio exercise) whereby individuals in the body scan and LKM condition had a significantly lower heart rate as compared to the rumination condition. The positive excitement condition had a significant effect on the slope (b = 0.835, SE = .33, p = .012), suggesting heart rate significantly increased in this condition over time.

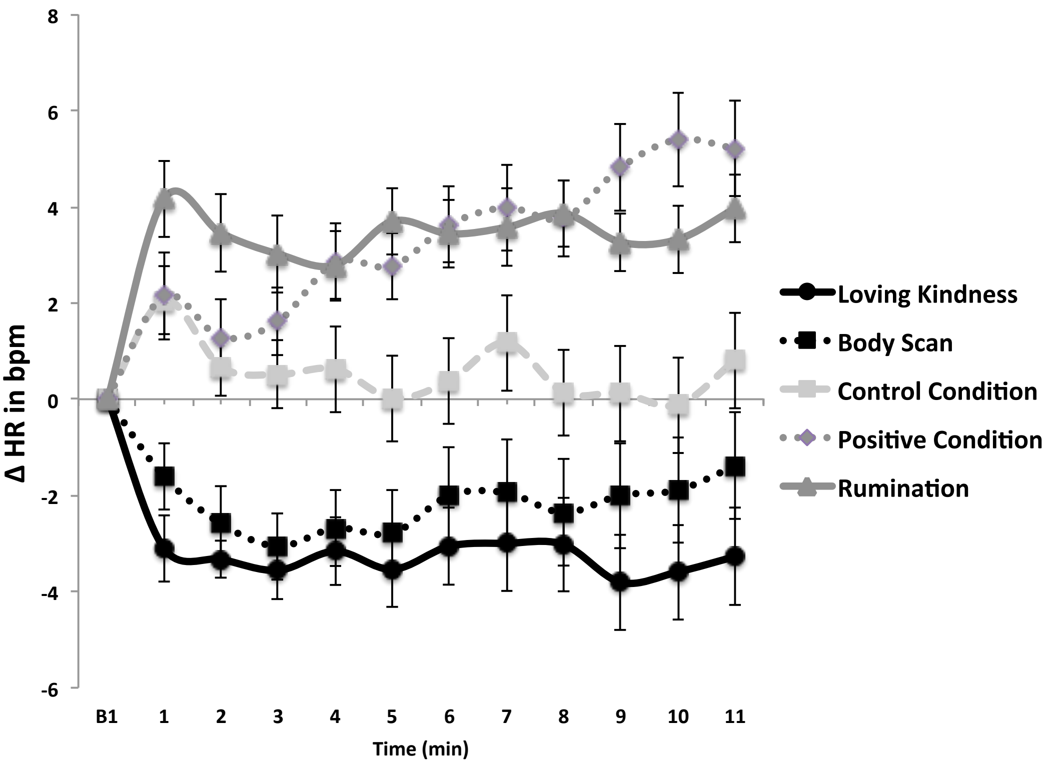

Figure 4.5 Baseline-to-exercise change in heart rate for the different experimental conditions ± 1 standard errors.

Did individual differences in trait self-compassion have an effect on the correlation between the self-compassion manipulations and heart rate change?

In order to check for moderation effects of trait levels of self-compassion we added the self-compassion X experimental condition interaction predictors to the GCM model. The model remained good with χ^2 (129) = 206.20, p < .001, CFI = .968; TLI =

.961; SRMR = .02; RMSEA = .06, 90% CI [0.049, 0.084]; AIC = 6651.40; aBIC = 6638.58. However, the Chi Square difference test indicated that this model was not significantly superior to the model which only included the different experimental groups, χ^2 (40) = 41.51, *p* = .20. Borderline significance was detected for the trait self-compassion moderator on the slope (*b* = .45, SE = .23, *p* = .05). Moreover, the model revealed that the self-compassion moderator interacted with LKM. Specifically, it had a significant effect on the association between LKM and HR slope (linear b = -0.48, SE = 0.15, *p* = .001 and quadratic growth b = 0.33, SE = 0.17, *p* = .045). These findings suggest that more self-compassionate individuals showed different patterns in terms of the curve of trajectory in their heart rate change throughout the LKM. Specifically the significant linear effect suggests that more self-compassionate individuals demonstrated a steeper decrease in heart rate throughout the LKM. The significant quadratic effect indicates that these individuals also showed a bigger downturn in heart rate over time beyond what was predicted by the liner factor.

Did individual differences in trait self-criticism have an effect on the correlation between the self-compassion manipulations and heart rate change?

The self-criticism x experimental condition interaction predictors were added to the GCM model to check for moderation effects of trait levels of self-criticism on heart rate change. This model remained a good fit with χ^2 (129) = 194.63, p < .001, CFI = .972; TLI = .967; SRMR = .02; RMSEA = .06, 90% CI [0.043, 0.079]; AIC = 6641.64; aBIC = 6628.82. However, the Chi Square difference test indicated that this model was not significantly superior to the group model, χ^2 (40) = 30.63, *p* = .43. Self-criticism had a significant effect on the linear slope (b = -0.09, SE = 0.03, *p* =

.005) and the quadratic growth (b = 0.01, SE < 0.01, p = 0.027). This suggests that self-criticism influenced the heart rate change throughout the experimental task regardless of the condition. Moreover, the trait self-criticism moderator interacted with the LKM. Specifically, it had a significant effect on the association between the linear slope and quadratic growth and the LKM (linear slope: b = 0.17, SE = 0.04, *p* < .001; quadratic growth: b = -0.01, SE < .01, *p* = .005). These findings suggest that more self-critical individuals showed different patterns in terms of the curve of trajectory in their heart rate change throughout the LKM. Specifically the significant linear effect suggests that more self-critical individuals demonstrated a steeper increase in heart rate throughout the LKM. The significant quadratic effect indicates that these individuals also showed a bigger upturn in heart rate over time beyond what was predicted by the liner factor.

Did individual differences in the anxious attachment style have an effect on the correlation between the self-compassion manipulations and heart rate change?

To check for moderation effects of anxious attachment style the attachment style x experimental condition interaction predictors were added to the GCM model. The model remained a good fit with $\chi^2(129) = 210.18$, p < .001, CFI = .966; TLI = .959; SRMR = .02; RMSEA = .06, 90% CI [0.051, 0.085]; AIC = 6652.68; aBIC = 6639.86. The Chi Square difference test indicated that this model was not significantly superior to the group model, $\chi^2(40) = 40.18$, *p* = .11. The attachment style moderator interacted with the LKM. Specifically, it had a significant effect on the association between the LKM and HR slope (b = 0.78, SE = 0.35, *p* = .029). This suggests that people with a more anxious attachment style showed an increase in heart rate throughout the LKM condition.

Did individual differences in experienced childhood adversity have an effect on the correlation between the self-compassion manipulations and heart rate change?

The experienced childhood adversity x experimental condition interaction predictor was added to the GCM model to check for moderation effects of experienced childhood adversity. The model remained a good fit with χ^2 (129) = 218.95, p < .001, CFI = .962; TLI = .955; SRMR = .02; RMSEA = .07, 90% CI [0.056, 0.089]; AIC = 6658.43; aBIC = 6645.61. However, the Chi Square difference test indicated that this model was not significantly superior to the group model (χ^2 (40) = 54.95, *p* = .06). The model results revealed that experienced childhood adversity moderator did not interact with any of the experimental conditions.

4.4.4.2 Heart Rate Variability Effects.

Did the self-compassion and control manipulations trigger different heart rate variability trajectories?

Figure 4.6 depicts the pattern of change in heart rate variability for the different experimental conditions. As the outcome variables were not multivariate normally distributed, we used the maximum likelihood estimation with robust standard errors (MLR). The model with continuous latent variables of intercept, slope, and quadratic growth of heart rate variability change at 11 time points as outcome and the five experimental conditions as independent variables revealed a good fit with χ^2 (89) = 176.83, p < .001, CFI = .943; TLI = .936; SRMR = .03; RMSEA = .08, 90% CI [0.068, 0.105]; AIC = 2145.70; aBIC = 2136.50. The model indicated that the Body Scan (*b* = 0.40, SE = .17, *p* = .022), Rumination (*b* = -0.39, SE = 0.10, *p* = .035), and

Loving Kindness Meditation (b = 0.91, SE = 0.18, $p < .001$) were significantly influencing the intercept. This suggests that these groups differed in their starting values in the first minute of the exercise in heart rate variability change whereby individuals in the body scan and LKM condition had significantly higher heart rate variability as compared to the rumination condition. In addition, the body scan condition had a significant effect on the linear slope and quadratic growth (linear slope: b = 0.14, SE = .05, p = .022; quadratic growth: b = - 0.01, SE < 0.01, p = .013). These results suggest the individuals assigned to the body scan demonstrated different pattern in terms of the curve of trajectory in their heart rate variability. In particular, the significant linear effect suggests that this group showed a steeper increase in heart rate variability. The significant quadratic effect suggest that these individuals also demonstrated a bigger upturn in heart rate variability over time beyond what was predicted by the linear factor.

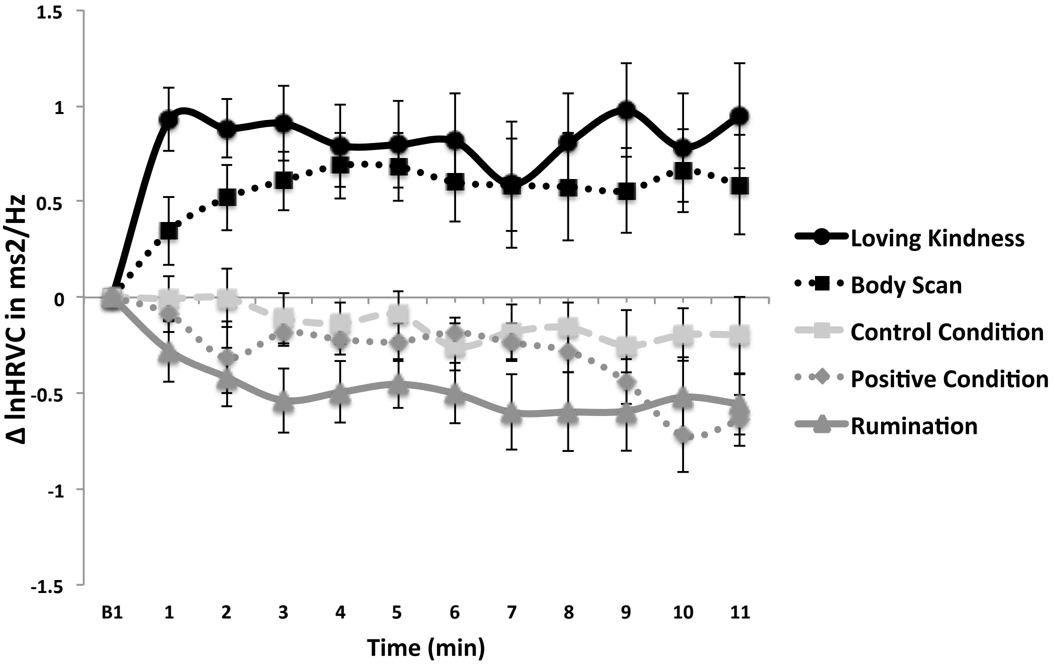

Figure 4.6 Baseline-to-exercise change in heart rate variability for the different experimental conditions ± 1 standard errors.

Did individual differences in trait self-compassion have an effect on the correlation between self-compassion manipulations the heart rate variability?

In order to check for moderation effects of trait levels of self-compassion I added the self-compassion x experimental condition interaction predictors to the GCM model. This model did not reveal convergence. Following our main research questions regarding the moderation effects for the two different meditation groups we only added the self-compassion x Body Scan condition and the self-compassion x LKM condition interaction predictors to the GCM model. This model remained a good fit with χ^2 (97) = 202.66, p < .001, CFI = .935; TLI = .926; SRMR = .03; RMSEA = .09, 90% CI [0.073, 0.109]; AIC = -2133.06; aBIC = 2122.99. The Satorra-Bentler Scaled Chi-Square Test indicated that this model was significantly superior to the group model, χ^2 (8) = 31.77, p < .001. The model revealed that the self-compassion moderator interacted with the LKM. Specifically, it had a significant effect on the association between LKM and the intercept, b = 0.06, SE = 0.03, p = .020, indicating that higher levels of self-compassion were associated with higher starting values in the first minute of the exercise in heart rate variability change in the LKM condition. In addition, the self-compassion moderator had a significant effect on the association between the LKM and slope, b = 0.02, SE < 0.01, p = .043, suggesting that higher levels of self-compassion where accompanied by a steeper increase in heart rate variability in the LKM condition.

Did individual differences in trait self-criticism have an effect on the correlation between the self-compassion manipulations and the heart rate variability?

The model including the self-criticism x experimental condition interaction predictors remained a good fit with χ^2 (129) = 221.85, p < .001, CFI = .947; TLI = .937; SRMR = .02; RMSEA = .07, 90% CI [0.057, 0.090]; AIC = 2134.56; aBIC = 212.04. However, the Satorra-Bentler Scaled Chi-Square Test indicated that this model was not significantly superior to the group model, χ^2 (40) = 41.67, p = .145. The model revealed that the self-criticism moderator interacted with the LKM. Specifically, it had a significant effect on the association between LKM and the intercept (b = - 0.06, SE = 0.02, p = .002) indicating that higher levels of self-criticism where associated with lower starting values in heart rate variability change in the LKM condition.

Did individual differences in the anxious attachment style have an effect on the correlation between the self-compassion manipulations and the heart rate variability?

The attachment style x experimental condition interaction predictor was added to the GCM model to check for moderation effects of anxious attachment style. The model remained a good fit with χ^2 (129) = 232.05, p < .001, CFI = .941; TLI = .929; SRMR = .02; RMSEA = .07, 90% CI [0.062, 0.094]; AIC = 2131.83; aBIC = 2122.31. However, the Satorra-Bentler Scaled Chi-Square Test indicated that this model was not significantly superior to the group model, χ^2 (40) = 52.98, *p* = .082). The anxious attachment moderator interacted with the LKM. In particular, it had a significant effect on the association between the slope and quadratic growth and the LKM (s: b = - 0.255, SE = 0.06, *p* < .001; q: b = -0.02, SE < .01, *p* = .005). This suggests, that more anxious attached individuals in the LKM demonstrated different pattern in terms of the curve of trajectory in their heart rate variability. Specifically, the significant linear effect suggests that more anxious attached individuals showed an increase in heart rate variability throughout the LKM. The significant quadratic effect suggest that these individuals additionally demonstrated a bigger upturn in heart rate variability over time beyond what was predicted by the linear factor.

Did individual differences in experienced childhood adversity have an effect on the correlation between the self-compassion manipulations and the heart rate variability?

In order to check for moderation effects of experienced childhood adversity we added the childhood adversity x experimental condition interaction predictors to the GCM model. The model remained an excellent fit with χ^2 (129) = 239.99, p < .001, CFI = .938; TLI = .926; SRMR = .02; RMSEA = .08, 90% CI [0.065, 0.097]; AIC = 2154.17; aBIC = 2140.65. The Satorra-Bentler Scaled Chi-Square Test indicated that this model was significantly superior to the group model, χ^2 (40) = 59.87, *p* = .023. The model revealed that the experienced childhood adversity moderator did not affect the patterns of change in heart rate variability and that the experienced childhood adversity moderator did not interact with any of the experimental conditions.

4.4.4.3 ***Skin Conductance Level Effects***.

Did the self-compassion and control manipulations trigger different skin conductance level trajectories?

The skin conductance level results are depicted in **Figure 4.7**. As the outcome variables were not multivariate normally distributed we used the maximum likelihood estimation with robust standard errors (MLR). The model with continuous latent variables of intercept and linear slope of skin conductance change at 11 time points as outcome and the five experimental conditions as independent variables revealed a poor fit with χ^2 (97) = 817.66, p < .001, CFI = .672; TLI = .665; SRMR = .16; RMSEA = .23, 90% CI [0.220, 0.250]; AIC = -2415.09; aBIC = -2421.28. It indicated that only the LKM (b = - 0.24, SE = 0.09, p = .013) and the rumination condition (b= 0.30, SE = 0.09, p = .002) had a significant effect on the intercept but no other significant effects. This finding suggests that these two groups had different starting values in the first minute of the exercise in skin conductance change whereby the rumination condition significantly induced higher skin conductance levels and the LKM significantly lower skin conductance levels as compared to the baseline. Moreover, the LKM had a significant effect on the slope (b = 0.23, SE = 0.09, p = .013) indicating that skin conductance level decreased more steeply in this experimental condition.

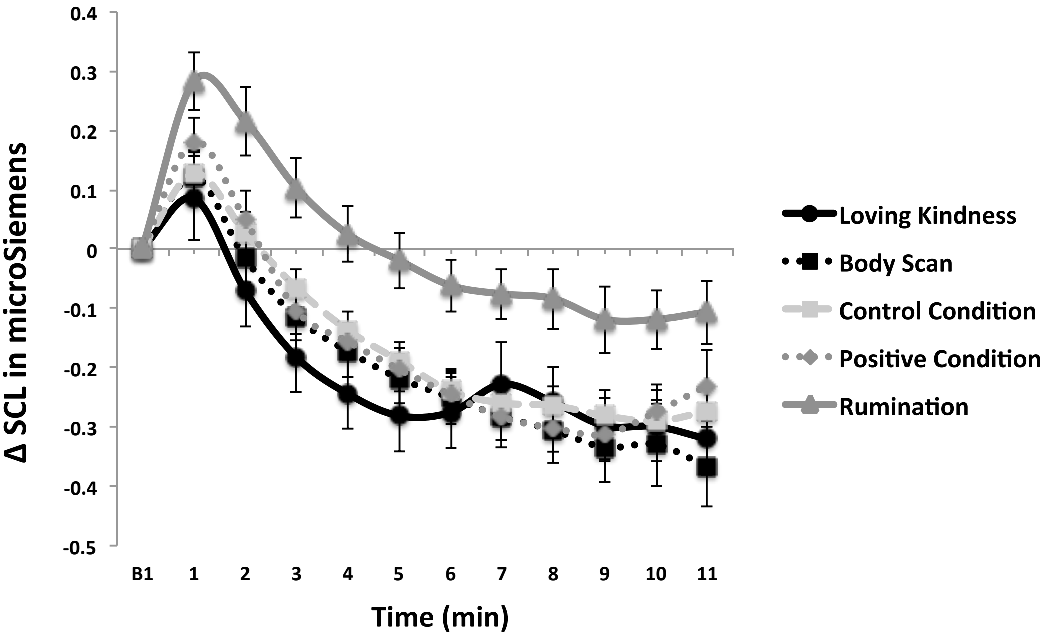

Figure 4.7 Baseline-to-exercise change in skin conductance level for the different experimental conditions ± 1 standard errors.

Did individual differences in trait self-compassion have an effect on the correlation between the self-compassion manipulations and skin conductance change?

The model including the self-compassion x experimental condition interaction predictor remained a poor fit with χ^2 (142) = 946.73, p < .001, CFI = .681; TLI = .654; SRMR = .12; RMSEA = .20, 90% CI [0.193, 0.217]; AIC = -2401.19; aBIC = -2409.97. The Satorra-Bentler Scaled Chi-Square Test indicated that this model was significantly superior to the group only model, χ^2 (45) = 63.49, p = .036. The model revealed that trait self-compassion as a moderator did not affect the patterns of change in skin conductance level and that the trait self- compassion moderator did not interact with any of the experimental conditions.

Did individual differences in trait self-criticism have an effect on the correlation between the self-compassion manipulations and skin conductance change?

In order to check for moderation effects of self-criticism we added the self-criticism x experimental condition interaction predictors to the GCM model. The model remained a poor fit with χ^2 (142) = 944.67, p < .001, CFI = .679; TLI = .652; SRMR = .12; RMSEA = .20, 90% CI [0.192, 0.217]; AIC = -2406.72; aBIC = -2415.50. The Satorra-Bentler Scaled Chi-Square Test indicated that this model was significantly superior to the group model, χ^2 (45) = 69.39, *p* = .011. The model revealed that self-criticism moderator did not affect the patterns of change in skin conductance level and that the self-criticism moderator did not interact with any of the experimental conditions.

Did individual differences in the anxious attachment style have an effect on the correlation between the self-compassion and control manipulations and skin conductance change?

The anxious attachment style x experimental condition interaction predictor was added to the GCM model to check for moderation effects of attachment style. The model remained a poor fit with χ^2 (142) = 959.11, p < .001, CFI = .683; TLI = .656; SRMR = .12; RMSEA = .20, 90% CI [0.194, 0.219]; AIC = -2407.64; aBIC = -2416.41. The Satorra-Bentler Scaled Chi-Square Test indicated that this model was significantly superior to the group model, χ^2 (45) = 69.81, *p* = .010). However, the attachment style moderator did not interact with any other experimental condition.

Did individual differences in experienced childhood adversity have an effect on the correlation between the self-compassion manipulations and skin conductance change?

In order to check for moderation effects of experienced childhood adversity we added the childhood adversity x experimental condition interaction predictors to the GCM model. The model remained a moderate fit with χ^2 (142) = 1009.38, p < .001, CFI = .679; TLI = .652; SRMR = .12; RMSEA = .21, 90% CI [0.200, 0.225]; AIC = -2401.51; aBIC = -2410.29. The Satorra-Bentler Scaled Chi-Square Test indicated that this model was significantly superior to the group model, χ^2 (45) = 94.54, p = < .001. The model revealed that the experienced childhood adversity moderator did not affect the patterns of change in skin conductance level and that the experienced childhood adversity moderator did not interact with any of the experimental conditions.

4.4.4.4 Summary of the model results.

In order to provide an overview of the model results, a summary of the main group effects on the physiological response trajectories is provided in Table 4.2. The results indicate that the LKM influenced all physiological response trajectories. Specifically, the LKM was associated with higher HRV, lower/ decreases in skin conductance levels, and decreases in heart rate accompanied specifically the LKM. Similarly, the rumination condition influenced all physiological response trajectories. In contrast to the LKM, the rumination condition was associated with lower HRV, higher skin conductance levels, and higher heart rate. Further, the results indicate that the body scan was associated with lower heart rate and higher/ increases in HRV. The positive excitement condition was associated with increases in heart rate throughout the experimental induction. The control condition did not influence the physiological response trajectories.

Table 4.2:

Summary of the effect of the experimental conditions on the physiological response trajectories.

	LKM			Bodyscan			Rumination			Positive Condition			Control		
	i	s	q	i	s	q	i	s	q	i	s	q	i	s	q
HR -Change	x			x			x				x				
HRV-Change	x			x	x	x	x								
SCL-Change	x	x					x								

Note: i = intercept; s = linear slope; q = quadratic growth; x = significant effect; to test if the control condition had any significant effects on the outcome variables, additional models have been run with the control condition as active condition. The results of these models revealed that the control condition did not influence the outcome variables, all $p > .05$; LKM = Loving Kindness Meditation

A summary of all the moderation effects is provided in Table 4.3. As can be seen in this table individual differences in particular had an effect on the correlation between the LKM and the outcome variables HR and HRV but not SCL.

Table 4.3:

Summary of the moderator effects for psychophysiological response trajectories.

	LKM			Bodyscan		
	i	**s**	**q**	**i**	**s**	**q**
HR -Change						
trait self-compassion x condition		x	x			
trait self-criticism x condition		x	x			
attachment style x condition		x				
cheildhood adversity x condition						
HRV-Change						
trait self-compassion x condition	x	x				
trait self-criticism x condition	x					
attachment style x condition		x	x			
cheildhood adversity x condition						
SCL-Change						
trait self-compassion x condition						
trait self-criticism x condition						
attachment style x condition						
cheildhood adversity x condition						

Note: i = intercept; s = linear slope; q = quadratic growth; x = significant effect; LKM = Loving Kindness Meditation

4.5 Discussion

This study used two experimental inductions designed to cultivate self-compassion, i.e., a loving-kindness meditation and a compassionate body scan, as well as control conditions thought to stimulate either the threat or the positive excitement affect systems, to investigate their effects on self-reported state self-compassion, self-criticism, positive affiliative affect, and related physiological responses. Specifically, this study tested the hypothesis that the cultivation of self-compassion is associated with increased positive affiliative affect and stimulates the soothing and contentment system, a system characterised by increased parasympathetic and decreased sympathetic activation. Moreover, this study aimed to explore whether individual differences moderate the hypothesised effects. Overall, the study found support for both hypotheses which is discussed in detail in the next section.

Effects of the experimental manipulations on self-report measures and physiology

The results of this study indicate that both the LKM and the Body Scan increased self-reported levels of state self-compassion and positive affiliative affect and decreased state levels of self-criticism. This was accompanied by a physiological response pattern of increased parasympathetic activity indicated by higher HRV, and decreased sympathetic activity indicated by lower skin conductance levels and decreases in heart rate. The rumination condition effectively stimulated the threat system. Specifically, this condition was associated with decreased self-reported levels of state self-compassion and positive affiliative affect as well as increases in state self-criticism. This was accompanied by a reduction in parasympathetic activation, indicated by decreased HRV. In addition, results indicate that this condition was associated with increased arousal indexed by increases in heart rate and delayed reductions in skin conduction level (inferring increased sympathetic activation). The induction designed to stimulate positive excitement affect - similar to the self-compassion inductions - was associated with increased self-reported levels of state self-compassion and positive affiliative affect and decreased state levels of self-criticism. Critically however, at the physiological level this condition was accompanied by a different response pattern, namely, it was not associated with increased parasympathetic activation but on the contrary there was evidence for increased arousal, indicated by gradual increases in heart rate over time. This is in line with research that positions this type of positive affect in the context of stimulation and excitement (Depue & Morrone-Strupinsky, 2005; Gilbert, 2009, 2014). Finally, the neutral control condition (supermarket scenario) did not significantly affect the self-report and physiological measures.

Taken together, the results indicate that in a healthy sample a short term cultivation of self-compassion has distinct effects on psychophysiological response patterns consistent with positive excitement affect and threat focused affect. The results of this study suggest that the cultivation of self-compassion both in a more direct (LKM) or more indirect way (BS) may enhance wellbeing because it is associated with the stimulation of the soothing and contentment affect system, a system characterised by self-soothing behaviour, a healthy tolerance for distress, and a motivation to care for oneself and others (Gilbert, 2009; Gillath et al., 2005). Supporting this argument, both self-compassion inductions enhanced parasympathetic activity as indicated by increased HRV. Higher HRV has been linked to flexible attention deployment, adaptive emotion regulation to threat contexts, and higher physical and psychological health (Appelhans & Luecken, 2006; Thayer & Lane, 2000; Thayer & Lane, 2007). Moreover, higher HRV has been suggested to be conducive to interpersonal approach, social affiliation and the ability to self-soothe when stressed (Depue & Morrone-Strupinsky, 2005; Porges, 2007). Furthermore, in line with Depue and Morrone-Strupinsky (2005) and Gilbert (2014), who argue that the stimulation of the soothing and contentment system is associated with down-regulation of the threat and positive excitement system, the self-compassion inductions in this study were associated with reduced sympathetic activation.

The results of this study are in line with previous research on physiological correlates associated with compassion inductions, which suggested that cultivation of compassion is associated with increased parasympathetic activity (Rockliff et al., 2008), decreased sympathetic arousal (Tang et al., 2009), reduced cortisol levels (Rockliff et al., 2008), and improved immune functioning (Breines et al., 2014).

The similarity in results revealed in the current study suggests that like compassion, self-compassion activates the soothing and contentment system and its physiological underpinnings. This demonstrates the link between the two constructs. To my knowledge, this study provides the first evidence to demonstrate this. This suggestion fits with Gilbert (2009), who positions compassion for the self and others in the context of the soothing and contentment system. Interestingly, Gilbert (2009) argues that individual differences in self-criticism, attachment experiences, and experienced neglect and abuse during childhood influence the ability to activate the soothing and contentment system. Thus, this study explored if individual differences impact the psychophysiological responses to the different self-compassion manipulations.

Role of individual differences in responses to the self-compassion manipulations

This study revealed that trait levels of self-criticism and self-compassion influence changes in self-reported state self-compassion after both the body scan and the LKM. In particular, participants low in self-compassion and high in self-criticism benefitted most from the self-compassion manipulations. In addition, trait levels of self-criticism and self-compassion facilitate these changes in state positive affiliative affect after the LKM. These results are in contrast to the hypothesis that individuals low in self-compassion and high in self-criticism might have difficulties cultivating self-compassion. One explanation might be that in general this sample had relatively high levels of self-compassion and low levels of self-criticism. For that reason, a ceiling effect might explain why participants with very high levels of self-compassion and very low levels of self-criticism did not show improvement on these outcome measures in responses to the self-compassion inductions.

Interestingly, this study revealed important individual differences in the physiological responses to the two different self-compassion inductions. People with lower levels of self-compassion, higher levels of self-criticism and attachment related anxiety did not show significant increases in HRV and decreases in heart rate during the LKM, while these individual differences did not influence the association between HRV increases and decreases in heart rate in the body scan condition. These results suggested that participants in the direct self-compassion manipulation (LKM) who are more self-critical, less self-compassionate, and have higher attachment related anxiety might have difficulties benefiting from this intervention and to activate the soothing and contentment system. This is in line with clinical observation, that for some people (particular self-critics and those with attachment difficulties or difficult relationships with care-givers) focusing on compassion for the self at first might be unfamiliar and feel unsafe (Gilbert et al., 2006; Gilbert & Irons, 2004; Gilbert & Procter, 2006). The data from this study suggests that for these people a more indirect approach to cultivate self-compassion like the body scan might be an easier way to stimulate the soothing and contentment system and self-compassionate feelings. This might be because this induction focuses less on the self, whereby self-compassion is more indirectly interwoven to the induction via instructions like “Whenever you notice that the mind has wandered off, bring it back with gentleness and kindness”. In contrast to the HRV and heart rate effect, no moderation effects of individual differences on the association between the self-compassion manipulations and skin conductance change have been found. This was in contrast to the hypothesis of this study. One reason for this might be that the growth curve model did not fit the skin conductance data very well. Thus, the data have to be interpreted with caution. In addition, reductions in skin conductance are an indicator of sympathetic activity and defence response (Sokolov, 1963). Given that the sample of this study was relatively self-compassionate, low in levels of self-criticism, securely attached and did not experience high levels of childhood adversity, the self-compassion inductions were unlikely to stimulate a threat-like response. Similar, these sample characteristics might explain the unexpected absence of any moderation effect of experienced childhood adversity on the association between the outcome variables and self-compassion manipulations. That is to say that the sample had a particularly narrow range and lower number of experienced childhood adversity compared to clinical samples.

Limitations

This study has several limitations. For instance, the age range of participants was very narrow. In addition, in general the sample was very homogenous is term of the levels of trait self-compassion, self-criticism, attachment style, and experienced childhood adversity. Future studies should be conducted to investigate if the findings extend across more diverse samples to make them comparable with clinical studies. Another limitation is the lack of respiratory data, as it has been demonstrated that breathing might affect cardiac vagal tone (Ritz & Dahme, 2006). Hence, HRV changes could be attributable to changes in breathing rate or depth. However, physical demands were kept constant throughout the study. In addition, care was taken that none of the experimental manipulations focused on the breath, making the influence of breathing on the HRV results unlikely. Moreover, there is evidence that respiration can be neglected when investigating the association between HRV and inhibition (Park, Vasey, Van Bavel, & Thayer, 2013; Ruiz-Padial, Sollers, Vila, & Thayer, 2003). Finally, the sample size in this study was based on a-priori power calculation and the recruitment target was met. Overall, a sample size of 135 is considered to be a good sample size for growth curve modelling (Curran, Obeidat, & Losardo, 2010). However, given that this study had five experimental conditions, non significant moderation effects may be due to the fact that this study has not been powered enough to detect small effect sizes with these the moderations (Muthen & Curran, 1997).

Conclusions

To my knowledge, this is the first study that applied a triangulation of self-report measures and physiological measures to investigate short-term effects of direct and indirect self-compassion inductions. The results indicate that one possible protective effect of self-compassion lies in the activation of the soothing and contentment affect system which is characterised by a content and calm state of mind with a disposition for kindness, care, social connectedness and the ability to self-soothe when stressed. Further explorations of these findings suggested that responses to the self-compassion induction were moderated by participants' tendencies to self-criticise, trait levels of self-compassion and attachment related anxiety. Individuals high in self-criticism, low in self-compassion and with an anxious attachment style tended to respond to the compassionate body scan (i.e., a more indirect approach to cultivate self-compassion) with higher activation of the soothing and contentment system but not the LKM (i.e., a more direct approach to cultivate self-compassion).

5 Study II: Does self-compassion meditation enhance positive self-referential processing?

5.1 Abstract

The cultivation of self-compassion is increasingly recognised as being beneficial in improving mental health, positive emotions and wellbeing. It is less well understood if the facilitation of self-compassion also reduces negative self-referential processing as is often reported in individuals with depression. To investigate the effect of self-compassion inductions on self-referential processing we studied the effects of two meditation exercises (Loving Kindness Meditation; Compassionate Body Scan) as compared to a rumination, control and positive excitement condition on behavioural and neural responses to a self-referential task (Markus, 1977) in 135 participants. P100, P200 and the late positive potentials (LPP) of the event-related brain potentials (ERP) to positive and negative personality adjectives were recorded before and after the audio exercises. Both self-compassion inductions and the positive excitement condition increased self-reported state self-compassion and decreased self-criticism whereas the rumination condition triggered the opposite pattern. These changes were accompanied by the expected enhanced tendency to prefer positively valenced information about the self and a corresponding adaptive alteration of LPP components. The results indicate that one possible protective effect of self-compassion lies in the activation of the positive affiliative affect system that enhances a more positive self-perception.

Keywords: self-referential processing, self-compassion, ERP, individual differences

5.2 Introduction

Cognitions of the self are learned from past experience and are defined by Markus (1977) as cognitive generalisations that organise and guide the processing of self-related information. Self-referential processing (SRP) refers to evaluations made concerning whether a stimulus is self-referent or not, and thus offers insights into a person's self-perception (Northoff et al., 2006). Disturbances in SRP of emotional stimuli have been associated with a range of mental health problems. For example, Mezulis et al. (2004) found in a meta-analysis that compared to healthy populations, patients suffering from depression and anxiety show a reduced tendency to prefer positively valenced information about the self when they were asked to rate the self-relevance of positive and negative personality adjectives. This fits with research showing that negative cognitions about the self and high levels of self-criticism have been associated with PTSD (e.g. Karl, Rabe, Zöllner, Maercker, & Stopa, 2009) and depression (Gilbert et al., 2004). In a recent review Cili and Stopa (2015) highlighted the importance of increased accessibility of a negative self in the maintenance of psychological disorders. Hence, there is a need to investigate the underlying mechanism of biased self-referential processing and to explore interventions that might facilitate a more positive perception of the self.

SRP is typically measured by a self-referential task (Markus, 1977) in which positive and negative personality adjectives are presented and participants indicate whether each word describes them or not. Within this task, self-perception is operationalised by the number of negative and positive words declared as "me" and the reaction time to negative and positive words, with a shorter time indicating more automatic, self-congruent word endorsement. This offers a way to understand an individual's self-perceptions at any one time. Indeed, studies investigating negative self-referential biases have shown that, relative to healthy individuals, depressed individuals are more likely to endorse negative emotional information about the self. This is also reflected in faster reaction times to negative adjectives and slower reaction times to positive adjectives (e.g. Auerbach et al., 2015; Shestyuk & Deldin, 2010; Yoshimura et al., 2009).

Recently, researchers utilised event-related brain potentials (ERP's) to gain insights into automatic and effortful cognitive encoding processes associated with SRP in healthy vs. depressed individuals. ERP's are the averaged neural activity in response to specific events derived from the raw electroencephalogram (EEG). They allow a better understanding of the dynamic nature of cognitive processing with high temporal precision. Thus, ERP's are particularly suited to examine early, automatic and late, effortful affective-cognitive processes. Early ERP components such as the P1 and the P2 are thought to reflect automatic processing of emotional stimuli (e.g. Flor et al., 1997; West & Holcomb, 2000), whereas late positive potentials (LPP) index more effortful elaboration and sustained engagement to emotional stimuli (e.g. Huang & Luo, 2006). Using a self-referential task, Shestyuk and Deldin (2010) found greater ERP component amplitudes to negative relative to positive words during automatic stimuli processing (indexed by the P2 component) for current and remitted depressed individuals, while the opposite pattern was found for the healthy compassion group. Similarly, Auerbach et al. (2015) reported that compared with healthy female adolescents, depressed adolescents exhibited greater ERP component amplitudes during automatic stimuli processing following negative words (indexed by the P1 component). Critically, this effect was associated with a more maladaptive self-view and self-criticism. In addition, both studies found evidence that depressed individuals showed greater ERP activity representing effortful evaluation and sustained engagement towards negative words as compared to positive words (indexed by the LLP component), whereas healthy individuals demonstrated the opposite pattern. Interestingly, Shestyuk and Deldin (2010) found that remitted depressed individuals did not demonstrate a negativity bias towards negative words during effortful word processing. They concluded, that effortful processing biases towards negative self-referent information in the context of depression might be mood-dependent whereas the automatic processing bias towards negative information about the self may be mood-independent and might present cognitive vulnerability for depression as suggested by Beck (1996).

These findings suggest that currently depressed individuals may have a biased self-referential processing towards negative information about the self, i.e. they have easier, automatic access to negative self-relevant information and sustained engagement to this information. This bias may over time contribute to the maintenance of depressive symptoms (e.g. Beck, 1996; Cili & Stopa, 2015; Williams, Healy, Teasdale, White, & Paykel, 1990). Interestingly, the effortful elaboration on negative information about the self in the context of depression is likely to be mood-dependent, e.g. remitted depressed individuals who are currently not feeling depressed do not demonstrate this bias (Shestyuk & Deldin, 2010). Indeed, there is evidence that the LPP (e.g. effortful elaboration of and sustained attention to emotional stimuli) may be sensitive to change. For example in a healthy student sample Hajcak et al. (2006) demonstrated that cognitive reappraisal can reduce the LPP following emotional pictures. Therefore, ERPs may be sensitive in picking up subtle changes in cognitive or affective processing and thus lend itself particularly well to understanding state changes in self-referential processing. Thus, the triangulation of self-referential tasks and ERP's may be particularly useful to investigate if —and how— interventions can improve maladaptive self-referential biases.

Within clinical psychology, the cultivation of self-compassion is increasingly recognised as being beneficial in improving mental health, positive emotions and wellbeing (Galante et al., 2014; Hofmann et al., 2011; Kuyken et al., 2010; Neff & Germer, 2013). Self-compassion has been defined as being kind to one's self (Neff, 2003b) and being able to use self-reassurance and soothing rooted in a secure attachment style (Gilbert, 2009) in times of adversity (Gilbert, 2009; Neff, 2003b). Further, it includes being non-judgmental about one-self (Gilbert, 2009; Neff, 2003b) and recognising one's experience as part of the human condition (Neff, 2003b), and being able to care for and affiliate with others (Gilbert, 2009). It is a state where a sense of safety can be activated and alleviate distress. This is in contrast to self-criticism characterised by maladaptive emotion-regulation strategies such as being harsh and judgmental to oneself (Gilbert, 2009; Neff, 2003b), feeling isolated (Neff, 2003b) and being in flight or fight or social rank mode (Gilbert, 2009).

There is now a large body of correlational work using the Self-Compassion Scale (SCS; Neff, 2003a) that shows a relationship between trait self-compassion, mental health and wellbeing (see Zessin et al., 2015). Research suggests that self-compassion is negatively related to self-criticism (Gilbert et al., 2004). Higher levels of trait self-compassion have been associated with well-being and quality of life (Wei et al., 2011; Zessin et al., 2015). In contrast, lower levels were associated with mental health problems such as PTSD (Thompson & Waltz, 2008) and depression (Kuyken et al., 2010). Taken together, one of the most consistent findings in the literature is that greater self-compassion is linked with less anxiety and depression (MacBeth & Gumley, 2012).

However, it is less well understood what mechanisms facilitate the beneficial effects of self-compassion. Given the strong negative association between self-compassion and depression, one hypothetical protective effect of cultivating self-compassion might be the activation of a more positive perception of the self. However, this has to date not been tested. Towards the goal of better understanding cognitive-affective processes that characterise adopting a more self-compassionate stance, the primary aim of this study was to examine behavioural and neural mechanisms associated with self-referential processing, when self-compassion is cultivated.

Interestingly, there is evidence that self-compassion can be cultivated both in short-term laboratory inductions and more intensive programs (Hofmann et al., 2011). For example, Kirschner, Kuyken, and Karl (2013) found that one-off meditation exercises designed to cultivate self-compassion directly (via a Loving Kindness Meditation with specific focus to cultivate self-compassion) or indirectly (via a compassionate body scan) can increase state levels of self-compassion and positive affiliative affect and decrease state levels of self-criticism in a student sample. There was also evidence that both self-compassion exercises decreased autonomic arousal and increased parasympathetic activity. One-off self-compassion inductions might lend themselves particularly well to investigating if adopting a self-compassionate stance is associated with increased positive self-perceptions.

Taken together, there is an emerging consensus that negative automatic and elaborate self-referential processing biases towards negative information and their neural underpinnings play an important role for the maintenance of mental health problems such as depression (Auerbach et al., 2015; Beck, 1996; Cili & Stopa, 2015;

Shestyuk & Deldin, 2010). Research suggests that interventions might be able to target self-referential processing biases associated with effortful elaboration of and sustained attention to negative stimuli, as they are likely to be mood dependent (Shestyuk & Deldin, 2010). The cultivation of self-compassion has recently been associated with improved depressive outcomes (Hofmann et al., 2011; Kuyken et al., 2010). However, it is not well understood if the facilitation of self-compassion also reduces negative self-referential processing as is often reported in individuals with depression. Hence, the goal of this study was to investigate the effect of self-compassion inductions as compared to control conditions on behavioural and neural mechanisms associated with self-referential processing. A self-referential task was administered before and after the experimental manipulations. A Loving Kindness Meditation (LKM) with a specific focus on the cultivation of self-compassion (adopted from Neff & Germer, 2013) was used as direct technique to cultivate state self-compassion. In addition, we used a compassionate body scan (directing kind and compassionate attention to one's own body sensations) as a more indirect approach to cultivate self-compassion (based on Neff & Germer, 2013). Both of these inductions have previously been shown to increase state levels of self-compassion (Kirschner et al., 2013). To stimulate the drive and excitement affect system (Gilbert, 2009), a positive-excitement condition was designed. Having a manipulation designed to stimulate positive affect systems enables exploration on the specificity effects of positive affect vs. self-compassion on self-referential processes. Moreover, we included a rumination condition designed to stimulate a more negative self-view (adopted from Roberts et al., 2013), as well as a neutral control condition. To date, it is unknown if a single self-compassion induction will affect self-referential processes but based on the above-mentioned considerations, this study aims to test the following hypotheses. First, when completing the self-referential task after the experimental manipulation, relative to the control conditions, participants in the direct and indirect self-compassion manipulation condition will endorse more positive words and fewer negative words as compared to baseline. Further, participants assigned to the self-compassion conditions will have faster RTs for endorsed positive words post manipulation. Second, ERP data will examine early automatic (P1 and P2 components) and late elaborated (LPP activity) cognitive processing of emotional stimuli. While relatively early cognitive-affective processes (e.g., the P1 and P2) are expected to remain the same after the experimental induction, we hypothesise that sustained, slow-wave components associated with encoding and elaboration of self-relevant information (e.g. LPP) may be more susceptible to change in the context of the experimental manipulations. Specifically we hypothesise that compared to before the self-compassion manipulation, participants will exhibit greater LPP activation following the presentation of positive words and less LPP activation following the presentation of negative words after the cultivation of self-compassion. The opposite patterns are expected for participants assigned to the rumination condition.

A secondary goal of this study was to examine if individual differences in trait self-compassion, self-criticism, attachment style, and experienced childhood adversity affect the possible changes in self-referential processing associated with the cultivation of self-compassion. This is because clinical observation informed that for some people (particularly self-critics and those with attachment difficulties or difficult relationships with care-givers) focusing on compassion for the self at first might be unfamiliar and difficult (e.g. Gilbert et al., 2006; Gilbert & Irons, 2004; Gilbert & Procter, 2006).

5.3 Methods

5.3.1 Participants

A total of 135 students were recruited from the University of Exeter (27 in each condition; for a detailed description of the sample characteristics see Table 5.4, the participant flow diagram is depicted in Figure 5.1). Groups did not differ in terms of age, $F(4, 134) = 1.35$, $p = .254$, $\eta^2_p = .004$, attachment related avoidance, $F(4, 134) = 1.11$, $p = .353$, $\eta^2_p = .003$, attachment related anxiety, $F(4, 134) = .63$, $p = .639$, $\eta^2_p = .003$, trait self-compassion, $F(4, 134) = .58$, $p = .673$, $\eta^2_p = .002$, trait self-criticism, $F(4, 134) = .56$, $p = .692$, $\eta^2_p = .001$, and perceived parenting characteristics: experienced abuse, $F(4, 134) = .61$, $p = .654$, $\eta^2_p = .002$, indifference, $F(4, 134) = .16$, $p = .957$, $\eta^2_p = .002$, and over-control, $F(4, 134) = .61$, $p = .654$, $\eta^2_p = .001$). Participants were native English speakers, right handed, with normal or corrected to normal vision and hearing. Exclusion criteria included current depression, currently taking psychopharmacological medication, epilepsy, cardiac problems and a history of brain surgery. All participants provided written informed consent and received course credits or £10 for participation. The study protocol was approved by the local Ethics Committee.

Table 5.4:

Means, Standard Deviations, and Significance Tests for the sample characteristics of the different experimental groups

	Group							
Characteristic	LKM	Body Scan	Rumination	Positive Condition	Neutral Condition	Test	p	η^2_p
n	27	27	27	27	27			
gender								
male/female: n	7/20	7/20	7/20	7/20	7/20			
Age in Years M(SD)	18.81(1.36)	19.81(2.83)	19.60(2.30)	18.93 (1.41)	19.50 (1.88)	$F(4, 134) = 1.35$	0.254	0.04
Relationship Structure Questionnaire								
Total avoidance	1.68(0.87)	1.53(0.64)	1.90(0.99)	1.95(1.07)	1.93(0.91)	$F(4, 134) = 1.11$	0.353	0.03
Total anxiety	1.96(1.27)	1.86(0.72)	1.74(0.53)	1.89(0.73)	2.11(0.99)	$F(4, 134) = 0.63$	0.639	0.02
Self Compassion Scale								
Total sum	19.75(5.11)	20.16(4.84)	18.61(3.62)	19.83(4.23)	19.19(4.51)	$F(4, 134) = 0.58$	0.673	0.02
FSCRS								
Reassure Self	21.25(5.53)	21.70(5.11)	19.85(5.66)	20.96(5.94)	19.44(5.53)	$F(4, 134) = 0.79$	0.528	0.02
Inadequate Self	13.05(7.27)	11.70(6.86)	14.48(8.17)	12.41(6.63)	13.22(7.26)	$F(4, 134) = 0.56$	0.692	0.01
Hated Self	1.59(3.24)	1.26(1.74)	1.88(2.66)	1.22(1.50)	2.77(3.26)	$F(4, 134) = 1.63$	0.171	0.04
MOPS								
Indifference	0.92(2.18)	1.01(2.21)	0.65(1.63)	0.94(1.66)	0.81(1.46)	$F(4, 134) = 0.16$	0.957	0.02
Abuse	0.44(0.81)	0.65(0.99)	0.68(1.43)	0.98(1.53)	0.65(1.43)	$F(4, 134) = 0.61$	0.653	0.02
Over control	2.17(1.70)	2.87(1.75)	2.37(1.81)	2.50(1.77)	2.68(1.99)	$F(4, 134) = 0.61$	0.654	0.01

Note. Trait self-compassion has been assessed via the SCS (Neff, 2003). The possible range of this scale is 0 – 30, with higher scores indicating higher trail levels of self-compassion. Attachment related avoidance and anxiety have been measured via the RSQ (FSCRS; P. Gilbert et al., 2004). The possible range of the two subscales is 0 – 7, with higher scores indicating higher attachment related anxiety or avoidance. The Forms of Self-Criticising/Attacking & Self-Reassuring Scale (Fraley et al., 2006) was used to assess trait level of self-criticism. The scale measures two forms of self-criticalness; inadequate self (possible range 0 – 33), and hated self (possible range 0 – 20), and one form of self-reassure, reassure self (possible range 0 -32). Experienced childhood adversity (i.e. experienced indifference: range 0 -18; experienced abuse: range 0 – 15; experienced over-control: range 0 -12) was assessed via the Measure of Parental Style (MOPS; Parker et al., 1997).

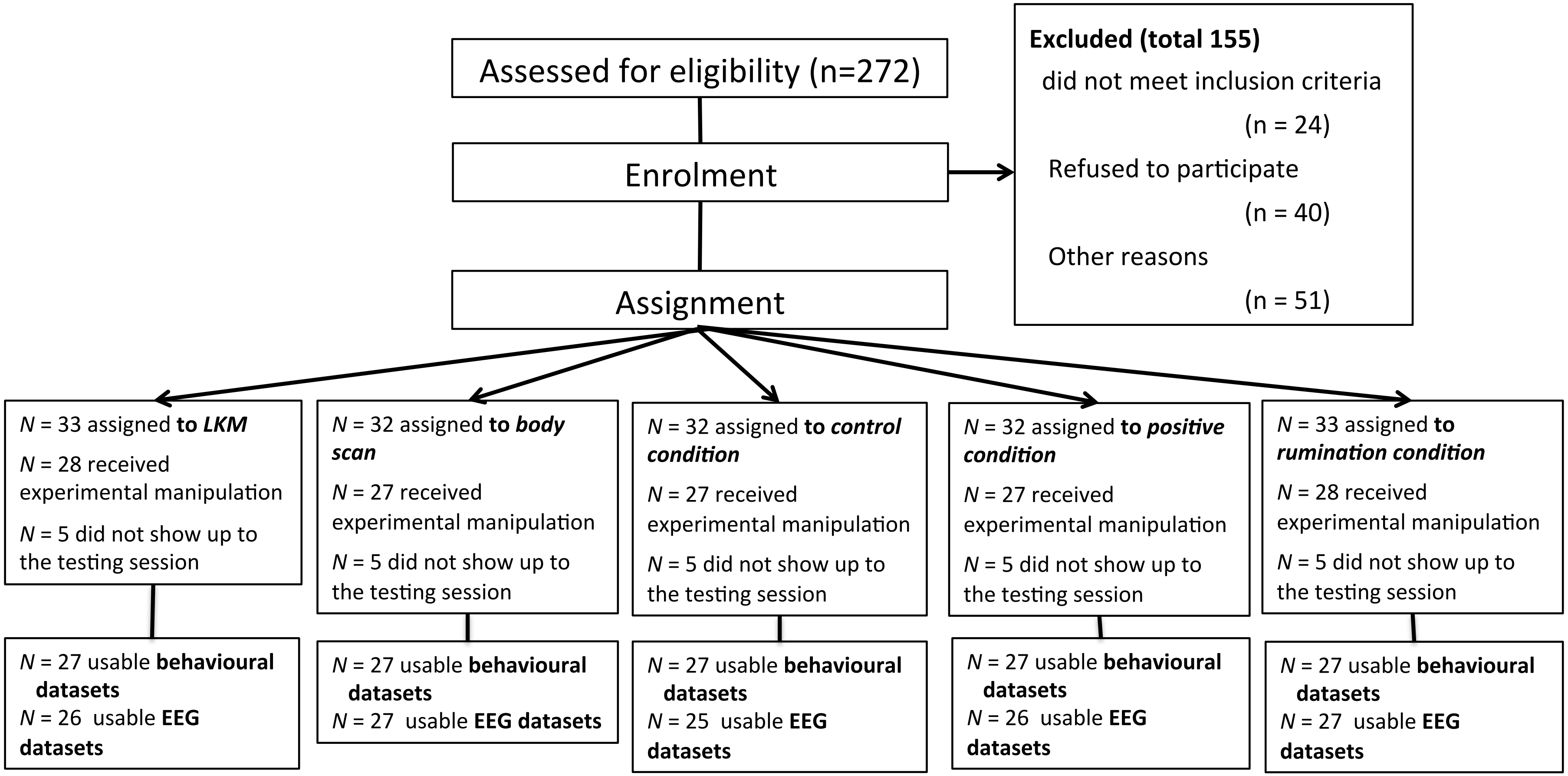

Figure 5.1 Participant flow diagram. *Note:* reasons for the exclusion of behavioural data or EEG data were poor data quality.

5.3.2 Materials

To establish study eligibility all participants underwent a depression screening using the Patient Health Questionnaire PHQ-9 for depression (PHQ-9; http://www.depression-primarycare.org/organizations/). The PHQ-9 is a standardised questionnaire often used to assess depressive symptoms in primary mental health settings. The PHQ-9 has excellent reliability (internal α=.89; test re-test α=.84) and is a valid measure for discriminating depression, with ROC analysis showing the area under the curve for diagnosing depression in PHQ-9 being 0.95 (Kroenke et al., 2001). Questions are scored from "0" (not at all) to "3" (nearly every day), with higher total scores indicating increased current depressive state. Although it is not a diagnostic tool, standardised cut-off scores can be used to conclude a tentative diagnosis. Individuals with score $\geq$ 10 have been shown to have a depression diagnosis with 88% sensitivity and 88% specificity (Kroenke et al., 2001). For use as an assessment tool a score $\geq$ 2 on either question one (little interest of pleasure in doing things) or question two (feeling down, depressed, or hopeless) must also be present to make a tentative depression diagnosis. Within this study the assessment tool diagnostic cut off from the PHQ-9 was used as a screening tool for study exclusion.

To assess individual difference variables hypothesised to moderate the impact of the experimental inductions on self-referential processing, we assessed trait levels of self-criticism, attachment style, experienced childhood adversity and trait levels of self-compassion.

The Forms of Self-Criticising/Attacking & Self-Reassuring Scale (FSCRS; Gilbert et al., 2004). The FSCRS was used to assess levels of self-criticism. It is a 22-item scale, which measures different ways people think and feel about themselves when things go wrong for them. The items are composed of three components. There are two forms of self-criticalness (inadequate self and hated self), and one form of self-reassurance (reassure self). The responses are given on a 5-point Likert scale (ranging from 0 = not at all like me, to 4 = extremely like me). Findings suggest good reliability (α = .90 for inadequate-self and α = .85 for both the hated-self and the reassured-self) and validity (e.g. Baiao, Gilbert, McEwan, & Carvalho, 2015). Recent research confirmed the original three-factor structure of the FSCRS in both clinical and non-clinical samples suggesting that self-criticism should not be seen as a single dimension (e.g. Baiao et al., 2015; Castilho, Pinto-Gouveia, & Duarte, 2015). Both forms of self-criticism have been positively linked depression and anxiety whereby the self-hating domain was more associated with self-harm and borderline phenomenology (Gilbert et al., 2004; Gilbert et al., 2010). In contrast, greater self-reassurance has been shown to be related to mental health and well-being (Gilbert et al., 2004). Cronbach's alpha in this sample was .73 for the inadequate self, .76 for the hated self, and .77 for the reassure self.

The Relationships Structures Questionnaire (RSQ; Fraley et al., 2006). The RSQ was used to measure attachment-related anxiety (Cronbach's α = .87 in this sample) and avoidance (Cronbach's α = .73 in this sample). This is a self-report designed to assess attachment patterns in a variety of close relationships. The same 10 items are used to assess attachment styles with respect to four targets (i.e., mother, father, romantic partner, and best friend). The responses are given on a 7-point Likert scale (ranging from 1 = strongly disagree, to 7 = strongly agree). Psychometric properties of the RSQ are adequate. Research has shown that the individual scales demonstrated a good retest-reliability over 30 days ($r = .88$ for the avoidance scores and $r = .92$ for the anxiety scores) and that the scales are meaningfully related to different outcomes (e.g. relationship satisfaction and depressive symptoms) (see Fraley, Heffernan, Vicary, & Brumbaugh, 2011; Fraley, Hudson, Heffernan, & Segal, 2015).

The Measure of Parental Style (MOPS; Parker et al., 1997). The MOPS was used to assess childhood adversity. The MOPS is a self-assessment tool to report perceived parenting styles across three measures (Indifference, Abuse, Overcontrol). The responses are given on a 4-point Likert scale (ranging from 0 = not true at all, to 3 = extremely true). The three subscales of the MOPS have shown good reliability across 4 weeks testing period ($r = .93$ for parental indifference, $r = .92$ for parental abuse, and $r = .87$ for parental over-control (Picardi et al., 2013)), and good internal consistency ($\alpha = .93$ for parental indifference, $\alpha = .82$ for parental over-control, and $\alpha = .87$ for parental abuse (Parker et al., 1997)). Higher scores on the three parental domains of the MOPS have been associated with mental health problems such as depression and anxiety disorders (Kuyken et al., 2015; Parker et al., 1997). It has good reliability (Cronbach's $\alpha = .93$ for indifference, .88 for abuse, and .79 for over control in this sample).

The Self-Compassion Scale (SCS; Neff, 2003). The SCS was used to measure trait levels of self-compassion. This is a 26 item self-report scale, which measures six dimensions of self-compassion: mindfulness (Cronbach's $\alpha = .73$ in this sample), over-identification (Cronbach's α = .66 in this sample), self-kindness (Cronbach's α = .85 in this sample), self-judgement (Cronbach's α = .76 in this sample), isolation (Cronbach's α = .75 in this sample), and common humanity (Cronbach's α = .38 in this sample). Each item is rated on a five-point scale, ranging from 1 ("almost never") to 5 ("almost always"). In this study I obtained the total of this scale (sum of the six self-compassion dimensions, with the negative dimensions – over-identification, self-judgment, and isolation - reversely coded) as a measure of trait self-compassion. Research demonstrated that the SCS has shown good test-retest reliability (r = .93) and convergent and discriminant validity (Neff, 2003; Neff, 2015; Neff, Kirkpatrick, & Rude, 2007; Neff, Rude, & Kirkpatrick, 2007). A more detailed description on the psychometric properties of the SCS can be found in chapter 2.1, pp. 5 – 8.

Visual Analogue Scales (VAS). To assess the effectiveness of the experimental inductions on a participant's mood, self-compassion, positive affiliative affect and self-criticism a series of questions using Visual Analogue Scales (ranging from 0 to 100) were used throughout the experiment. Four questions were asked of participants about their state affiliative affect (i.e., feeling securely attached, safe, loved and connected; Cronbach's α = .66 in this sample) based on the state adult attachment measure (SAAM; Gillath et al., 2009), three about their state self-compassion (Cronbach's α = .73 in this sample) adopted from the Self-Compassion Scale (SCS; Neff, 2003), two about their general affect (r = .73 in this sample), and one about their state self-criticism (based on the Forms of Self-Criticising/Attacking & Self-Reassuring Scale (MOPS; Parker et al., 1997)). See appendix I for the exact wording of the VAS used in this study.

Experimental inductions. The induction tapes for the five different conditions were developed and recorded together with an experienced MBCT therapist from the ACCEPT clinic, an NHS commissioned depression service that is part of the University of Exeter Mood Disorders Centre. Feedback on the tapes was gathered from an expert team consisting of researchers and therapists within our centre. The tapes were also matched in terms of word density (610 – 630 words) and length (11.5 minutes). In the compassionate body scan participants are guided to direct kind and compassionate attention to their body sensations. In the Loving Kindness condition participants are guided to direct loving/friendly feelings toward themselves and others. In the rumination condition participants are asked to dwell on a sad/negative memory or current problem. In the control condition participants are guided through a routine supermarket-shopping scenario. In the positive excitement condition participants were asked to think about certain aspects of a positive event or situation where they were working through or achieving something great. Feedback on the final audio exercises was gathered from experienced mindfulness and meditation practitioners as well as staff within our clinical department to ensure ecological validity. For a detailed description of the experimental inductions see appendix II.

Adjectives for the self-referential task. The adjectives for the self-referential task were chosen from the English Lexicon Project Web site (http://elexicon.wustl.edu/) by the research team. Positive adjectives tap into the concept of positive affiliative affect/ positive self-concept (e.g. loved, gentle, secure, mindful). Negative adjectives tap into the concept of negative affiliative affect/ negative self-concept (e.g. alone, insecure, useless, tense). The adjectives were matched in terms of word length and frequency and evaluated by an expert team within our clinical department to ensure ecological validity. The final set of adjectives contained 38 positive and 38 negative adjectives[6]. There were no differences between positive and negative stimuli when comparing frequency, t (74) = 1.41, p = .163, and length, t (74) = -1.29, p = .202.

Apparatus. The testing was run and behavioural data collected using E-prime 2 software (Psychology Software Tools, Sharpsburg, PA) running on a standard PC with a 17″ CRT monitor; responses were recorded using a standard computer keyboard.

Experimental Design for the self-referential Task (Markus, 1977). As shown in Figure 5.2, each trial consisted of a fixation cross presented for 500 ms, followed by the presentation of the positive or negative adjective presented until participants responded to it by either pressing the "me" (e.g. describes me) or "not me" (e.g. doesn't describe me). This was followed by a blank screen presented for 1450 – 1550 ms; i.e., a presentation time was randomly chosen within this time range.

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[6] The following positive (n = 38) and negative (n = 38) words were included in the self-referential task (alphabetical order): adorable, afraid, alert, alone, angry, balanced, bright, calm, capable, carefree, controlling, creative, curious, depressed, detached, discouraged, distressed, docile, easy-going, embarrassed, excluded, friendly, frustrated, gentle, grateful, happy, healthy, helpless, honest, hopeful, hostile, imaginative, inferior, insecure, joyful, kind, lively, lonely, loved, loyal, lucky, mindful, moody, nervous, peaceful, protected, proud, rejected, respectful, rigid, rude, sad, satisfied, scornful, secure, self-critical, selfish, stupid, supported, suspicious, tender, tense, thoughtful, tranquil, ugly, uncertain, uneasy, unfortunate, unhappy, unpopular, unsupported, upset, useless, warm-hearted, wise, worried.

In total, participants completed 76 trials (38 positive and 38 negative adjective trials). Stimuli were pseudo-randomly presented, with no more than two words of the same valence repeated. Before the experiment, participants were instructed about procedure and familiarised with the paradigm by completing a test run with 12 trials.

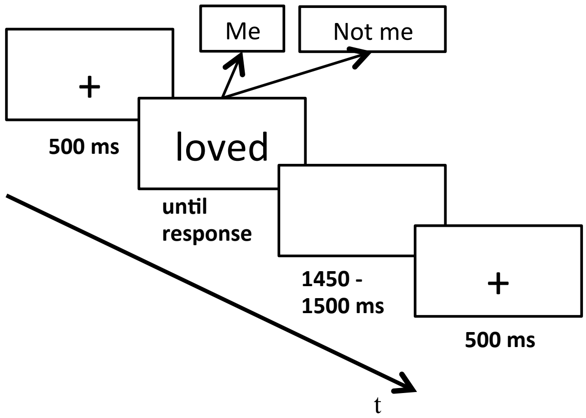

Figure 5.2 Experimental procedure self-referential task

5.3.3 Procedure

Participants were screened for the exclusion criteria and asked to complete a few questionnaires (SCS: Neff, 2003, FSCRS: Gilbert et al., 2004), RSQ: Fraley et al., 2006 MOPS: Parker et al., 1997) using an online survey.

Eligible participants were invited to the laboratory session. Following informed consent, participants completed a self-referential task. After this, participants completed an 8 minute baseline period (divided into eight one minutes blocks, four with their eyes open 4 with their eyes closed) where participants were instructed to relax. Following the baseline, participants listened to one of the five induction tapes and finally were asked to complete a one-minute baseline period with their eyes closed. Before and after the first baseline and following the induction tape participants completed a manipulation check. For this we used visual analogue scales (ranging from 0 to 100) to answer 11 questions about state affiliative affect, state self-compassion and general affect. Finally, participants completed another self-referential task. During the whole experimental procedure psychophysiological measurements (EEG, ECG, SCL) were recorded. Of the recorded psychophysiological measurements only the EEG/ERP data during the self-referential tasks are presented here.

Randomisation. Eligible participants were randomly assigned to one of the five experimental conditions. This was achieved using a random number-generator to create a sort key. The participant numbers have than been sorted according to the random sort key and hence randomly assigned to one of the five experimental blocks.

5.3.4 EEG Recording and Data Preprocessing

Recording. The electroencephalogram (EEG) was acquired using 64 active Ag/AgCl electrodes embedded in a cap connected to EEG amplifiers (Acticap and BrainAmp, Brain Products, Munich, Germany) in a shielded and temperature-controlled room (21 degrees Celsius). The A/D rate (sampling rate) was 500Hz with a time constant of 10s, and a high frequency cut-off of 250Hz. Electrolyte gel was used to ensure proper conductivity and electrode impedances were kept below 10kΩ.

Data preprocessing. Data preprocessing was performed using BrainVision Analyzer 2.1 software (Brain Products, Germany) with individual preprocessing completed blind to participant group. Files were visually inspected and channels with excessive artefact throughout the recording were removed. Signals were measured with ears as reference and machine reference to Cz. Offline filters (Butterworth Zero

Phase Filters; low cutoff 0.1 Hz, time constant 1, 24 dB/oct; high cutoff 30 Hz 24 dB/oct; notch filter at 50 Hz) were applied on the non-segmented data and trials were segmented 200 ms before and 1200 ms after stimulus onset. All files were downsampled to 250 Hz for processing (recordings were sampled to ensure Nyquist frequency was met) before an independent component analysis transform was conducted to identify and remove vertical and horizontal eye movement artifacts as well as eyeblinks and electrocardiogram artefacts. Intervals for individual channels were rejected using a semiautomatic procedure using the following criteria with intervals marked as bad if these conditions were violated in the 200 ms before or 1200 ms after event: (a) maximal allowed voltage step 50 μV/ms (b) maximal allowed difference of values in intervals 100 μV, interval length 100 ms (c) minimal allowed amplitude of -100 μV (d) maximal allowed amplitude 100 μV.

Determination of ERPs. The mean percentages of accepted epochs in this study were 92.95 (SD = 10.93) for positive word pre manipulation, 92.91 (SD = 14.62) for positive words post-manipulation, 93.17 (SD = 10.20) for negative words pre-manipulation, and 92.75 (SD = 14.44) for negative words post-manipulations. Scalp location and component time window were consistent with past research using a similar self-referential task (Auerbach, Stanton, Proudfit, & Pizzagalli, 2015). Specifically, the P1, P2, and early and LPP components were calculated as the mean area across the average of electrode sites Pz, P1, POz, P2 for the following time window: a) P1 = 100 ms to 200ms, (b) P2 = 200 ms to 300 ms, (c) early LPP = 400 ms to 600 ms. The late LPP was examined across the average of frontocentral midline electrode sites Fz and FCz, and operationalised as the average area in the 600 ms to 1,200 ms post-stimulus time window. The P2 component was quantified as a positive peak in the 200-300 ms time window post-stimulus, and the LPP was quantified as the average area in the 600- to 800 ms post-stimulus time window post-stimulus. All components were statistically analysed using SPSS (version 22).

5.3.5 Statistical analysis

All data were explored using the Shapiro-Wilk test of normality to explore their distribution (all $p > .05$); this test is appropriate for sample sizes < 50. Boxplots were used to identify outliers with regard to each of the outcome parameters. Cases were deemed as outliers if they were over 3 standard deviations away from the mean and didn't represent a meaningful observation. Outliers were assigned "a raw score on the offending variable that is one unit larger (or smaller) than the next most extreme score in the distribution" (Tabachnick & Fidell, 2001, p. 77).

Manipulation checks. For testing the effectiveness of the experimental inductions on participant's state self-compassion and state self-criticism, a series of repeated measures ANOVAs with time (pre vs. post self-compassion manipulation) as within-subjects factor and condition as between-subjects factor were conducted.

Behavioural data. Three-way mixed ANOVA's with Group, Time (pre/ post self-compassion manipulation) and condition (positive words, negative words) as the within-subject factors, and group as the between-subject factor were run for the variables endorsed words and RT (i.e., endorsed words) to analyse the behavioural self-referential processing data.

Moderation analyses. To answer the research question about the effect of individual differences on the association between word endorsement change and changes in ERP components to positive and negative words in response to the direct and indirect meditation manipulation, a series of simple moderation analyses were performed following suggestions and using the SPSS script provided by Hayes (2012). We used residualised gain scores in the relevant constructs as outcome in the moderation models. Residualised gain scores, as validated index of pre-post change that controls for variance in initial pre-scores, were calculated by regression of post-score on pre-score on the relevant construct (Mintz et al., 1979; Speckens et al., 2006; Williams, Zimmerman, Rich, & Steed, 1984). Moderation analyses were performed using mean-centred continuous predictors (individual difference variables hypothesised to moderate the impact of the experimental inductions) and interaction terms of condition (self-compassion manipulations vs. control condition) and trait predictors. In order to further characterise the nature of significant interactions we used the Johnson–Neymann (J–N) technique (Johnson & Neyman, 1936; Potthoff, 1964). The J–N technique allows one to directly identify points in the range of the moderator variable where the effect of the predictor on the outcome transitions from being statistically significant to non-significant by finding the value of the moderator variable for which the ratio of the conditional effect to its standard error is equal to the critical *t* score.

5.3.6 Sample size determination and justification

Sample size was determinated using a priori sample size calculations (Faul et al., 2007). The sample size was determined for a 5 (group) x 2 (time) mixed ANOVA, assuming a statistical power of .80, a = .05 and a medium effect size (f = .25). Based on this calculation it was found that a minimum of 130 participants were required for this study to detect an effect of group on the outcome variables (first hypotheses).

The sample size for testing the moderation hypothesis was based on regression models that involved three predictors (group, individual differences variable, group X individual difference interaction term). To detect a medium effect size for the interaction term (f^2= .15) a minimum of 120 participants would be required.

5.4 Results

5.4.1 Manipulation Checks

To confirm that the experimental inductions were effective in leading to expected changes in state self-compassion and state self-criticism we carried out a number of manipulation checks.

Changes in state Self-Compassion. The scores for the self-compassion ratings are depicted in **Figure 5.3** A. The Group X Time ANOVA did not yield a main effect of Group, $F(4, 130) = 1.59$, $p > .05$, $\eta^2_p = .04$. However, in line with our hypothesis, there was a significant Group X Time interaction, $F(6.96, 226.29) = 9.83$, $p < .001$, $\eta^2_p = .23$. Simple contrasts revealed that there was a significant increase in self-compassion in the *body scan condition* with higher scores after the body scan as compared to pre body scan, $F(1, 26) = 26.31$, $p < .001$, $\eta^2_p = .50$, 95% CI [6.65, 15.55]. Similar patterns could be found for the *positive condition,* $F(1, 26) = 14.01$, $p = .001$, $\eta^2_p = .52$, 95% CI [3.30, 11.34], and for the *loving kindness condition,* $F(1, 26) = 22.93$, $p < .001$, $\eta^2_p = .47$, 95% CI [5.38, 13.47]. In contrast, a significant decrease in self-compassion could be found in the *rumination condition* after the indication as compared to before, $F(1, 26) = 7.98$, $p = .009$, $\eta^2_p = .23$, 95% CI [-12.82, -2.02].There was no pre/ post difference in the *control condition,* $F(1, 26) = .27$, $p = .607$, $\eta^2_p = .01$, 95% CI [-4.39, 2.61].

Changes in state self-criticism. Similar to the state self-compassion findings, the Group X Time ANOVA examine changes in state self-criticism did not yield a main effect of Group, $F(4,130) = 1.88$, $p > .05$, $\eta^2_p = .05$**.** Critically, and as hypothesised, There was a significant time by group interaction indicating that the ratings for the different time points did differ between the groups, $F(7.75, 251.92) = 5.69$, $p < .001$, $\eta^2_p = .15$. The self-criticism ratings are depicted in **Figure 5.3** B. Simple contrasts revealed that there was a significant decrease in self-critical ratings in the *body scan group* with lower ratings after the body scan exercise as compared to before, $F(1, 26) = 8.55$, $p < .007$, $\eta^2_p = .25$, 95% CI [-17.34, -3.02]. A similar pattern was found in the *positive condition*, $F(1, 26) = 7.54$, $p = .011$, $\eta^2_p = .23$, 95% CI [-15.63, -2.24, and for the loving kindness condition, $F(1, 26) = 7.00$, $p = .014$, $\eta^2_p = .21$, 95% CI [-7.69, -0.97]. In contrast, there was a significant increase in self-critical ratings with higher ratings after the induction as compared to before in the *rumination condition*, $F(1, 26) = 22.73$, $p < .001$, $\eta^2_p = .47$, 95% CI [8.94, 22.49]. No pre/ post manipulation difference emerged for the control condition, $F(1, 26) = .03$, $p = .857$, $\eta^2_p > .00$, 95% CI [-4.96, 5.93].

Summary of the manipulation check findings. The results of the manipulation checks indicate that the different conditions showed the expected effects. The Loving Kindness Meditation and the Body Scan increased levels of state self-compassion and decreased state levels of self-criticism. Similar patterns could be found for the positive condition. The opposite patterns have been found for the rumination condition. Finally, the control condition did not affect participant's ratings.

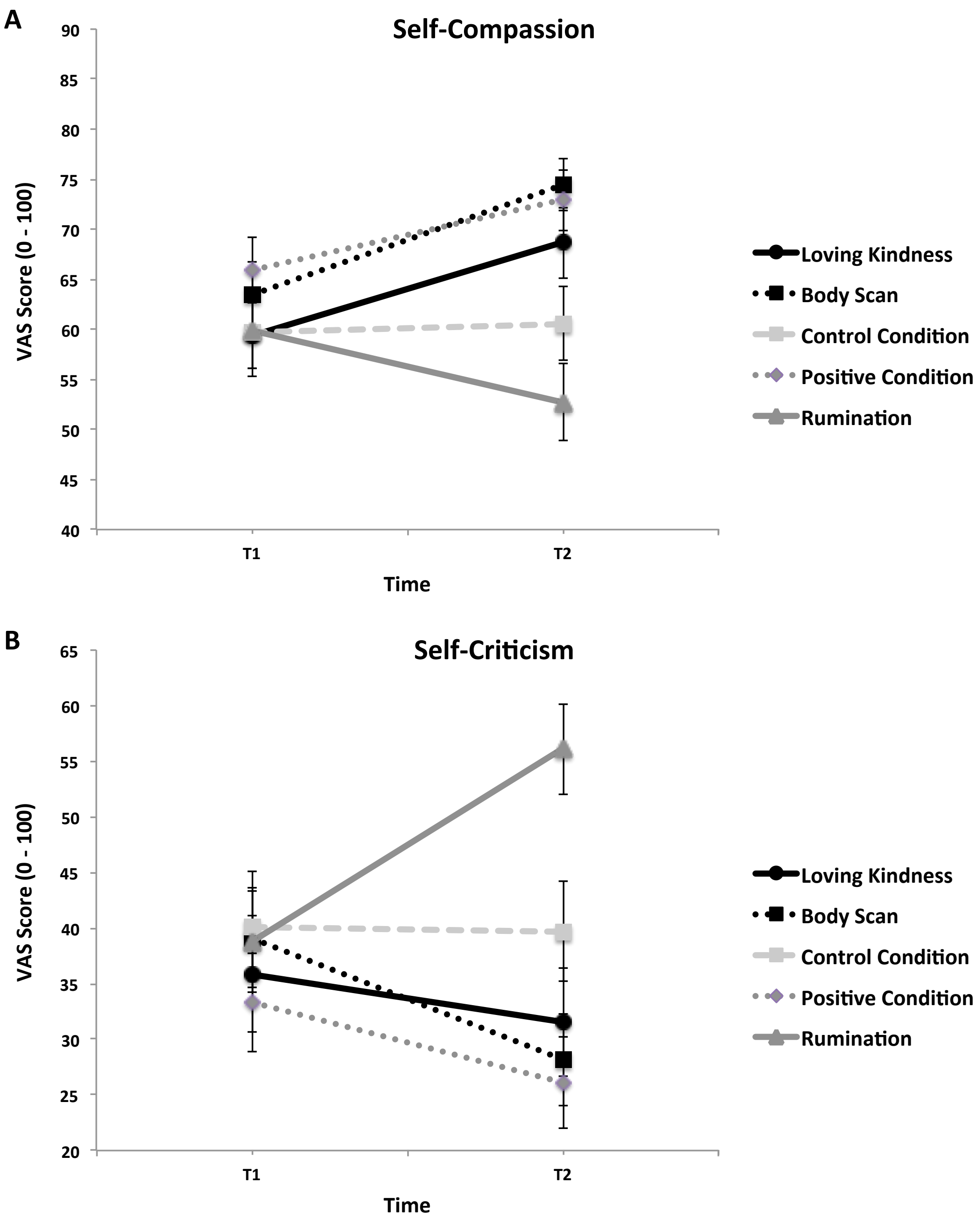

Figure 5.3 Graphs display group mean changes in self-reports ± 1 standard errors for (A) changes in state-self-compassion and (B) changes in self-criticism.

Note: T1 = post baseline; T2 post experimental condition. VAS Sample item for state self-compassion included: "*Right now: I feel like not being kind and understanding towards myself (0) – I feel like being very kind and understanding towards myself (100)*". VAS sample item for the self-criticism change included: "*Right now: I don't feel at all self-critical (0) – I feel very self-critical (100)*".

5.4.2 Behavioural Data

Word endorsement. When examining words endorsed, the Group X Condition (positive words endorsed, negative words endorsed) X Time (pre manipulation, post manipulation) interaction was significant, $F(4,130) = 7.41$, $p = .007$, $\eta^2_p = .18$. This indicates that positive and negative word endorsement before and after the experimental manipulations did differ between the groups. Simple contrasts revealed that there was no significant change in positive words endorsed in *the body scan condition,* $F(1,26) = .39$, $p = .539$, $\eta^2_p = .01$, 95% CI [-3.50, 1.88], but a significant decrease in negative words endorsed after the manipulation, $F(1,26) = 8.43$, $p = .007$, , $\eta^2_p = .25$, 95% CI [.66, 3.86], (see Figure 5.4 A). After the *loving kindness condition*, a significant increase in positive words endorsed, $F(1,26) = 5.89$, $p = .023$, $\eta^2_p = .19$, 95% CI [-4.52, -.37] and decrease in negative words endorsed, $F(1,26) = 9.08$, $p = .006$, $\eta^2_p = .26$, 95% CI [.85, 4.49]) was found (see Figure 5.4 B). A similar pattern was found for the *positive condition* (positive word endorsement: $F(1,26) = 7.23$, $p = .012$, $\eta^2_p = .22$, 95% CI [-5.10, -.68]; negative word endorsement: $F(1,26) = .10.54$, $p = .003$, $\eta^2_p = .29$, 95% CI [1.29, 5.75]); see Figure 5.4 C). In contrast, after the *rumination condition,* a significant decrease in positive words endorsed, $F(1,26) = 6.71$, $p = .016$, $\eta^2_p = .21$, 95% CI [.62, 5.38]) and a trend for increased endorsement of negative words, $F(1,26) = 3.83$, $p = .061$, $\eta^2_p = .13$, 95% CI [-4.33, .11]), was found (see Figure 5.4 D). As expected, the *control condition* did not significantly influence positive, $F(1,26) = .62$, $p = .438$, $\eta^2_p = .02$, 95% CI [-2.00, .89] or negative, $F(1,26) = .24$, $p = .632$, $\eta^2_p = .01$, 95% CI [-1.44, 2.33], word endorsement (see Figure 5.4 E). Simple contrasts exploring group differences revealed that there were no group differences in positive words endorsed, $F(4, 130) = 1.85$, $p = .124$, $\eta^2_p = .05$, and negative words endorsed, $F(4, 130) = 1.18$, $p = .322$,

$\eta^2_p = .04$, at T1. Similar to the T1 findings, there was no group difference in positive words endorsed at T2, $F(4, 130) = 1.92$, $p = .110$, $\eta^2_p = .06$. However, the groups differed in negative word endorsement at T2, $F(4, 130) = 10.12$, $p < .001$, $\eta^2_p = .24$. Between subject comparison indicated that individuals assigned to the rumination condition endorsed significantly more negative words as compared to individuals assigned to the other experimental conditions post manipulation, $p = .048$ 95 % CI [.08, 13.99]. No other group differences yield significance, all $p > .05$

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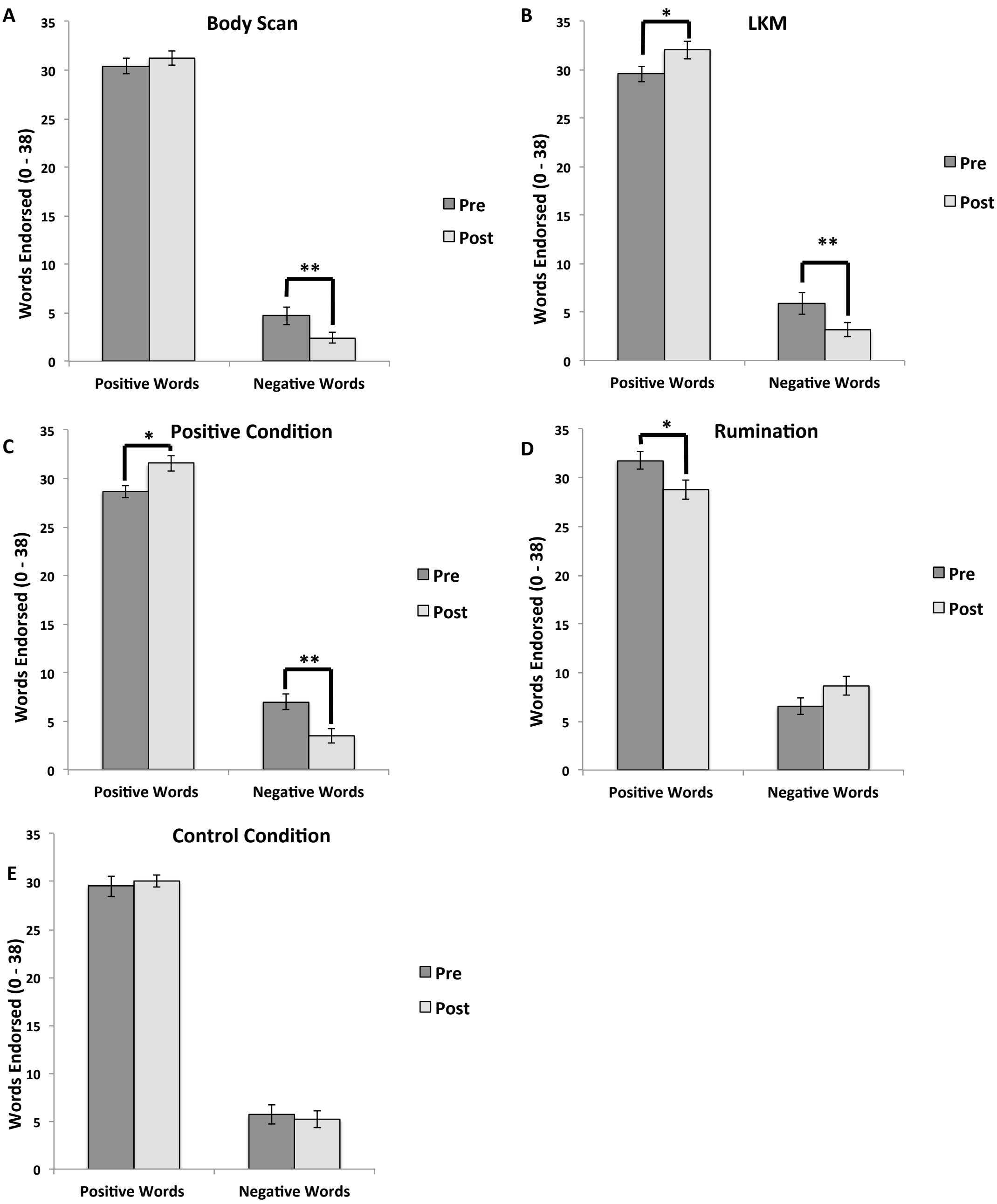


Figure 5.4 Word-endorsement before and after the experimental manipulations for (A) Body Scan (n = 27), (B) Loving Kindness Meditation (n = 27), (C) Positive Condition (n = 27), (D) Rumination (n = 27), and (E) Control Condition (n = 27). Word endorsement differences for * $p < .05$ and ** $p < .001$.

Reaction time. The Condition (positive words endorsed, negative words endorsed) X Time (pre-manipulation, post-manipulation) X Group ANOVA revealed a significant Condition X Time X Group interaction, $F(4,100) = 4.53$, $p = .002$, $\eta^2_p = .15$. Simple contrasts revealed that reaction times for all groups were faster to endorse positive words relative to endorsing negative words pre-manipulation, *body scan*: $F(1,25) = 28.68$, $p < .001$, , $\eta^2_p = .53$, 95% CI [-342.32, -131.52]; *LKM*: $F(1,26) = 21.36$, $p < .001$, , $\eta^2_p = .45$, 95% CI [-406.19, -156.09], *positive condition*: $F(1,24) = 19.26$, $p < .001$, , $\eta^2_p = .45$, 95% CI [-353.89, -127.50]; *rumination*: $F(1,25) = 28.68$, $p < .001$, , $\eta^2_p = .53$, 95% CI [-401.01, -178.25]; *control condition*: $F(1,26) = 43.01$, $p < .001$, , $\eta^2_p = .64$, 95% CI [-379.28, -197.69]; see **Figure 5.5**. A similar pattern was found post-manipulation for the *body scan*, $F(1,21) = 26.98$, $p < .001$, , $\eta^2_p = .56$, 95% CI [-492.46, -210.89], the *LKM*, $F(1,20) = 11.10$, $p = .003$, , $\eta^2_p = .36$, 95% CI [-725.24, -166.72], the *positive condition*, $F(1,17) = 17.95$, $p = .001$, , $\eta^2_p = .51$, 95% CI [-388.85, -130.32], and the *control condition*, $F(1,23) = 18.67$, $p < .001$, , $\eta^2_p = .45$, 95% CI [-353.45, -124.59]. No difference between reaction times to positive vs. negative endorsed words were found after the *rumination*, $F(1,21) = 3.82$, $p = .064$, , $\eta^2_p = .15$, 95% CI [-112.65, 3.49]. Simple contrast investigating pre- vs. post-manipulation differences within the same word valence revealed that for the *body scan*, reaction times were faster to positive endorsed words post-manipulation, $F(1,26) = 10.92$, $p = .003$, , $\eta^2_p = .29$, 95% CI [31.76, 170.30]. A similar pattern was found post-manipulation for the *LKM*, $F(1,26) = 12.71$, $p = .001$, , $\eta^2_p = .33$, 95% CI [67.99, 253.25], the *positive condition*, $F(1,26) = 30.51$, $p > .001$, , $\eta^2_p = .54$, 95% CI [75.96, 166.01], and the *control condition*, $F(1,25) = 7.75$, $p = .010$, , $\eta^2_p = .29$, 95% CI [27.31, 182.52]. For the *rumination* condition no difference between reaction times to positive endorsed words were found, $F(1,26) = .40$, $p = .53$, $\eta^2_p = .02$, 95% CI [-59.18, 111.81]. In contrast, no differences between reaction times to negative endorsed words pre-/ post-manipulation were found for the *body scan*, $F(1,20) = .71$,

p = .410, η^2_p = .03, 95% CI [-88.06, 207.02], the *LKM*, F(1,20) = .19, p = .663, η^2_p = .01, 95% CI [-307.21, 199.68], and *positive condition*, F(1,17) = .19, p = .669, , η^2_p = .01, 95% CI [-125.65, 190.83]. After the *rumination* condition, significantly faster reaction times to negative endorsed words were found, F(1,21) = 9.64, p = .005, η^2_p = .29, 95% CI [73.73, 372.73]. A similar pattern was found post manipulation for the *control condition,* F(1,22) = 6.78, p = .016, η^2_p = .24, 95% CI [33.23, 293.62]. Simple contrasts exploring group differences revealed that there were no group differences in RT to positive words endorsed at T1, F(4, 139) = 2.43, p = .07, η^2_p = .06, or T2, F(4, 129) = 2.03, p = .09, η^2_p = .06. Moreover, there were no group differences in RT to negative endorsed words at T1, F(4, 122) = 1.48, p = .210, η^2_p = .04. A significant group difference was found for the RT to negative words endorsed at T2, F(4, 103) = 3.28, p = .014, η^2_p = .11. Explorations of this effect revealed that individuals assigned to the rumination condition significantly responded faster to negative endorsed words as compared to individuals assigned to the other experimental conditions post manipulation, p = .001, 95 % CI (-719.58, -200.50). The other groups did not differ in their RT to negative endorsed words, all p > .05.

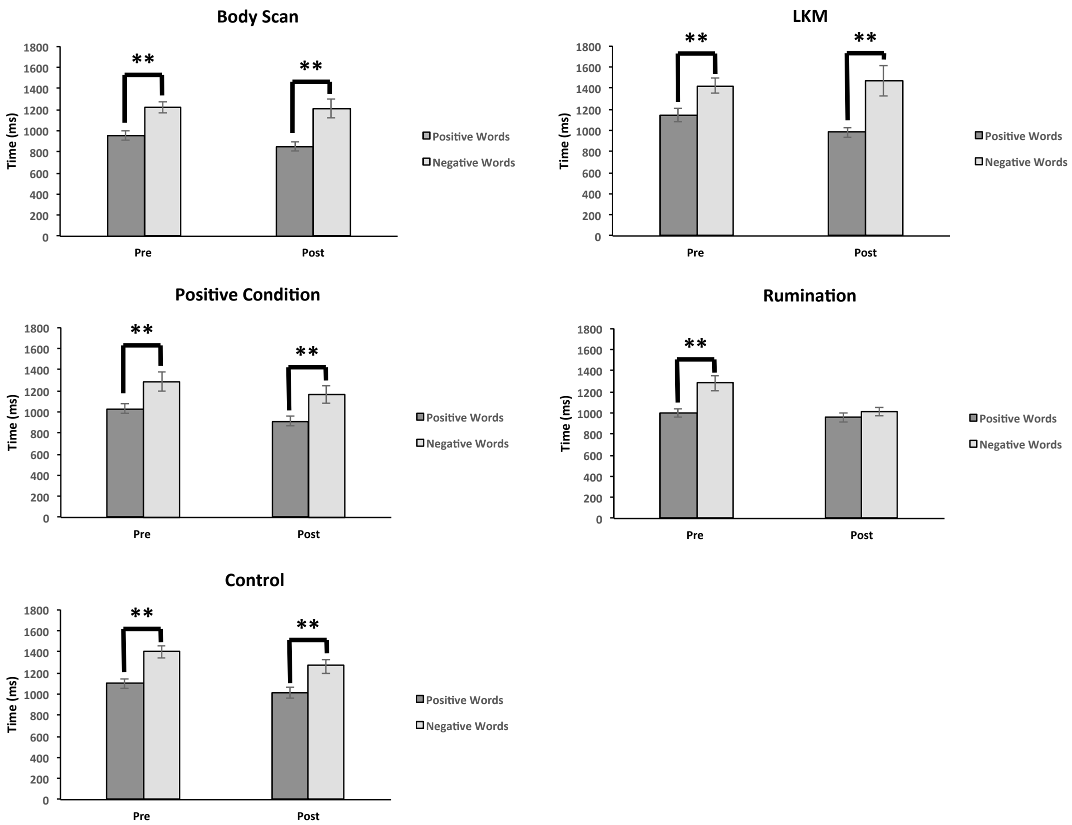


Figure 5.5 Reaction times to endorsed positive and negative words before and after the experimental manipulations for (A) Body Scan (n = 21), (B) Loving Kindness Meditation (n = 21), (C) Positive Condition (n = 18), (D) Rumination (n = 22), and (E) Control Condition (n = 23). Reaction times differences for ** $p < .001$.

5.4.3 Associations between individual differences and word endorsement change after the two self-compassion manipulations

To determine if individual differences in trait self-compassion, trait self-criticism, attachment style or experienced childhood adversity predict change in positive and negative word endorsement changes a series of simple moderation analyses were run.

5.4.3.1 Change in word endorsement induced by the Loving kindness meditation.

Positive word endorsement change. The model including trait self-compassion as the moderator was significant in predicting change in endorsed positive words, $F(3, 50) = 6.11$, $p < .001$, $R^2 = .22$. Only the interaction, $b = .18$, $t(50) = 3.60$, $p < .001$, made a significant contribution to the model. The Johnson-Neyman (J-N) technique revealed that the conditional effect of trait self-compassion on positive word endorsement change transitioned in significance at an SCS sum-score of 15.84 (range: 8.60 – 28.90 in this sample), $b = -.68$, $SE = .33$, $t(50) = 2.01$ $p = .05$, 95% CI [-1.36, .00], with the relation between positive word endorsement change and condition significant at SCS sum-scores below this threshold (29.63 % in our sample) and non-significant at SCS sum-scores above this threshold (70.37 %). This indicates that particular participants with low levels of trait self-compassion (self-compassion score below 15.84) showed a relative decrease in positive endorsed words after the LKM. In addition, the conditional effect of trait self-compassion on positive word endorsement change transitioned in significance at an SCS sum-score of 22.45 (range: 8.60 – 28.90 in this sample), $b = .54$, $SE = .27$, $t(50) = 2.001$ $p = .05$, 95% CI [.00, 1.08], with the relation between positive word endorsement change and condition significant at SCS sum-scores above this threshold (35.19 % in our sample) and non-significant at SCS sum-scores below this threshold (64.81 %). This indicates participants describing themselves as very self-compassionate (trait self-compassion score above 22.45) showed a relative increase in positive endorsed words after the LKM.

Similarly, the model including trait self-criticism as the moderator was significant in predicting change in endorsed positive words, $F(3, 50) = 7.23$, $p < .001$, $R^2 = .19$. Again, only the interaction, $b = .12$, $t(50) = 3.83$, $p < .001$, made a significant contribution to the model. Based on the Johnson-Neyman (J-N) technique it was yielded that the conditional effect of trait self-criticism on positive word endorsement change transitioned in significance at a self-criticism score of 7.30 (range: 0.00 – 33.00 in this sample), $b = .62$, $SE = .30$, $t(50) = 2.01$ $p = .05$, 95% CI [.00, 1.23], with the relation between positive word endorsement change and condition significant at self-criticism scores below this threshold (25.93 % in our sample) and non-significant at SCS sum-scores above this threshold (74.07 %). This indicates that participants with lower levels of trait self-criticism (trait self-criticism score below 7.3) showed a relative increase in positive endorsed words after the LKM. In addition, the conditional effect of trait self-criticism on positive word endorsement change transitioned in significance at a self-criticism score of 13.41 (range: 0.00 – 33.00 in this sample), $b = -.58$, $SE = .28$, $t(50) = 2.01$ $p = .05$, 95% CI [-1.13, .00], with the relation between positive word endorsement change and condition significant at self-criticism scores above this threshold (20.37 % in our sample) and non-significant at self-criticism scores below this threshold (79.63 %). This indicates that self-critical participants (trait self-criticism score above 13.41) showed a relative decrease in positive endorsed words after the LKM. In contrast, attachment style and experienced childhood adversity did not moderate the effects, all $p > .05$.

Negative word endorsement change. In contrast to the positive word endorsement change findings, no model with negative word endorsement as outcome/dependent variable and condition (LKM vs. control condition) as predictor, and trait levels of self-compassion, self-criticism, anxious attachment style or experienced childhood adversity as moderator variable reached significance, all $p >$ .05.

5.4.3.2 *Change in word endorsement induced by the Body Scan.*

Positive word endorsement change. The model including attachment related avoidance as the moderator was significant in predicting change in endorsed positive words , $F(3, 50) = 10.53$, $p < .001$, $R^2 = .29$. Only the interaction, $b = 1.07$, $t(50\ ) =$ 3.79, $p < .001$, made a significant contribution to the model. Based on the Johnson-Neyman (J-N) technique showed that the conditional effect of attachment related avoidance on positive word endorsement change transitioned in significance at an attachment related avoidance score of .49 (range: 0.33 – 4.38 in this sample), $b = -.91$, $SE = .45$, $t(50) = 2.01$ $p = .05$, 95% CI [-1.83, .00], with the relation between positive word endorsement change and condition significant at attachment related avoidance scores below this threshold (1,85 % in our sample) and non-significant at attachment related avoidance scores above this threshold (98.15 %). This indicates that a very small group of participants with very low attachment related avoidance showed a relative decrease in positive endorsed words after the body scan. In addition, the conditional effect of attachment related avoidance on positive word endorsement change transitioned in significance at an attachment related avoidance score of 1.80 (range: 0.33 – 4.38 in this sample), $b = .50$, $SE = .25$, $t(50) = 2.01$ $p = .05$, 95% CI [.00, .99], with the relation between positive word endorsement change and condition significant at attachment related avoidance scores above this threshold (42.59 % in our sample) and non-significant at attachment related avoidances below this threshold

(57.41 %). This indicates that in particular participants with higher attachment related avoidance (attachment related avoidance score above 1.80) showed a relative increase in positive endorsed words after the body scan. Individual differences in trait self-compassion, self-criticism, and experienced childhood adversity did not moderate the effects, all $p > .05$.

Negative word endorsement change. The model including attachment related avoidance as the moderator was significant in predicting change in endorsed negative words, $F(3, 50) = 3.09$, $p = .03$, $R^2 = .12$. Only the predictor, condition, (b =-.71, $t(50) = 2.61$, $p = .012$) made a significant prediction in the model. This indicates that the body scan was associated with a relative decrease in negative word endorsement as compared to the control condition. No individual differences had a significant effect on the relationship between state positive affiliative affect change and condition, all $p > .05$.

5.4.4 Early ERP components P1 and P2

For the P1 responses to *positive words*, the Group X Time (pre manipulation, post manipulation) ANOVA revealed only a main effect of Time, with larger amplitudes post-manipulation ($F(4,126) = 6.84$, $p = .010$, $\eta^2_p = .05$). No other effects emerged for the P1 amplitudes to positive words (Group X Condition: $F(4,126) = .56$, $p = .689$, $\eta^2_p = .01$; Group: $F(4,126) = .89$, $p = .471$, $\eta^2_p = .02$; see Figure 5.6).

Similarly to the P1 responses to positive words, there was only a main effect of Time for P1 responses to *negative words*, with larger amplitudes post-manipulation ($F(4,126) = 4.12$, $p = .044$, $\eta^2_p = .02$). There were no other effects for the P1 amplitudes to negative words (Group X Condition: $F[4,126] = .84$, $p = .504$, $\eta^2_p = .02$; Group: $F[4,126] = .63$, $p = .640$, $\eta^2_p = .02$; see Figure 5.7).

Similar to the P1 findings, there was only a main effect of Time, with larger amplitudes post-manipulation for P2 responses to *positive words*, $F(4,126) = 14.93$, $p < .001$, $\eta^2_p = .11$ (see Figure 5.6) and *negative words*, $F(4,126) = 10.28$, $p = .002$, $\eta^2_p = .08$ (see Figure 5.7). No other effects have been found for the P2 amplitudes to positive words (Group X Condition: $F([,126] = 2.23$, $p = .070$, $\eta^2_p = .07$; Group: $F[4,126] = 1.08$, $p = .370$, $\eta^2_p = .03$) and negative words (Group X Condition: $F[4,126] = .78$, $p = .777$, $\eta^2_p = .01$; Group: $F[4,126] = .39$, $p = .810$, $\eta^2_p = .01$).

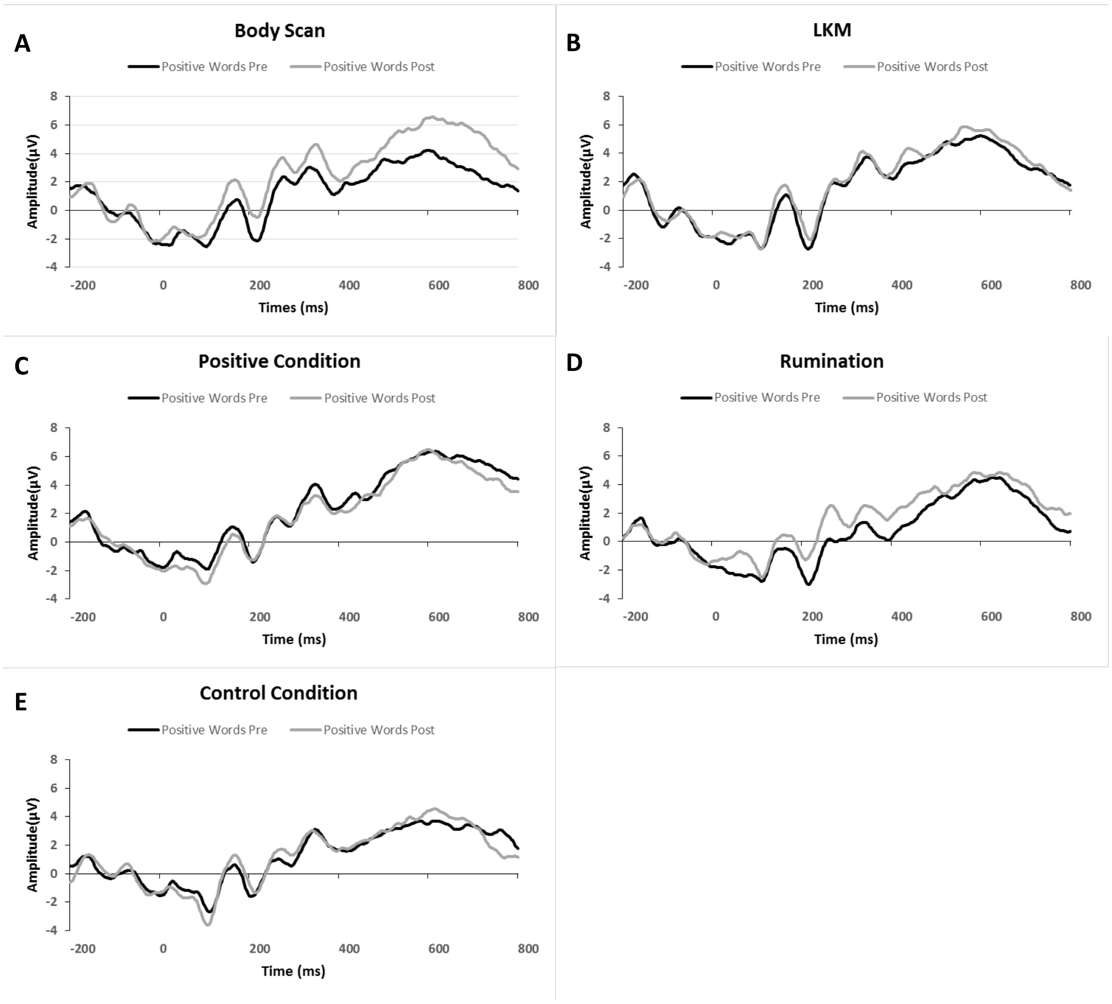


Figure 5.6 Averaged ERPs in response to positive words pre- and post-manipulation. P1 (100–200 ms), P2 (200-300 ms), and early LPP (400-600 ms) averaged across electrode sites Pz, Poz, P1, P2 for (A) body scan (n = 27), (B) LKM (n = 26), (C) positive condition (n= 26), (D) rumination (n = 27), and (E) control condition (n = 25).

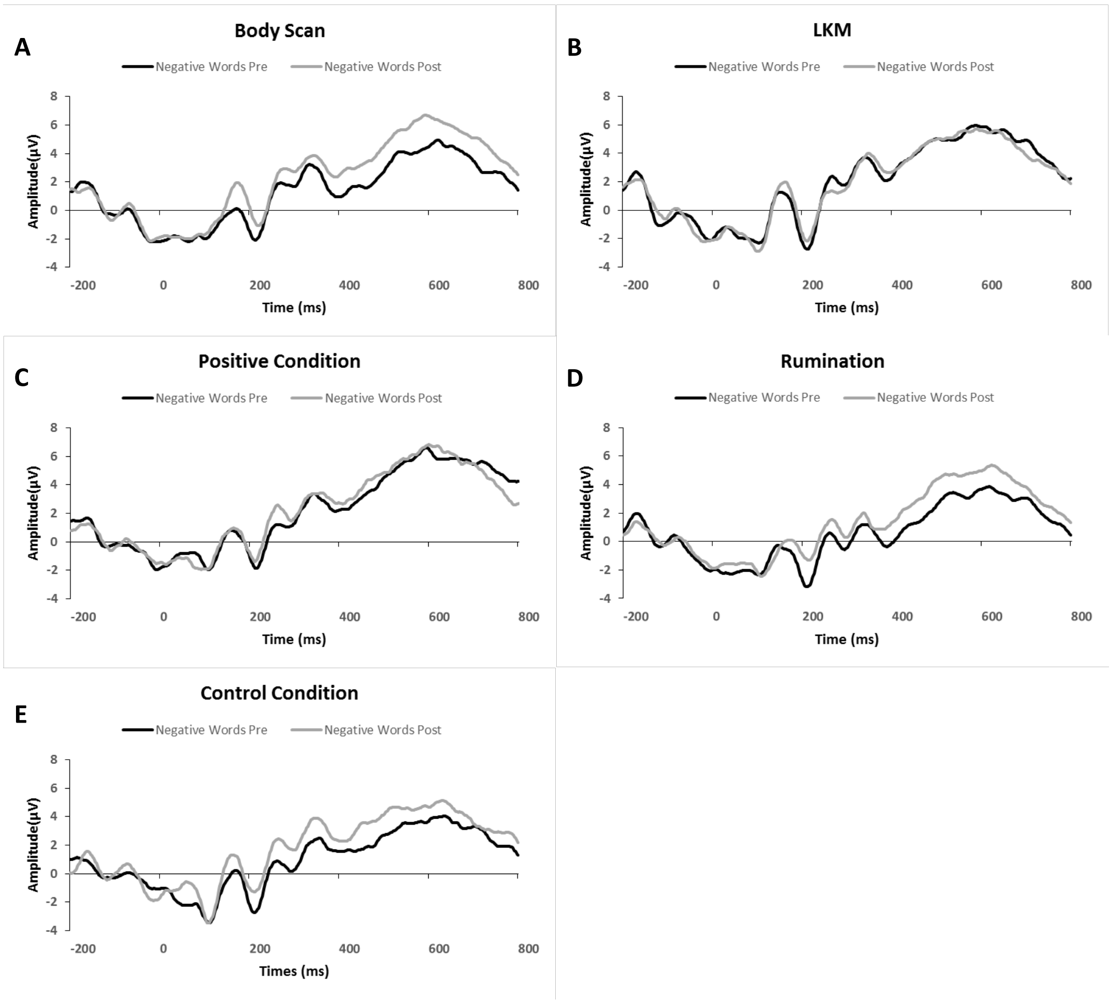


Figure 5.7 Averaged ERPs in response to negative words pre- and post-manipulation. P1 (100–200 ms), P2 (200-300 ms), and early LPP (400-600 ms) averaged across electrode sites Pz, Poz, P1, P2 for (A) body scan (n = 27), (B) LKM (n = 26), (C) positive condition (n= 26), (D) rumination (n = 27), and (E) control condition (n = 25).

5.4.5 Late ERP components LPP

The early LPP mean area was examined from 400 ms to 600 ms post-stimulus in parietal-occipital midline electrode sites. For the early LPP responses to positive words, the Group X Time (pre-manipulation, post-manipulation) ANOVA revealed a main effect of Time, with larger amplitudes post-manipulation, $F(4,126) = 5.39$, $p = .022$, $\eta^2_p = .04$. Critically, and as hypothesised, this effect was qualified by a significant Group x Time interaction, $F(4,126) = 2.57$, $p = .044$, $\eta^2_p = .08$. Simple contrasts revealed that only the body scan significantly increased the early LLP activation, $F(1, 26) = 11.58$, $p = .002$, $\eta^2_p = .31$, 95% CI [-3.43, -.78] (all other $p > .05$; see Figure 5.6). The main effect of group was not significant, $F(4,126) = 1.15$, $p = .334$, $\eta^2_p = .03$.

For the early LPP activation in response to *negative words,* only the main effect of time was significant, with less early LPP activity in responses to negative words post-manipulation, $F(4,126) = 7.87$, $p = .006$, $\eta^2_p = .06$. No other significant effects emerged for early LPP activation towards negative words (Group X Time: $F[4,126] = 1.24$, $p = .296$, $\eta^2_p = .03$; Group: $F[4,126] = 1.35$, $p = .254$, $\eta^2_p = .04$; see Figure 5.7).

The late LPP was examined along fronto-central midline electrodes sites, and the two-way ANOVA indicated a significant main effect of Time, $F(4,126) = 7.54$, $p = .007$, $\eta^2_p = .06$, with lower late LPP activity post-manipulation. In addition, there was a significant main effect of Group, $F(4,126) = 2.61$, $p = .036$, $\eta^2_p = .08$. The main effects of Time and group were qualified by a significant Group X Time interaction for late LPP activity to positive words, $F(4,126) = 3.68$, $p = .007$, $\eta^2_p = .11$. Simple contrasts revealed that there was a significant decrease in late LPP activity after the positive condition, $F(1, 25) = 8.08$, $p = .009$, $\eta^2_p = .24$, 95% CI [.62, 3.91], and the control condition, $F(1, 25) = 7.71$, $p = .020$, $\eta^2_p = .24$, 95% CI [.57, 3.87]. No significant pre-/post- differences have been found for the other conditions (all $p > .05$; see Figure 5.8).

The Group X Time (pre-manipulation, post-manipulation) ANOVA examining late LPP activity change in response to *negative words* did not yield a main effect of Group, $F(4,126) = 1.94$, $p = .108$, $\eta^2_p = .06$) or Time, $F(4,126) = 2.92$, $p = .133$, $\eta^2_p = .02$). However, there was a significant Group X Condition interaction, $F(4,126) = 2.5$, $p = .042$, $\eta^2_p = .08$. Simple contrast revealed that there was a significant increase in late LPP activation in responses to negative words after the rumination condition, $F(1,26) = 5.46$, $p = .027$, $\eta^2_p = .17$, 95% CI [-3.27, -.21], whereas participants in the LKM demonstrated the opposite pattern, $F(1,25) = 6.20$, $p = .020$, $\eta^2_p = .19$, 95% CI [.38, 3.99]. No effects have been found for the other experimental manipulations (all $p > .05$; see Figure 5.9).

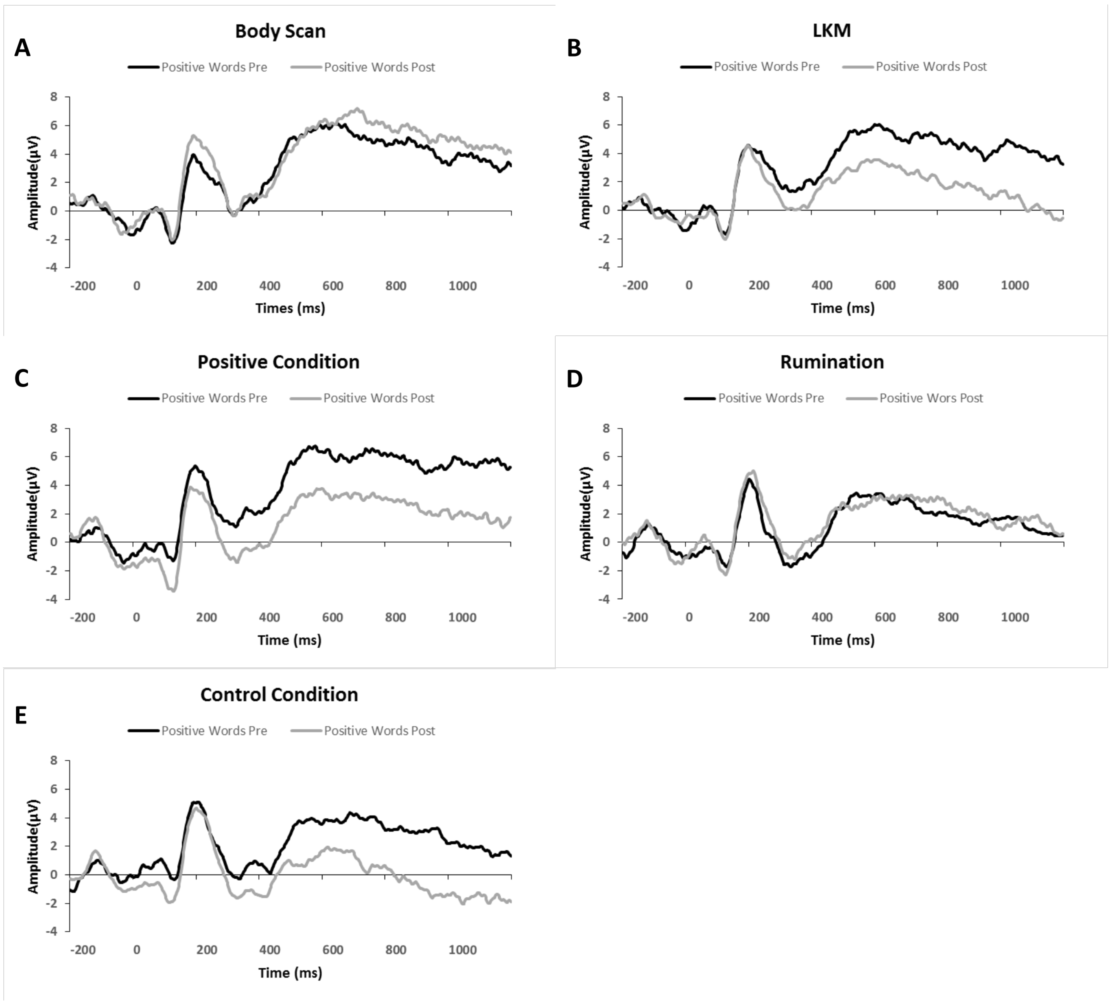


Figure 5.8 Average ERPs Late LPP activity (600 -1,200 ms) in response to positive words averaged across electrode sites Fz and FCz for (A) body scan (n = 27), (B) LKM (n = 26), (C) positive condition (n= 26), (D) rumination (n = 27), and (E) control condition (n = 25).

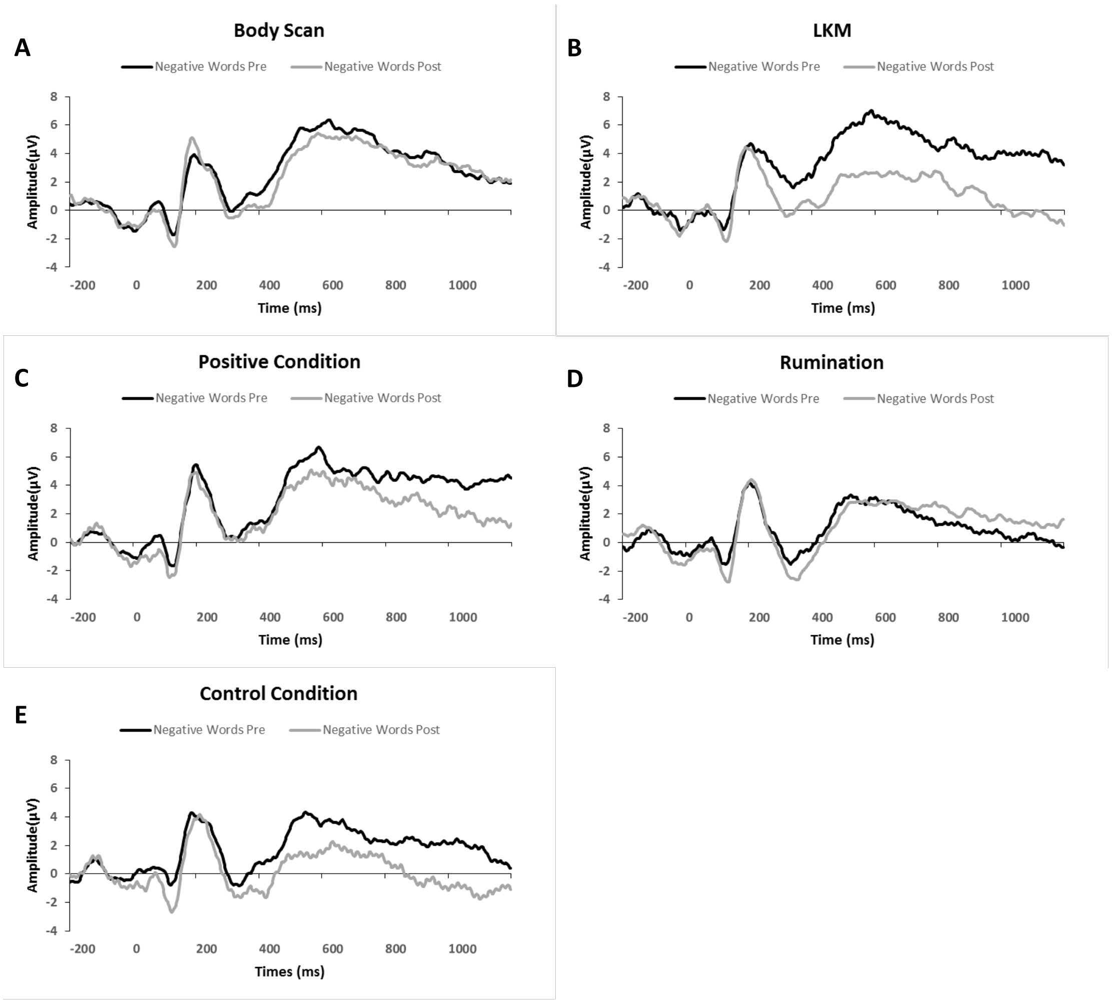


Figure 5.9 Averaged ERPs Late LPP activity (600 -1,200 ms) in response to negative words averaged across electrode sites Fz and FCz for (A) body scan (n = 27), (B) LKM (n = 26), (C) positive condition (n= 26), (D) rumination (n = 27), and (E) control condition (n = 25).

5.5 Discussion

The goal of this study was to investigate the effect of self-compassion inductions as compared to control conditions on behavioural and neural mechanisms associated with self-referential processing. Results indicated that the experimental conditions successfully manipulated self-reported state levels of self-compassion and self-criticism. Specifically, the Loving Kindness Meditation and the Body Scan increased levels of state self-compassion and decreased state levels of self-criticism. Similar patterns could be found for the positive excitement condition. The opposite pattern has been found for the rumination condition. Finally, the neutral control condition did not affect participants' ratings. With respect to word endorsement change in response to the experimental manipulation, participants assigned to the direct self-compassion manipulation (LKM) significantly endorsed more positive words and fewer negative words after the self-compassion manipulation as compared to before. This is in line with the hypothesised increase of a positive self-perception if a more self-compassionate stance is adopted. Similarly, the positive excitement condition led to the same effect. This fits with the suggestion that this type of positive affect has been associated with a positive self-view (e.g. Gilbert, 2009). The body scan was only associated with a decrease in negative words endorsed but no change was found in positive word endorsement. In contrast, the rumination induction significantly decreased positive word endorsement but no change was found in respect to negative words endorsed. The activation of a more positive self-perception following the self-compassion inductions and the positive condition was accompanied by faster reaction times to positive words post-manipulation, while reaction times towards negative words were not affected. In contrast, reaction times were significantly faster towards negative words after the rumination condition.

Interestingly, individual differences in trait levels of self-compassion and self-criticism moderated the positive word-endorsement change following the LKM. The moderation analyses indicated that only participants with higher levels of trait self-compassion and lower levels of trait self-criticism showed an increase in positive words endorsement. In contrast, people with lower levels of self-compassion and higher levels of self-criticism demonstrated a decrease in positive words endorsed after the LKM. With respect to the more indirect self-compassion induction, the compassionate body scan, participants with higher attachment related avoidance showed an increase in positive endorsed words after the body scan. The finding that self-criticism and lower levels of self-compassion are linked to a decrease in positive self-perception when engaging in the direct self-compassion induction (LKM) provides further support that these individuals may find the cultivation of self-compassion difficult at first (Gilbert et al., 2006; Gilbert & Irons, 2004; Gilbert & Procter, 2006). Self-critics often report that they feel reluctant to let go of their self-criticism and negative self-views when confronted with the cultivation of self-compassion (Gilbert et al., 2010). These difficulties might be a barrier to the development of a more positive self-perception when self-compassion is cultivated. The findings of this study raise the interesting question of whether more intensive self-compassion interventions can lead to a more positive perception of the self for this group of individuals. The finding in this study that a more indirect approach to cultivate self-compassion (the compassionate body scan) led to a less negative self-perception and that these changes were not moderated by individual differences in trait levels of self-criticism suggest that this approach might be more beneficial for self-critics as this approach does not directly confront these individuals with their negative self-views.

As a whole, the findings of this study support the hypothesis that on a behavioural level the cultivation of self-compassion can lead to a more positive and reduced negative perception of the self. Similarly, the positive excitement condition increased a positive perception of the self, while the rumination induction induced a more negative perception of the self.

Early and late cognitive-affective processes

Scalp-recorded ERPs, which provide excellent temporal resolution, have been utilised to identify temporal dynamics associated self-referential processing changes induced by the different experimental inductions. The P1 and P2 components of the ERP have been used to investigate early (likely automatic) encoding of positive and negative words. In this context, results of the current study indicate that the behavioural changes in self-referential processing following the experimental induction were not accompanied by changes in automatic processing of the words indexed by the P1 and P2 components of the ERPs. This suggests that a single induction might not be sufficient enough to impact very early and automatic encoding processes to emotional stimuli. This is in line with previous research suggesting that these early and automatic components reflect habitual self-referential processing (Shestyuk & Deldin, 2010). Of particular interest for future research would be to investigate if longer and more intensive programs designed to cultivate self-compassion can increase early and automatic encoding processing of positive words and decrease early and automatic processing of negative words. This would have important clinical relevance, as for individuals at high risk of depression the automated lexical processing of depressogenic content – especially self-relevant information – are suggested to reinforce and intensify depressive systems (Auerbach et al., 2015; Beck, 1996; Shestyuk & Deldin, 2010).

Interestingly and unexpectedly, regardless of experimental condition or word valence there was a greater P1 and P2 positivity after the manipulations. One might speculate that there was an automatic bias towards both positive and negative words after the inductions. However, increases to both word types likely reflect that the same word list was used before and after the experimental manipulations and that the altered P1 and P2 responses index recognition of the words (Hauk, Davis, Ford, Pulvermuller, & Marslen-Wilson, 2006). Indeed, there is evidence that the P1 and P2 are susceptible to word recognition (e.g. Almeida & Poeppel, 2013; Grill-Spector, Henson, & Martin, 2006).

Critically, in line with hypotheses, the results of this study indicated that the experimental manipulations affected the sustained engagement of elaborative processing towards positive and negative words (indexed by early and late LPP) differently. The LPP is initially maximal over parietal regions (i.e., early LPP) and propagates at more frontal recording sites (i.e., late LPP) several hundred milliseconds after stimulus presentation (Foti, Hajcak, & Dien, 2009). In terms of the function of the early and late LPP, they both have been associated with sustained engagement and elaborated encoding of emotional stimuli (Ruchkin, Johnson, Mahaffey, & Sutton, 1988). Critically however, the frontal propagation of self-referential biases towards negative stimuli has been argued to reflect prefrontal cortex abnormalities in depression (Lemogne et al., 2010). The results of this study indicate that there was greater early LPP activity (activation over parietal-occipital regions) in response to positive words after the body scan condition. This indicates that the body scan induced greater sustained attention towards positive words and suggests that this condition was accompanied with the expected bias to positive self-relevant information. Critically however, this sustained attention towards positive words did not propagate over frontocentral regions (indexed by late LPP activity). No other conditions impacted changes in early LPP activation to positive or negative words. Interestingly, there was evidence for decreased late LPP activation towards positive words after the excited positive condition and neutral control condition. These results indicate a decrease in sustained attention towards positive words after these two experimental conditions. In addition, there was a decrease in late LPP activity in responses to negative words after the LKM indicating less sustained attention to and elaborated processing of negative words, when a self-compassionate stance is adopted. One explanation for this finding might be that for these individuals the negative words lose their emotional importance and do not indicate threat. In contrast, the opposite pattern was found after the rumination condition. Whereas decreased sustained attention towards negative words after the LKM and increased sustained attention towards negative words after the rumination condition were expected, decreases in sustained attention towards positive words after the positive excited and neutral control conditions were unexpected. One possible explanation for these findings might be that the decreases in LPP activity towards positive words reflect that less attention and processing were required when the words were repeated (Codispoti, Ferrari, & Bradley, 2006). However, given that this decrease was not found after the other experimental conditions, firm conclusion of the effects of the re-presentation of the word list on cognitive processing processes cannot be drawn. Taken together, these results indicate that the experimental manipulations did influence late cognitive-affective processes in responses to positive and negative information about the self. Interestingly, there was some evidence that the self-compassion inductions were associated with either increased sustained attention towards positive words (body scan condition) or decreased sustained attention towards negative information about the self (LKM). However, the possible effect of the repeated presentation of the word list on LPP activity and unexpected decreases in sustained attention towards positive words after the positive condition make the interpretation of these findings less clear. Repeating the self-referential task with new word lists may help to elucidate the results of the current study.

The results of this study raise important clinical implications. There is good evidence that dysfunction in self-orientated cognitions in depression, with both automatic and more elaborated processing biases towards negative information about the self play an important role in reinforcing and intensifying depressive systems (Auerbach et al., 2015; Shestyuk & Deldin, 2010). The cultivation of self-compassion might be particularly beneficial for depressed individuals as it facilitates positive self-referential processing and reduces negative self-referential processing. This study is the first to show that a short-term cultivation of self-compassion in a healthy sample can decrease elaborated processing of negative information about the self (LKM) and increase elaborated processing of positive information about the self (compassionate body scan). Future studies will need to examine if these results extend to depressive samples. In addition, research is needed to examine if longer interventions designed to cultivate self-compassion can also influence early (automatic and likely habitual) processing biases towards negative information about the self and thus reduce depressive symptoms.

Limitations

Given the explorative character of this study, it is important to highlight several limitations. First, the self-referential task is a valuable tool to elicit early and late components associated with the perception if the self; however, the present study could not explicitly examine endorsed versus non-endorsed words between groups. In particular, all of the participants in this study endorsed comparatively few negative words as being self-relevant (see Figure 5.4). This prevented us from computing ERPs only in response to words endorsed as being self-relevant. Moreover, the self-referential task used in this study did not include neutral words. Although this is consistent with other studies using this paradigm (e.g. Auerbach et al., 2015; Shestyuk & Deldin, 2010), inclusion of a neutral valence may provide important contextual information when interpreting ERP data. Second, in order to separate effects of time or repetition from the genuine effects of the experimental manipulations further studies are required. That is to say, that the findings in this study may be influenced by the reuse of the task itself or use of the same word lists; replicating the study with a different word list after the experimental manipulation would be necessary to determine if the findings are due to changes in processing or simply due to the words being presented twice.

Conclusion

This study represents the first attempt to explore the effects of a direct and indirect self-compassion induction on behavioural and neural self-referential processes. Both self-compassion inductions increased self-reported state self-compassion and decreased self-criticism. These changes were accompanied by the expected enhanced tendency to prefer positively valenced information about the self for the direct self-compassion induction and a reduced tendency to endorse negative information about the self for both self-compassion inductions. The enhanced tendency to prefer positively valenced information about the self following the direct self-compassion induction was moderated by individual differences in trait levels of self-compassion and self-criticism, with higher levels of self-criticism and lower levels of self-compassion being linked to a decrease in positive self-perception. In addition, there was some evidence that the tendency to prefer positive information about the self was accompanied by adaptive alterations in sustained attention to emotional stimuli. The results indicate that one possible protective effect of self-compassion lies in the activation of the positive affiliative affect system that enhances a more positive self-perception.

6 Study III: Correlates of the short-term cultivation of self-compassion in healthy vs. individuals at high risk of depression

6.1 Abstract

The cultivation of self-compassion is increasingly recognised as being beneficial in improving mental health, positive emotions and wellbeing. This study tested whether vulnerability to relapse in individuals with recurrent depression might be reflected in altered psychological and physiological responses to a self-compassion exercise that in healthy individuals very potently elicits the activation of the positive affiliative affect system, a system characterised by a content and calm state of mind with a disposition for kindness, care, social connectedness and the ability to self-soothe when stressed. Heart-Rate (HR), Heart-Rate-Variability (HRV), and Skin-Conductance-Level (SCL) during a guided self-compassion meditation were recorded in 50 participants (25 healthy control and 25 remitted depressed individuals). In addition changes in positive affiliative affect, self-compassion and self-criticism were assessed. The results of this study indicate that compared to healthy controls, individuals at risk of depression - particularly individuals with high levels of self-criticism - demonstrated difficulties activating the positive affiliative affect system on a physiological level via the cultivation of self-compassion. Clinical implications of the findings are discussed.

Keywords: Self-compassion, psychophysiology, positive affiliative affect, depression

6.2 Introduction

With a lifetime prevalence of around 16 %, depression, is a very prevalent disorder associated with significant impairment and suffering (Kessler et al., 2009; Kessler & Bromet, 2013; Wittchen et al., 2011). Much of the burden of depression is caused because it typically runs a recurrent course, with rates of recurrence/relapse greater than 50% for those who have their first episode and 90% for those who have had three or more episodes (Kessing et al., 2004). If we can better understand the mechanisms implicated in recurrent/relapsing depression, then psychological interventions can target these mechanisms, potentially breaking up the pattern of relapse/recurrence and support sustained remission/recovery (Clark, 2004).

The model of cognitive vulnerability to depressive relapse and recurrence (Segal et al., 2013) states that if people who have a history of several depressive episodes become distressed or experience sad mood, they are at high risk of depressive relapse/recurrence. This is because for these people sad mood has become associated with specific maladaptive cognitions, like negative beliefs about the self and a tendency to ruminate or catastrophise. These maladaptive thought processes maintain low mood and potentially escalate into a depressive episode (Beck & Haigh, 2014; Teasdale & Barnard, 1993). In those at risk for depression, these maladaptive thought processes have become automatic and once activated people find it difficult to disengage from them (Teasdale & Barnard, 1993). Several theoretical and empirical arguments converge to suggest that self-compassion might be a resilient response to cognitive reactivity in people at risk for depression (Feldman & Kuyken, 2011; Kuyken et al., 2010).

Self-compassion has been defined as being kind to one's self (Neff, 2003b) and being able to use self-reassurance and soothing rooted in a secure attachment style (Gilbert, 2009) in times of adversity (Gilbert, 2009; Neff, 2003b). Further, it includes being non-judgmental about one's self (Gilbert, 2009; Neff, 2003b) and recognising one's experience as part of the human condition (Neff, 2003b) and being able to care for and affiliate with others (Gilbert, 2009). It is a state where a sense of safety can be activated and alleviate distress. This is in contrast to self-criticism which is characterised by maladaptive emotion regulation strategies such as being harsh and judgmental to one's self (Gilbert, 2009; Neff, 2003b), feeling isolated (Neff, 2003b) and being in flight or fight or social rank mode (Gilbert, 2009). Self-criticism therefore exacerbates a sense of threat in difficult times (Gilbert, 2009).

There is now a large body of correlational work showing a relationship between self-compassion, emotion regulation, wellbeing and mental health (MacBeth & Gumley, 2012; Zessin et al., 2015). For example, Karl and Kuyken (2010) found a significant negative association between trait self-compassion and self-reported cognitive-behavioural avoidance and rumination in a sample of trauma survivors with a history of depression. They argue (based on cross-sectional data) that self-compassion may be protective because it prevents people from engaging in maladaptive thought processes that take up individual's attentional resources, serve avoidance and thus prevent adaptive processing and memory update. In a series of five studies with undergraduate student samples, self-compassion attenuated emotional reactions to a range of stressful real, remembered and imagined events (Leary et al., 2007).

Critically however, most of the research on self-compassion in depressive samples to date heavily relies on self-reporting and the psychophysiological underpinnings of self-compassion that facilitate its beneficial effects are currently under-studied in the literature. Paul Gilbert (2009) positions compassion (for self and others) in the context of a soothing and contentment system accompanied by a specific physiological activation pattern that enables an individual to respond adaptively to emotional challenges and to relate to other individuals. Drawing on a review of positive and affiliative emotions (Depue & Morrone-Strupinsky, 2005), the social engagement system (Porges, 2007), and studies of threat based emotions (LeDoux, 1998), Gilbert (2009) proposes a tripartite affective system, which consists of one negative 'threat-focused' affect system and two positive affect systems. One of the two positive systems is focused upon stimulation and excitement, while the other is associated with feeling safe, with secure attachment, affiliating with others, and the ability to self-soothe when stressed. Gilbert (2009) suggests that compassion (for the self and others) enhances wellbeing because it stimulates the soothing and contentment system. The stimulation of this system is suggested to promote a calm physiological state, that is conducive to interpersonal approach and social affiliation (Depue & Morrone-Strupinsky, 2005). This calm physiological state is associated with enhanced parasympathetic activity that gives raise to the beat-to-beat variability in heart rate known as heart rate variability (HRV), which has been linked to flexible attention deployment and adaptive emotion regulation to threat contexts (Thayer & Lane, 2000) and is suggestive of the ability to self-soothe when stressed (Porges, 2007). Furthermore, the soothing and contentment system is proposed to be important in down-regulating the negative sympathetic threat-seeking system (Depue & Morrone-Strupinsky, 2005; Gilbert, 2014).

Gilbert (2014) argues that people with psychological difficulties have an increased sensitivity to feel anxiety, anger or despair because their threat-protection system becomes quickly activated in times of distress. In contrast, they have difficulties activating the soothing and contentment system in times of adversity. This is because experienced childhood adversity and attachment difficulties may result in a reduced capacity activate this system as their experiences precluded them from being exposed to this positive learning opportunity (Gilbert et al., 2010; Mikulincer & Shaver, 2007). However, this theorised argument has to date not been empirically tested within individuals at high risk for depression.

Taken together, one possible protective effect of self-compassion lies in the activation of the positive affiliative affect system, which is characterised by a content and calm state of mind with a disposition for kindness, care, social connectedness and the ability to self-soothe when stressed. It is hypothesised that people at high risk of depression might have particular difficulties activating the soothing and contentment system, especially in times of distress, which makes it difficult for them to step out of reactivity.

Interestingly, there is evidence that self-compassion can be cultivated both in short-term laboratory inductions and more intensive programs (Galante et al., 2014; Hofmann et al., 2011). For example, Kirschner et al. (2013) found that one-off meditation exercises designed to cultivate self-compassion can increase state levels of self-compassion and positive affiliative affect and decrease state levels of self-criticism in a student sample. There was also evidence that self-compassion exercises decreased autonomic arousal and increased parasympathetic activity. Critically, to date it has not been tested if individuals at high risk of depression differ in their ability to activate the soothing and contentment system via the cultivation of self-compassion as compared to healthy individuals.

Towards the goal of a better understanding of psychophysiological differences between people at risk of depression and healthy individuals, the primary aim of this study was to examine psychophysiological correlates associated with the short-term cultivation of self-compassion. To maximise the integrity of the experimental self-compassion induction used in this study, it was developed and recorded together with mindfulness teachers with extensive experience. Self-compassion was induced using a loving kindness mediation with a specific focus on cultivating self-compassion (adopted from Neff & Germer, 2013). This study recruited formerly depressed participants (remitted depressed group) as well as healthy controls, using clinical interviews to assess history of depression. It aimed to test the following hypotheses: firstly, when exposed to a self-compassion induction, relative to healthy participants remitted depressed individuals will demonstrate less self-reported increases in state levels of self-compassion, positive affiliative affect, and less decreases in state self-criticism. Physiological measurements will examine skin conductance (inferring sympathetic activity), heart rate (inferring autonomic arousal), and HRV (inferring parasympathetic activity). When examining differences in physiological responses to the self-compassion induction, it is hypothesised that remitted depressed individuals will demonstrate less of a decrease in sympathetic activity and autonomic arousal and fewer increases in parasympathetic activity, as compared to healthy participants. This is because the stimulation of the soothing and contentment system may be more challenging for individuals with an underlying psychopathology such as recurrent depression (Gilbert, 2014). Based on clinical observations that for some people who are very self-critical and experienced attachment difficulties and adversity with caregivers, focusing on self-compassion can be difficult (Gilbert & Irons, 2004), it is further hypothesised that individual differences in trait levels of self-compassion, self-criticism, attachment style and experienced childhood adversity will moderate the hypothesised effects.

6.3 Method

6.3.1 Participants

Participants with a history of depression but not currently depressed (remitted depressed group; $N = 25$) and a never-depressed control group (healthy control group; $N = 25$) were recruited from the greater Exeter area through the use of online advertisements and flyers (see Figure 6.1 for participant flow diagram). Inclusion criteria for participants included the following: age over 18 years, English as first language, right-handedness. For never depressed control participants, exclusion criteria included history of depression, current other axis-I disorders, visual or hearing difficulties which were not corrected for by contact lenses, glasses or a hearing aid, very sensitive skin or diagnosed skin condition, history of brain surgery, high blood pressure, fitted peacemaker, and history of epilepsy. The remitted depressed group had the same exclusion criteria, with exception of history of depression (inclusion criteria was at least 3 past episodes). In addition, for the participants of the remitted depressed group, exclusion criteria included attendance of formal concurrent psychotherapy.

Sample characteristics are depicted in Table 6.5. Groups did not differ in terms of age, gender ratio, attachment related anxiety – assessed by the Relationships Structures Questionnaire (RSQ; Fraley et al., 2006) -, experienced over-control in childhood – measured via the Measure of Parental Style (MOPS; Parker et al., 1997) -, and the hated self subscale of the Forms of Self-Criticising/Attacking & Self-Reassuring Scale (FSCRS; P. Gilbert et al., 2004). As expected, self-report depressive symptom scores –

assessed by the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996)- between the remitted depressed and healthy group were significantly different. In addition, the groups did differ in terms of trait self-compassion – assessed by the Self-Compassion Scale (SCS; Neff, 2003)-, trait self-criticism – measured by the FSCRS (Gilbert et al., 2004)-, attachment related avoidance – assessed by the Relationships Structures Questionnaire (RSQ; Fraley et al., 2006)-, and on the subscales of experienced childhood adversity abuse and indifference on the Measure of Parental Style (MOPS; Parker et al., 1997).

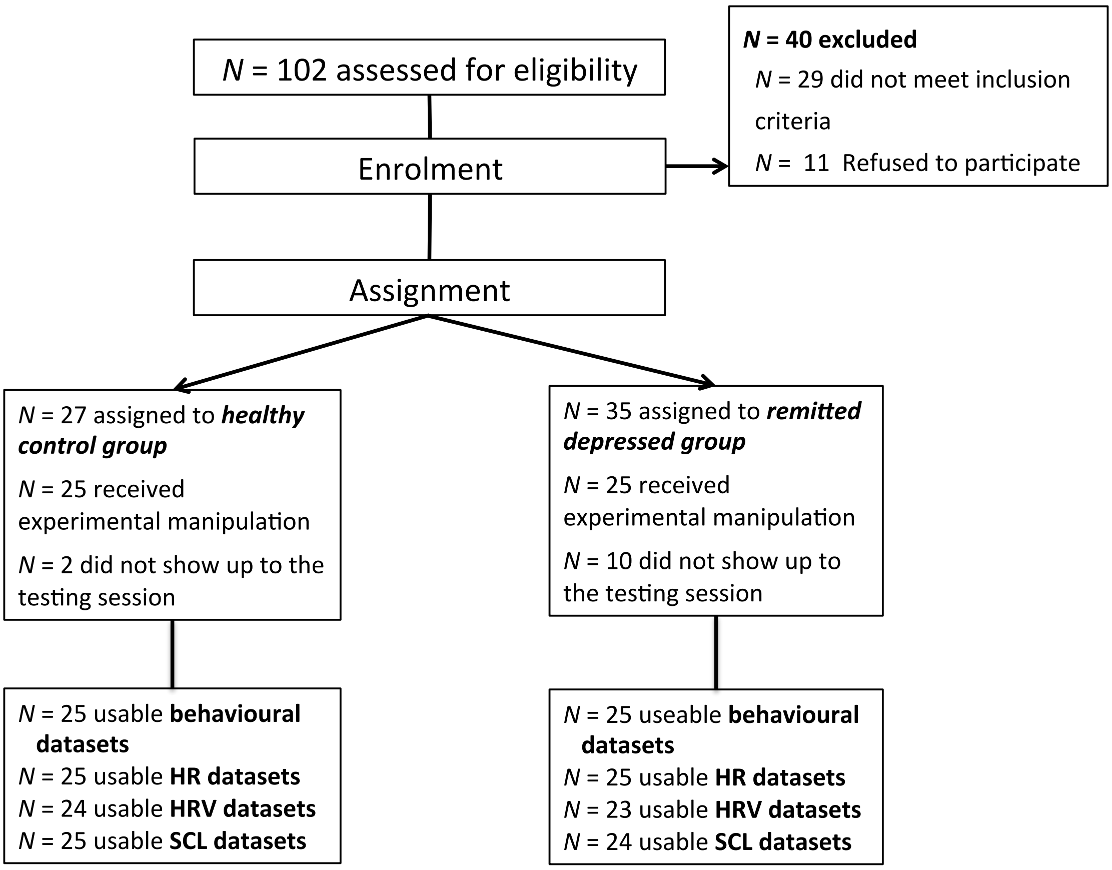


Figure 6.1 Participant flow diagram.

Table 6.5:

Means, Standard Deviations, and Significance Tests for the sample characteristics of the two different groups

Characteristic	Group		Test	p
	Healthy control	Remitted depressed		
n	25	25		
gender				
male/female: n	7/18	6/19	$\chi2(1, N=50)) = .10$	.747
Female: %	72	76		
Age in Years *M*(*SD*)	48.96(10.32)	46.16(11.38)	$t(48) = -.91$	.367
Relationship Structure Questionnaire				
Total avoidance: *M*(*SD*)	1.66 (0.81)	2.62 (1.08)	$t(48) = 3.47$	.001
Total anxiety: *M*(*SD*)	1.86 (1.2)	2.47 (1.09)	$t(48) = 1.76$	.086
Self Compassion Scale				
Tota sum: *M*(*SD*)	21.36 (3.58)	15.43 (4.14)	$t(48) = - 5.19$	< .001
FSCRS				
Reassure Self: *M*(*SD*)	21.62 (6.29)	17.70 (4.67)	$t(48) = -2.45$	.018
Inadequate Self: *M*(*SD*)	11.04 (7.50)	18.54 (9.08)	$t(48) = 3.16$	.003
Hated Self: *M*(*SD*)	1.70 (3.76)	3.50 (3.37)	$t(48) = 1.74$	.089
MOPS				
Indifference: *M*(*SD*)	0.87 (0.60)	3.02 (3.94)	$t(48) = 2.42$	.020
Abuse: *M*(*SD*)	0.46 (1.04)	2.40 (2.83)	$t(48) = 3.13$	.003
Over control: *M*(*SD*)	1.81 (1.56)	2.40 (2.83)	$t(48) = 1.25$	.217
BDI: *M (SD)*	1.12 (1.48)	11.79 (9.59)	$t(48) = 5.38$	< .001
Number of depressive Episodes: *M*(*SD*)		4.72 (4.03)		
Age of onset first depressive Episode: *M*(*SD*)		26 (9.45)		
Medication				
Yes/No		7/18		

Note. Trait self-compassion has been assessed via the SCS (Neff, 2003). The possible range of this scale is 0 – 30, with higher scores indicating higher trail levels of self-compassion. Attachment related avoidance and anxiety have been measured via the RSQ (RSQ; Fraley et al., 2006). The possible range of the two subscales is 0 – 7, with higher scores indicating higher attachment related anxiety or avoidance. The Forms of Self-Criticising/Attacking & Self-Reassuring Scale (Fraley et al., 2006) was used to assess trait level of self-criticism. The scale measures two forms of self-criticalness; inadequate self (possible range 0 – 33), and hated self (possible range 0 – 20), and one form of self-reassurance, reassure self (possible range 0 -32). Experienced childhood adversity (i.e. experienced indifference: range 0 -18; experienced abuse: range 0 – 15; experienced over-control: range 0 -12) was assessed via the Measure of Parental Style (MOPS; Parker et al., 1997). BDI-II = Beck Depression Inventory, Second Edition – used as measurement for depressive symptoms.

Seven participants of the remitted depressed group were on antidepressant medication (selective serotonin reuptake inhibitors (SSRIs)); because no differences emerged for medicated versus unmedicated participants, data were pooled together across all remitted depressed participants for subsequent analyses.

6.3.2 Materials

Self-report measurements. To assess individual difference variables hypothesised to moderate the impact of the self-compassion manipulation we assessed trait levels of self-criticism, attachment style, experienced childhood adversity and trait levels of self-compassion.

The Forms of Self-Criticising/Attacking & Self-Reassuring Scale (FSCRS; Gilbert et al., 2004). The FSCRS was used to measure levels of self-criticism. It is a 22-item scale, which measures different ways people think and feel about themselves when things go wrong for them. The items make up three components There are two forms of self-criticalness (inadequate self, and hated self), and one form of self-reassure, reassure self. The responses are given on a 5-point Likert scale (ranging from 0 = not at all like me, to 4 = extremely like me). Findings suggest good reliability (α = .90 for inadequate-self and α = .85 for both the hated-self and the reassured-self) and validity (e.g. Baiao, Gilbert, McEwan, & Carvalho, 2015). Recent research confirmed the original three-factor structure of the FSCRS in both clinical and non-clinical samples suggesting that self-criticism should not be seen as a single dimension (e.g. Baiao et al., 2015; Castilho, Pinto-Gouveia, & Duarte, 2015). Both forms of self-criticism have been positively linked depression and anxiety whereby the self-hating domain was more associated with self-harm and borderline phenomenology (Gilbert et al., 2004; Gilbert et al., 2010). In contrast, greater self-reassurance has been shown to be related to mental health and well-being (Gilbert et al., 2004). Cronbach's alpha in this sample was .93 for the inadequate self, .79 for the hated self, and .82 for the reassure self.

The Relationships Structures Questionnaire (RSQ; Fraley et al., 2006). The RSQ assesses attachment dimensions of anxiety (Cronbach's α = .85 in this sample) and avoidance (Cronbach's α = .72 in this sample). This is a self-report designed to assess attachment patterns in a variety of close relationships. The same 10 items are used to assess attachment styles with respect to four targets (i.e., mother, father, romantic partner, and best friend). The responses are given on a 7-point Likert scale (ranging from 1 = strongly disagree, to 7 = strongly agree). Psychometric properties of the RSQ are adequate. Research has shown that the individual scales demonstrated a good retest-reliability over 30 days (r = .88 for the avoidance scores and r = .92 for the anxiety scores) and that the scales are meaningfully related to different outcomes (e.g. relationship satisfaction and depressive symptoms) (see Fraley, Heffernan, Vicary, & Brumbaugh, 2011; Fraley, Hudson, Heffernan, & Segal, 2015).

The Measure of Parental Style (MOPS; Parker et al., 1997). The MOPS was used to asses experienced childhood adversity. It is a self-assessment tool to measure perceived parenting styles across three measures (Indifference, Abuse, Overcontrol). The responses are given on a 4-point Likert scale (ranging from 0 = not true at all, to 3 = extremely true). The three subscales of the MOPS have shown good reliability across 4 weeks testing period (r = .93 for parental indifference, r = .92 for parental abuse, and r = .87 for parental over-control (Picardi et al., 2013)), and good internal consistency (α = .93 for parental indifference, α = .82 for parental over-control, and α = .87 for parental abuse (Parker et al., 1997)). Higher scores on the three parental domains of the MOPS have been associated with mental health problems such as depression and anxiety disorders (Kuyken et al., 2015; Parker et al., 1997). It displayed good reliability (Cronbach's α = .91 for indifference, .86 for abuse, and .61 for over control in this sample).

The Self-Compassion Scale (SCS; Neff, 2003). The SCS is a 26 item self-report scale, which measures six dimensions of self-compassion: mindfulness (Cronbach's α = .79 in this sample), over-identification (Cronbach's α = .82 in this sample), self-kindness (Cronbach's α = .80 in this sample), self-judgement (Cronbach's α = .83 in this sample), isolation (Cronbach's α = .87 in this sample), and common humanity (Cronbach's α = .83 in this sample). Each item is rated on a five-point scale, ranging from 1 ("almost never") to 5 ("almost always"). For the total scale the internal consistency coefficient was α = .91. In this study I obtained the total of this scale (sum of the six self-compassion dimensions, with the negative dimensions – over-identification, self-judgment, and isolation - reversely coded) as measure of trait self-compassion. Research demonstrated that the SCS has shown good test-retest reliability (r = .93) and convergent and discriminant validity (Neff, 2003; Neff, 2015; Neff, Kirkpatrick, & Rude, 2007; Neff, Rude, & Kirkpatrick, 2007). A more detailed description on the psychometric properties of the SCS can be found in chapter 2.1, pp. 5 – 8.

The Beck Depression Inventory, Second Edition (BDI II; Beck, Steer & Brown, 1996). The BDI-II was used to measure the intensity of depression symptoms over the past two weeks. For each of the 21 items, participants endorse a statement that best describes their experience, on a 4-point (0-3) scale. Higher scores indicat higher levels of depressive symptoms, cutoffs for the BDI-II include: (a) 0 to 13 = minimum depression, (b) 14 to 19 = mild depression, (c) 20 to 28 = moderate depression, and (d) 29 to 63 = severe depression. In the current study, the Cronbach's alpha for the BDI-II was .94, suggesting excellent internal consistency.

VAS. To assess the effectiveness of the self-compassion manipulation on participant's mood, self-compassion, positive affiliative affect and self-criticism a series of questions using Visual Analogue Scales (ranging from 0 to 100) have been used throughout the experiment. Four questions asked participants about their state affiliative affect (i.e., feeling securely attached, safe, loved and connected; Cronbach's α = .66 in this sample; Cronbach's α = .84 in this sample) based on the state adult attachment measure (SAAM; Gillath, et al., 2009), three about their state self-compassion (Cronbach's α = .78 in this sample) adopted from the Self-Compassion Scale (SCS; Neff, 2003), and one about their state self-criticism (based on the Forms of FSCRS (Gilbert al., 2004).

Self-Compassion Manipulation. The self-compassion manipulation in this study was developed and recorded together with an experienced MBCT therapist from the ACCEPT clinic, an NHS commissioned depression service that is part of the University of Exeter Mood Disorders Centre. The guided mediation was 11.5 minutes long. The basis of the manipulation was a Loving Kindness Mediation (Neff & Germer, 2013; Salzberg, 1995) that was tailored to specifically cultivate state self-compassion and incorporating the clinical experiences of the therapist. During the manipulation participants were guided to direct loving/friendly feelings towards a close person. They were then asked to direct the same feelings towards themselves. Feedback on the final audio exercises was gathered from experienced mindfulness and meditation practitioners as well as staff within our clinical department to ensure ecological validity.

6.3.3 Procedure

The South West Cornwall and Plymouth NHS Research Ethics Committee provided approval for the study (ref. 13/SW/0099, see Appendix V). Prior to data collection, written informed consent was received from participants. Age, gender, highest level of education obtained, and current use of medication were assessed in a brief semi-structured interview. In addition, participants underwent the depression questions from the DSM-IV Structured Clinical Interview for Diagnosis (SCID-I; First, Spitzer, Gibbon, & Williams, 1995), to assess that clients have experienced a previous major depressive episode (for the remitted depressed group) and were currently not depressed. The number of prior episodes was also measured, as well as the onset of the first depressive episode. Further, participants were screened for exclusion criteria and for current other axis-I disorders using the SCID-I screening module and excluded if they meet current criteria for any disorder. Eligible participants completed a pack of self-report questionnaires and were invited to the laboratory session. The self-report questionnaires contained measures of self-compassion, self-criticism, attachment style, childhood adversity and depression. During the laboratory session, participants completed a self-referential task. The data of the self-referential task are not presented here. After this, participants completed an 8-minute baseline period (divided into eight one minutes blocks, four with their eyes open and four with their eyes closed) where participants were invited to relax. Following the baseline, participants listened to the self-compassion manipulation and finally were asked to complete a one-minute baseline period with their eyes closed. Before and after the first baseline and following the self-compassion manipulation participants completed a manipulation check. For this we used visual analog scales (ranging from 0 to 100) to answer 11 questions about state affiliative affect. Finally, participants completed another self-referential task. During the whole experimental procedure psychophysiological measurements (EEG, ECG, SCL) were recorded.

6.3.4 Psychophysiological Recording and Pre-processing

The autonomic nervous system measures described below were recorded using a BIOPAC™ MP150 system connected to a computer running the commercially available software AcqKnowledge 4.2 (BIOPAC Systems; Goleta, CA), with acquisition sampling rate of 2000Hz. These data were filtered and corrected offline using specialised analysis programmes within the AcqKnowledge 4.2 software; as described in the respective sections below.

Heart rate (HR). The heart rate was acquired as an indicator of physiological arousal and in particular as a measure that distinguishes between physiological orientation (i.e., an organism's allocation of attention towards novel stimuli and response inhibition to familiar or insignificant stimuli (Jung et al., 2000) and defence response (i.e., an organism's protective reflex from aversive stimuli (Sokolov, 1963)). HR determination in beats per minute was based on a semi-automatic R-wave detection algorithm implemented in the software AcqKnowledge (Version 4.2., BIOPAC Systems Inc., Goleta, CA). Raw ECG data were filtered applying a FIR bandpass filter between 0.5 and 35 Hz and 8000 coefficients. Artefact detection (i.e., noisy, missing or ectopic beats) and removal was performed using a template correlation and interpolation from the adjacent R-peaks based on Berntson and colleagues (Berntson et al., 1990; Berntson & Stowell, 1998) and Solem et al. (2006). The interpolation procedure was used for less than 5% of the ECG data. Mean HR in beats per minute was then extracted from the R-waves for each data section. For the different experimental conditions, mean HR values were determined for the duration of the 11 minutes of the exercise in one-minute segments. A minute prior to the meditation start was used as a baseline.

Heart rate variability (HF HRV). High frequency heart rate variability as an indicator of parasympathetic activation and adaptive physiological regulation capacity (J. F. Thayer & Lane, 2000) was determined from the artefact-free ECG (see above) by calculating a time series of the R-peaks and submitting it to a fast Fourier transformation that calculates the power spectrum of the R-R interval variation in a given time window (Berntson et al., 1997; Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996). Of particular interest was the frequency range between 0.15 Hz and 0.4 Hz (high frequency, HF). This high frequency band of HRV is generally considered a marker of parasympathetic input. Mean HF HRV were then extracted for each data section similar to the heart rate.

Skin conductance level (SCL). Skin conductance (SC) was applied as a measure of sympathetic activation and physiological defense response (Sokolov, 1963). SC was recorded from bipolar Ag/AgCl reusable strap electrodes on the medial phalanx of the *middle and ring finger of the non-dominate hand, at a sampling rate of 125Hz.* No filters were run on SC data; however the data were manually screened for recording or movement artefacts, of which none were found within data portions of interest. Mean SCL, Maximum SCL values and minimum SCL values were extracted for the same time windows and a range correction (Lykken et al., 1966) was applied to each data section for each participant to give a mean SCL corrected for individual differences. The formula for this was: Corrected SCL = (SCL mean – SCL min) / (SCL max-SCL min).

To obtain measures of HR, HRV and SCL change throughout the audio exercise and in order to control for individual differences we calculated participants' change values for each minute of the experimental condition. These change values were calculated by subtracting values for each minute of the audio exercise from the averaged baseline values of the participant.

6.3.5 Statistical data analysis

Data were analysed using statistical software SPSS version 21 (SPSS Inc, Chicago, Illinois), R (http://www.r-project.org) and Mplus version 7.3 (Muthen & Muthen, 2014). The data distribution were explored using the ShapiroeWilk test of normality and by visual inspection. Where required we checked for multivariate normality using the Mardia test of multivariate non-normality (Mardia, 1980). Boxplots were used to identify outliers with regard to each of the outcome parameters. Cases were deemed as outliers if they were over 3 standard deviations away from the mean and didn't represent a meaningful observation. Outliers were assigned "a raw score on the offending variable that is one unit larger (or smaller) than the next most extreme score in the distribution" (Tabachnick & Fidell, 2007, p. 77).

Manipulation checks. For testing the effectiveness of the self-compassion manipulation on participant's state self-compassion, positive affiliative affect and self-criticism, a series of repeated measures ANOVAs with Time (pre vs. post self-compassion manipulation) as within-subjects factor and group (remitted depressed vs. healthy control) as between-subjects factor were conducted.

Moderation analyses. To answer the research question about the effect of individual differences on the association between self-report change in self-compassion, positive affiliative affect and self-criticism in response to the direct and indirect meditation condition, a series of simple moderation analyses were performed following suggestions and using the SPSS script provided by Hayes (2012). We used residualised gain scores in the self-report measures as outcome in the moderation models. Residualised gain scores, as validated index of pre-post change that controls for variance in initial pre-scores, were calculated by regression of post-score on pre-score on the relevant manipulation check scores (Mintz et al., 1979; Speckens et al., 2006; Williams, Zimmerman, Rich, & Steed, 1984). Moderation analyses were performed using mean-centred continuous predictors (individual difference variables hypothesised to moderate the impact of our self-compassion manipulation) and interaction terms of group (remitted depressed vs. healthy controls) and trait predictors. In order to further characterise the nature of significant interactions we used the Johnson–Neymann (J–N) technique (Johnson & Neyman, 1936; Potthoff, 1964). The J–N technique allows to directly identify points in the range of the moderator variable where the effect of the predictor on the outcome transitions from being statistically significant to non-significant by finding the value of the moderator variable for which the ratio of the conditional effect to its standard error is equal to the critical *t* score.

Latent growth curve modelling (LGCM). To investigate if (a) the two different groups (healthy control vs. remitted depressed group) demonstrated different body responses throughout the self-compassion inductions and if (b) individual differences in trait self-compassion, self-criticism, attachment style and experienced childhood adversity have an effect on the correlation between the self-compassion induction and physiological changes, a LGCM approach was applied using the software MPlus, version 7.2 (Muthen & Muthen, 2012). LGCM is a novel statistical approach for longitudinal/repeated measures data that combines and extends features of repeated measures ANOVA and structural equation modelling (Duncan, Duncan & Strycker, 2011) and allows to capture the average trend or pattern of change over time and between-person differences around the average trend (Browne, 1993; Meredith & Tisak, 1990; B. O. Muthen & Curran, 1997; Willett & Sayer, 1994).

Within LGCM, the basic growth model is fit as a restricted common factor model (Meredith & Tisak, 1990). Specifically, repeated measures of a variable represent indicators of continuous latent variables, growth factors, that represent different aspects of change and capture individual differences in a trajectory. Typically, these are the intercept (i.e., mean starting value) and the linear (i.e., rate of growth) and quadratic (i.e., levelling off, or coming down) slopes. LGCM can be calculated by statistical software package such as Mplus (Muthén & Muthén, 2014).

There are a number of advantages of this statistical approach. First, LGCM can model aspects of change as random effects; i.e., the means, variances, and covariance's of individual differences in intercepts and slopes can be estimated. Second, LGCM can handle missing data easily if they are missing at random. Third, the antecedents and sequelae of change can be examined. Fourth, LGCM allows to include time-varying covariates. Last but not least, within LGCM, the goodness of fit of the model to data can be estimated. In this study, common overall fit indices such as the root mean squared error of approximation (RMSEA), comparative fit index (CFI), the Tucker-Lewis index (TLI), and the standardized root mean square residual (SRMR) have been used to establish adequate fit of the models (see Schermelleh-Engel et al., 2003). Comparisons between the different models within each outcome variable have been made informal by using indices such as the sample size adjusted Bayesian Information Criterion (aBIC; whereby smaller values indicate a better model fit), the Akaike Information Criterion (AIC), and formal by using the Chi-Square Test (for multivariate normal outcome variables) or the Satorra-Bentler Scaled Chi-Square Test (for non-normal outcomes) (Bryant & Satorra, 2012; Satorra & Bentler, 2001).

There are also some disadvantages to LGCM. First, they require multinormally distributed variables However, recently, procedures have been introduced that allow computing LGCM with multivariately non-normal data. For example, within Mplus there is the robust maximum likelihood estimation (MLR, Muthen & Kaplan, 1985;

Muthén & Muthén, 2014). Second, there is the SEM-inherent requirement for relatively large samples. However, it has been shown that basic LGMs perform well with small total numbers (Muthen & Muthen, 2002) (Muthen & Muthen, 2002).

6.3.6 Sample size determination and justification

Sample size was determinated using a priori sample size calculations (Faul et al., 2007). The sample size was determined for a 2 (group) x 2 (time) mixed ANOVA, assuming a statistical power of .80, a = .05 and a medium effect size (f = .25). Based on this calculation it was found that a minimum of 50 participants were required for this study to detect an effect of group on the outcome variables (first hypotheses).

The sample size for testing the moderation hypothesis was based on regression models that involved three predictors (group, individual differences variable, group X individual difference interaction term). To detect a medium effect size for the interaction term (f^2= .15) a minimum of 55 participants would be required. This recruitment target was not quite met (sample size in this study was n = 50). However, because of difficulties recruiting the clinical sample within the timeline of the PhD project, I stopped the recruitment once I met the recruitment target for the first hypotheses.

Post data collection I decided to use a growth curve modeling approach (GCM) instead of repeated measures ANOVAs to analyze the physiological outcome variables. This was because the GCM approach has the advantage of taking temporal dynamics into account (see chapter 6.3.5 page 168 for a detailed description of the

LGCM approach). The literature suggests that the sample size of the present study is sufficient GCM (Curran et al., 2010; Muthen & Muthen, 2002).

6.4 Results

6.4.1 Manipulation Checks

To examine if the self-compassion manipulation led to changes in self-compassion, positive affiliative affect and self-criticism we carried out a number of manipulation checks.

Changes in state Self-compassion. The scores for the self-compassion ratings are depicted in Figure 6.2 A. There was a significant main effect of time, with higher self-compassion scores post meditation, $F(1, 48) = 28.16$, $p < .001$, $\eta^2_p = .37$. In addition, we found a significant main effect of group, indicating lower self-compassion scores in the remitted depressed group, $F(1, 48) = 6.83$, $p = .012$, $\eta^2_p = .13$. Finally, there was no significant Time x Group interaction, $F(1, 48) = .05$, $p > .05$, $\eta^2_p = .001$.

Changes in state self-criticism. The Group X Time ANOVA revealed a main effect of Time, with lower self-criticism scores post manipulation, $F(1, 48) = 6.84$, $p = .012$, $\eta^2_p = .13$. No other effects yielded significance (Group: $F[1, 48] = .44$, $p > .05$, $\eta^2_p = .01$; Group X Time: $F[1, 48] = .25$, $p > .05$, $\eta^2_p = .005$; see Figure 6.2 B).

Changes in state positive affiliative affect. The scores for the positive affiliative affect ratings are displayed in in Figure 6.2 C. Similar to the changes in state self-compassion, the main effect of Time emerged as significant, with higher positive affiliative affect post self-compassion manipulation, $F(1, 48) = 28.15$, $p < .001$, $\eta^2_p = .37$. Moreover, there was a significant main effect of Group, indicating lower general state positive affiliative affect in the remitted depressed group, $F(1, 48) = 9.04$, $p = .004$, $\eta^2_p = .16$. No significance was found for the Group X Time interaction, $F(1, 48) = .12$, $p > .05$, $\eta^2_p = .002$.

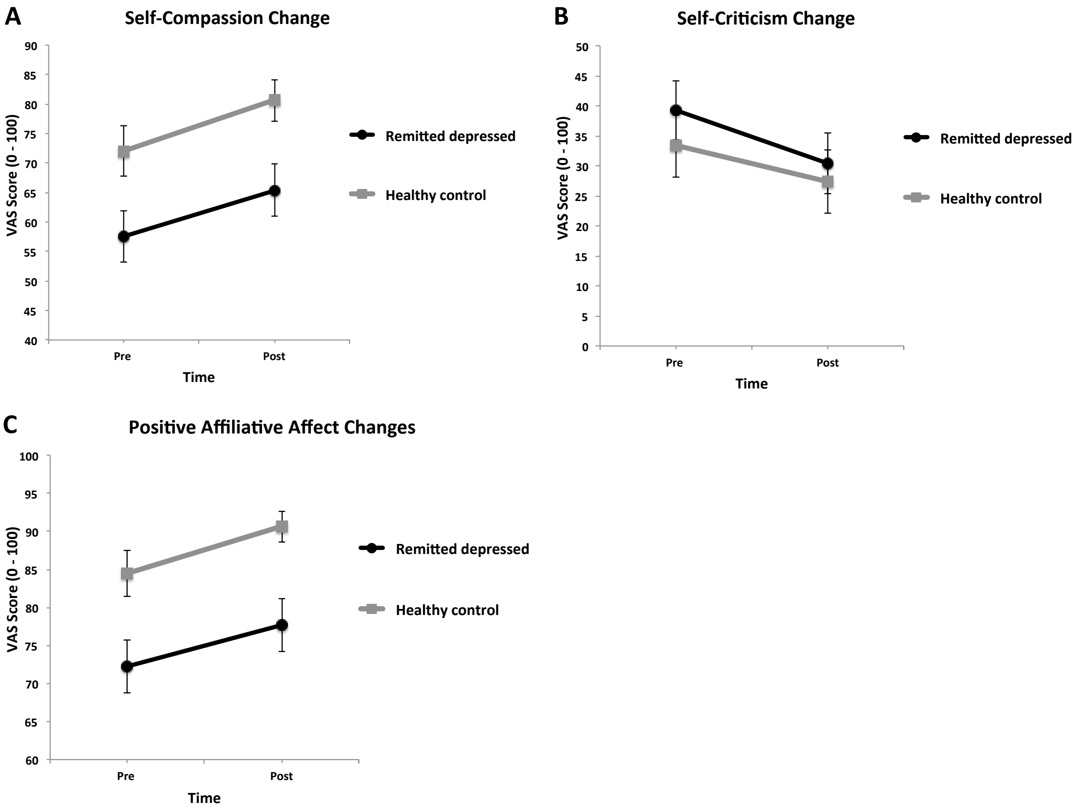


Figure 6.2 Graphs display group mean changes in self-reports ± 1 standard errors. *Note:* Pre = pre self-compassion manipulation; Post = post self-compassion manipulation; VAS Sample item for state self-compassion included: *"Right now: I feel like not being kind and understanding towards myself (0) – I feel like being very kind and understanding towards myself (100)"*. VAS sample item for the self-criticism change included: *"Right now: I don't feel at all self-critical (0) – I feel very self-critical (100)"*. VAS sample for positive affiliative affect included: *"right now: I don't feel loved and safe at all (0) – I feel very loved and safe (100).*

6.5 Associations between individual differences and changes in self-compassion, positive affiliative affect and self-criticism

To determine if individual differences in trait self-compassion, trait self-criticism, attachment style or experienced childhood adversity predict change in state self-compassion, positive affiliative affect and self-criticism, a series of simple moderation analyses were run.

6.5.1.1 Self-compassion change.

No model including condition and the different moderators reached significance in predicting state self-compassion change. This suggests that there was no difference in state self-compassion change between the remitted depressed and healthy control group. In addition, individual differences did not moderate the relationship between self-criticism change and group.

6.5.1.2 Self-criticism change.

Similar to the state self-compassion change, no model including condition and the different moderators yielded significance in predicting state self-criticism change. Again, this suggests that the two groups did not differ in state self-criticism change in response to the self-compassion manipulation. Moreover, in contrast with our hypotheses, individual differences did not moderate the relationship between self-criticism change and group.

6.5.1.3 Positive affiliative affect change.

The model including trait self-compassion as the moderator and group as predictor yielded significance in predicting change in positive affiliative affect, $F(3, 45) = 5.01$, $p = .004$, $R^2 = .18$. Within this model, the interaction made a significant contribution to the model, $b = .17$, $t(45) = 2.65$, $p = .011$. Based on the Johnson-Neyman (J-N) technique it was shown that the conditional effect of trait self-compassion on positive affiliative affect change transitioned in significance at a trait self-compassion score of 18.66 (range: 8.30 – 26.75 in this sample), $b = -.59$, $SE = .29$, $t(45) = 2.01$ $p = .05$, 95% CI [-1.18, .00], with the relation between positive affiliative affect change and group significant at trait self-compassion scores below this threshold (51.02 % in our sample) and non-significant at self-compassion scores above this threshold (48.98 %). This indicated that participants in the remitted depressed group with relatively low trait levels of self-compassion showed a relative decrease in positive affiliative affect after the self-compassion manipulation. In line with these findings, self-critical participants in the remitted depressed group showed a relative decrease in positive affiliative affect after the LKM. This was quantified by a significant trait self-criticism x group interaction, $b = -.08$, $t(45) = 2.65$, $p = .003$. The J-N technique revealed that the conditional effect of trait self-criticism on positive affiliative affect change transitioned in significance at a self-criticism score of 13.23 (FSCRS inadequate self subscale; Range: 1.00 – 34.00 in this sample), $b = -.48$, $SE = .24$, $t(45) = 2.01$ $p = .05$, 95% CI [-.96, .00], with the relation between positive affiliative affect change and group significant at self-criticism scores above this threshold (48.98 in our sample) and non-significant at SCS sum-scores below this threshold (51.02 %). No other individual differences had a significant effect on the relationship between positive affiliative affect change and group, all $p > .05$.

6.5.2 Effects of the self-compassion manipulation on physiological responses

6.5.2.1 Heart rate effects.

Did the self-compassion manipulation trigger different heart rate trajectories in remitted depressed vs. healthy control participants?

Figure 6.3 depicts the pattern of change in heart rate for remitted depressed and healthy control participants. As the outcome variables were not multivariate normal distributed we used the maximum likelihood estimation with robust standard errors (MLR). The model with continuous latent variables of intercept, slope, and quadratic growth of heart rate change at 11 time points as outcome and group as independent variable revealed an acceptable fit with $\chi^2(65) = 125.33$, $p < .001$, CFI = .910; TLI = .908; SRMR = .10; RMSEA = .13, 90% CI [.10, .17]; AIC = 2103.06; aBIC = 2074.39. The model indicated group had a significant effect on the intercept, b = 2.22, SE = .66, p = .001. This suggests that the two groups differed in their starting values in the first minute of the self-compassion manipulation in heart rate change, whereby remitted depressed individuals had significantly higher heart rate as compared to the healthy controls.

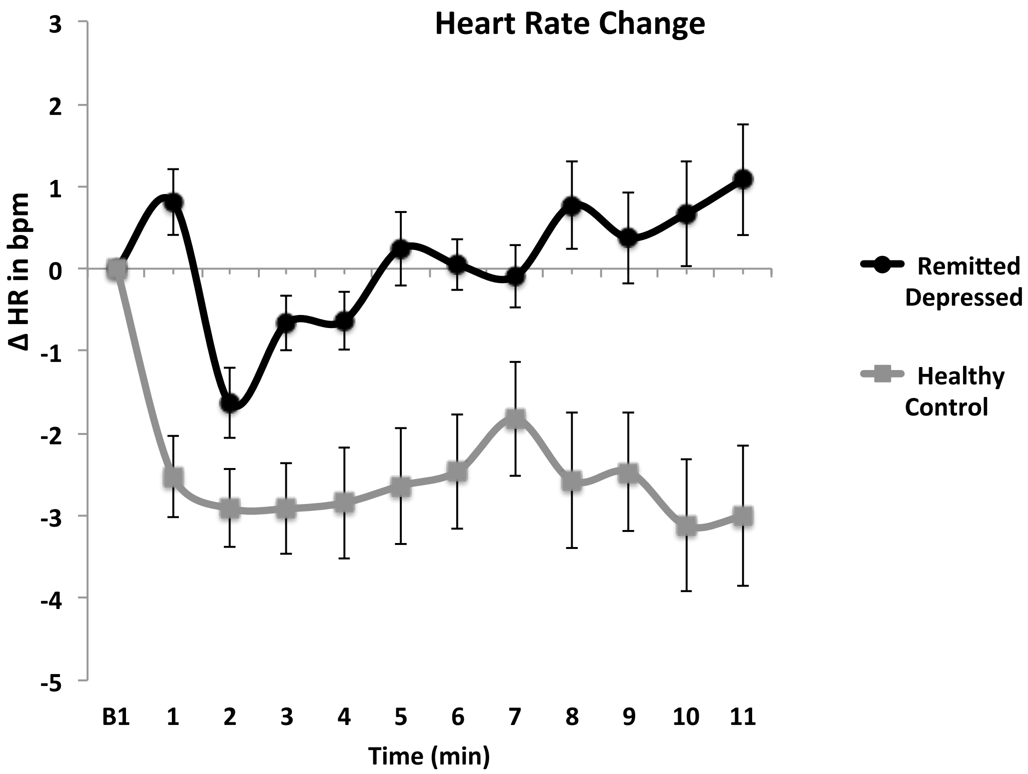


Figure 6.3 Baseline-to-exercise change in heart rate for remitted depressed individuals (N = 24) and healthy controls (N = 25) ± 1 standard errors.

Did individual differences in trait self-compassion have an effect on the correlation between the group and heart rate change?

In order to check for moderation effects of trait levels of self-compassion we added the self-compassion x group interaction predictor to the GCM model. The model remained an acceptable fit with χ^2 (81) = 147.27, p < .001, CFI = .908; TLI = .900; SRMR = .09; RMSEA = .13, 90% CI [.09, .16]; AIC = 2063.86; aBIC = 2027.14. However, the Satorra-Bentler Scaled chi square difference test indicated that this model was not significantly superior to the model only including group as independent variable, χ^2 (16) = 19.52, p = .24. The model results revealed that trait self-compassion did not interact with the group variable.

Did individual differences in trait self-criticism have an effect on the correlation between the group and heart rate change?

The self-criticism x group interaction predictor was added to the GCM model to answer this question. The model remained an acceptable fit with χ^2 (81) = 160.55, p < .001, CFI = .891; TLI = .882; SRMR = .09; RMSEA = .14, 90% CI [.14, .17]; AIC = 2031.23; aBIC = 1994.93. In addition, the Satorra-Bentler scaled Chi square difference test indicated that this model was significantly superior to the group model, χ^2 (16) = 38.89, p = .001. Within this model, the trait self-criticism moderator had a significant effect on the association between the remitted depressed group and the intercept, b = .25, SE = .11, p = .023. This suggests that self-critical individuals in the remitted depressed group had higher starting values in heart rate during the first minute of the self-compassion manipulation.

Did individual differences in attachment style have an effect on the correlation between the group and heart rate change?

The model including the attachment style x group interaction predictor remained an acceptable fit with χ^2 (81) =157.88, p < .001, CFI = .893; TLI = .884; SRMR = .09; RMSEA = .14, 90% CI [.11, .17]; AIC = 2030.63; aBIC = 1993.33. In addition, the Satorra-Bentler Scaled chi square difference test indicated that this model was significantly superior to the group model, χ^2 (16) = 33.32, p = .007. However, the model results revealed that attachment style did not interact with the group variable.

Did individual differences in experienced childhood adversity have an effect on the correlation between the group and heart rate change?

To answer this question, we added the experienced childhood adversity x group interaction predictor to the GCM model. The model remained an acceptable fit with χ^2 (81) = 146.55, $p < .001$, CFI = .901; TLI = .893; SRMR = .09; RMSEA = .13, 90% CI [.10, .17]; AIC = 1911.84; aBIC = 1872.71. However, the Satorra-Bentler scaled Chi square difference test indicated that this model was not significantly superior to the group model, χ^2 (16) = 17.87, $p = .33$. Within this model, the experienced childhood abuse moderator had a trend for a significant effect on the association between the remitted depressed group and the slope ($b = .24$, SE = .11, $p = .050$). This suggests that individuals who experienced childhood abuse in the remitted depressed group had an increase in heart rate throughout the self-compassion manipulation.

6.5.2.2 Heat rate variability effects.

Did the self-compassion manipulation trigger different heart variability rate trajectories in remitted depressed vs. healthy control participants?

Baseline to self-compassion manipulation change in heart rate variability is depicted in Figure 6.4. As the outcome variables were not multivariate normal distributed we used the maximum likelihood estimation with robust standard errors (MLR). The model with continuous latent variables of intercept, slope, and quadratic growth of heart variability rate change at 11 time points as outcome and group as independent variable revealed an acceptable fit with χ^2 (65) = 116.326, $p < .001$, CFI = .895; TLI = .893; SRMR = .06; RMSEA = .13, 90% CI [.09, .16]; AIC = 5794.05; aBIC = 5836.61. The model indicated that group had a significant effect on the intercept, b =

-127.78, SE = 26.28, $p < .001$. This suggests that the two groups differed in their starting values in the first minute of the self-compassion manipulation in heart variability rate change, whereby remitted depressed individuals had significantly lower heart rate variability as compared to the healthy controls.

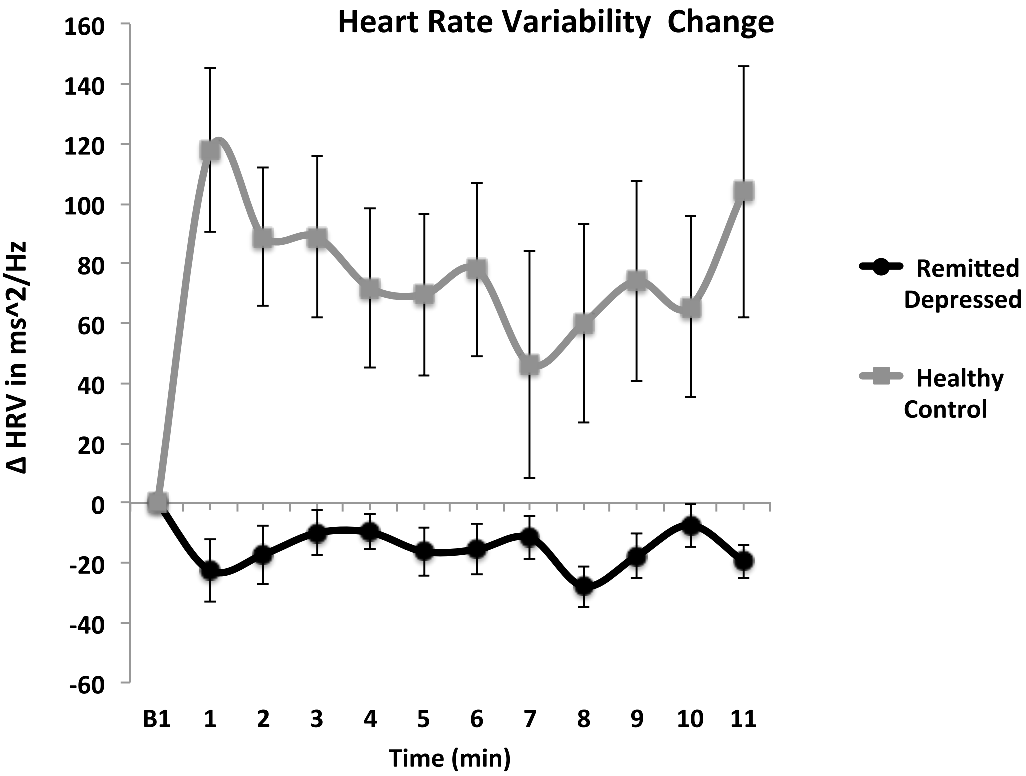


Figure 6.4 Baseline-to-exercise change in heart rate variability for remitted depressed individuals (N = 23) and healthy controls (N = 24) ± 1 standard errors

Did individual differences in trait self-compassion have an effect on the correlation between the group and heart rate variability change?

In order to check for moderation effects of trait levels of self-compassion we added the self-compassion x group interaction predictor to the GCM model. The model remained an acceptable fit with $\chi^2(81) = 149.31$, $p < .001$, CFI = .879; TLI = .868;

SRMR = .06; RMSEA = .13, 90% CI [.10, .16]; AIC = 5679.81; aBIC = 5732.84. The Satorra-Bentler Scaled chi square difference test indicated that this model was significantly superior to the group model, χ^2 (16) = 35.59, p = .003. The model results revealed that trait self-compassion did not interact with the group variable.

Did individual differences in trait self-criticism have an effect on the correlation between the group and heart rate variability change?

The self-criticism x group interaction predictor was added to the GCM model to check for moderation effects of trait levels of self-criticism. The model remained an acceptable fit with χ^2 (81) = 149.89, p < .001, CFI = .878; TLI = .867; SRMR = .06; RMSEA = .13, 90% CI [.10, .17]; AIC = 5684.15; aBIC = 5737.18. The Satorra-Bentler Scaled chi square difference test indicated that this model was significantly superior to the group model, χ^2 (16) = 39.50, p < .001. The interaction between the self-criticism moderator and the group variable yielded significance. Specifically, it had a significant effect on the association between the remitted depressed group and quadratic growth, b = .19, SE = .071, p = .006. These findings suggest that more self-critical individuals on the remitted depressed group demonstrated different pattern in terms of the curve of trajectory in their heart rate variability. The significant quadratic effect suggests that more self-critical individuals showed a bigger downturn in heart rate variability over the time of the LKM.

Did individual differences in attachment style have an effect on the correlation between the group and heart rate variability change?

To answer this question, we added the attachment style x group interaction predictor to the GCM model. The model remained an acceptable fit with χ^2 (81) = 148.28, p <

.001, CFI = .879; TLI = .869; SRMR = .06; RMSEA = .13, 90% CI [.10, .17]; AIC = 5555.57; aBIC = 5607.96. The Satorra-Bentler Scaled chi square difference test indicated that this model was significantly superior to the group model, χ^2 (16) = 35.82, p = .003. The model results revealed that attachment style did not interact with the group variable.

Did individual differences in experienced childhood adversity have an effect on the correlation between the group and heart rate variability change?

In order to check for moderation effects of experienced childhood adversity we added the experienced childhood adversity x group interaction predictor to the GCM model. The model remained an acceptable fit with χ^2 (81) = 140.07, p < .001, CFI = .885; TLI = .876; SRMR = .06; RMSEA = .13, 90% CI [.10, .17]; AIC = 5555.57; aBIC = 5607.96. The Satorra-Bentler Scaled chi square difference test indicated that this model was not significantly superior to the group model, χ^2 (16) = 19.90, p = .003. However, no interaction between experienced childhood adversity and the group variable was found.

6.5.2.3 Skin Conductance Level Effects.

Did the self-compassion manipulation trigger different heart rate trajectories in remitted depressed vs. healthy control participants?

The pattern of change in skin conductance level for remitted depressed and healthy control participants are depict in Figure 6.5. The model with continuous latent variables of intercept and slope of skin conductance change at 11 time points as outcome and group as independent variable revealed a poor fit with $\chi^2(70) = 209.95$, $p < .001$, CFI = .821; TLI = .831; SRMR = .13; RMSEA = .20, 90% CI [.17, .23]; AIC = -1127.83; aBIC = -1150.27. The model indicated that group had a significant effect on the slope, $b = .01$, SE = .004, $p = .001$. This suggests that the two groups differed in the way their skin conductance developed throughout the self-compassion manipulation, whereby the healthy control group demonstrated a steeper decrease in skin conductance level throughout the self-compassion exercise as compared to the remitted depressed group.

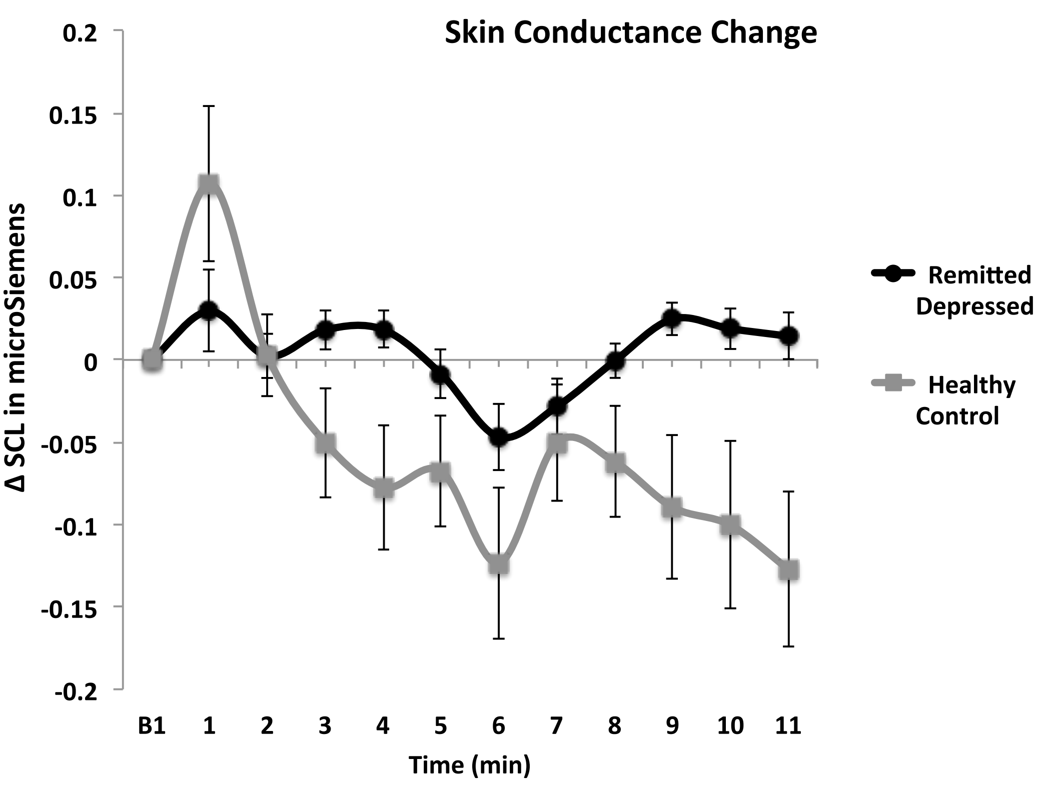


Figure 6.5 Baseline-to-exercise change in skin conductance levels for remitted depressed individuals (N = 24) and healthy controls (N = 25) ± 1 standard errors

Did individual differences in trait self-compassion have an effect on the correlation between the group and skin conductance level change?

In order to check for moderation effects of trait levels of self-compassion we added the self-compassion x group interaction predictor to the GCM model. The model remained a poor fit with χ^2 (88) = 235.59, p < .001, CFI = .810; TLI = .810; SRMR = .11; RMSEA = .18, 90% CI [.15, .22]; AIC = -1095.06; aBIC = -1122.91. However, the Chi square difference test indicated that this model was not significantly superior to the group model, χ^2 (18) = 25.64, p = .10. A significant effect was detected for the trait self-compassion moderator on the slope, b = .002, SE = .001, p = .01. Critically, in line with our hypotheses, the model revealed a trend for an interaction between the self-compassion moderator and the group variable. Specifically, it had a trend for a significant effect on the association between the remitted depressed group and slope, b = -.002, SE = .001, p = .06. These findings suggest that individuals with higher levels of trait self-compassion showed a steeper decrease in skin conductance level throughout the self-compassion manipulation.

Did individual differences in trait self-criticism have an effect on the correlation between the group and skin conductance level change?

To answer this question, we added the self-criticism x group interaction predictor to the GCM model. The model remained a poor fit with χ^2 (88) = 220.34, p < .001, CFI = .824; TLI = .824; SRMR = .11; RMSEA = .18, 90% CI [.15, .21]; AIC = -1067.71; aBIC = -1096.01. However, the chi square difference test indicated that this model was not significantly superior to the group model, χ^2 (18) = 16.76, p = .54. Within this model, the trait self-criticism moderator had a significant effect on the slope, b = .002, SE = .001, p = .002. This suggests, that regardless of group trait levels of self-criticism influenced the development of skin conductance level throughout the self-compassion manipulation. Moreover, borderline significance was detected for an effect of self-criticism on the association between the remitted depressed group and the slope, b = .002, SE = .001, p = .050. This suggests, that self-critical individuals in the remitted depressed group had an increase in skin conductance level throughout the self-compassion manipulation.

Did individual differences in attachment style have an effect on the correlation between the group and skin conductance level change?

The attachment style x group interaction predictor was added to the GCM model to check for moderation effects of attachment style. The model remained a poor fit with χ^2 (88) = 239.64, p < .001, CFI = .803; TLI = .803; SRMR = .11; RMSEA = .19, 90% CI [.16, .22]; AIC = -1066.62; aBIC = -1094.92. In addition, the chi square difference test indicated that this model was significantly superior to the group model, χ^2 (18) = 29.69, p = .041. The results of this model suggest that the attachment related avoidance predictor had a significant effect on the intercept, b = .06, SE = .03, p = .037, with higher skin conductance levels at the beginning of the self-compassion manipulation for avoidant attached individual regardless of group belonging.

Did individual differences in experienced childhood adversity have an effect on the correlation between the group and skin conductance level change?

To answer this question, we added the self-criticism x group interaction predictor to the GCM model. The model remained a poor fit with χ^2 (88) = 228.85, p < .001, CFI = .808; TLI = .808; SRMR = .11; RMSEA = .19, 90% CI [.16, .22]; AIC = -998.85; aBIC = -1028.06. However, the chi square difference test indicated that this model was not significantly superior to the group model, χ^2 (18) = 18.90, p = .39. The model results revealed that experienced childhood adversity did not influence skin conductance level change or interact with the group variable.

6.6 Discussion

Recent research suggests that the cultivation of self-compassion might be a resilient response to cognitive reactivity in people at risk for depression (Feldman & Kuyken, 2011; Kuyken et al., 2010). The aim of this study was to test if vulnerability to relapse in individuals with recurrent depression might be reflected in altered psychological and physiological responses to a self-compassion exercise that in healthy individuals very potently elicits the activation of the positive affiliative affect system, which is characterised by a content and calm state of mind with a disposition for kindness, care, social connectedness, and the ability to self-soothe when stressed. This study showed that a brief self-compassion introduction differentially cultivated self-compassion in these two groups, whereby individuals at risk of depression demonstrated reduced capacity to activate the soothing and contentment system.

Effects of self-compassion induction on self-report measures and physiology

Although self-reported changes in state self-compassion, self-criticism, and positive affiliative affect showed the predicted pattern of increased self-reported self-compassion, positive affiliative affect and decreased self-criticism after the self-compassion induction for both groups, the results indicated general lower self-reported self-compassion, positive affiliative affect, and higher self-criticism in the remitted depressed group. This main effect for group is in line with general higher levels of trait self-criticism and lower levels of trait self-compassion within this group and previous research suggesting negative association between self-compassion, self-criticism and depression (Gilbert et al., 2004; MacBeth & Gumley, 2012). However, the self-report results suggest that a single self-compassion induction can successfully increase subjective levels of positive affiliation and self-compassion. In contrast, self-report data for the remitted depressed group were not corroborated by the expected physiological response pattern that has been shown in previous research (Kirschner et al., 2013). This suggests that self-report data must be interpreted with caution in this sample and may signify a variety of issues. First, social desirability or demand characteristics may account for this discrepancy between self-report and physiological response. Second, recurrently depressed individuals may have difficulties in differentiating and labelling emotional and bodily experiences (e.g. Dunn et al., 2010).

For the healthy control group on the other hand, the behavioural changes were accompanied by a compatible physiological response pattern of increased parasympathetic activity, indicated by higher HRV and decreased sympathetic activity, indicated by lower skin conductance levels as well as decreases in heart rate. This physiological activation pattern is in line with the hypothesised stimulation of the soothing and contentment system that enables an individual to respond adaptively to emotional challenges and to relate to other individuals (Gilbert, 2009). Higher HRV has been linked to flexible attention deployment and adaptive emotion regulation to threat contexts (Thayer & Lane, 2000) and is suggestive of the ability to self-soothe when stressed (Porges, 2007). In addition, reduced parasympathetic activity is in line with the expected down-regulation of the threat system via the cultivation of self-compassion. Thus one possible protective effect of self-compassion lies in the activation of the soothing and contentment affect system which is characterised by a content and calm state of mind with a disposition for kindness, care, social connectedness and the ability to self-soothe when stressed. This is in line with previous research on physiological correlates of compassion, which demonstrated increased parasympathetic activity (Rockliff et al., 2008) and decreased sympathetic arousal (Tang et al., 2009) associated with compassion meditations.

With respect to the remitted depressed group, the self-reported increases in state levels of self-compassion, positive affect and decreases in self-criticism were not accompanied by changes in parasympathetic activity or sympathetic activity. These results suggest that for people at high risk of depression a single intervention designed to cultivate self-compassion is not associated with the stimulation of the soothing and contentment system.

Role of individual differences on the effects of self-compassion induction on self-report measures and physiology

Exploration of the role of individual differences in response to the self-compassion intervention revealed that differences in trait levels of self-compassion, self-criticism, attachment style, and experienced childhood abuse moderated the participant's responses to the intervention in the remitted depressed group. Specifically, within the remitted depressed group participants with low levels of trait self-compassion and higher levels of trait self-criticism demonstrated relative decreases in self-reported positive affiliative affect. Similarly, trait levels of self-criticism moderated the association between physiological activity and the self-compassion intervention. Results revealed that very self-critical people in the remitted depressed group showed increased heart rate and SCL and decreased HRV. In addition, experienced childhood abuse was associated with increases in heart rate in the remitted depressed control group. These results indicate that in particular self-critical individuals in the remitted depressed group demonstrated a threat-like response to the self-compassion induction characterised by increased sympathetic and decreased sympathetic activation, as well decreases in self-reported positive affiliative affect. This finding is also in line with Rockliff et al. (2008), who found decreases in HRV and a lack of significant cortisol reductions in response to compassion-focussed imagery (CFI) for a subgroup of individuals with high levels of self-criticism and an insecure attachment style, while the other participants demonstrated increases in HRV and significant cortisol decreases. In line with this argument, Longe et al. (2010) found that participants scoring higher in self-criticism showed increased amygdala activation when attempting to engage in self-reassurance thinking and conclude that this suggests that self-critical individuals experience difficulties with interventions aimed at positive thinking/self-compassion because the amygdala is implicated in responding to threat (Adolphs, 2002).

Integrating these results suggests that the proposed protective effect of self-compassion via the stimulation of the soothing and contentment affect system may rely on important individual differences and be made more challenging when there is an underlying psychopathology such as recurrent depression. First, very self-critical individuals at risk of depression may find it particularly difficult to activate this system. This is in line with clinical observations that for some individuals (particular self-critics) focusing on compassion for the self can at first be threatening and feel unsafe (Gilbert & Irons, 2004). Secondly, the activation of this system might rely on attachment and childhood adversity experiences. In this study, the remitted depressed group reported significantly higher attachment related avoidance and experienced childhood abuse as compared to the healthy control group. Difficulties in the activation of the soothing and contentment system associated with the self-compassion induction in this study might be attributed to these differences. Indeed, several researchers argue that the capacity for self-compassion and the development of the soothing and contentment system are rooted in the secure attachment system and a safe relationship with primary caregivers (Gilbert, 2009; Gillath et al., 2005; Neff & McGehee, 2010).

Limitations

This study has several notable limitations. In the current study, 7 of 25 depressed adolescents were taking SSRI medication. However, there were no differences between medicated and unmedicated remitted depressed participants in terms of self-reported depression symptoms, trait levels of self-compassion, attachment style, self-criticism, experienced childhood abuse or physiological outcome measures and their use of medication was stable for the last three months before the testing. Hence it is unlikely that medication impacted the results of this study. Another limitation is the lack of respiratory data, as it has been demonstrated that breathing might affect cardiac vagal tone (Ritz & Dahme, 2006). Hence HRV changes could be attributable to changes in breathing rate or depth. However, physical demands were kept constant throughout the study. In addition the self-compassion intervention was deliberately kept in non-breathing focus, making an influence of breathing on the HRV results unlikely. Moreover, there is evidence that respiration can be neglected when investigating the association between HRV and inhibition (Park et al., 2013; Ruiz-Padial et al., 2003).

Conclusion and clinical implications

This study investigated psychophysiological correlates associated with the cultivation of self-compassion in healthy individuals and people at risk of depression. The findings suggest that one possible protective effect of self-compassion lies in the activation of the soothing and contentment affect system which is characterised by a content and calm state of mind with a disposition for kindness, care, social connectedness and the ability to self-soothe when stressed. Critically, individuals at risk of depression (particularly self-critics) demonstrated difficulties in activating this system on a physiological level. This finding raises important implications for psychotherapy. It is yet to be explored whether therapeutic interventions can work on difficulties in cultivating self-compassion, if the therapeutic interventions will impact HRV and other physiological parameters linked to soothing, and if these methodologies could be adapted for evaluating psychotherapies. Given the increasing interest in self-compassion as a resilient response to distress in individuals at risk for depression, further research into the physiological processes underlying its cultivation may indicate ways to develop interventions to foster self-compassion among people at great risk of depression.

7 Study IV: Does mindfulness based cognitive therapy change psychophysiological responses to a short-term self-compassion manipulation?

7.1 Abstract

Mindfulness-based cognitive therapy (MBCT) is an efficacious intervention for recurrent depression. Researchers only recently started to investigate how and why MBCT works. Evidence is increasing that self-compassion might be one of the mechanisms of change in MBCT. However, the question of how the cultivation of self-compassion through MBCT is beneficial in preventing depressive recurrence is still under-studied. Based on the hypothesis that self-compassion facilitates a more adaptive deactivation of the biobehavioural threat and activation of a calming and soothing response in individuals at risk of depression, the aim of this study was to investigate psychophysiological responses to a self-compassion induction in remitted depressed individuals (N= 25) before and after the participation in MBCT as compared to a passive control group (N = 25) tested at similar time intervals. The results of the study are in support of the hypothesis that, compared to the passive control group, MBCT might be particularly beneficial for individuals at risk of depression, because it helps them to develop skills to access and activate the soothing and contentment system when invited to direct compassion towards the self. This was particularly reflected in increased parasympathetic (indexed by increased heart rate variability) and decreased sympathetic (indexed by decreased heart rate and skin conductance levels) activation as well as increased self-reported positive affiliative affect and self-compassion in response to the self-compassion induction following MBCT. These physiological response patterns are suggested to be associated with adaptive emotion regulation and self-soothing in times of distress. Directions for future research are discussed.

Keywords: Mindfulness-cognitive based therapy, depression, self-compassion, physiology, positive affiliative affect

7.2 Introduction

Depression causes significant disability and suffering, as well as costs to society (Collins et al., 2011; Wittchen et al., 2011). Much of the burden of depression is caused because it typically runs a recurrent course, with rates of recurrence/relapse greater than 50% for those who have their first episode and 90% for those who have had three or more episodes (Kessing et al., 2004). Hence, there is a great demand for optimising treatments that can prevent depressive recurrence.

Mindfulness based cognitive therapy (MBCT), an eight week psychosocial program, is an efficacious intervention for recurrent depression and has recently been shown to be effective in reducing rates of relapse (e.g. Kuyken et al., 2015; Kuyken et al., in press; Piet & Hougaard, 2011). MBCT's theoretical foundation is a model of cognitive vulnerability to depressive relapse and recurrence (Segal et al., 2013). The model proposes that if people who have a history of several depressive episodes become distressed or experience sad mood, they are at high risk of depressive relapse/recurrence. This is because for these people sad mood has become associated with specific maladaptive cognitions, like negative beliefs about the self and a tendency to ruminate or to catastrophise. These maladaptive thought processes maintain low mood and potentially escalate into a depressive episode (Beck & Haigh, 2014; Teasdale & Barnard, 1993). In those at risk for depression these maladaptive thought processes have become automatic and, once activated, people find it difficult to disengage from them (Teasdale & Barnard, 1993).

This (re) activation of dysfunctional thinking styles triggered by dysphoric states is suggested to be a key mechanism for depressive relapse/recurrence (Segal et al., 2006). MBCT was developed to target this cognitive reactivation (Segal et al., 2013).

MBCT is a manualised skill-based eight-week group treatment. Mindfulness practices within MBCT are drawing extensively from mindfulness-based stress reduction (MBSR) program (Kabat-Zinn, 2013). The core skill is to learn to disengage from unhelpful thinking patterns before these spirals lead into depression. Recognition of the emergence of unhelpful thoughts, feelings and sensations are achieved through mindfulness meditation training, such as the body scan, mindful movement and mindfulness of the breath, which cultivates attitudes of acceptance and non-judgment (Kabat-Zinn, 1994). In addition, MBCT includes cognitive components form cognitive behavioural therapy (CBT). CBT elements in MBCT include psychoeducation about the importance of cognitions in depression. The role of maladaptive cognitions, rumination and avoidance in inducing and maintaining depressive systems are explored and plans are drawn up for identifying and managing warning signs of relapse.

The effectiveness of MBCT in reducing depressive relapse or recurrence has been evaluated in a meta-analysis by Piet and Hougaard (2011). Their findings suggest that MBCT significantly reduced rates of depressive relapse and recurrence compared with usual care or placebo. In addition, there is evidence that MBCT with support to taper or discontinue antidepressant treatment was as effective for prevention of depressive relapse or recurrence as maintenance of antidepressants (Kuyken et al., 2015). Despite the increasing evidence of the effectiveness of MBCT and its empirically founded theoretical rationale, researchers have just started to investigate how and why MBCT works. Evidence is increasing that self-compassion might be one of the key mechanisms of change in MBCT (Holzel et al., 2011; Kuyken et al., 2010; van der Velden et al., 2015).

Self-compassion has been defined as being kind to one's self (Neff, 2003) and being able to use self-reassurance and soothing rooted in a secure attachment style (Gilbert, 2009) in times of adversity (Gilbert, 2009; Neff, 2003). Further, it includes being non-judgmental about one's self (Gilbert, 2009; Neff, 2003), recognising one's experience as part of the human condition (Neff, 2003) and being able to care for and affiliate with others (Gilbert, 2009). It is a state where a sense of safety can be activated and distress alleviated. This is in contrast to self-criticism characterised by maladaptive emotion regulation strategies such as being harsh and judgmental to one-self (Gilbert, 2009; Neff, 2003), feeling isolated (Neff, 2003) and being in flight or fight or social rank mode (Gilbert, 2009). Self-criticism therefore exacerbates a sense of threat in difficult times (Gilbert, 2009).

In a key study, Kuyken et al. (2010) examined the link between MBCT treatment, cognitive reactivity, self-compassion, and relapse in depression in a randomised controlled trail (RCT). They found that MBCT was associated with significantly greater improvements in self-compassion as compared to pharmacotherapy. In this study cognitive reactivity was operationalised as a change in depressive thinking during a sad mood induction. The authors found that MBCT participants demonstrated greater cognitive reactivity post treatment as compared to pharmacotherapy. Interestingly, the study results indicated that MBCT reduced the link between cognitive reactivity and depressive relapse, whereas higher cognitive reactivity predicted relapse in the pharmacotherapy control group. Further, the authors found that changes in self-compassion in the MBCT group significantly moderated the relationship between cognitive reactivity and depressive symptoms at 15-month-follow-up. These findings suggest that the decoupling between cognitive reactivity and depressive symptoms at follow up appears to be linked to the cultivation of self-compassion during MBCT. The authors concluded that, in line with the theoretical premise of MBCT, self-compassion may reduce problematic cognitive reactivity to negative mood in people at high risk of depression and might be a key mechanism via which MBCT works. The suggestion of a key role of self-compassion as an adaptive emotion-regulation strategy is consistent with correlational research. For example, Karl and Kuyken (2010) found a significant negative association between trait self-compassion and self-reported cognitive-behavioural avoidance and rumination in a sample of trauma survivors with a history of depression. They argue based on cross-sectional data that self-compassion may be protective because it prevents people from engaging in maladaptive thought processes that take up an individual's attentional resources, serve avoidance and thus prevent adaptive processing and memory update. More recently, Diedrich, Grant, Hofmann, Hiller, and Berking (2014) compared self-compassion with a range of other emotion regulation strategies (e.g. reappraisal of the situation, or accepting the negative emotions) in mood repair following a sad mood induction in a clinically depressed sample. They revealed that employing self-compassion to regulate their depressed mood after the sad mood induction was associated with greater reductions in depressive mood as compared to the waiting control condition. No differences in depressive mood reductions have been found between the self-compassion, acceptance and reappraisal condition. However, the authors found that the comparative effectiveness of self-compassion and reappraisal was moderated by a participant's baseline depressive mood, indicating that self-compassion was more effective than reappraisal for individuals with high self-reported depressive mood at baseline. Diedrich et al. (2014) concluded that self-compassion might be an adaptive emotion regulation strategy, particularly for individuals with high levels of depressed mood.

Critically, the question of *how* self-compassion supports adaptive emotion regulation in individuals at great risk of depression, is still under-studied and there are several limitations in the current literature. Specifically, there is an over-reliance on self-report measures, which may have introduced errors like social desirability and/ or deliberate over- or under-reporting of subjective mood changes. In addition, there are currently no studies investigating the physiological underpinnings of self-compassion change pre/ post MBCT.

Evidence is increasing that self-compassion might exert its protective effects by stimulating physiological systems associated with affiliation and wellbeing (Kirschner, Kuyken, & Karl, 2013). Drawing on a review of positive and affiliative emotions (Depue & Morrone-Strupinsky, 2005), the social engagement system (Porges, 2007), and studies of threat based emotions (LeDoux, 1998), Gilbert (2009) proposes a tripartite affective system, which consists of one negative 'threat-focused' affect system and two positive affect systems. One of the two positive systems is focused upon stimulation and excitement, while the other is associated with feeling safe, securely attached, affiliated with others, and with the ability to self-soothe when stressed. Gilbert (2009) positions compassion (for self and others) in the context of the soothing and contentment system. This system is suggested to promote a calm physiological state that is conducive to interpersonal approach and social affiliation (Depue & Morrone-Strupinsky, 2005). This calm physiological state is associated with enhanced parasympathetic activity as assessed by the beat-to-beat variability in heart rate known as heart rate variability (HRV), which has been linked to flexible attention deployment and adaptive emotion regulation to threat contexts (Thayer & Lane, 2000) and is suggestive of the ability to self-soothe when stressed (Porges, 2007). Furthermore, the soothing and contentment system is proposed to be important in down-regulating the negative sympathetic threat-seeking system (Depue & Morrone-Strupinsky, 2005; Gilbert, 2014).

Supporting this proposition, Kirschner et al. (2013) found that one-off meditation exercises designed to cultivate self-compassion directly (via a Loving Kindness Meditation with specific focus to cultivate self-compassion) or indirectly (via a compassionate body scan) can increase state levels of self-compassion and positive affiliative affect and decrease state levels of self-criticism in a student sample. Affect changes were accompanied by increased parasympathetic activation (indexed by increased HRV) and decreased sympathetic activation (indexed by decreases in heart rate and skin conductance level) in response to the self-compassion inductions. They concluded that one possible protective effect of self-compassion lies in the activation of the soothing and affiliative affect system.

Towards the goal of better understanding of how the cultivation of self-compassion via MBCT might be a key mechanism to prevent relapse into depression, the aim of this study was to apply a triangulation of subjective and physiological measures to investigate pre/ post MBCT changes to a self-compassion induction in remitted depressed individuals. To maximise the integrity of the experimental manipulation used in this study, the self-compassion induction was developed and recorded together with mindfulness teachers with extensive experience. A Loving Kindness Meditation (LKM) with a specific focus on the cultivation of self-compassion (adopted from Neff & Germer, 2013) was used as an exercise to cultivate state self-compassion (Kirschner et al., 2013). Based on the above-mentioned findings this study aimed to test the following hypotheses. First, compared to a passive control group, MBCT participants will demonstrate higher increases in self-reported trait levels of self-compassion. Moreover, decreases in self-criticism and depressive symptoms are expected. Second, compared to the responses to a self-compassion induction before the MBCT course, higher activation of the positive affiliative, soothing and contentment system—characterised by higher reductions in skin conductance and heart rate (inferring increased sympathetic activation) and increased heart rate variability (inferring increased parasympathetic activation)—is expected when participants are asked to adopt a self-compassionate stance after the MBCT course. In contrast, no changes in responses to the self-compassion induction are expected for the remitted depressed control group.

7.3 Methods

7.3.1 Participants

This study had two principal groups of participants: a) previously depressed individuals who underwent an eight-week MBCT program in routine NHS services (remitted depressed MBCT group; N = 25) and b) previously depressed individuals who haven't undergone any intervention (remitted depressed control group; N = 25; see Figure 7.1 for participant flow diagram). Inclusion criteria for participants included the following: age over 18 years, English as first language (or English fluency), right-handedness, and a diagnosis of recurrent major depressive disorder in full or partial remission according to the DSM-IV (at least three previous episodes). Exclusion criteria for all groups included: participants being currently depressed; current other axis-I disorders; previous attendance of an MBCT class for depression; and those receiving formal concurrent psychotherapy. In addition, we screened out participants who: a) had visual or hearing difficulties which were not corrected for by contact lenses, glasses or a hearing aid b) had very sensitive skin or a diagnosed skin condition c) had a history of brain surgery d) suffered from high blood pressure e) had a change in medication within the last 3 months) had a pacemaker fitted f) suffered from epilepsy. The MBCT participants were recruited from those taking part in groups run at the ACCEPT clinic, an NHS commissioned depression service that is part of the University of Exeter Mood Disorders Centre. The recovered-depressed individuals in the no-intervention control condition were recruited via advertisement online and in newspapers and from a database of previously depressed individuals held at the Mood Disorders Centre who have said they are willing to be contacted to take part in future research.

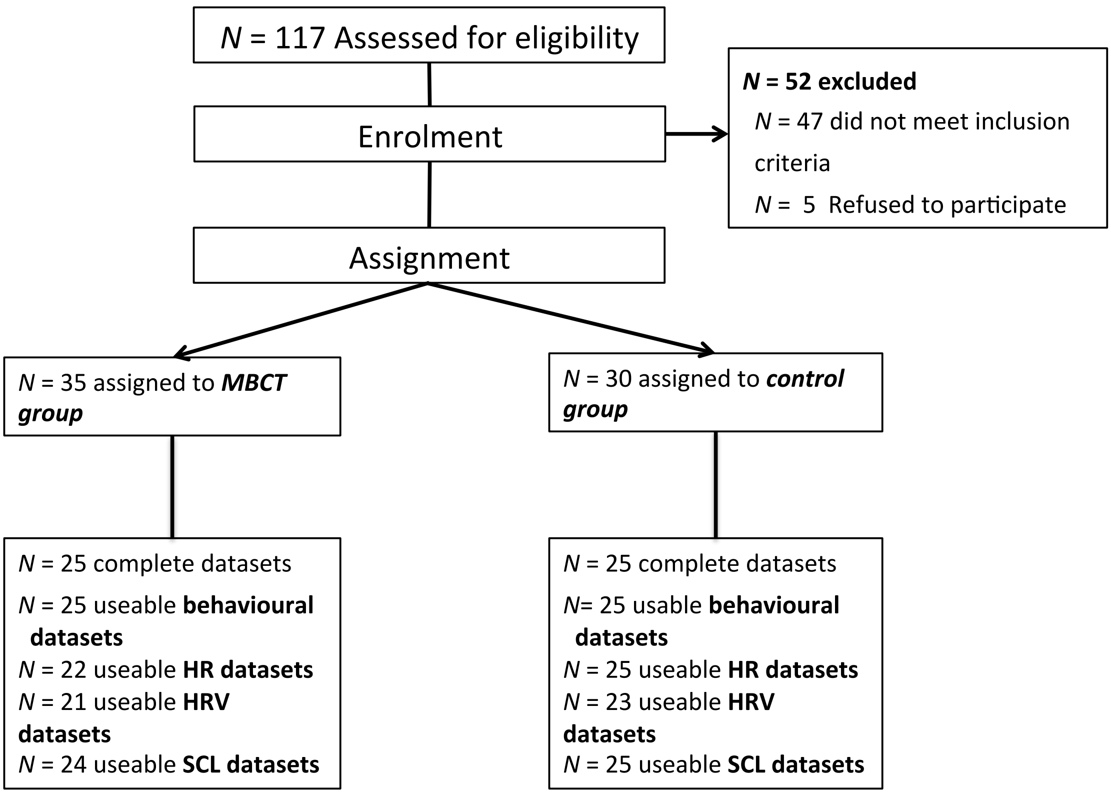


Figure 7.1 Participant flow diagram.

Sample characteristics at baseline are depicted in Table 7.6. Groups did not differ in terms of age, gender ratio, attachment related anxiety and avoidance – assessed by the Relationships Structures Questionnaire (RSQ; Fraley, Niedenthal, Marks, Brumbaugh, & Vicary, 2006) — experienced indifference, overcontrol or abuse in childhood – measured via the Measure of Parental Style (MOPS; Parker et al., 1997) — the hated self and reassure self subscale of the Forms of Self-Criticising/Attacking & Self-Reassuring Scale (FSCRS, Gilbert, Clarke, Hempel, Miles, & Irons, 2004), self-report depressive symptom scores – assessed by the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996)— and trait self-compassion – assessed by the Self-Compassion Scale (SCS; Neff, 2003). The two groups did differ on the inadequate self-subscale of the FSCRS (Gilbert, Clarke, Hempel, Miles, & Irons, 2004).

Table 7.6

Means, Standard Deviations, and Significance Tests for the sample characteristics at baseline of the different groups.

Characteristic	Baseline: remitted depresed MBCT	Baseline: remitted depressed Control	Test	*p*
n	25	25		
gender				
male/female: n	10/15	5/20	$\chi2(1, N = 50) = 2.38$	.123
Female: %	60	80		
Age in Years *M*(*SD*)	49.92 (9.68)	47.16 (11.89)	$t(48) = .90$	.373
Material status: *n* (%)				
Single	6 (24)	10 (40)		
Married or as living with someone as if married	12 (48)	12 (48)		
Seperated, divorced, or widowed	7 (28)	3 (12)		
Level of education: *n* (%)				
No educational qualification	0	0		
Some school qualification	0	1 (4)		
High school and/ or vcational qualification	1 (4)	1 (4)		
University degree/ professional qualification	24 (96)	23 (92)		
Number of depressive Episodes: *M*(*SD*)	5.36 (4.06)	5.56 (5.15)	$t(48) = .15$	.879
Age of onset first depressive Episode: *M*(*SD*)	27.12 (8.27)	23.96 (8.09)	$t(48) = 1.37$	.178
Medication				
Yes/No	16/9	17/8	$\chi2(1, N = 50) = .09$	.765
Medicated: %	64	68		
Self Compassion Scale				
Total: *M*(*SD*)	14.58 (3.75)	15.91 (4.34)	$t(48) = 1.15$	.257
FSCRS				
Reassure Self: *M*(*SD*)	16.21 (3.90)	18.29 (5.62)	$t(48) = 1.49$	.143
Inadequate Self: *M*(*SD*)	21.17 (8.04)	15.33 (8.61)	$t(48) = 2.43$	.019
Hated Self: *M*(*SD*)	4.70 (3.35)	3.13 (3.72)	$t(48) = 1.55$	.129
MOPS				
Indifference: *M*(*SD*)	3.69 (3.67)	2.50 (3.930	$t(48) = 1.04$	.303
Abuse: *M*(*SD*)	2.98 (3.58)	2.29 (2.48)	$t(39.22) = .75$	.465
Over control: *M*(*SD*)	2.59(2.32)	3.21 (2.91)	$t(48) = .79$	.432
Relationship Structure Questionnaire				
Total avoidance: *M*(*SD*)	2.73 (1.10)	2.59 (1.23)	$t(48) =.40$	.688
Total anxiety: *M*(*SD*)	2.57 (1.23)	2.13 (1.28)	$t(48) =1.21$	.231
BDI: *M (SD)*	16.08 (10.21)	11.21 (10.07)	$t(48) = 1.68$	.100

Note. Trait self-compassion has been assessed via the SCS (Neff, 2003). The possible range of this scale is 0 – 30, with higher scores indicating higher trait levels of self-compassion. Attachment related avoidance and anxiety have been measured via the RSQ (Fraley et al., 2006). The possible range of the two subscales is 0 – 7, with higher scores indicating higher attachment related anxiety or avoidance. The Forms of Self-Criticising/Attacking & Self-Reassuring Scale (FSCRS; Gilbert et al., 2004) was used to assess trait level of self-criticism. The scale measures two forms of self-criticalness; inadequate self (possible range 0 – 33), and hated self (possible range 0 – 20), and one form of self-reassure, reassure self (possible range 0 -32). Experienced childhood adversity (i.e. experienced indifference: range 0 -18; experienced abuse: range 0 – 15; experienced over-control: range 0 -12) was assessed via the Measure of Parental Style (MOPS; Parker et al., 1997). BDI = Beck Depression Inventory.

7.3.2 Materials

Self-report measurements. To assess individual difference variables hypothesised to influence the impact of the self-compassion manipulation we assessed trait levels of self-criticism, attachment style, experienced childhood adversity and trait levels of self-compassion. In addition, we repeated the assessment of trait levels of self-compassion; self-criticism and self-reported depressive symptom scores post treatment, as they were thought to be important to the change process in MBCT (Feldman & Kuyken, 2012).

The Forms of Self-Criticising/Attacking & Self-Reassuring Scale (FSCRS; Gilbert et al., 2004). The FSCRS was used to measure levels of self-criticism. It is a 22-item scale, which measures different ways people think and feel about themselves when things go wrong for them. The items are composed of three components. There are two forms of self-criticalness: inadequate self, and hated self, and there is one form of self-reassure: reassure self. The responses are given on a 5-point Likert scale (ranging from 0 = not at all like me, to 4 = extremely like me). Findings suggest good reliability (α = .90 for inadequate-self and α = .85 for both the hated-self and the reassured-self) and validity (e.g. Baiao, Gilbert, McEwan, & Carvalho, 2015). Recent research confirmed the original three-factor structure of the FSCRS in both clinical and non-clinical samples suggesting that self-criticism should not be seen as a single dimension (e.g. Baiao et al., 2015; Castilho, Pinto-Gouveia, & Duarte, 2015). Both forms of self-criticism have been positively linked depression and anxiety whereby the self-hating domain was more associated with self-harm and borderline phenomenology (Gilbert et al., 2004; Gilbert et al., 2010). In contrast, greater self-reassurance has been shown to be related to mental health and well-being (Gilbert et al., 2004). Cronbach's alpha in this sample was .92 (at T1) and .91 (at T2) for the inadequate self, .72 (at T1) and .78 (at T2) for the hated self, and .76 (at T1) and .84 (at T2) for the reassure self.

The Relationships Structures Questionnaire (RSQ; Fraley et al., 2006). The RSQ assesses attachment dimensions of anxiety (Cronbach's α = .81 in this sample) and avoidance (Cronbach's α = .71 in this sample). This is a self-report designed to assess attachment patterns in a variety of close relationships. The same 10 items are used to assess attachment styles with respect to four targets (i.e., mother, father, romantic partner, and best friend). The responses are given on a 7-point Likert scale (ranging from 1 = strongly disagree, to 7 = strongly agree). Psychometric properties of the RSQ are adequate. Research has shown that the individual scales demonstrated a good retest-reliability over 30 days ($r = .88$ for the avoidance scores and $r = .92$ for the anxiety scores) and that the scales are meaningfully related to different outcomes (e.g. relationship satisfaction and depressive symptoms) (see Fraley, Heffernan, Vicary, & Brumbaugh, 2011; Fraley, Hudson, Heffernan, & Segal, 2015).

The Measure of Parental Style (MOPS; Parker et al., 1997). The MOPS was used to asses experienced childhood adversity. It is a self-assessment tool to measure perceived parenting styles across three measures (Indifference, Abuse, Overcontrol). The responses are given on a 4-point Likert scale (ranging from 0 = not true at all, to 3 = extremely true). The three subscales of the MOPS have shown good reliability across 4 weeks testing period (r = .93 for parental indifference, r = .92 for parental abuse, and r = .87 for parental over-control (Picardi et al., 2013)), and good internal consistency (α = .93 for parental indifference, α = .82 for parental over-control, and α = .87 for parental abuse (Parker et al., 1997)). Higher scores on the three parental domains of the MOPS have been associated with mental health problems such as depression and anxiety disorders (Kuyken et al., 2015; Parker et al., 1997). It had a good reliability (Cronbach's α = .81 for indifference, .83 for abuse, and .77 for over control) in this sample.

The Self-Compassion Scale (SCS; Neff, 2003). The SCS is a 26 item self-report scale, which measures six dimensions of self-compassion: mindfulness, over-identification, self-kindness, self-judgment, isolation, and common humanity. Each item is rated on a five-point scale, ranging from 1 ("almost never") to 5 ("almost always"). Confirmatory factor analysis suggests a single higher-order factor. The SCS has good reliability and validity, including high associations with mental health outcomes (Neff, 2003). For the total scale the internal consistency coefficient was α = .82 at T1 and .88 at T2. Research demonstrated that the SCS has shown good test-retest reliability (r = .93) and convergent and discriminant validity (Neff, 2003; Neff, 2015; Neff, Kirkpatrick, & Rude, 2007; Neff, Rude, & Kirkpatrick, 2007). A more detailed description on the psychometric properties of the SCS can be found in chapter 2.1, pp. 5 – 8.

The Beck Depression Inventory, Second Edition (BDI-II; Beck, Steer & Brown, 1996). The BDI-II was used to measure the intensity of depression symptoms over the past two weeks. For each of the 21 items, participants endorse a statement that best describes their experience, on a 4-point (0-3) scale. Higher scores indicate higher levels of depressive symptoms, cutoffs for the BDI-II include: (a) 0 to 13 = minimum depression, (b) 14 to 19 = mild depression, (c) 20 to 28 = moderate depression, and (d) 29 to 63 = severe depression. In the current study, the Cronbach's alpha for the BDI-II was .93 at T1 and .94 at T2, suggesting excellent internal consistency.

VAS. To assess the effectiveness of the self-compassion manipulation on participants' mood, self-compassion, positive affiliative affect and self-criticism, a series of questions using Visual Analogue Scales (ranging from 0 to 100) were used throughout the experimental sessions. Four questions asked participants about their state affiliative affect (Cronbach's $\alpha = .87$ at T1 and .80 at T2 in this sample) based on the state adult attachment measure (SAAM; Gillath, Hart, Noftle, & Stockdale, 2009), three about their state self-compassion (Cronbach's $\alpha = .78$ at T1 and .76 at T2 in this sample) adopted form the Self-Compassion Scale (SCS; Neff, 2003), and one about their state self-criticism (based on the Forms of Self-Criticising/Attacking & Self-Reassuring Scale (FSCRS, Gilbert, Clarke, Hempel, Miles, & Irons, 2004).

Self-Compassion Manipulation. The self-compassion manipulation in this study was developed and recorded together with an experienced MBCT therapist from the ACCEPT clinic, an NHS commissioned depression service that is part of the University of Exeter Mood Disorders Centre. The guided mediation was 11.5 minutes long. The basis of the manipulation was a Loving Kindness Mediation (LKM; see Salzberg, 1995) that was tailored to specifically cultivate state self-compassion and incorporating the clinical experiences of the therapist. During the manipulation participants were guided to direct loving/friendly feelings towards a close person. They were then asked to direct the same feelings towards themselves. Feedback on the final audio exercises was gathered from experienced mindfulness and meditation practitioners as well as staff within our clinical department to ensure ecological validity.

7.3.3 Procedure

The South West Cornwall and Plymouth NHS Research Ethics Committee provided approval for the study (ref. 13/SW/0099). The remitted depressed MBCT group was tested at three time points; immediately before the intervention (time one), immediately after the intervention (time two), and at one-year follow-up (time three). The remitted depressed control group was tested at similar intervals.

Time one assessment

Prior to data collection, written informed consent was received form participants. Age, gender, highest level of education obtained, and current use of medication were assessed in a brief semi-structured interview. In addition, participants underwent the depression questions from the DSM-IV Structured Clinical Interview for Diagnosis (SCID-I; First et al., 1995), to assess that clients have experienced a previous major depressive episode and were currently not depressed. The number of prior episodes was also measured, as well as the onset of the first depressive episode. Further participants were screened for exclusion criteria and for other current axis-I disorders using the SCID-I screening module and excluded if they meet current criteria for any disorder. Eligible participants completed a pack of self-report questionnaires and were invited to the laboratory session. The self-report questionnaires contained measures of self-compassion, self-criticism, attachment style, childhood adversity and depression. During the laboratory session, participants completed a self-referential task. The data of the self-referential task are not presented here. After this, participants completed an 8-minute baseline period (divided into eight one minutes blocks, four with their eyes open 4 with their eyes closed) where participants were invited to relax. Following the baseline, participants listened to the self-compassion manipulation (described below) and finally were asked to complete a one-minute baseline period with their eyes closed. Before and after the first baseline and following the self-compassion manipulation participants completed a manipulation check. For this we used visual analogue scales (ranging from 0 to 100) to answer 11 questions about state affiliative affect. Finally, participants completed another self-referential task. During the whole experimental procedure psychophysiological measurements (ECG, SCL) were recorded.

Time two assessment

This was identical to the time one assessment, except that the demographic, the attachment style, and experienced childhood adversity measurements were not repeated. For the MBCT group, session two was scheduled in the two weeks immediately following the course. For the other participants session two was scheduled for eight to ten weeks after the first assessment.

Time three assessment

The follow-up assessment was scheduled one year after the initial testing session. Participants underwent the SCIDI structured clinical interview to assess current depression status and whether or not they had experienced a major depressive episode in the past year. Participants were additionally asked to complete self-report questionnaires packages containing measures of self-compassion, self-criticism, and depression. The data of the follow-up assessment are not presented here.

7.3.4 Psychophysiological Recording and Preprocessing

The autonomic nervous system measures described below were recorded using a BIOPAC™ MP150 system connected to a computer running a commercially available software AcqKnowledge 4.2 (BIOPAC Systems; Goleta, CA), with acquisition sampling rate of 2000Hz. These data were filtered and corrected offline using specialised analysis programmes within the AcqKnowledge 4.2 software, as described in the respective sections below.

Heart rate (HR). The heart rate was acquired as an indicator of physiological arousal and in particular as a measure that distinguishes between physiological orientation (i.e., an organism's allocation of attention towards novel stimuli and response inhibition to familiar or insignificant stimuli (Jung et al., 2000)) and defence response (i.e., an organism's protective reflex from aversive stimuli (Sokolov, 1963)). HR determination in beats per minute was based on a semi-automatic R-wave detection algorithm implemented in the software AcqKnowledge (Version 4.2., BIOPAC Systems Inc., Goleta, CA). Raw ECG data were filtered applying a FIR bandpass filter between 0.5 and 35 Hz and 8000 coefficients. Artefact detection (i.e., noisy, missing or ectopic beats) and removal was performed using a template correlation and interpolation from the adjacent R-peaks based on Berntson and colleagues (Berntson, Quigley, Jang, & Boysen, 1990; Berntson & Stowell, 1998) and Solem, Laguna, and Sornmo (2006). The interpolation procedure was used for less than 5% of the ECG data. Mean HR in beats per minute was then extracted from the R-waves for each data section. For the different experimental conditions, mean HR values were determined for the duration of the 11 minutes of the exercise in one-minute segments. A minute prior to the meditation start was used as a baseline.

Heart rate variability (HF HRV). High frequency heart rate variability as an indicator of parasympathetic activation and adaptive physiological regulation capacity (J. F. Thayer & Lane, 2000) was determined from the artefact-free ECG (see above) by calculating a time series of the R-peaks and submitting it to a fast Fourier transformation that calculates the power spectrum of the R-R interval variation in a given time window (Berntson et al., 1997; Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996). Of particular interest was the frequency range between 0.15 Hz and 0.4 Hz (high frequency, HF). This high frequency band of HRV is generally considered a marker of parasympathetic input. Mean HF HRV were then extracted for each data section similar to the heart rate.

Skin conductance level (SCL). Skin conductance (SC) was applied as a measure of sympathetic activation and physiological defense response (Sokolov, 1963). SC was recorded from bipolar Ag/AgCl reusable strap electrodes on the medial phalanx of the *middle and ring finger of the non-dominate hand, at a sampling rate of 125Hz.* No filters were run on SC data; however the data were manually screened for recording or movement artefacts, of which none were found within data portions of interest. Mean SCL, Maximum SCL values and minimum SCL values were extracted for the same time windows and a range correction (Lykken, Rose, Luther, & Maley, 1966) was applied to each data section for each participant to give a mean SCL corrected for individual differences. The formula for this was: Corrected SCL = (SCLmean – SCL min) / (SCL max-SCL min).

To obtain measures of HR, HRV and SCL change throughout the audio exercise and in order to control for individual differences we calculated participants' change values for each minute of the experimental condition. These change values were calculated by subtracting values for each minute of the audio exercise from the averaged baseline values of the participant.

7.3.5 Statistical data analysis

Data were analysed using statistical software SPSS version 21 (SPSS Inc, Chicago, Illinois) and R (http://www.r-project.org). The data distribution were explored using the ShapiroeWilk test of normality and by visual inspection. Boxplots were used to identify outliers with regard to each of the outcome parameters. Cases were deemed as outliers if they were over 3 standard deviations away from the mean and didn't represent a meaningful observation. Outliers were assigned "a raw score on the offending variable that is one unit larger (or smaller) than the next most extreme score in the distribution" (Tabachnick & Fidell, 2007, p. 77).

Manipulation checks. MBCT-related changes in responses to the self-compassion manipulation were analysed using mixed ANOVA's with Time (before and after self-compassion manipulation) and Assessment (pre and post MBCT) as within subject factors and group (remitted depressed MBCT vs. remitted depressed control) as between subject factors.

MBCT related psychophysiological changes in response to the self-compassion manipulation. In order to test if MBCT is related to changes in autonomic arousal in responses to the self-compassion manipulation, we computed an average change score for heart rate, heart rate variability and skin conductance change for the first and second assessment. MBCT-related changes in autonomic arousal in responses to the self-compassion manipulation were then analysed using mixed ANOVA's with Time (pre and post MBCT) as within subject factors and group (remitted depressed MBCT vs. remitted depressed control) as between subject factors.

7.3.6 Sample size determination

Sample size was determinate using a priori sample size calculations (Faul et al., 2007). The sample size was determined for a 2 (group) x 2 (time) mixed ANOVA, assuming a statistical power of .80, a = .05 and a medium effect size (f = .25). Based on this calculation it was found that a minimum of 50 participants were required for this study to detect an effect of group on the outcome variables.

7.4 Results

7.4.1 MBCT-related changes in self-compassion, criticism and depression

Changes in self-compassion, self-criticism and self-reported depression scores are depicted in Figure 7.2 A (remitted depressed MBCT) and Figure 7.2 B (remitted depressed control). A significant increase in self-compassion could be found post MBCT, $t(24) = 2.35$, $p = .028$, 95 % CI [.21, 3.33], $r = .43$. In line with these findings, there was a significant increase on the reassuring self subscale of the FSCRS post MBCT, $t(24) = 4.21$, $p < .001$, 95 % CI [2.43, 7.14], $r = .65$. Moreover, MBCT led to a significant decrease in self-criticism. This was quantified by significant reductions on the inadequate self, $t(24) = 4.49$, $p < .001$, 95 % CI [-9.86, -3.63], $r = .67$, and on the hated self, $t(24) = 2.55$, $p = .018$, 95 % CI [-4.08, -.42], $r = .46$, subscales of the FSCRS. Finally, there was a significant decrease self-reported depressive system scores post MBCT, $t(24) = 5.55$, $p < .001$, 95 % CI [-11.41, -5.23], $r = .75$. In contrast, no changes in self-compassion, self-criticism, or self-reported depression scores have been found for the remitted depressed control group between the first and second assessment, all $p > .05$.

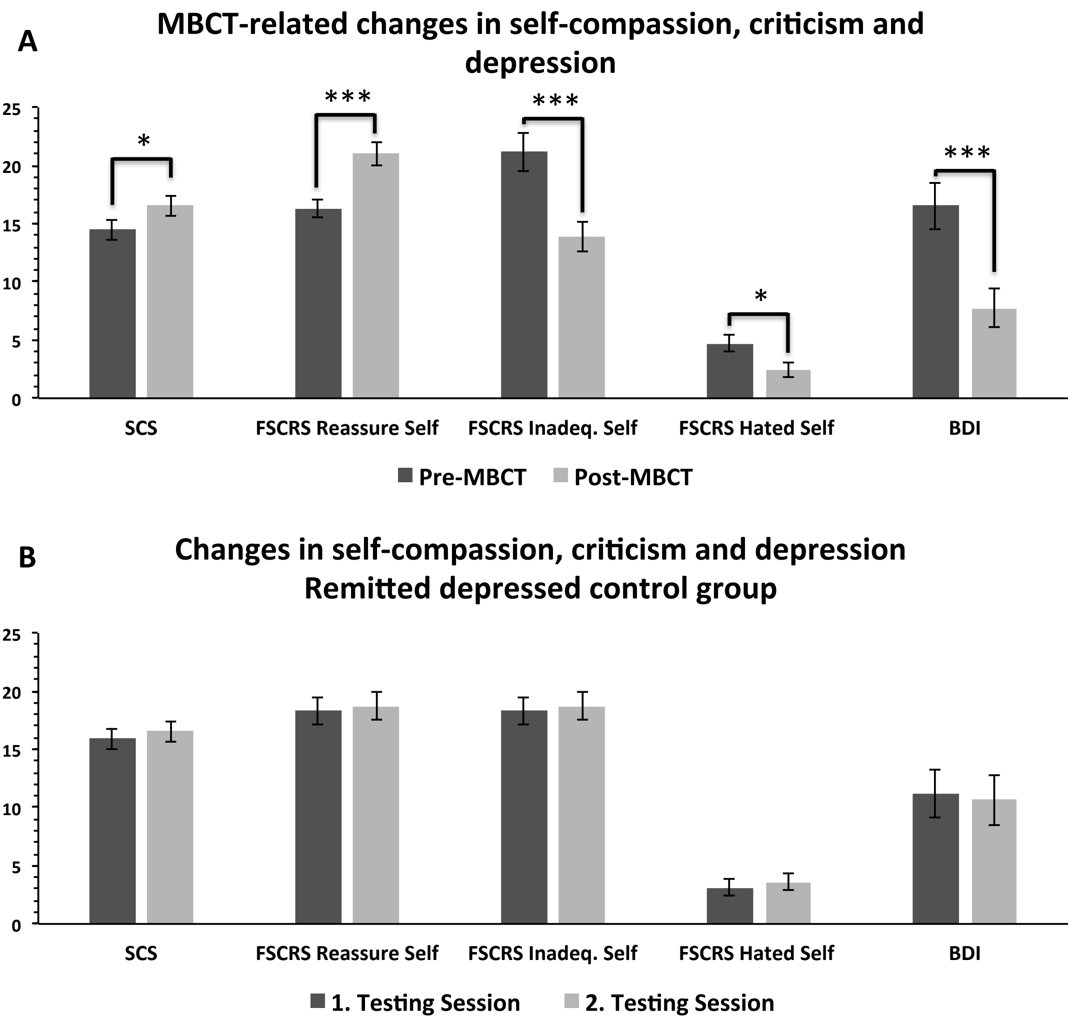


Figure 7.2 Changes in self-compassion, self-criticism, and depression ± 1 standard errors for (A) remitted depressed MBCT group (n =25) and (B) remitted depressed control group (n = 25). Data reflect between-groups differences for * $p < .05$ and *** $p < .001$.

7.4.2 MBCT-related changes in responses to self-compassion manipulation

To assess to what extent MBCT facilitated increases in state levels of self-compassion, criticism and positive affiliative affect in response to the self-compassion manipulation, we carried out a number of manipulation checks.

Changes in Self-compassion. The scores for the state self-compassion ratings are depicted in Figure 7.2 A and B. There was a significant main effect of Time, with higher self-compassion scores post self-compassion manipulation regardless of Group, $F(1, 48) = 47.61$, $p < .001$, $\eta^2_p = .49$. In addition, the main effect of Treatment yielded significance, $F(1, 48) = 12.60$, $p = .001$, $\eta^2_p = .21$. Critically, this effect was qualified by a significant Treatment X Group interaction, $F(1, 48) = 7.26$, $p = .018$, $\eta^2_p = .13$. Simple contrasts confirmed that the MBCT group demonstrated significant increases in state self-compassion following the self-compassion manipulation at the first assessment, $F(1, 24) = 15.53$, $p = .001$, $\eta^2_p = .39$, 95% CI [3.97, 12.72], and after the MBCT course, $F(1, 24) = 9.73$, $p = .005$, $\eta^2_p = .29$, 95% CI [1.55, 7.66]. A similar pattern was found for the remitted depressed control group at the first assessment, $F(1, 24) = 6.08$, $p = .021$, $\eta^2_p = .20$, 95% CI [1.06, 11.97], and the second assessment, $F(1, 24) = 20.06$, $p < .001$, $\eta^2_p = .45$, 95% CI [5.65, 15.32]. In addition, the between subject simple effect revealed that there was no difference between the groups in their state levels of self-compassion before the self-compassion manipulation at the first assessment, $F(1, 48) = .70$, $p = .407$, $\eta^2 = .01$, 95% CI [-15.36, 8.17]. However, a significant difference in state levels of self-compassion before the self-compassion manipulation was found at the second assessment, $F(1, 48) = 5.81$, $p = .026$, $\eta^2 = .10$, 95% CI [1.68, 25.07], with higher scores in the remitted depressed MBCT group.

No other significant effects emerged for the self-compassion change (main effect group: $F[1,48] = .39$, $p = .531$, $\eta^2_p = .00$; Group X Time X Treatment: $F[1,48] = 3.06$, $p = .087$, $\eta^2_p = .06$).

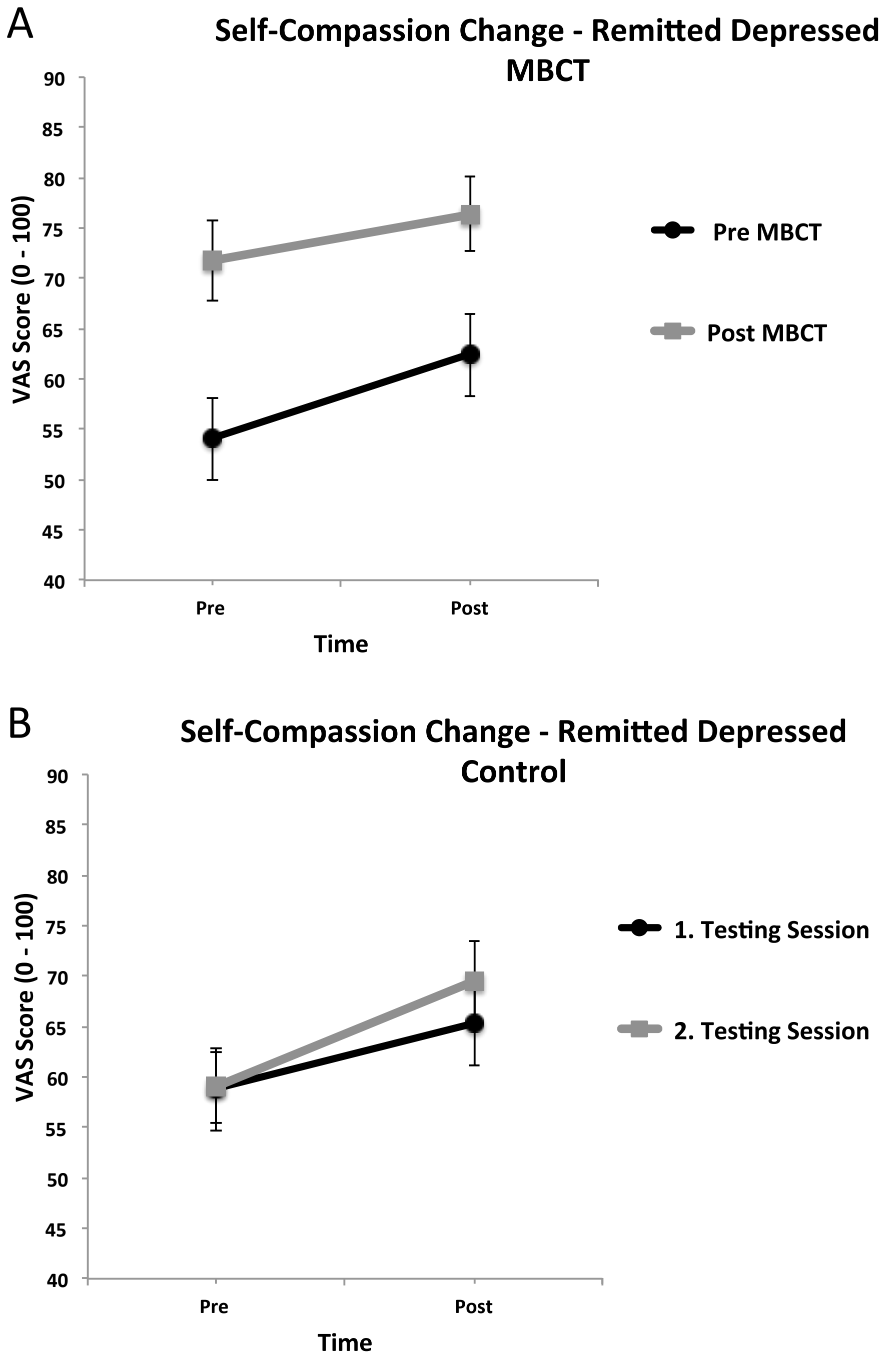


Figure 7.3 Graphs display group mean changes in self-reported state self-compassion ± 1 standard errors. *Note:* Pre = pre self-compassion manipulation; Post = post self-compassion manipulation VAS Sample item included: *"Right now: I feel like not being kind and understanding towards myself (0) – I feel like being very kind and understanding towards myself (100)"*.

Changes in Self-criticism. The Time (pre/ post induction) X Treatment (pre/ post MBCT) X Group (remitted depressed MBCT, remitted depressed control) ANOVA revealed a main effect of Time, with lower self-criticism scores post self-compassion manipulation across groups, $F(1, 48) = 4.41$, $p = .041$, $\eta^2_p = .08$. Moreover, there was a significant main effect of treatment, $F(1, 48) = 7.05$, $p = .011$, $\eta^2_p = .13$. The main effect of Treatment was qualified by a significant Treatment X Group interaction, $F(1, 48) = 4.30$, $p = .044$, $\eta^2_p = .08$. Figure 7.4 A and B shows scores for the state self-criticism ratings for the two groups. Simple contrasts revealed that the remitted depressed MBCT group had lower self-criticism scores post vs. pre MBCT, $F(1, 24) = 4.94$, $p = .036$, $\eta^2_p = .17$, 95% CI [.95, 25.76], whereas no differences between the first and second testing session emerged for the remitted depressed control group, $F(1, 24) = 1.72$, $p = .202$, $\eta^2_p = .07$, 95% CI [-2.26, 10.14]. Moreover, simple contrasts revealed that there was a significant decrease in state self-criticism scores after the self-compassion manipulation in the remitted depressed MBCT group at the first assessment, $F(1, 24) = 4.38$, $p = .047$, $\eta^2_p = .15$, 95% CI [.10, 14.98], whereas no change in state self criticism scores in responses to the self-compassion manipulation was found post MBCT, $F(1, 24) = .26$, $p = .614$, $\eta^2_p = .01$, 95% CI [-5.23, 8.67]. For the remitted depressed control group, no changes in state self-criticism in response to the self-compassion manipulation were found at the first or second assessment, all $p > .05$. Between subjects, simple effects revealed no group differences in state self-criticism before the self-compassion manipulation at the first assessment ($p = .407$, $\eta^2 < .01$) or second assessment ($p = .773$, $\eta^2 < .00$). No other significant effects emerged for the self-criticism change (main effect group: $F[1,48] =$

.17, p = .681, η^2_p < .00; Group X Time X Treatment: F[1,48] = .14, p = .712, η^2_p < .00).

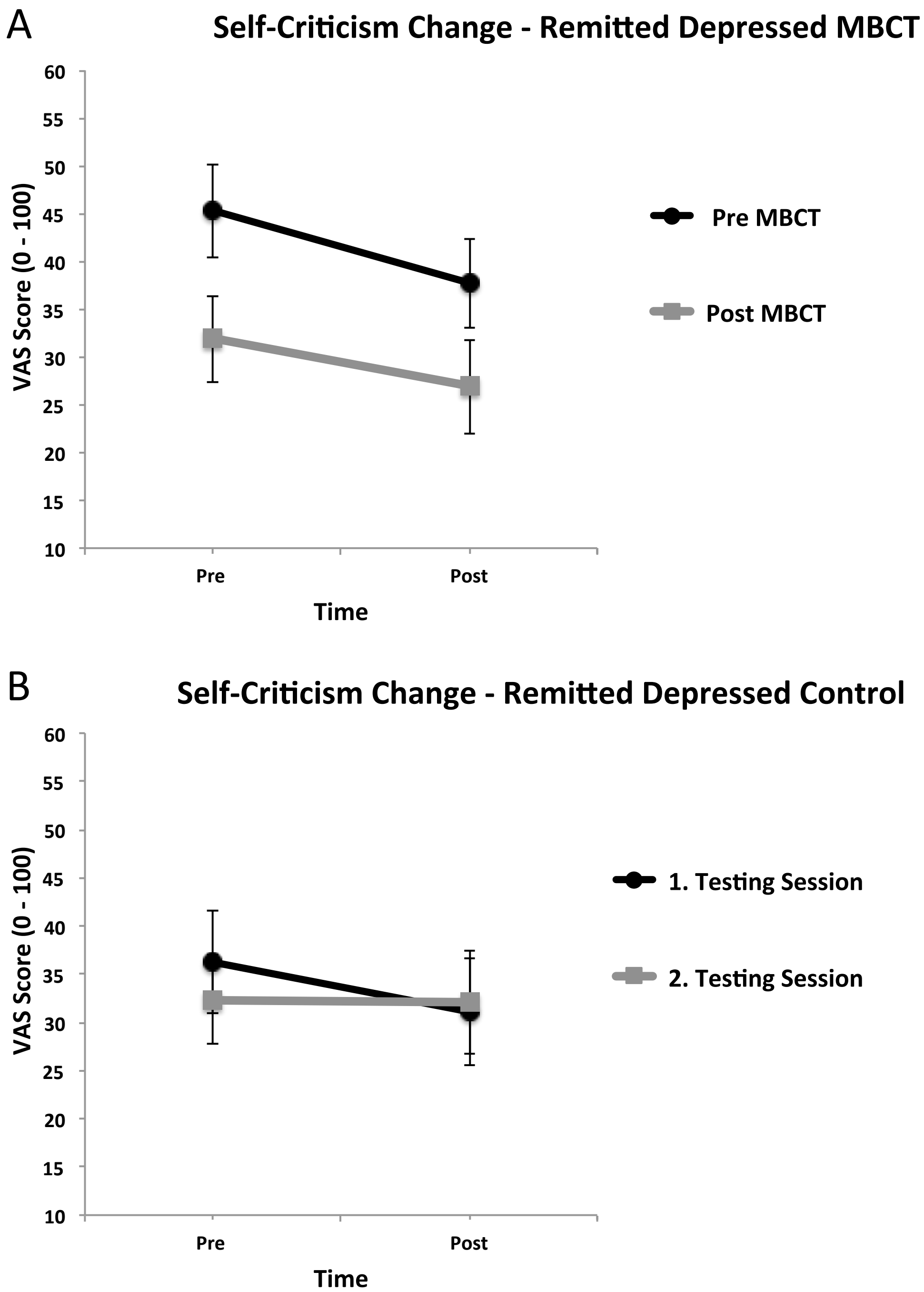
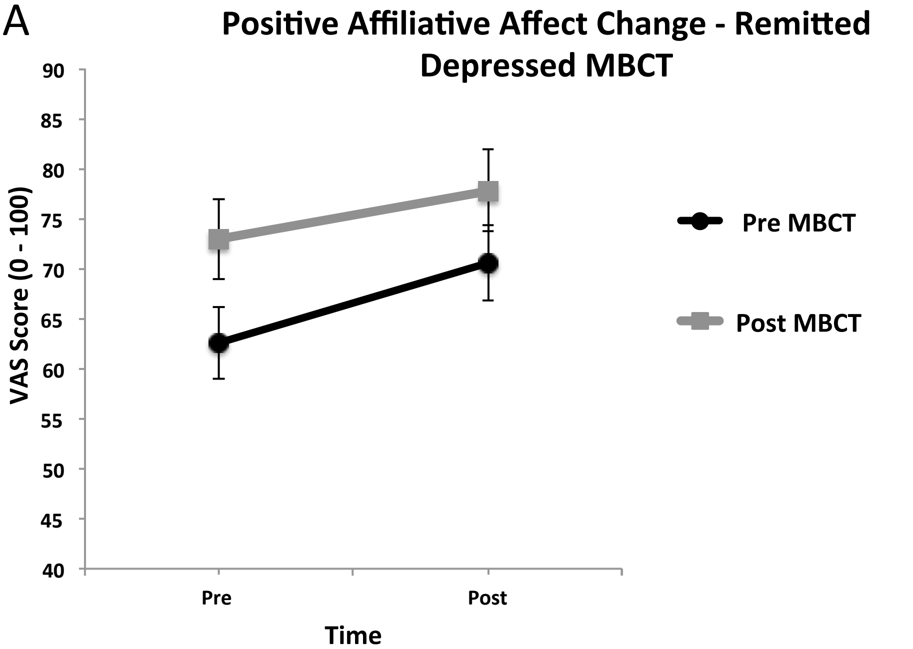


Figure 7.4 Graphs display group mean changes in self-reported state self-criticism ± 1 standard errors. *Note:* Pre = pre self-compassion manipulation; Post = post self-compassion manipulation. VAS sample item for the self-criticism change included: *"Right now: I don't feel at all self-critical (0) – I feel very self-critical (100)"*.

Changes in positive affiliative affect. Figure 7.5 A and B depict the scores for the state positive affiliative affect change in response to the self-compassion manipulation. There was a significant main effect of Time, with higher positive affect scores post self-compassion manipulation regardless of Group, $F(1, 48) = 34.09$, $p < .001$, $\eta^2_p = .42$. In addition, the main effect of Treatment yielded significance, $F(1, 48) = 6.62$, $p = .013$, $\eta^2_p = .12$. This effect was qualified by a significant Treatment X Group interaction, $F(1, 48) = 7.23$, $p = .013$, $\eta^2_p = .12$. Simple contrast revealed that the remitted depressed MBCT group had higher general positive affiliative affect scores post vs. pre MBCT, $F(1, 24) = 12.50$, $p = .002$, $\eta^2_p = .34$, 95% CI [4.32, 16.43]), whereas no differences between the first and second testing session emerged for the remitted depressed control group, $F(1, 24) = .02$, $p = .904$, $\eta^2_p = .00$, 95% CI [-.38, 4.30]. Moreover, simple contrast yielded a significant increase in state positive affiliative affect following the self-compassion manipulation for the remitted depressed MBCT group at the first assessment, $F(1, 24) = 21.25$, $p < .001$, $\eta^2_p = .47$ 95% CI [4.12, 11.81], and post MBCT, $F(1, 24) = 12.46$, $p = .002$, $\eta^2_p = .34$ 95% CI [2.02, 7.71]. The remitted depressed control demonstrated similar patterns at the first assessment, $F(1, 24) = 6.69$, $p = .016$, $\eta^2_p = .22$, 95% CI [1.10, 7.80]), and at the second assessment, $F(1, 24) = 6.87$, $p = .015$, $\eta^2_p = .22$, 95% CI [.97, 8.12]. In addition, the between subject simple effect indicated that the remitted depressed control group had higher state levels of positive affiliative affect before the self-compassion manipulation at the first assessment as compared to the remitted depressed MBCT group, $F(1, 48) = 7.18$, $p = .010$, $\eta^2 = .13$, 95% CI [-23.59, -3.26]. However, no group differences in state levels of positive affiliative affect before the self-compassion manipulation were found at the second assessment, $F(1, 48) = .21$, $p = .652$, $\eta^2 < .00$, 95% CI [-13.46, 8.50]. No other significant effects emerged for the positive affiliative affect change ANOVA (main effect group: F(1,48 = 1.77, p = .189, η^2_p = .04; Group X Time X Treatment: F(1,48 = 1.27, p = .265, η^2_p = .03).

A



B

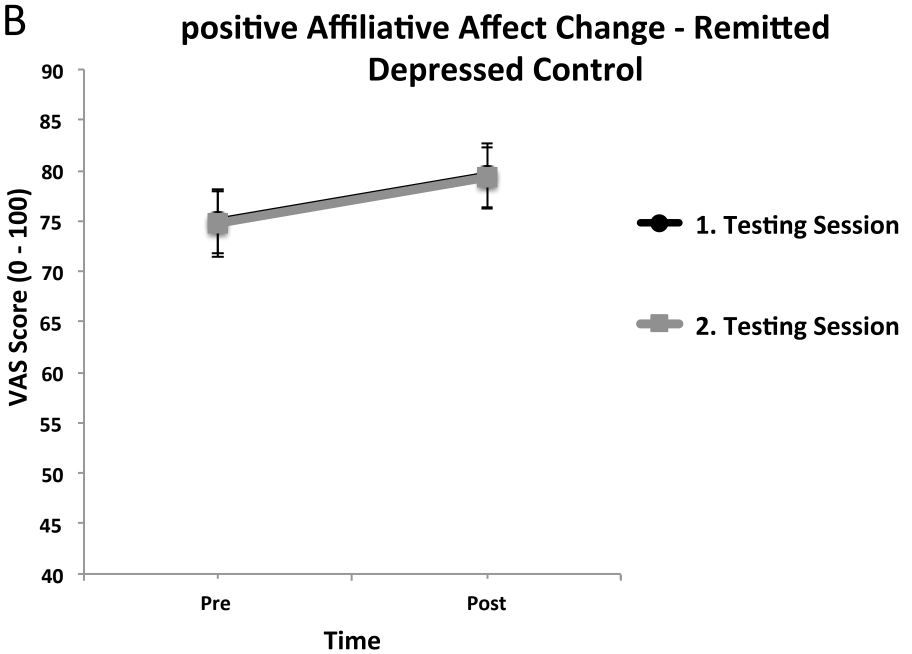


Figure 7.5 Graphs display group mean changes in self-reported state positive affiliative affect ± 1 standard errors. *Note:* Pre = pre self-compassion manipulation; Post = post self-compassion manipulation; VAS sample for positive affiliative affect included: *"Right now: I don't feel loved and safe at all (0) – I feel very loved and safe (100).*

The results of the MBCT-related changes in responses to self-compassion manipulation indicate a similar pattern in respect to the changes in state self-compassion, criticism and positive affiliative affect. The self-compassion manipulation was successful in increasing levels of self-compassion and positive affiliative affect. Critically, this effect remained post MBCT although levels of self-compassion and positive affiliative affect were significantly higher before the self-compassion manipulation. However, the results for the state self-criticism changes were less consistent.

7.4.3 MBCT related psychophysiological changes in response to the self-compassion manipulation.

Heart rate effects. Pattern of change in heart rate for the two groups at the first and second assessment are depicted in Figure 7.6. The two-way ANOVA indicated a significant Time X Group interaction, $F(1,45) = 42.76, p < .001, \eta^2_p = .49$. The heart rate results suggest that the remitted depressed MBCT group had a decrease in heart rate throughout the self-compassion manipulation *post* treatment as compared to *pre* treatment, whereas the remitted depressed control group demonstrated no change in their heart rate responses to the self-compassion manipulation. Simple contrast revealed that the remitted depressed MBCT group showed a higher decrease in heart rate post MBCT, $F(1,21) = 45.61, p < .001, \eta^2_p = .65$, 95% CI [-5.15, -2.72], but no differences between the first and second assessment emerged for the remitted depressed control group, $F(1,24) = 1.08, p = .309, \eta^2_p = .04$, 95% CI [-1.05, .35]. When examining the between-subject simple contrast, no differences emerged at the first assessment, $F(1,45) = 2.37$, $p = .131$, $\eta^2 = .05$, 95% CI [-.26, 1.75]; however, relative to the remitted depressed control group, the remitted depressed MBCT group demonstrated a decrease in heart rate in response to the self-compassion manipulation post MBCT, $F(1,45) = 29.97$, $p < .001$, $\eta^2 = .41$, 95% CI [-4.94, -2.15].

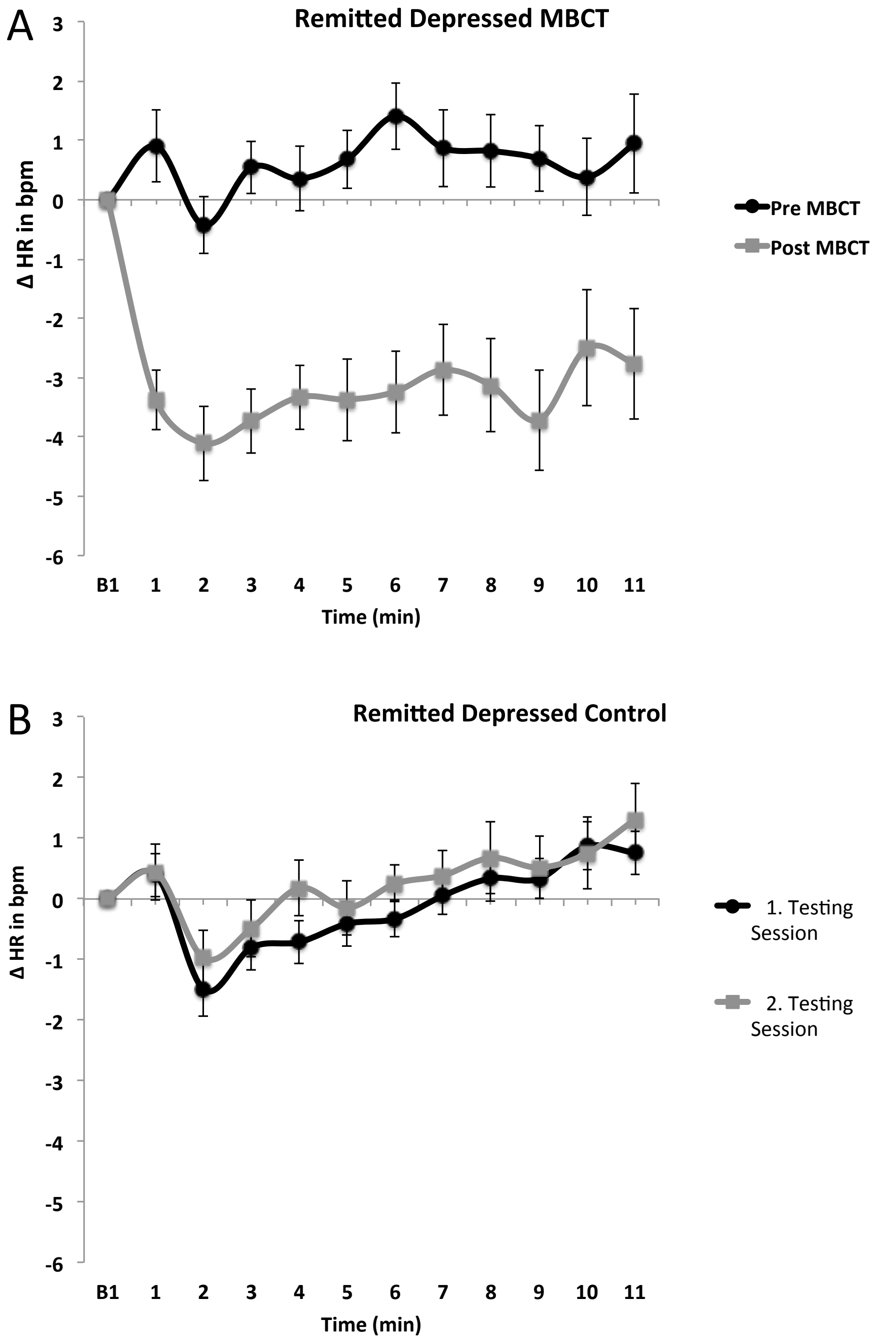


Figure 7.6 Baseline-to-exercise change in heart rate for the different experimental conditions ± 1 standard errors. For the remitted depressed MBCT group (A) and the remitted depressed control group (B).

Heart rate variability effects. The two-way ANOVA yielded a significant Time X Group interaction, $F(1,39) = 17.95$, $p < .001$, $\eta^2_p = .32$. Simple contrast revealed that the remitted depressed MBCT group demonstrated higher heart rate variability in response to the self-compassion manipulation after they completed the MBCT course as compared to their responses before the course, $F(1,17) = 10.76$, $p = .004$, $\eta^2_p = .32$, 95% CI [16.42, 75.63] (see Figure 7.7 A). In contrast, the remitted depressed control group demonstrated the opposite pattern, with lower heart rate variability in response to the self-compassion manipulation at the second testing session as compared to the first testing session, $F(1,22) = 5.29$, $p = .031$, $\eta^2_p = .19$, 95% CI [-24.67, 1.28] (see Figure 7.7 B). Critically, further exploration showed that the two groups did not differ in their heart rate variability responses to the self-compassion manipulation at the first testing session, $F(1, 41) = .59$, $p = .457$, $\eta^2 = .09$, 95% CI [-26.12, 14.35], but at the second testing session, $F(1, 42) = 29.97$, $p < .001$, $r = .42$, 95% CI [-26.12, 14.35].

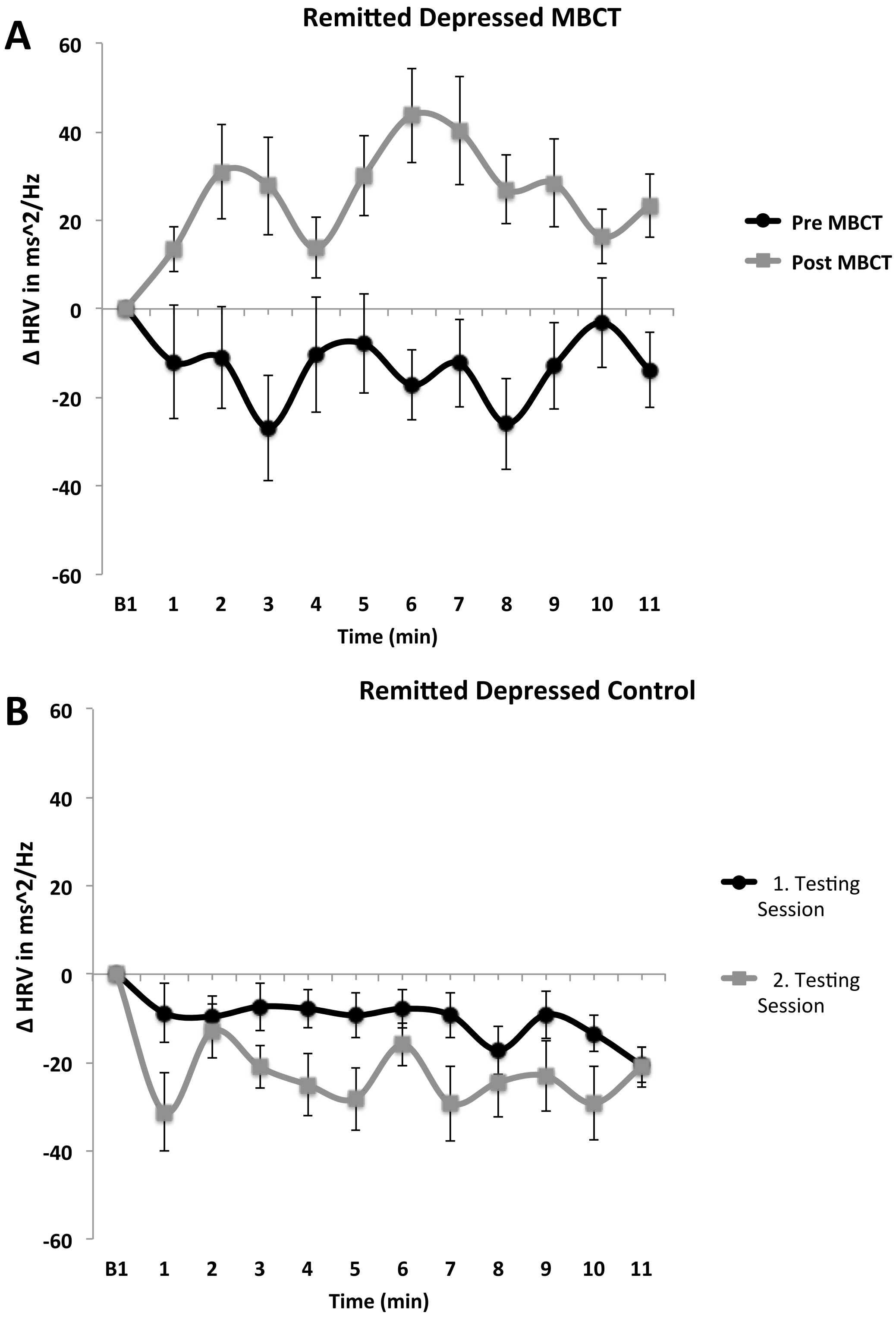


Figure 7.7 Baseline-to-exercise change in heart rate variability for the different experimental conditions ± 1 standard errors. For the remitted depressed MBCT group (A) and the remitted depressed control group (B).

Skin Conductance Level Effects. **Figure 7.8** shows the pattern of change in skin conductance level for the two groups at the first and second assessment. The two-way ANOVA revealed a significant Time X Group interaction, $F(1,43) = 8.38$, $p = .007$, $\eta^2_p = .16$. Simple contrast revealed that the remitted depressed control group demonstrated significantly higher SCL in response to the self-compassion intervention at the second as compared to the first testing session, $F(1, 22) = 4.97$, $p = .036$, $\eta^2 = .18$, 95% CI [-.01, .17]. In contrast, there was a trend for a decrease in SCL in response to the self-compassion intervention after the MBCT course as compared to before, $F(1, 45) = 4.07$, $p = .057$, $\eta^2 = .16$, 95% CI [-.29, .-.01]. An examination of the between-subject simple contrast revealed no group differences at the first assessment $F(1, 45) = .73$, $p = .392$, $\eta^2 = .01$, 95% CI [-.07, .17]. However, there was a trend for group differences at the second assessment, $F(1, 45) = 3.67$, $p = .061$, $\eta^2 = .10$, 95% CI [-.28, .01], with lower SCL in response to the self-compassion manipulation in the MBCT group.

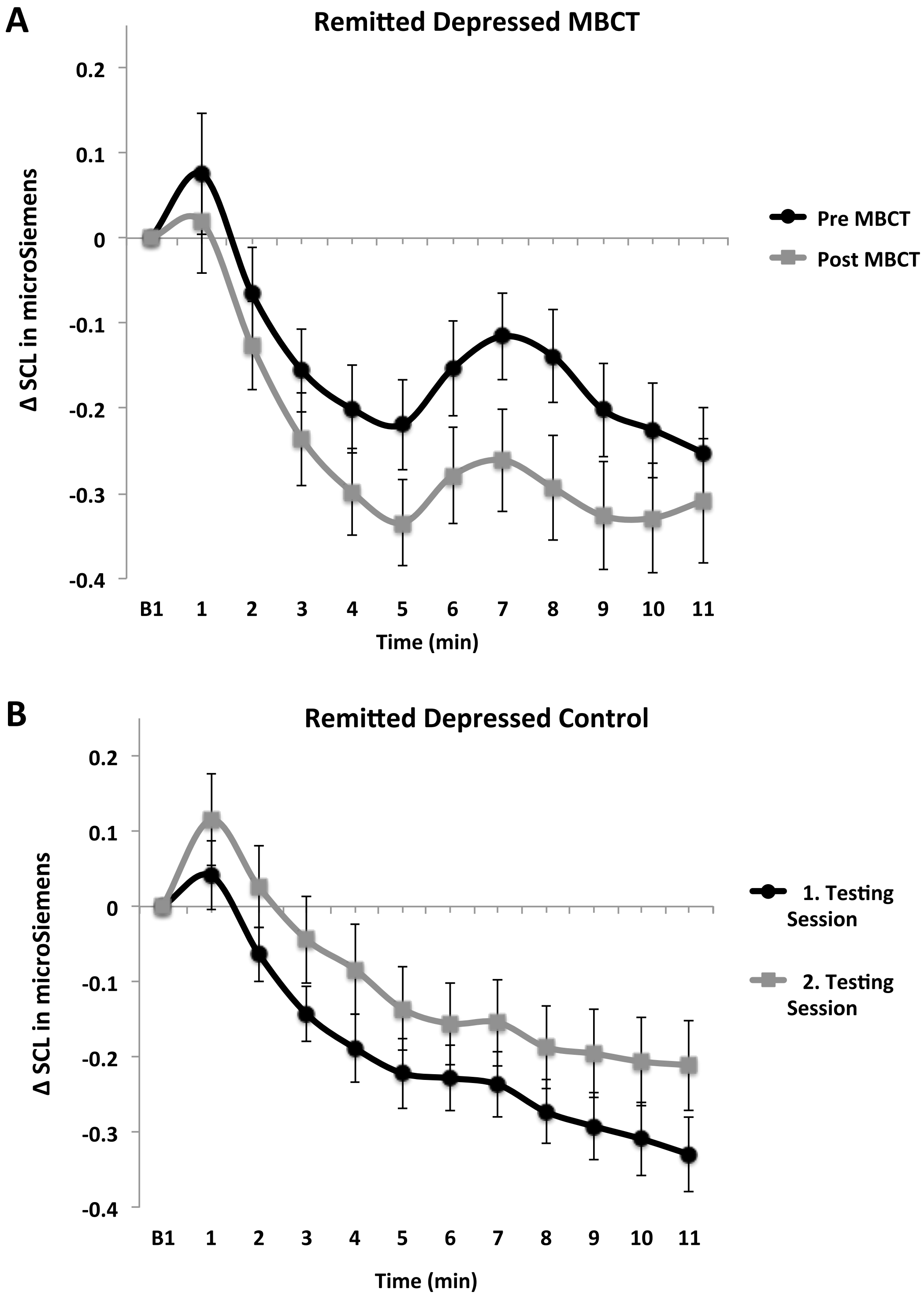


Figure 7.8 Baseline-to-exercise change in skin conductance level for the different experimental conditions ± 1 standard errors. For the remitted depressed MBCT group (A) and the remitted depressed control group (B).

7.5 Discussion

Building on work suggesting that self-compassion might be one of the key mechanisms of change in MBCT (Holzel et al., 2011; Kuyken et al., 2010; van der Velden et al., 2015) and following proposals that applying a triangulation of subjective and physiological measures might help a better understanding of how the cultivation of self-compassion is beneficial in preventing relapse to depression (as well as addressing a current gap in the literature (van der Velden et al., 2015)), the aim of this study was to investigate psychophysiological changes associated with self-compassion in remitted depressed individuals who underwent MBCT. Specifically, this study tested the hypothesis that MBCT will lead to improvements of trait levels of self-compassion, self-criticism, and depressive symptoms. Moreover, the aim of this study was to investigate if MBCT facilitates the activation of the soothing and contentment system – a system characterised by increased parasympathetic and decreased sympathetic activation — through a short-term experimental self-compassion induction. Overall, this study found support for both hypotheses, which is discussed in more detail in the following section.

MBCT-related changes in self-compassion, criticism and depression

The results of this study revealed that MBCT was associated with significant improvements in self-reported trait levels of self-compassion, self-criticism, and depressive symptoms. These findings replicate previous findings (Kuyken et al., 2010) and support theoretical arguments suggesting that the cultivation of self-compassion is a skill learnt during MBCT (Feldman & Kuyken, 2011). Toward the goal of better understanding psychophysiological processes associated with these improvements, a particular aim of this study was to investigate physiological response changes to a self-compassion induction following MBCT.

MBCT-related psychophysiological changes in response to the self-compassion manipulation

With respect to the self-reported state changes in self-compassion, self-criticism, and positive affiliative affect, this study found that self-compassion could be temporarily increased by a one-off self-compassion induction in both groups at the first testing session. Specifically, the self-compassion induction increased self-reported levels of self-compassion and positive affiliative affect. In addition, the self-compassion induction significantly decreased state levels of self-criticism in the MBCT group pre-treatment, but not in the remitted depressed control group. Post-treatment, the MBCT group showed an elevation in self-reported state self-compassion and positive affiliative affect, and reduced state self-criticism before the self-compassion induction. These changes are likely to reflect the improvements in trait self-compassion, self-criticism and depressive symptoms following MBCT. Critically, the MBCT still demonstrated increases in self-reported self-compassion and positive affiliative affect following the self-compassion induction. In contrast, post treatment the MBCT group did not demonstrate changes in state self-criticism in response to the self-compassion induction. One explanation for this finding might be that the decreased state levels of self-criticism before the self-compassion induction led to ceiling effects. Therefore the possible range for improvements was narrower making a significant effect more difficult to detect. On the other hand, no changes in response to the self-compassion induction between the first and second assessment have been found for the remitted depressed passive control group. Taken together, the self-report data indicated that the self-compassion induction successfully increased state-levels of self-compassion and positive affiliative affect for both groups at both testing sessions, with a similar increase from a higher baseline in the MBCT group at the second assessment.

With respect to the physiology accompanying the self-compassion induction, the data of this study revealed MBCT related changes in physiological response patterns to the self-compassion induction. Specifically, when compared to pre-treatment, this study suggested that following MBCT the self-compassion induction was accompanied by a physiological response pattern of increased parasympathetic activity indicated by higher HRV, and decreased sympathetic activity indicated by lower skin conductance levels and decreases in heart rate. In contrast, the passive control condition did not demonstrate improvements in physiological response when exposed to the self-compassion induction the second time. These findings suggest that MBCT might be effective in preventing relapse and increasing wellbeing because it appears to enable individuals at risk of relapse into depression to activate the soothing and contentment system, a system characterised by self-soothing behaviour, a healthy tolerance for distress, and a motivation to care for oneself and others (Gilbert, 2009; Gillath, Shaver, & Mikulincer, 2005). Supporting this argument, following MBCT the self-compassion inductions enhanced parasympathetic activity that gave raise to HRV. Higher HRV has been linked to flexible attention deployment, adaptive emotion regulation to threat contexts, and both physical and psychological health (Appelhans & Luecken, 2006; Thayer & Lane, 2000; Thayer & Lane, 2007).

Moreover, higher HRV has been suggested to be conducive to interpersonal approach, social affiliation and the ability to self-soothe when stressed (Depue & Morrone-Strupinsky, 2005; Porges, 2007). Furthermore, in line with Depue and Morrone-Strupinsky (2005) and Gilbert (2014), who argue that the stimulation of the soothing and contentment system is associated with the down-regulation of the threat and positive excitement system, the self-compassion inductions in this study were associated with reduced sympathetic activation.

This suggestion is in line with emerging theory (Gilbert, 2009) and recent findings (Diedrich et al., 2014; Leary, Tate, Adams, Allen, & Hancock, 2007) that self-compassion in the face of negative thoughts and distress is adaptive and thus emphasises it as a key skill to be learned from MBCT (Feldman & Kuyken, 2011; Kuyken et al., 2010). This study is the first to show a possible psychophysiological mechanism via which the cultivation of self-compassion through MBCT may help individuals to respond more adaptively in the face of negative thoughts, memories, feelings and depressive symptoms. Hence, MBCT might be particularly beneficial for individuals at risk of depression, because it helps them to develop skills to access and activate the under-stimulated soothing and contentment system.

An intriguing aspect of the present findings is that the self-report data for both groups at the first assessment were not corroborated by the expected physiological response pattern that has been shown in previous research (Kirschner et al., 2013). One possible explanation might be that social desirability or demand characteristics may account for this discrepancy between self-report and physiological responses. Interestingly, following MBCT the self-report data was accompanied by the expected physiological response pattern. In contrast, the remitted depressed passive control group still demonstrated a discrepancy between self-report and physiological responses. These findings may therefore also be explained by another aspect, namely that recurrently depressed individuals may have difficulties in differentiating and labelling emotional and bodily experiences (e.g. Dunn et al., 2010). MBCT teaches people to observe thoughts and feelings without explicitly trying to change or avoid them and this might partly account for improved introspection in the MBCT group following treatment in this study. These results also highlight how important it is to use non-self-report measures. Therefore this study supports the call for the triangulation of self-report and physiological to enhanced investigations in this field (see Kuyken et al., 2010; van der Velden et al., 2015).

Limitations

This study had several notable limitations. First, the study did not use an active control group, meaning that other factors could have been responsible for the results. Future research might address this limitation by using an active control group like relaxation training to establish specific effects associated with MBCT. Second, this study did not include follow-up data. Future research will need to examine whether the enhanced activation of the soothing and contentment system through the cultivation of self-compassion predicts reduced relapse rates and wellbeing at one or two year follow- ups. Third, although the physiological changes associated with the increased capacity to cultivate self-compassion are suggested to enable self-soothing and adaptive emotion regulation in times of distress (Porges, 2007; Thayer & Lane, 2000; Thayer & Lane, 2007) this study did not explicitly test whether these changes translate into more adaptive responses in the face of negative thoughts, memories, feelings and depressive symptoms. The fourth limitation is the lack of respiratory data, as it has been demonstrated that breathing might affect cardiac vagal tone (Ritz & Dahme, 2006). Hence HRV changes could be attributable to changes in breathing rate or depth. On the other hand, there is evidence that respiration can be neglected when examining HRV (Park, Vasey, Van Bavel, & Thayer, 2013; Ruiz-Padial, Sollers, Vila, & Thayer, 2003). In addition, physical demands were kept constant throughout the study and the self-compassion intervention was deliberately kept in non-breathing focus, making an influence of breathing on the HRV results unlikely. Fifth, there was a group difference in trait levels of self-criticism at baseline, with higher self-criticism levels in the MBCT group. However, including self-criticism as a covariate in the analyses of this study did not reveal any changes to the results. Finally, the current study did not follow a RCT design. Therefore, participants have not been randomly allocated to either the MBCT intervention or the passive control group. However, the groups did not differ in terms of the assessed sample characteristics at baseline, except the trait levels of self-criticism (see limitation stated above). In addition, for feasibility reasons it was not possible to follow a RCT design for this project.

Conclusions and implication for future research

Consistent with theory and data suggesting that self-compassion might be one of the key mechanisms of change in MBCT (Holzel et al., 2011; Kuyken et al., 2010; van der Velden et al., 2015), this study revealed the first evidence that the cultivation of self-compassion through MBCT might be protective in preventing relapse to depression because it increases the activation of the positive affiliative affect system, a system characterised by a content and calm state of mind with a disposition for kindness, care and social connectedness that is accompanied by a specific physiological response pattern associated with adaptive emotion regulation and self-soothing in times of distress. The findings of this study have important clinical implications. The triangulation of behavioural and physiological measurements might be a valuable evaluation tool for psychotherapies. Further research is need to investigate if the psychophysiological changes found in this study translate into the suggested reduced relapses at study follow-ups and more adaptive responses in the face of negative thoughts, memories, feelings and depressive symptoms.

8 General discussion

In this final chapter the findings of the studies reported in the thesis will be considered in relation to one another and in relation to the identified gaps in the current literature of self-compassion. Prior to this, the purpose, methodology and main findings of the thesis will be summarised. Further, this chapter will reflect on the limitations of this thesis and outline implications for future research.

8.1 Summary of the purpose, methodology and main findings of the thesis

Despite the growing evidence that self-compassion is associated with lower levels of ill mental health and improved wellbeing (Kuyken et al., 2010; MacBeth & Gumley, 2012; Wei, Liao, Ku, & Shaffer, 2011; Zessin, Dickhauser, & Garbade, 2015), the mechanism underlying self-compassion and its beneficial effects are not well understood. Therefore, this thesis attempted to address this gap by applying a triangulation of behavioural and physiological methods to explore potential psychological and biological mechanisms underlying the cultivation of self-compassion in both healthy and clinical samples. Integrating previous findings and theory on self-compassion (see Chapter 2, pp. 2 - 41) within the broaden-and-build-up framework of resilience (Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008), this thesis suggested that the cultivation of self-compassion over time will initiate two fundamental processes:

1. The cultivation of self-compassion by meditative techniques will enhance positive affiliative affect (e.g., love, care, feeling securely attached) and a greater tendency to prefer positively valenced information about the self. This state should be reflected in activation of the soothing and contentment system that is characterised by the dynamic balancing of the sympathetic and parasympathetic nervous systems and a greater ability to self-soothe when stressed (Broaden).

2. In line with Kuyken et al. (2010), who established that self-compassion attenuated the toxic effects of reactivity during a sad mood induction in individuals with a history of recurrent depression, we suggest that self-compassion reduces problematic reactivity to negative stimuli and builds an individual's resilience which in turn leads to reduced symptoms of depression and increased wellbeing.

One identified gap in the current self-compassion literature was a lack of adequate experimental, short-term self-compassion interventions. To test the proposed broaden hypothesis and address this current gap in the literature, the self-compassion inductions used in this thesis were tailored in line with existing definitions and theory (Gilbert, 2009; Neff, 2003a) and have been recorded by and incorporated clinical experiences from an experienced mindfulness therapist and trainer. In addition, manipulation checks were used to ensure the paradigm was fit for the purpose to cultivate self-compassion. Furthermore, the triangulation of self-report and physiological measures within this thesis allowed me to address the current debate on the measurement issues of self-compassion (see Chapter 1.1, pp. 6-7).

Based on these considerations, this thesis endeavoured to address the following research questions within four studies:

1. Will meditative techniques designed to cultivate self-compassion increase positive affiliate affect and facilitate access to a more positive self-attitude? (Study I and Study II)
2. Will increased positive affiliative affect be accompanied by increased parasympathetic and decreased sympathetic activation of the autonomic nervous system? (Study I)
3. Will a more positive self-perception be accompanied by enhanced automatic and elaborate processing of positive information about the self, as evidenced by early and late components of the ERP? (Study II)
4. Are there differences between healthy individuals and individuals at risk for depression to cultivate a self-compassionate stance? (Study III)
5. Will individual differences in trait self-compassion, self-criticism, attachment style and adverse childhood experiences moderate a person's capacity to cultivate self-compassion? (Study I, II, and III)
6. Will the participation in MBCT alter an individual's psychophysiological responses to a self-compassion induction? (Study IV)

Summary of the main findings and answers to the research questions

The goal of Study I was to use two experimental inductions designed to cultivate self-compassion, i.e., a loving-kindness meditation (direct approach) and a compassionate body scan (indirect approach), to investigate their effects on self-reported state self-compassion, self-criticism, positive affiliative affect, and related physiological responses. Specifically, this study tested the hypothesis that the cultivation of self-compassion is associated with increased positive affiliative affect and stimulates the soothing and contentment system, a system characterised by increased parasympathetic and decreased sympathetic activation (addressing research question I and II). Moreover, this study aimed to explore whether individual differences moderate the hypothesised effects (addressing research question V). This study included two self-compassion inductions to explore if direct and indirect approaches were equally effective and to address the individual differences question posed by clinicians that directly cultivating self-compassion does not work in some people (e.g. Gilbert & Procter, 2006). The results revealed that both self-compassion inductions increased positive affiliative affect and simulated the soothing and contentment system. Further explorations of these findings suggested that responses to the self-compassion induction were moderated by participants' tendencies to self-criticise, trait levels of self-compassion and attachment related anxiety. Individuals high in self-criticism, low in self-compassion and with an anxious attachment style tended to respond to the compassionate body scan (i.e., a more indirect approach to cultivate self-compassion) with higher activation of the soothing and contentment system but not in the LKM (i.e., a more direct approach to cultivate self-compassion). These findings suggest that more indirect self-compassion inductions worked better for individuals who might need to gradually build up the soothing system and are in line with the indirect nature of MBCT (see discussion about the role of individual differences on the capacity to cultivate self-compassion in the next section).

Study II explored the effect of a direct (loving kindness mediation) and a indirect (compassionate body scan) self-compassion induction on behavioural and neural self-referential processes (addressing research question I and III). This study further investigated the role of individual differences on the changes in self-referential processing in response to the self-compassion inductions (addressing research question V). Results of Study II revealed that both self-compassion inductions increased access to a more positive self-attitude. This was reflected by an enhanced tendency to prefer positively valenced information about the self for the direct self-compassion induction and a reduced tendency to endorse negative information of the self for both self-compassion inductions. The enhanced tendency to prefer positively valenced information about the self following the direct self-compassion induction was moderated by individual differences in trait levels of self-compassion and self-criticism, with higher levels of self-criticism and lower levels of self-compassion being linked to a relative decrease in positive self-perception. In addition, there was some evidence that the tendency to prefer positive information about the self was accompanied by adaptive alterations in sustained attention to and elaborated processing of emotional stimuli. This was reflected in increased sustained attention to — and elaboration of — positive words following the compassionate body scan and increased sustained attention to — and elaboration of — negative words after the loving kindness meditation. No effect of the self-compassion inductions has been found on automatic word processing (indexed by the P1 and P2 components).

Study III tested whether vulnerability to relapse in individuals with recurrent depression might be reflected in altered psychological and physiological responses to a self-compassion exercise that in healthy individuals very potently elicits the activation of the positive affiliative affect system (addressing research questions VI and V). The results of this study indicate that compared to healthy controls, individuals at risk of depression — particularly individuals with high levels of self-criticism — demonstrated difficulties in activating the positive affiliative affect system on a physiological level via the cultivation of self-compassion.

The final study in this thesis investigated psychophysiological responses to a self-compassion induction in remitted depressed individuals before and after the participation in MBCT (addressing research question VII). The results of the study revealed that compared to the remitted depressed passive control group, MBCT might be particularly beneficial for individuals at risk of depression, because it helps them to develop skills to access and activate the soothing and contentment system. This was reflected in increased parasympathetic (indexed by increased heart rate variability) and decreased sympathetic (indexed by decreased heart rated and skin conductance levels) activation as well as increased self-reported positive affiliative affect and self-compassion in response to the self-compassion induction following MBCT.

Taken together, the results of the four studies of this thesis partly support the broaden hypothesis whereby the cultivation of self-compassion enhanced positive affiliative affect, a greater tendency to prefer positively valenced information about the self, and the activation of the soothing and contentment system. These positive states have in the literature been associated with broadening (e.g. Mikulincer et al., 2011). However the studies also revealed that the capacity to activate the soothing and contentment system and gain a more positive self-perception through the cultivation of self-compassion might rely on certain individual differences. General implications of the studies, their relation to one another, and their relation to the current literature will be discussed in more detail in the following section.

8.2 Integration and Critical Discussion

Self-compassion and the soothing and contentment system

The most consistent finding of the empirical studies of this thesis is that the cultivation of self-compassion was accompanied by the activation of the soothing and contentment system as well as increased self-reported positive affiliative affect. This is in line with the suggested broaden hypothesis proposing that the cultivation of self-compassion may enhance wellbeing because it is associated with the stimulation of the soothing and contentment affect system, a system characterised by self-soothing behaviour, a healthy tolerance for distress, and a motivation to care oneself and others (Gilbert, 2009; Gillath, Shaver, & Mikulincer, 2005).

Supporting this argument, this thesis demonstrated that a short-term self-compassion induction could enhance parasympathetic activity as indicated by increased HRV. There is consensus in the literature that higher HRV has been linked to flexible attention deployment, adaptive emotion regulation to threat contexts, and higher physical and psychological health (Appelhans & Luecken, 2006; Thayer & Lane, 2000; Thayer & Lane, 2007). Moreover, higher HRV has been suggested to be conducive to interpersonal approach, social affiliation and the ability to self-soothe when stressed (Depue & Morrone-Strupinsky, 2005; Porges, 2007). In addition, the results of this thesis indicated that the short-term cultivation of self-compassion was associated with reduced sympathetic activation. This is in line with Depue and Morrone-Strupinsky (2005) and Gilbert (2014), who argue that the stimulation of the soothing and contentment system is associated with a down-regulation of the threat and positive excitement system.

Self-compassion and self-referential processing

Biases towards negative information about the self have been attributed an important role in the development and maintenance of mental health problems like depression (Beck, 1996; Cili & Stopa, 2015; Williams, Healy, Teasdale, White, & Paykel, 1990). This thesis provided the first evidence that in a healthy student sample, a short-term cultivation of self-compassion might be accompanied by an increased access to more positive self-representations. These results raise important clinical implications. There is good evidence that dysfunctions in self-orientated cognitions in depression, with both automatic and more elaborated processing biases towards negative information about the self, play an important role in reinforcing and intensifying depressive systems (Auerbach, Stanton, Proudfit, & Pizzagalli, 2015; Shestyuk & Deldin, 2010). The cultivation of self-compassion might be particularly beneficial for depressed individuals as it facilitates positive self-referential processing and therefore might reduce the bias towards negative information about the self often found in depressed individuals (Mezulis, Abramson, Hyde, & Hankin, 2004). Future studies will need to examine if the results found in this thesis will extend to depressive samples. In addition, research is needed to examine if longer interventions designed to cultivate self-compassion can also influence early (automatic and likely habitual) processing biases towards negative information about the self and thus reduce depressive symptoms.

Role of individual differences on the capacity to cultivate self-compassion

Another consistent finding of this thesis is that the proposed protective effects of self-compassion via the stimulation of the soothing and contentment affect system and access to a more positive perception of the self may rely on important individual differences — such as self-criticism, attachment problems, and experienced childhood adversity — and might be made more challenging when there is an underlying psychopathology such as recurrent depression. This suggestion was reflected in two key findings, which will be discussed below.

First, within this thesis self-critical individuals and particularly self-critical individuals at risk of depression demonstrated several difficulties in activating the soothing system. This is in line with clinical observations that for some individuals (particularly self-critics) focusing on compassion for the self can at first be threatening and feel unsafe (Gilbert & Irons, 2004). In addition, these findings are in line with compassion focused imagery findings which support the argument that for self-critical individuals focusing on compassion can activate the threat system indicated by higher HPA activation (Duarte et al., 2015; Rockliff et al., 2008) and increased amygdala activation (Longe et al., 2010).

Second, the activation of the soothing system might rely on attachment and childhood adversity experiences. The results of the studies in this thesis provided evidence that difficulties in the activation of the soothing and contentment system associated with the self-compassion induction might be attributed to difficult attachment experiences and experienced childhood adversity. Indeed, several researchers argue that capacities for self-compassion and the development of the soothing and contentment system are rooted in a secure attachment system and a safe relationship with primary caregivers (Gilbert, 2009; Gillath et al., 2005; Neff & McGehee, 2010). As discussed earlier in this thesis (see chapter 2.2.1, pp. 17 – 19), early attachment experiences shape internal working models of self and others (Bartholomew & Horowitz, 1991) and lead to the development of the emotion regulation strategies used in times of distress (Mikulincer & Shaver, 2007). Therefore, individuals who experienced adversity and have not experienced secure and warm relationships with caregivers but were exposed to neglect or abuse (emotional and physical) may have a reduced capacity to generate self-compassion and activate the soothing system in times of distress, as their experience precluded them from being exposed to this positive learning opportunities and they rely on maladaptive emotion regulation strategies in times of distress (Gilbert et al., 2010; Mikulincer & Shaver, 2007).

Given the importance of the soothing system in promoting adaptive emotion regulation in the face of life's challenges and adversities (Gilbert, 2009; Mikulincer & Shaver, 2007; Porges, 2007; Thayer & Lane, 2000), individuals who have difficulties in activating this system might be at particular risk of chronification of mental health problems and lower resilience and reduced wellbeing (Appelhans & Luecken, 2006; Gilbert, 2014; Thayer, Friedman, Borkovec, Johnsen, & Molina, 2000). Hence, it is important to signpost individuals who have difficulties in activating the soothing system and offer them specific interventions that facilitate access to this system.

The results of this thesis suggest that more indirect approaches to cultivate self-compassion like the compassionate body-scan or MBCT might enable individuals with attachment difficulties, experienced childhood adversity, or higher levels of self-criticism to activate the soothing and contentment system. This was reflected in the absence of an effect of individual differences on the activation of the positive affiliative affect system through the compassionate body scan in a healthy student sample. Moreover, there was evidence that the cultivation of self-compassion following MBCT was accompanied by increased activation of the soothing system in remitted depressed individuals. Given that the remitted depressed MBCT participants reported significantly higher attachment related difficulties, experienced childhood adversity, and self-criticism as compared to the healthy participants in this thesis, the results of this study indicate that MBCT might be particularly beneficial for them, because it helps them to develop skills to access and activate the under-developed soothing and contentment system in the face of negative thoughts, memories, feelings and depressive symptoms. This is in line with recent research that suggests that MBCT is of particular benefit for individuals who report childhood adversity (Williams et al., 2014) and that those most at risk of depressive relapse benefit the greatest amount from MBCT (Kuyken et al., in press). This thesis offers the first evidence of which psychophysiological mechanisms might be responsible for these findings.

Summary of the contribution of this thesis

This thesis addressed theoretical, empirical and methodological gaps. First, it informed an on-going debate in the literature about the relation of self-compassion to and difference from the scientifically older concept of self-compassion. To the best of my knowledge this thesis provides the first evidence to demonstrate that like compassion (e.g. Duarte, McEwan, Barnes, Gilbert, & Maratos, 2015; Rockliff, Gilbert, McEwan, Lightman, & Glover, 2008; Rockliff et al., 2011; Tang et al., 2009), self-compassion activates the soothing and contentment system and its physiological underpinnings. This suggestion is consistent with theoretical arguments put forward by Gilbert (2009), who positions compassion for the self and others in the context of the soothing and contentment system. These similarities support the relationship between self-compassion and compassion. However, this thesis also provided evidence that self-compassion impacts upon self-referential processes. Hence there is good evidence that while these constructs share certain similarities they are also distinct from each other.

Secondly, this thesis addressed several gaps in the current empirical and methodological self-compassion literature: (1) a lack of existing adequate experimental/one-off self-compassion interventions, (2) a lack of studies that measure state changes in self-compassion, and (3) a lack of triangulation studies applying self-report and bio-behavioural measurements that investigate psychophysiological correlates of self-compassion which might be facilitators of beneficial change. To address these gaps, the self-compassion inductions used in this thesis have been developed very carefully in line with existing definitions and theory (Gilbert, 2009;

Neff, 2003a) and have been recorded by and incorporated clinical experiences from an experienced mindfulness therapist and trainer. In addition, manipulation checks — assessing state self-compassion, state self-criticism, and positive affiliative affect — have been used to ensure the inductions are fit for the purpose of cultivating self-compassion. Furthermore, we used a triangulation of self-report and physiological measures to investigate the effects of the inductions. The results of this thesis suggest that the developed experimental self-compassion induction procedures may lend themselves well to investigating underlying mechanisms of the cultivation of self-compassion. The findings of this thesis across the studies are comparable as they used the same experimental procedure in both healthy and clinical samples. In the healthy controls the self-reports were associated with the expected physiological changes. Interestingly – in the clinical samples — the self-report data were not corroborated by the expected physiological response pattern. As discussed previously these findings may be explained because recurrently depressed individuals may have difficulties in differentiating and labelling emotional and bodily experiences (e.g. Dunn et al., 2010). These results highlight how important it is to use triangulation studies.

However, there are several limitations of this thesis and gaps in the self-compassion literature that could not be addressed. In the following section the limitations of this thesis will be discussed in more detail.

8.3 Reflections on the Limitation of this Thesis

When integrating the findings into the general conceptualisations of self-compassion and the self-compassion literature, a number of limitations should be borne in mind. Firstly, this research was not designed to test the effect of self-compassion in times of personal adversity, as participants in this thesis have not been asked to apply self-compassion in the face of an experimentally induced stressor. Hence the building up of resilience hypothesis could not fully be tested. Although increased activation of the soothing and contentment system through the cultivation of self-compassion is suggested to be associated with adaptive emotion regulation in times of distress (Porges, 2007; Thayer & Lane, 2000), future research is needed to explicitly investigate if the cultivation self-compassion reduces the problematic reactivity to negative stimuli and leads to a building up of resilience which in turn leads to reduced symptoms of depression and increased wellbeing. It is important to note that in this thesis the absence of experimentally induced adversity was deliberately chosen. This was because the aim was to establish a paradigm that reliably cultivates self-compassion and its underlying physiology. Now that the self-compassion paradigm has been established across different studies and samples the building-up hypothesis can be addressed.

Secondly, while this thesis provided evidence that self-compassion can be seen as a healthy sense of self that facilitates adaptive emotion regulation in face of difficulties via active self-soothing processes, this research could not contribute towards the existing disagreement regarding the interplay of self-compassion and self-criticism in the conceptualisation of self-compassion (Gilbert, 2009; K. Neff, 2003). The results of this thesis suggest that trait self-criticism influences the capacity to activate the soothing and contentment system and a more positive self-perception. However, this thesis could not comment upon whether these two concepts are sides from the same construct (Neff, 2003) or represent two different constructs (Gilbert, 2009). Interestingly, Falconer, King, and Brewin (2015) very recently developed a state questionnaire including both constructs, which investigates the short-term interactions between self-compassion and self-criticism and their associations with changes in situations and mood. They found a clear two-factor structure, suggesting that self-compassion and self-criticism are two distinct constructs. However, to date this questionnaire has only been tested in a healthy student sample and replications in more diverse samples are called for. An interesting avenue for further research would be a combination of this questionnaire with the psychophysiological self-compassion induction paradigm of this thesis. This would allow one to a) investigate if the questionnaire introduced by Falconer, King, and Brewin (2015) is sensitive in picking up state changes in self-compassion and self-criticism following a self-compassion induction, and b) if these changes are associated with specific physiological response pattern.

Finally, all participants in this thesis were of very high socioeconomic status. Hence, replications with more diverse samples are called for.

8.4 Implications for Future Research

Possibly the key limitation of this thesis is that it did not test if the suggested broaden mechanisms translate into the building up of resilience, i.e. the ability to respond to and recover from challenging events and the capacity to endure and continue in the face of adversity. Therefore, further research is needed to investigate if the increased activation of the soothing and contentment system and increased positive perception of the self through the cultivation of self-compassion translate into more adaptive responses in the face of negative thoughts, memories, feelings, depressive symptoms and adversity.

I would also like to draw attention to the value of gaining in-depth qualitative data (e.g. Petitmengin, 2006) about the personal experiences individuals have when they are asked to cultivate self-compassion. This information would be particularly valuable from individuals who have difficulties in activating the soothing and contentment system and difficulties in offering themselves compassion in times of distress. If we can better understand their fears and their blocks in self-compassion and the soothing system, then self-compassion interventions can target these difficulties better and potentially prevent complication of mental health problems and lower resilience and wellbeing.

Finally, given that the self-compassion induction paradigm developed in this thesis very potently elicits the activation of the positive affiliative affect and soothing system in healthy individuals, this methodology could be adopted for evaluating psychotherapies. Given that the ability to self-soothe has such great importance for psychopathology (Gilbert, 2010), the self-compassion paradigm used in this thesis might be used as an assessment tool to investigate the progress of individuals across therapy sessions as well as evaluating treatment outcomes.

8.5 Summary and Conclusion

This thesis applied a triangulation of behavioural and physiological methods to explore potential psychological and biological mechanisms underlying the cultivation of self-compassion in both healthy and clinical samples. Drawing on theory and previous research on self-compassion, the aim of this thesis was to investigate if the cultivation of self-compassion enhances positive affiliative affect (e.g., love, care, feeling securely attached) and a greater tendency to prefer positively valenced information about the self. It was suggested that this state would be reflected in activation of the soothing and contentment system that is characterised by the dynamic balancing of the sympathetic and parasympathetic nervous systems and a greater ability to self-soothe when stressed.

The results of this research broadly supported this hypothesis. Detailed exploration of the results indicated that the proposed protective effects of self-compassion via the stimulation of the soothing and contentment affect system and access to a more positive perception of the self may rely on important individual differences — such as self-criticism, attachment problems, and experienced childhood adversity — and might be made more challenging when there is an underlying psychopathology such as recurrent depression. In this context, the results of this thesis indicate that more indirect approaches to cultivate self-compassion like the compassionate body-scan or MBCT might enable individuals with attachment difficulties, experience of childhood adversity, or higher levels of self-criticism to activate the soothing and contentment system.

What remains unknown is whether the activation of the soothing system and a more positive self-perception through the cultivation of self-compassion translate into the building-up of resilience and in turn leads to reduced symptoms of depression and increased wellbeing.

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10 Appendix

LIST OF CONTENTS

Appendix I: Visual Analogue Scales used as Manipulation Checks in Study I, II, III, and IV

Right now:

0--100

I don't feel at all self-critical	**I feel very self-critical**

0--100

I feel like not being kind and understanding towards myself at all	**I feel like being very kind and understanding towards myself**

0--100

I am not tolerant of my flaws and inadequacies at all	**I am very tolerant of my flaws and inadequacies**

0--100

I don't feel loved and safe at all	**I feel very loved and safe**

0--100

I don't have a desperate need to feel loved	**I have a desperate need to feel loved**

0--100

The idea of being emotionally close to someone doesn't make me nervous at all	**The idea of being emotionally close to someone makes me very nervous**

0--100

I don't feel a sense of togetherness with others at all	**I very much feel a sense of togetherness with others**

0--100

I don't feel calm at all	**I feel very calm**

Appendix II: Scripts of the experimental Inductions used in Studies I - IV

Script for Loving Kindness Meditation clip (in the style of Loving-Kindness for Beginners (Neff & Germer, 2013))

Sit in a comfortable position, reasonably upright and relaxed (pause for 2 sec). You will now be guided through a few minutes exercise with the purpose of bringing warmth and good will into your life. Close your eyes fully or partly (pause for 2 sec). Take a few deep breaths to settle into your body and into the present moment (pause for 3 sec).

Bring to mind a person or other living being who naturally makes you smile. This could be a child, your grandmother, your cat or dog - whoever naturally brings happiness to your heart. Perhaps it's a bird outside your window. Let yourself feel what it's like to be in that being's presence (pause for 2 sec). Allow yourself to enjoy the good company.
(Pause)

Now, recognize how vulnerable this loved one is--just like you, subject to sickness, aging, and death. Also, this being wishes to be happy and free from suffering, just like you and every other living being. Repeat softly and gently, feeling the importance of your words:

May you be safe.

May you be peaceful.

May you be healthy.

May you live with ease.

(Pause)

May you be safe.

May you be peaceful.

May you be healthy.

May you live with ease.

(Pause)

When you notice that your mind has wandered, return to the words and the image of the loved one you have in mind. Savour any warm feelings that may arise. Go slow.

(Pause)

Now add yourself to your circle of good will. Put your hand over your heart and feel the warmth and gentle pressure of your hand (for just a moment or for the rest of the exercise), saying:

May you and I be safe.

May you and I be peaceful.

May you and I be healthy.

May you and I live with ease.

(Pause)

May you and I be safe.

May you and I be peaceful.

May you and I be healthy.

May you and I live with ease.

(Pause)

Visualize your whole body in your mind's eye, notice any stress or uneasiness that may be lingering within you, and offer kindness to yourself.

May I be safe.

May I be peaceful.

May I be healthy.

May I live with ease.

Repeat the phrases inwardly with enough space between them so that they are pleasing you. Gather all your attention behind one phrase at a time. (Pause)

If you find your attention wandering, don't worry. You can simply let go of distractions and begin again.

May I be safe.

May I be peaceful.

May I be healthy.

May I live with ease. (Pause)

Feelings, thoughts, or memories may come and go; allow them to arise and pass away. Let the anchor be the repetition of this traditional phrases:

May I be safe.

May I be peaceful.

May I be healthy.

May I live with ease. (Pause)

Just rest and sit quietly in your own body, savouring the good will and compassion that flows naturally from your own heart. Know that you can return to the phrases anytime you wish.
(Pause for 15 sec)

Gently open your eyes.

Script for Body Scan Meditation clip more guided version (in the style of Compassionate Body Scan (Neff & Germer, 2013) and Body Scan Meditation (Salzberg, 1995))

Sit in a comfortable position, reasonably upright and relaxed (pause for 2 sec).You will now be guided through a few exercise with the purpose of doing a scan of your body from the bottom to the top as a way of getting centred – a reminder that you can be at home in your body. Close your eyes fully or partly (pause for 2 sec). Take a few deep breaths to settle into your body and into the present moment (pause for 3 sec).

Start with your feet. Notice what your feet feel like (pause for 2 sec). Are they warm or cool, dry or moist? Then notice if there's any discomfort there (pause for 2 sec). If so, mentally soften the area as if you were placing a warm towel on it. If you wish, bring some compassion the area with words like "there's a little pain there, it's okay." (pause for 3 sec)
Just feel the sensations of your body—pleasure, pain, or nothing at all—and let every sensation be just as it is (pause for 3 sec).

Now bring a measure of gratitude to your feet. Your feet have such a small surface area yet they hold up your entire body all day long. They work hard for us although we rarely pay any attention to them. If your feet feel good today, you can also extend gratitude for the discomfort that you don't have (pause for 5 sec).

When you notice your mind has wandered, as it will after a few seconds, just return to the sensations in your body. (Pause) Make sure that your awareness is saturated with tenderness, gratitude, and respect for each area of your body. (Pause)

After you have given compassionate awareness to the sensations in your feet, now slowly move your awareness up to your knees, your thighs and pelvic area and see what sensations you fell there. (Pause) Let this exercise be gentle and peaceful. (Pause)

As you move from one part of your body to another, return your awareness again and again to whatever sensations are present at the moment, making sure to bring gratitude, kindness, and respect to each body part. (Pause) Now bring awareness to your stomach. Remind yourself how hard your stomach works to digest your food. Seeing if it's possible to see what sensations you feel there. (Pause)

Now slowly move awareness up to your chest, throat and neck, noticing any sensations you find there. (Pause) Your awareness is gentle, receptive; you are not looking for anything special but rather staying open to whatever feelings you might find. You don't have to do anything about them; you are just noticing them; let this exercise be gentle and peaceful. (Pause)

Finally move your attention to your head, noticing any sensations you find there. Make sure to bring gratitude, kindness, and respect to each body part. (Pause) Remind yourself the way your eyes and ears guide, inform, and delight you all day long. (Pause)

Now that you have paid loving attention to your body; give your entire body a final shower of affection. (Pause)

Gently open your eyes.

Script for Rumination induction (adopted from Roberts, Watkins, & Wills, 2013)

Sit in a comfortable position (pause for 2 sec). You will now be guided through a few minutes exercise with the purpose of focusing your attention on a problem and difficulty that is still unresolved and bothering you – so this is an ongoing and unresolved concern that has been repeatedly coming into your mind over the past week and causing you to go over it again and again and make you feel negative, sad, down or stressed. (Pause) Close your eyes fully or partly (pause for 2 sec). Take a few deep breaths to settle into your body and into the present moment (pause for 3 sec).
First of all we need to find a current problem; after this we will ask to dwell on this current problem or concern, in the way that you usually dwell on and ruminate about unresolved concerns, as intensely as you can, until we ask to open your eyes. (Pause)
Now think about a current problem in your life; Examples of the kind of difficulty that we would like you to think about are...

An on-going concern about the status of an important relationship, which you feel that you should be managing better

Concerns that you struggle with academic responsibilities or exams.

A recent conflict in a close relationship that is coming into your mind over the past week and causing you to go over it again and again and make you feel negative, sad, down or stressed.

Concerns that you have failed to achieve a goal that is of personal importance to you.

Feeling that you disappoint someone that means a lot to you and that you may lose them as a result of this

Financial worries

Concerns that you find new friends during your time at the university away from home.

(Pause)

Think about an event that still is very important for you and thinking of it still makes you feel negative, sad, down or stressed. (Pause)

If nothing comes to mind please think about the types of concerns we gave you or just think about a problem or concern that bothers you at the moment. Or think about a future event that worries you and think about the worst case scenario (Pause).

Now please dwell on this current problem or concern, in the way you usually dwell on and ruminate about unresolved concerns, as intensely as you can, until we ask you to open your eyes. (Pause)

Play back what you were thinking in the situation. What thoughts or images were running through your mind? Allow yourself to dwell on these thoughts and images as you bring the problem /difficulty back in to focus. (pause).

Focus on how this problem /difficulty bothers and troubles you (Pause) What are you thinking about yourself? (pause).

Think about what is important about this difficulty in terms of your progress on important personal goals (Pause) And just staying with your low mood and what you are thinking about the situation (pause).

Focus on how this problem reflects a lack of progress on important personal goals (Pause)

Think about how this problem/difficulty is still unresolved (Pause). And now, try to work out why you feel sad in this situation. Think about why you react this way. (pause)

Concentrate on the aspects of the problem that reflect unfinished business (Pause)

Focus on the aspects of the difficulty that repeatedly come to mind (Pause)

Think about any related concerns and unresolved issues that this problem reminds you of (Pause) And if there are particular parts of your memory that are especially sad, see if it's possible to focus upon them (Pause).

And staying with these thoughts and feelings for as long as you can (Pause).

(Pause, then end) Please open your eyes.

Script for the positive mood induction clip

Sit in a comfortable position (pause for 2 sec).You will now be guided through a few minutes exercise with the purpose of focusing your attention on an event that made you feel really happy, excited and enthusiastic. (Pause) Close your eyes fully or partly (pause for 2 sec). Take a few deep breaths to settle into your body and into the present moment (pause for 3 sec).

First of all we need to find a positive event; after that we will ask you to think about certain aspects of the event as intensely as you can.

Now think about a moment or event that made you feel really happy, excited and enthusiastic. Examples of the kind of event that we would like you to think about are …

An event where you achieved something great or had a great success like:

Passing you driving test; get a great mark for an exam; finishing school; performing in front of people, winning a competition, race, in a lottery ...

Someone is giving you a compliment for your work, being praised by your teacher or parents for doing well

You are winning an important game

You performed better than anyone else

(Pause)

Think of an event that was and perhaps still is very important for you and thinking of it still makes you happy and excited and proud of yourself. (Pause)

Play back what you were thinking in the situation. What thoughts or images were running through your mind? Allow yourself to think about these thoughts and images as you bring the positive event back in to focus. (pause).

Focus on how this event makes you happy and excited (Pause). Bring to mind how satisfied and perhaps proud you are about yourself. How good you feel after having accomplished this (pause).

Focus on how this event makes you feel happy (Pause)

Think about how important this event is and how excited you feel. (Pause)

Focus on how energetic you feel (Pause)

Think about how enthusiastic you feel (Pause)

Focus on how self-confident you feel (Pause)

… How dynamic and excited (Pause). And now, try to work out why you feel that way in this situation. Think about why you react this way. (pause)

Think about any related positive thoughts and images that this positive event reminds you of (Pause) And if there are particular parts of your memory that are especially positive, see if it's possible to focus upon them (Pause).

Try to open to all of these positive feelings and stay with these thoughts and feelings for as long as you can (Pause)

Please open your eyes.

Script for Control condition - supermarket scenario

Sit in a comfortable position, reasonably upright and relaxed (pause for 2 sec). You will now be guided through a few minutes exercise.. Close your eyes fully or partly (pause for 2 sec). We would like you to think about a normal or routine supermarket scenario. Try to think of a particular time that you visited a supermarket to do a large or weekly shopping (pause for 2 sec). Try to remember as much details as possible. (Pause for 3 sec)

Think about arriving at the supermarket (Pause for 2 sec). What time in the day is it (Pause). Is it in the late morning or early afternoon? How does the supermarket look like? (Pause for 2 sec) Do you have plenty of time to do the shopping or are you in a rush (Pause)?

You may select a trolley to store your items or a shopping basket? (Pause for 3 sec) See if it's possible to think about how the trolley or shopping basket looks like. (Pause for 3 sec)

Now think about entering the shop (Pause for 3 sec). Try to remember if you noticed anything special? (Pause for 3 sec) Is the shop quiet and empty or is it crowded? (Pause) Do you hear or see anything special (Pause for 3 sec) maybe a special offer (Pause for 3 sec).

And now try to imagine which goods you come across first (Pause for 3 sec) Think about walking down the first aisle (Pause for 3 sec). Are there particular items you are looking for (Pause for 3 sec).

Now think about putting the items you need to buy into your trolley or shopping basket. (Pause for 3 sec) Think about going through the shop aisle by aisle … (Pause for 8 sec) see if it is possible to imagine the shopping as much detailed as possible (Pause for 5sec)

Do you have problems to reach an item? (Pause for 3 sec) Do you have to reach up to a top shelf? (Pause for 3 sec) Do you have to weight an item (Pause for 3 sec) do you notice something special (Pause for 3 sec) Or do you hear something special (Pause for 3 sec)

And now, think about going to the check-out/till to pay (Pause for 3 sec). Think about putting your items out of the trolley or shopping basket (Pause for 3 sec). Think about paying your purchases (Pause for 3 sec). Are you paying by card or cash? (Pause for 3 sec) Do you get some cash back (Pause for 3 sec).

Now think about putting your purchases back in the trolley or did you use a bag to carry them home? (Pause for 3 sec) Think about taking your purchases home (Pause for 3 sec)

Open your eyes.

Appendix III: Ethics Approval Study I and II

UNIVERSITY OF EXETER

Psychology Research Ethics Committee

Psychology, College of Life & Environmental Sciences

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Telephone +44 (0)1392 724611
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Email Marilyn.evans@exeter.ac.uk

To: **Hans Kirschner**
From: **Cris Burgess**
CC: **Anke Karl & Willem Kuyken**
Re: **Application 2011/579 to Ethics Committee**
Date: **26 March 2016**

The School of Psychology Ethics Committee met on 07/03/11 and your proposal was discussed. The Committee raised a number of conditions of agreement to this application being accepted. You would be expected to address these before beginning the research and the project has been approved in principle for the duration of your study.

The conditions are as follows:

- Please supply clarification of exclusion cut-off on the depression measures
- Applicants need to discuss the security of the server that will be used for the screening survey with John Staplehurst. If necessary, the in-house survey server should be used. Potential issue with Data Protection compliance

In any correspondence with the Ethics Committee about this application, please quote the reference number above.

Yours sincerely,

Cris Burgess
Chair of School Ethics Committee

Appendix IV: Information Sheet and Consent Form for Study I and II

UNIVERSITY OF EXETER
MOOD DISORDERS CENTRE

PARTICIPANT INFORMATION SHEET

Title: Personality and emotion processing

Principal Researcher: Hans Krischner
Supervisors: Dr Anke Karl, Professor Willem Kuyken

You are being invited to take part in a study which aims to investigate the relationship between emotion processing, personality, and brain and body responses. Before you decide whether you would like to take part, please read through the following information which will clarify why the study is being conducted, and what your involvement would be. Take time to decide whether or not you would like to participate.

What is the purpose of the study?

The purpose of this study is to investigate the relationship between emotion processing, personality, and brain and body responses. The findings could hopefully help us to understand processes and mechanisms that prevent mental health problems, such as depression, and facilitate wellbeing. The study is part of a PhD being carried out by the Principal Researcher (Hans Kirschner, see contact details below, pg 4).

Am I required to take part?

It is entirely up to you if you wish to take part. If you do decide to take part, you are free to change your mind at any time and can withdraw during the study by letting the Principle Researcher know. If you decide not to take part after you have started the study, any data collected from you will no longer be included in the results of the study and will instead be destroyed.

What does participation involve?

If you think that you would like to take part and would like to know more, the Principal Researcher can contact you by telephone to discuss the study in more detail, and to answer any questions you may have regarding it (alternatively, you can contact the Principle Researcher – see pg 4).

In order to take part in this study you must complete an online questionnaire (insert Survey Gizmo link), for information and screening purposes, which will take no more than 20 minutes. Individuals who fulfil the inclusion criteria will then be invited to participate in the laboratory session which lasts approximately 1.5 hour and includes two tasks and the measurement of your brain activity, and your heart rate and the sweat response. For this we will clean your skin with alcohol and a peeling gel and place leads on your head, chest and fingers which we fill with a salty gel that can be easily wiped off. After we have setting up this you will listing to one of 5 different emotion tapes (these will be randomly chosen). These can temporarily lead to pleasant or unpleasant emotional responses. After this exercise we will ask you to conduct a short computer task that involves fast responses (button presses) to different emotional words. The precise instructions will be given on the day by the researcher.

Expenses and payments:

There is no payment for taking part in this study. However, if you are a Psychology student at the University of Exeter, you will be awarded credits for the 'PSY1206 Introduction to Research Methods' module (2 – 2.5 course credits). In addition you have chance to win 1x50£; 2x40£; 1x30£; 1x20 and 10x10£ for the participation.

If you are not eligible to take part in the laboratory session you can claim 0.5 credits for filling out the online screening questionnaire.

Are there disadvantages of taking part in this study?

There are no known disadvantages associated with taking part in the study. The measurement of brain activity and bodily responses will be done using safe and well-established procedures; the leads can be removed in less than a minute and the gel can be easily wiped and/or washed off. You may want to wash and blow-dry your hair after the session and this can be done in our lab. The tapes can temporarily lead to unpleasant responses; in the unlikely event that you experience it as extremely unpleasant we will stop the testing.

What if there is a problem?

If you wish to complain, or have any concerns about any aspect of the way you have been approached or treated during the course of this study, you can contact the Study Supervisor, Dr Anke Karl (contact details on page 4).

What are the possible advantages of taking part?

There are no direct advantages for you. However, the findings of this study will hopefully help us to understand how emotion processing and brain and body responses are related. This may help us to understand processes and mechanisms that prevent mental health problems, such as depression, and facilitate wellbeing. If you decide to take part, we also hope that you will find the experience interesting and enjoyable.

Will my taking part in the study be kept confidential?

All information which is collected from you during the research would be kept strictly confidential within the limits of the law. You will be allocated your own unique study code number, ensuring that all information that you give will contain your number rather than your actual name. identifiable information will be stored in a locked cabinet and only the researchers of this project will have access to it. In accordance with British Psychological Society research guidelines, all data for the study will be securely stored away for 20 years and will be destroyed after this time.

What will happen with the results?

It is planned that the results will be written up in order to inform clinicians and researchers who are interested in mood disorders. Any write-up of the findings for this study will not mention you personally. If you would like to obtain a copy of the findings, we will be more than happy to send them to you when they become available.

Who has reviewed this study?

This study has been reviewed and approved by the School of Psychology Ethics Committee, University of Exeter.

Contact Details:

If you require further information or would like to ask any questions, please do not hesitate to contact the Principal Researcher using the details below.

Principal Researcher:

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For more information about the Mood Disorder Centre, please visit http://www.exeter.ac.uk/mooddisorders/

UNIVERSITY OF EXETER
MOOD DISORDERS CENTRE

Participant Consent Form

Title: *Personality and emotion processing*

Researcher:
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Please read statement and initial box

1) I confirm that I have read and understood the Information Sheet for the above study. I have had the opportunity to consider the information and ask questions, and have had these answered satisfactorily. ☐

2) I am aware that my participation is voluntary and that I can withdraw my consent at any point during the studywithout giving any reason, and without my legal rightsor medical care being affected. ☐

3) I understand that I have the right to obtain information about the findings of the study after it is completed. ☐

4) I understand that sections of the data collected during the study may be looked at by relevant individuals of the University of Exeter (i.e. the research Supervisors) and from regulatory authorities, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my data. ☐

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

6) I would like my name and contact details to be kept on a secure and confidential database so that I can be contacted about taking part in other studies within the Mood Disorders Centre. ☐

______________________	____________	______________________
Name of participant (print)	**Date:**	**Signature**
______________________	____________	______________________
Name of researcher (print)	**Date:**	**Signature**

One copy for participant, one copy for researcher

Appendix V: Ethics Approval Letter Study III and IV

NHS
Health Research Authority

NRES Committee South West - Cornwall & Plymouth
Bristol Research Ethics Committee Centre
Level 3
Block B
Whitefriars
Lewins Mead
Bristol
BS1 2NT

Telephone: 0117 342 1330

09 May 2013

Mr Hans Kirschner
PhD Student
University of Exeter
Perry Road
School of Psychology
University of Exeter
EX4 4QG

Dear Mr Kirschner

Study title:	**Compassion for the self - How does it support emotion regulation?**
REC reference:	**13/SW/0099**
Protocol number:	**Protocol_Ethics**
IRAS project ID:	**128538**

Thank you for your letter of 08 May 2013, responding to the Committee's request for further information on the above research and submitting revised documentation.

The further information has been considered on behalf of the Committee by the Chair.

We plan to publish your research summary wording for the above study on the NRES website, together with your contact details, unless you expressly withhold permission to do so. Publication will be no earlier than three months from the date of this favourable opinion letter. Should you wish to provide a substitute contact point, require further information, or wish to withhold permission to publish, please contact the Co-ordinator Charlotte Allen, nrescommittee.southwest-cornwall-plymouth@nhs.net.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised, subject to the conditions specified below.

Ethical review of research sites

NHS sites

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" below).

Non-NHS sites

Conditions of the favourable opinion

The favourable opinion is subject to the following conditions being met prior to the start of the study.

Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

Management permission ("R&D approval") should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements.

Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at http://www.rdforum.nhs.uk.

Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of approvals from host organisations

It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

Document	*Version*	*Date*
Covering Letter		03 April 2013
Covering Letter		08 May 2013
Evidence of insurance or indemnity		01 August 2012
Investigator CV		04 April 2013
Letter from Sponsor		19 March 2013
Other: CV - Dr Anke Karl		04 April 2013
Other: Invitation Letter - Patient Version	1	01 February 2013
Other: Invitation Letter - Recovered Patient Version	1	01 February 2013

Other: Invitation Letter - Control Group Version	1	01 February 2013
Other: Materials	1	01 February 2013
Other: Poster - Control Group Version	1	01 February 2013
Other: Poster - Recovered Patient Version	1	01 February 2013
Other: Debriefing Sheet	1	01 February 2013
Other: CV Prof Willem Kuyken		04 April 2013
Other: CV - Ksenia Trischel		04 April 2013
Other: MDC Protocol for Assessing and Reporting Risk		
Participant Consent Form: Patient and Recovered Patient Version	1	01 February 2013
Participant Consent Form: Control Group Version	1	01 February 2013
Participant Information Sheet: Control Group	2.0	30 April 2013
Participant Information Sheet: Patient Group	2.0	30 April 2013
Participant Information Sheet: Recovered Patient Group	2.0	30 April 2013
Protocol	2.0	30 April 2013
REC application	3.5	04 April 2013
Response to Request for Further Information		08 May 2013

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

After ethical review

Reporting requirements

The attached document *"After ethical review – guidance for researchers"* gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study

The NRES website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

Feedback

You are invited to give your view of the service that you have received from the National Research Ethics Service and the application procedure. If you wish to make your views known please use the feedback form available on the website.

Further information is available at National Research Ethics Service website > After Review

13/SW/0099	Please quote this number on all correspondence

We are pleased to welcome researchers and R & D staff at our NRES committee members' training days – see details at http://www.hra.nhs.uk/hra-training/

With the Committee's best wishes for the success of this project.

Yours sincerely

pp. [signature]

Canon Ian Ainsworth-Smith
Chair

Email:nrescommittee.southwest-cornwall-plymouth@nhs.net

Enclosures:	"After ethical review – guidance for researchers" *(via email)*
Copy to:	*Gail Seymour*

Appendix VI: Information Sheets and Consent Forms for Study III and IV

UNIVERSITY OF EXETER
MOOD DISORDERS CENTRE

Participant Information – Control Group Version

(Version 2.0, 30/04/2013)

Emotion processing and brain activity in individuals with a history of depression

Principal Researcher: Hans Krischner
Supervisors: Dr Anke Karl, Professor Willem Kuyken

You are being invited to take part in a study which aims to investigate the relationship between emotion processing, brain and body responses. Before you decide whether you would like to take part, please read through the following information which will clarify why the study is being conducted, and what your involvement would be. Take time to decide whether or not you would like to participate.

What is the purpose of the study?

The Mood Disorders Centre is a partnership between the NHS and the University of Exeter. Our mission is to conduct psychological research for the benefit of people who suffer from depression. Mindfulness-based Cognitive Therapy (shortened to MBCT) is a new treatment for depression that helps people develop skills that may prevent them from becoming depressed again in the future. In two studies it has been shown to halve rates of depression recurring compared to normal NHS treatment and we would like to find out how MBCT might work and through which underlying processes. This research aims to investigate to what extent MBCT influences the relationship between emotion processing, and brain and body responses. First, we will compare a group of people who have a history of depression to a group of people who have never been depressed, to determine to what extent positive emotion experience is altered in those with a history of depression. Second, we will follow up a group of people with a history of depression who are undergoing MBCT, as compared to a group of people with a history of depression who are not undergoing MBCT to see how this changes the relationship between emotion processing, and brain and body responses. In summary this study consist of 3 groups a) a never depressed control group (tested only once) b) a group of people with a history of depression undergoing an MBCT Treatment and c) a group of people with a history of depression not undergoing MBCT. The findings could hopefully help us to understand processes and mechanisms that prevent mental health problems, such as depression, and facilitate wellbeing. The study is part of a PhD being carried out by the Principal Researcher (Hans Kirschner, see contact details below, pg 4).

Why have I been chosen?

You have been chosen because you indicated that you have no history of depression. We are particular interested to compare your results with participants with a history of depression.

Am I required to take part?

It is entirely up to you if you wish to take part. If you do decide to take part, you are free to change your mind at any time and can withdraw during the study by letting the Principal Researcher know. If you decide not to take part after you have started the study, any data collected from you will no longer be included in the results of the study and will instead be destroyed.

What does participation involve?

If you think that you would like to participate and would like to know more, the Principal Researcher can contact you by telephone to discuss the study in more detail, and to answer any questions you may have regarding your participation (alternatively, you can contact the Principal Researcher – see pg 4).

If you agree to take part in this study, we will invite you to attend one testing session., The session will last between 1.5 and 2 hours, depending on how quickly you complete the tasks and if you wish to have breaks. The session includes two short tasks, a few questionnaires and the measurement of your brain activity, and your heart rate and the sweat response. For this we will place leads on your head, chest and fingers which we fill with a salty gel that can be easily wiped off (you will have the opportunity to wash your hair after the experiment). We will then ask you to listen to a tape with a guided meditation exercise. Before and after the meditation we will ask you to conduct a short computer task that involves fast responses (button presses) to different emotional words. The precise instructions will be given on the day by the researcher.

In the week after each testing sessions, we will also ask you to briefly rate your emotional state up to eight times per day, at random times in your waking day. We will give you a watch that beeps at these times. These ratings should be quick and easy to give, comparable to writing a brief text message.

Expenses and payments:

We will reimburse your travel costs and offer £10 to reimburse you for your time taken to participate in the study.

Are there disadvantages of taking part in this study?

There are no known disadvantages associated with taking part in the study. The measurement of brain activity and bodily responses will be done using safe and well-established procedures; the leads can be removed in less than a minute and the gel can be easily wiped and/or washed off. You may want to wash and blow-dry your hair after the session and this can be done in our lab. The tasks on the testing session are engaging and mainly pleasant; most people feel that time goes by easily when doing them.

What if there is a problem?

If you wish to complain, or have any concerns about any aspect of the way you have been approached or treated during the course of this study, you can contact the Study Supervisor, Dr Anke Karl (contact details on page 4).

What are the possible advantages of taking part?

There are no direct advantages for you. However, the findings of this study will hopefully help us to understand how emotion processing and brain and body responses are related in depression. This may help us to understand processes and mechanisms that prevent mental health problems, such as depression, and facilitate wellbeing. If you decide to take part, we also hope that you will find the experience interesting and enjoyable.

Will my taking part in the study be kept confidential?

All information which is collected from you during the research would be kept strictly confidential within the limits of the law. You will be allocated your own unique study code number, ensuring that all information that you give will contain your number rather than your actual name. Identifiable information will be stored in a locked cabinet and only the researchers of this project will have access to it. The only exception would be if the interview revealed a significant risk of harm to yourself or others, in which case information may be fed back to your doctor but normally only after discussion with you. In accordance with British Psychological Society research guidelines, all data for the study will be securely stored away for 20 years and will be destroyed after this time. If you wish we can inform your GP about your participation in the study.

What will happen with the results?

It is planned that the results will be written up in order to inform clinicians and researchers who are interested in mood disorders. Any write-up of the findings for this study will not mention you personally. If you would like to obtain a copy of the findings, we will be more than happy to send them to you when they become available.

Who is organising and funding the research? Who has reviewed the study?

This research is sponsored by the University of Exeter. The research has been approved by an NHS ethics committee.

Contact Details:

If you require further information or would like to ask any questions, please do not hesitate to contact the Principal Researcher using the details below.

Principal Researcher:

Hans Kirschner

Mood Disorders Centre
Washington Singer Laboratories
Perry Road
Exeter
EX4 4QG

Tel: 07500924494

Email: hk283@exeter.ac.uk

Supervisors:

Professor Willem Kuyken

Mood Disorders Centre
Washington Singer Laboratories
Perry Road
Exeter
EX4 4QG

Tel: 01392 264659

Email :W.Kuyken@Exeter.ac.uk

Dr Anke Karl

Mood Disorders Centre
Washington Singer Laboratories
Perry Road
Exeter
EX4 4QG

Tel: 01392 725271

Email : A.Karl@exeter.ac.uk

For more information about the Mood Disorder Centre, please visit http://www.exeter.ac.uk/mooddisorders/

UNIVERSITY OF EXETER
MOOD DISORDERS CENTRE

Participant Information – Recovered Patient Version (Version 2.0, 30/04/2013)

Emotion processing and brain activity in individuals with a history of depression

Principal Researcher: Hans Krischner
Supervisors: Dr Anke Karl, Professor Willem Kuyken

You are being invited to take part in a study which aims to investigate the relationship between emotion processing, brain and body responses. Before you decide whether you would like to take part, please read through the following information which will clarify why the study is being conducted, and what your involvement would be. Take time to decide whether or not you would like to participate.

What is the purpose of the study?

The Mood Disorders Centre is a partnership between the NHS and the University of Exeter. Our mission is to conduct psychological research for the benefit of people who suffer from depression. Mindfulness-based Cognitive Therapy (shortened to MBCT) is a new treatment for depression that helps people develop skills that may prevent them from becoming depressed again in the future. In two studies it has been shown to halve rates of depression recurring compared to normal NHS treatment and we would like to find out how MBCT might work and through which underlying processes. This research aims to investigate to what extent MBCT influences the relationship between emotion processing, and brain and body responses. First, we will compare a group of people who have a history of depression to a group of people who have never been depressed, to determine to what extent positive emotion experience is altered in those with a history of depression. Second, we will follow up a group of people with a history of depression who are undergoing MBCT, as compared to a group of people with a history of depression who are not undergoing MBCT to see how this changes the relationship between emotion processing, and brain and body responses. In summary this study consist of 3 groups a) a never depressed control group (tested only once) b) a group of people with a history of depression undergoing an MBCT Treatment and c) a group of people with a history of depression not undergoing MBCT. The findings could hopefully help us to understand processes and mechanisms that prevent mental health problems, such as depression, and facilitate wellbeing. The study is part of a PhD being carried out by the Principal Researcher (Hans Kirschner, see contact details below, pg 4).

Why have I been chosen?

You have been chosen because you have a history of depression but currently do not report symptoms of depression. You will be compared to a group of people who are going through the MBCT programme.

Am I required to take part?

It is entirely up to you if you wish to take part. If you do decide to take part, you are free to change your mind at any time and can withdraw during the study by letting the Principal Researcher know. If you decide not to take part after you have started the study, any data collected from you will no longer be included in the results of the study and will instead be destroyed.

What does participation involve?

If you think that you would like to participate and would like to know more, the Principal Researcher can contact you by telephone to discuss the study in more detail, and to answer any questions you may have regarding your participation (alternatively, you can contact the Principal Researcher – see pg 4).

If you agree to take part in this study, we will invite you to attend two testing sessions, scheduled about ten weeks apart. Each session will last between 1.5 and 2 hours, depending on how quickly you complete the tasks and if you wish to have breaks. Each session includes two short tasks, a few questionnaires and the measurement of your brain activity, and your heart rate and the sweat response. For this we will place leads on your head, chest and fingers which we fill with a salty gel that can be easily wiped off (you will have the opportunity to wash your hair after the experiment). We will then ask you to listen to a tape with a guided meditation exercise. Before and after the meditation we will ask you to conduct a short computer task that involves fast responses (button presses) to different emotional words. The precise instructions will be given on the day by the researcher.

In the week after each testing sessions, we will also ask you to briefly rate your emotional state up to eight times per day, at random times in your waking day. We will give you a watch that beeps at these times. These ratings should be quick and easy to give , comparable to writing a brief text message.

Approximately one year after you have completed the second testing session, we will ask you to come in for a shorter testing sessions (lasting about 45 minutes), where we will ask you to rate your mood at the present time and to answer questions so we can assess if you have been depressed in the twelve months following the last testing session.

Expenses and payments:

We will reimburse your travel costs and offer £10 to reimburse you for your time taken to participate in the study.

Are there disadvantages of taking part in this study?

There are no known disadvantages associated with taking part in the study. The measurement of brain activity and bodily responses will be done using safe and well-established procedures; the leads can be removed in less than a minute and the gel can be easily wiped and/or washed off. You may want to wash and blow-dry your hair after the session and this can be done in our lab. The tasks on the testing session are engaging and mainly pleasant; most people feel that time goes by easily when doing them.

What if there is a problem?

If you wish to complain, or have any concerns about any aspect of the way you have been approached or treated during the course of this study, you can contact the Study Supervisor, Dr Anke Karl (contact details on page 4).

What are the possible advantages of taking part?

There are no direct advantages for you. However, the findings of this study will hopefully help us to understand how emotion processing and brain and body responses are related in depression. This may help us to understand processes and mechanisms that prevent mental health problems, such as depression, and facilitate wellbeing. If you decide to take part, we also hope that you will find the experience interesting and enjoyable.

Will my taking part in the study be kept confidential?

All information which is collected from you during the research would be kept strictly confidential within the limits of the law. You will be allocated your own unique study code number, ensuring that all information that you give will contain your number rather than your actual name. Identifiable information will be stored in a locked cabinet and only the researchers of this project will have access to it. The only exception would be if the interview revealed a significant risk of harm to yourself or others, in which case information may be fed back to your doctor but normally only after discussion with you. In accordance with British Psychological Society research guidelines, all data for the study will be securely stored away for 20 years and will be destroyed after this time. If you wish we can inform your GP about your participation in the study.

What will happen with the results?

It is planned that the results will be written up in order to inform clinicians and researchers who are interested in mood disorders. Any write-up of the findings for this study will not mention you personally. If you would like to obtain a copy of the findings, we will be more than happy to send them to you when they become available.

Who is organising and funding the research? Who has reviewed the study?

This research is sponsored by the University of Exeter. The research has been approved by an NHS ethics committee.

Contact Details:

If you require further information or would like to ask any questions, please do not hesitate to contact the Principal Researcher using the details below.

Principal Researcher:

Hans Kirschner

Mood Disorders Centre
Washington Singer Laboratories
Perry Road
Exeter
EX4 4QG

Tel: 07500924494

Email: hk283@exeter.ac.uk

Supervisors:

Professor Willem Kuyken

Mood Disorders Centre
Washington Singer Laboratories
Perry Road
Exeter
EX4 4QG

Tel: 01392 264659

Email :W.Kuyken@Exeter.ac.uk

Dr Anke Karl

Mood Disorders Centre
Washington Singer Laboratories
Perry Road
Exeter
EX4 4QG

Tel: 01392 725271

Email : A.Karl@exeter.ac.uk

For more information about the Mood Disorder Centre, please visit
http://www.exeter.ac.uk/mooddisorders/

UNIVERSITY OF EXETER
MOOD DISORDERS CENTRE

Participant Information – Patient version

(Version 2.0, 30/04/2013)

Emotion processing and brain activity in individuals with a history of depression

Principal Researcher: Hans Krischner
Supervisors: Dr Anke Karl, Professor Willem Kuyken

You are being invited to take part in a study which aims to investigate the relationship between emotion processing, brain and body responses. Before you decide whether you would like to take part, please read through the following information which will clarify why the study is being conducted, and what your involvement would be. Take time to decide whether or not you would like to participate.

What is the purpose of the study?

The Mood Disorders Centre is a partnership between the NHS and the University of Exeter. Our mission is to conduct psychological research for the benefit of people who suffer from depression. Mindfulness-based Cognitive Therapy (shortened to MBCT) is a new treatment for depression that helps people develop skills that may prevent them from becoming depressed again in the future. In two studies it has been shown to halve rates of depression recurring compared to normal NHS treatment and we would like to find out how MBCT might work and through which underlying processes. This research aims to investigate to what extent MBCT influences the relationship between emotion processing, and brain and body responses. First, we will compare a group of people who have a history of depression to a group of people who have never been depressed, to determine to what extent positive emotion experience is altered in those with a history of depression. Second, we will follow up a group of people with a history of depression who are undergoing MBCT, as compared to a group of people with a history of depression who are not undergoing MBCT to see how this changes the relationship between emotion processing, and brain and body responses. In summary this study consist of 3 groups a) a never depressed control group (tested only once) b) a group of people with a history of depression undergoing an MBCT Treatment and c) a group of people with a history of depression not undergoing MBCT. The findings could hopefully help us to understand processes and mechanisms that prevent mental health problems, such as depression, and facilitate wellbeing. The study is part of a PhD being carried out by the Principal Researcher (Hans Kirschner, see contact details below, pg 4).

Why have I been chosen?

You have been chosen because you have a history of depression but currently do not report symptoms of depression and are about to start the MBCT programme.

Am I required to take part?

It is entirely up to you if you wish to take part. If you do decide to take part, you are free to change your mind at any time and can withdraw during the study by letting the Principal Researcher know. If you decide not to take part after you have started the study, any data collected from you will no longer be included in the results of the study and will instead be destroyed.

What does participation involve?

If you think that you would like to participate and would like to know more, the Principal Researcher can contact you by telephone to discuss the study in more detail, and to answer any questions you may have regarding your participation (alternatively, you can contact the Principal Researcher – see pg 4).

If you agree to take part in this study, we will invite you to attend two testing sessions, one just before you start the MBCT programme and one just after the MBCT programme. Each session will last between 1.5 and 2 hours, depending on how quickly you complete the tasks and if you wish to have breaks. Each session includes two short tasks, a few questionnaires and the measurement of your brain activity, and your heart rate and the sweat response. For this we will place leads on your head, chest and fingers which we fill with a salty gel that can be easily wiped off (you will have the opportunity to wash your hair after the experiment). We will then ask you to listen to a tape with a guided meditation exercise. Before and after the meditation we will ask you to conduct a short computer task that involves fast responses (button presses) to different emotional words. The precise instructions will be given on the day by the researcher.

In the week after each testing sessions, we will also ask you to briefly rate your emotional state up to eight times per day, at random times in your waking day. We will give you a watch that beeps at these times. These ratings should be quick and easy to give, comparable to writing a brief text message.

Approximately one year after you have completed the MBCT programme, we will ask you to come in for a shorter testing sessions (lasting about 45 minutes), where we will ask you to rate your mood at the present time and to answer questions so we can assess if you have been depressed in the twelve months following the MBCT programme.

Expenses and payments:

We will reimburse your travel costs and offer £10 to reimburse you for your time taken to participate in the study.

Are there disadvantages of taking part in this study?

There are no known disadvantages associated with taking part in the study. The measurement of brain activity and bodily responses will be done using safe and well-established procedures; the leads can be removed in less than a minute and the gel can be easily wiped and/or washed off. You may want to wash and blow-dry your hair after the session and this can be done in our lab. The tasks on the testing session are engaging and mainly pleasant; most people feel that time goes by easily when doing them.

What if there is a problem?

If you wish to complain, or have any concerns about any aspect of the way you have been approached or treated during the course of this study, you can contact the Study Supervisor, Dr Anke Karl (contact details on page 4).

What are the possible advantages of taking part?

There are no direct advantages for you. However, the findings of this study will hopefully help us to understand how emotion processing and brain and body responses are related in depression. This may help us to understand processes and mechanisms that prevent mental health problems, such as depression, and facilitate wellbeing. If you decide to take part, we also hope that you will find the experience interesting and enjoyable.

Will my taking part in the study be kept confidential?

All information which is collected from you during the research would be kept strictly confidential within the limits of the law. You will be allocated your own unique study code number, ensuring that all information that you give will contain your number rather than your actual name. Identifiable information will be stored in a locked cabinet and only the researchers of this project will have access to it. The only exception would be if the interview revealed a significant risk of harm to yourself or others, in which case information may be fed back to your doctor but normally only after discussion with you. In accordance with British Psychological Society research guidelines, all data for the study will be securely stored away for 20 years and will be destroyed after this time. If you wish we can inform your GP about your participation in the study.

What will happen with the results?

It is planned that the results will be written up in order to inform clinicians and researchers who are interested in mood disorders. Any write-up of the findings for this study will not mention you personally. If you would like to obtain a copy of the findings, we will be more than happy to send them to you when they become available.

Who is organising and funding the research? Who has reviewed the study?

This research is sponsored by the University of Exeter. The research has been approved by an NHS ethics committee.

Contact Details:

If you require further information or would like to ask any questions, please do not hesitate to contact the Principal Researcher using the details below.

Principal Researcher:

Hans Kirschner

Mood Disorders Centre
Washington Singer Laboratories
Perry Road
Exeter
EX4 4QG

Tel: 07500924494

Email: hk283@exeter.ac.uk

Supervisors:

Professor Willem Kuyken

Mood Disorders Centre
Washington Singer Laboratories
Perry Road
Exeter
EX4 4QG

Tel: 01392 264659

Email :W.Kuyken@Exeter.ac.uk

Dr Anke Karl

Mood Disorders Centre
Washington Singer Laboratories
Perry Road
Exeter
EX4 4QG

Tel: 01392 725271

Email : A.Karl@exeter.ac.uk

For more information about the Mood Disorder Centre, please visit
http://www.exeter.ac.uk/mooddisorders/

Participant Consent Form – Control Group

Title: *Emotion processing and brain activity*

Researcher:
Hans Kirschner
Mood Disorders Centre
Washington Singer Laboratories
Perry Road
Exeter
EX4 4QG
hk283@exeter.ac.uk

Supervisors:
Dr Anke Karl &Professor Willem Kuyken
Mood Disorders Centre
Washington Singer Laboratories
Perry Road
Exeter
EX4 4QG
A.Karl@exeter.ac.uk
W.Kuyken@Exeter.ac.uk

Please read statement and initial box

1) I confirm that I have read and understood the Information Sheet for the above study. I have had the opportunity to consider the information and ask questions, and have had these answered satisfactorily. ☐

2) I am aware that my participation is voluntary and that I can withdraw my consent at any point during the studywithout giving any reason, and without my legal rightsor medical care being affected. ☐

3) I understand that I have the right to obtain information about the findings of the study after it is completed. ☐

4) I understand that sections of the data collected during the study may be looked at by relevant individuals of the University of Exeter (i.e. the research Supervisors) and from regulatory authorities, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my data. ☐

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

6) I would like my name and contact details to be kept on a secure and confidential database so that I can be contacted about taking part in other studies within the Mood Disorders Centre. ☐

______________________	____________	__________________
Name of participant (print)	**Date:**	**Signature**
______________________	____________	__________________
Name of researcher (print)	**Date:**	**Signature**

One copy for participant, one copy for researcher

UNIVERSITY OF EXETER
MOOD DISORDERS CENTRE

Participant Consent Form

Title: *Emotion processing and brain activity in individuals with a history of depression*

Researcher:
Hans Kirschner
Mood Disorders Centre
Washington Singer Laboratories
Perry Road
Exeter
EX4 4QG
hk283@exeter.ac.uk

Supervisors:
Dr Anke Karl &Professor Willem Kuyken
Mood Disorders Centre
Washington Singer Laboratories
Perry Road
Exeter
EX4 4QG
A.Karl@exeter.ac.uk
W.Kuyken@Exeter.ac.uk

Please read statement and initial box

1) I confirm that I have read and understood the Information Sheet for the above study. I have had the opportunity to consider the information and ask questions, and have had these answered satisfactorily. ☐

2) I am aware that my participation is voluntary and that I can withdraw my consent at any point during the study without giving any reason, and without my legal rights or medical care being affected. ☐

3) I understand that I have the right to obtain information about the findings of the study after it is completed. ☐

4) I understand that sections of the data collected during the study may be looked at by relevant individuals of the University of Exeter (i.e. the research Supervisors) and from regulatory authorities, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my data. ☐

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

6) I would like my name and contact details to be kept on a secure and confidential database so that I can be contacted about taking part in other studies within the Mood Disorders Centre. ☐

7) I agree that Hans Kirschner/ the research team accesses my file for retrieving the session-by-session mod rating to anonymise them for further analyses ☐

8) I agree that my GP is informed about my study participation ☐

If you agree, please give GPs contact details:

……..

…….

Name of participant (print)	**Date:**	**Signature**
Name of researcher (print)	**Date:**	**Signature**

One copy for participant, one copy for researcher

Appendix VII: Advertisement Study III and IV

UNIVERSITY OF EXETER

mood disorders CENTRE

Have you suffered from depression in the past?

Are you interested in helping researchers to better understand depression and how to treat it?

We are conducting a study at the University of Exeter examining the relationship between emotion processing, personality, and brain and body responses in individuals with a history of depression.

The findings could hopefully help us to understand processes and mechanisms that prevent mental health problems, such as depression, and facilitate wellbeing. ***We will reimburse your travel costs and offer £20 for taking part in the laboratory sessions.***

We are interested in people aged over 18, who have been depressed a number of times in their lives but who are not currently feeling depressed. We are interested regardless of whether or not you have been in contact with mental health professional for these matters. We will ask you to complete some questionnaires and tasks on the computer and ***listen to a tape with a guided meditation***, at two testing sessions eight weeks apart. We will also ask you to fill in some questionnaire measures about your mood one year later.

For more information, please call 1392 724633 or email hk283@exeter.ac.uk.

Poster – patient and recovered depressed control group version
(Version 1.0, 01/02/2013)

UNIVERSITY OF EXETER

Poster – patient and recovered depressed control group version
(Version 1.0, 01/02/2013)

mood disorders CENTRE

Are you aged between 27 and 67 and interested in helping researchers to better understand depression and how to treat it?

Do you have no personal history of depression?

We are conducting a study at the University of Exeter examining the relationship between emotion processing, personality, and brain and body responses in individuals who not have a history of depression to establish to what extent this is altered in those who have suffered from clinical depression.

The findings could hopefully help us to understand processes and mechanisms that prevent mental health problems, such as depression, and facilitate well-being. **We will reimburse your travel costs and offer £10 for taking part in the laboratory sessions.**

We are interested in people aged over 18, who have been depressed a number of times in their lives but who are not currently feeling depressed. We are interested regardless of whether or not you have been in contact with mental health professional for these matters. We will ask you to complete some questionnaires and tasks on the computer and **listen to a tape with a guided meditation**.

Information Meditation Study: ***1392 724633*** or **hk283@exeter.ac.uk**

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Appendix VIII: Publication Arising from the Thesis

Preliminary data of Study I has been presented at the 53rd Annual Society for Psychophysiological Research (SPR) Meeting, October 2-6, 2013, Florence, Italy (Kirschner, Kuyken, & Karl, 2013).

53rd Annual SPR Meeting October 2-6, 2013 Florence, Italy

UNIVERSITY OF EXETER

COMPASSION FOR THE SELF: PSYCHOPHYSIOLOGICAL CORRELATES OF A NEW CONCEPT

mood disorders centre

Hans Kirschner[1], Willem Kuyken[1] & Anke Karl[1]

University of Exeter, UK[1]

Background

What is Self-Compassion?

Self-compassion can be defined as being ***kind*** to and ***caring*** for oneself in times of adversity (Leary et al., 2007) and "perceiving one's experiences as part of the larger human experience; and holding painful thoughts and feelings in balanced awareness" (Neff et al., 2007, p. 908)

defining features: *kindness, empathy, equanimity and patience*

What is known:

Self compassion is associated with...

- **Lower levels of:**
  - Depression,
  - Anxiety,
  - PTSD,
  - Stress,
  - Rumination,
  - Body shame,
  - Perfectionism,
  - Self-criticism

  (e.g. Neff, 2009; Gilbert et al., 2004; Thompson et al., 2008; Kuyken et al., 2010)

- **Increased levels of:**

  Life satisfaction, well-being, happiness (e.g. Wei et al., 2011)

What do we need to find out?

- How might self-compassion exert its protective effects?
- What are the biobehavioural correlates of self-compassion?

How might self-compassion exert its protective effects?

Suggestion: Broaden and build-up framework of resilience by Fredrickson et al. (2008)

2 processes:

(a) ***broadening*** an individual's momentary emotional processing and thinking which enables them to draw on higher-level and novel connections and ideas and

(b) these broadened mindsets help to ***build new personal resources***.

Safe and content mode may facilitate broadening

- Gilbert's model of the three affect regulation systems (Gilbert, 2009)
- Activation of the social engagement system (Polyvagal theory, Porges et al., 2007)

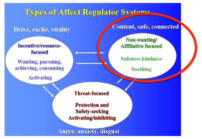

Figure 1: Gilbert's model of the three affect regulation systems

However – people differ in their ability to activate safe and content mode

- **self-criticism** associated with fear of compassion/ affiliative emotions (Gilbert et al., 2010)

Research Questions

1. Will meditative techniques such as compassionate bodyscan and loving kindness meditation increase positive affiliate affect as compared to the control conditions?
2. Will increased positive affiliative affect be accompanied by lower physiological arousal indicated by a lower heart rate?
3. Will trait self-criticism moderate the ability to cultivate self-compassion?

Methods

Participants

- 135 Students matched on gender and age randomly assigned to one of the 5 conditions

Design

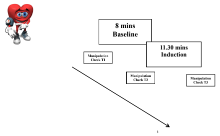

Figure 2: Experimental procedure

Experimental conditions

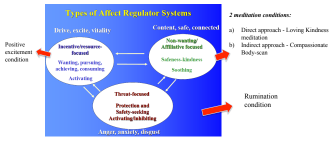

Figure 3: Experimental condition based on Gilbert's model of the three affect regulation systems

Results

Results 1: Can Self-Compassion increase positive affiliative affect?

0---100

I feel like not being kind and understanding towards myself at all — I feel like being very kind and understanding towards myself

- Significant time x group interaction, $F(4,130) = .17$, $p > .05$, $\eta^2 = .01$
- Similar pattern for affiliative affect
- Opposite pattern for self-criticism

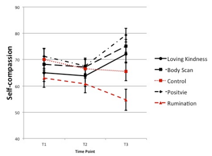

Figure 4: Self-reported change in self-compassion offer the 3 time-points

Results 2: Is increased positive affiliative affect accompanied by lower physiological arousal?

- Yes, significant Time x Group interaction for heart rate during the audio exercise ($F(4,130) = 1.51$, $p = .02$, $\eta^2 = .08$), in particular :
  - Decrease in heart rate in both of the self-compassion meditation conditions
  - Increase in heart rate in the rumination condition
  - Significant gradual increase in heart rate in the positive excitement condition over the whole exercise

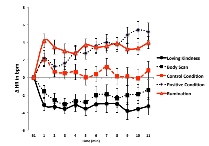

Figure 5: Heart-rate-change over the 11 minutes of the audio exercise

Results 3: Will trait self-criticism moderate the ability to cultivate self-compassion?

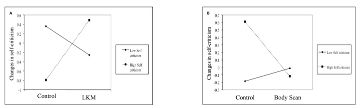

Figure 6A & 6B: Moderation plots for the association between meditation condition and trait self-criticism

- Trait self-criticism moderates association between meditation condition and self-criticism change after meditation

Discussion

Will meditative techniques such as compassionate bodyscan and loving kindness meditation increase positive affiliate affect as compared to the control conditions?

- Increase in self-compassion in both of the meditation conditions but in the positive condition as well

Will increased positive affiliative affect be accompanied by lower physiological arousal indicated by a lower heart rate?

- Increase in self-compassion accompanied by decrease in heart rate

Will trait self-criticism moderate the ability to cultivate self-compassion?

- Trait self-criticism moderates association between meditation condition and self-criticism change after meditation
- trait self-criticism facilitates increase in self-criticism/ self-compassion after LKM while in the bodyscan we observed the opposite

Conclusions

- Broaden hypotheses partly supported
- Individual differences in levels of self-criticism influence the response to different meditation approaches

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