The Differential Impacts of Distraction and Acceptance on Attentional Focus, Anxious Affect, and Executive Control Under High- and Low-Threat Circumstances

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Declaration

I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution.

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Abstract

Previous research into the use of strategies to regulate affect has mostly focused on how effective particular strategies are in reducing unpleasant affect. More recently affect regulation strategies have been recognised as effortful, conscious processes, that may pose a cost to subsequent executive control. The aim of this thesis was to further our understanding of what processes may be involved in making affect regulation strategies effective in reducing anxious affect and in preserving the capacity to demonstrate executive control. The present research compared the effects of the cognitive affect regulation strategies, distraction and acceptance, under high- and low-threat conditions on (1) attentional focus and engagement in rumination, worry and suppression, (2) affect, and (3) subsequent executive control. University student participants (N = 180) were randomly allocated to one of the six experimental conditions in a 2 (threat) X 3 (regulation strategy: distraction, acceptance, mind-wandering control) design. Electrocardiogram (ECG) responses were recorded throughout the experiment. Reported affect was measured following each experimental phase. Following baseline, participants were told of an upcoming task of high- or low-threat value and were then directed to undertake a regulation strategy. Subsequently, participants completed two executive control tasks: response inhibition and working memory. Participants then undertook their allocated threat-manipulation task followed by a recovery period when they reported on their attentional focus and engagement in worry, rumination and suppression during regulation.

The results indicated that participants spontaneously initiated regulatory attempts (shown by the mind-wandering control conditions) to direct attentional focus away from threats and feelings, equally in both high- and low-threat levels. Distraction resulted in less reported attentional diversion from threats relative to mind-wandering. Acceptance facilitated attention to threat-related thoughts relative to mind-wandering and towards

affect relative to distraction. Worry, rumination and suppression increased in high-threat circumstances but did not differ between regulatory conditions. Regulatory conditions that resulted in more attention to threats (i.e., distraction and acceptance) also showed increased reported affect and physiological arousal, although acceptance did lead to reduced arousal during sustained regulation in high-threat circumstances. Regulation was shown to moderate the impact of threat on response inhibition but not working memory. Distraction impaired inhibitory ability under both high- and low-threat. Acceptance preserved executive control in high-threat circumstances, across both executive control measures. However, under low-threat, acceptance impaired prepotent response inhibition, but had no impact on working memory. Increased threat led to impairments to working memory when averaged across all regulatory conditions. Heart rate was negatively related to executive control but did not account for the effects of threat or regulation on executive control. These findings suggested that increased affect did not necessarily equate to impaired executive control. Rather, the findings suggested that the affect regulation strategies of distraction and acceptance involve processes that, independent of affect, can either preserve or impair the ability to demonstrate executive control.

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Chapter 1: Introduction

The experience of anxious affect, characterised by tension, apprehension and increased physiological arousal, is subjectively unpleasant (C. D. Spielberger, 1972), cognitively unhelpful (Eysenck & Calvo, 1992b; Eysenck, Darakshan, Santos, & Calvo, 2007), and can be harmful to physical health (Bleil, Gianaros, Jennings, & Flory, 2008). Increased stress and anxiety have been implicated in the development of mental health problems, including depression (Hammen, 2005). Furthermore, anxiety and affective disorders, including depression, are the most prevalent of diagnosed psychiatric disorders in Western countries (Bijl, Ravelli, & van Zessen, 1998; Kessler et al., 1994). In addition, stress and anxiety have also been implicated in the development and maintenance of a range of physical health problems including the maintenance of chronic pain (T. Pincus, Burton, Vogel, & Field, 2002), and an increased predisposition to develop heart disease (Esch, Stefano, Fricchione, & Benson, 2002). Hence, prolonged states of anxious affect are linked to impaired psychological and physical health.

Anxious affect can be categorised as part of a primitive fear-based response, developed through the evolutionary process, to meet clearly identifiable threats to one's own physical safety within the immediate situation (C. D. Spielberger, 1972). Present day situations that elicit anxiety often involve a symbolic threat that is inherent in a mentally demanding task or in a socially evaluative situation. These circumstances may lead to negative outcomes that may potentially damage one's positive self-perceptions (i.e., ego-threat; Epstein, 1972). A multitude of situations provide the necessary features to elicit anxious affect, some of which, if avoided, would restrict life quality and functioning (e.g., not attending a job interview or avoiding asking a romantic interest out on a date) and hence must be tolerated to meet one's needs. Therefore, effective strategies that alter attention and thought with the aim of reducing stress and anxiety in stressful situations, are of particular importance to human health, well-being and optimum functioning. Such strategies are referred to as cognitive regulation strategies (Garnefski & Kraaij, 2006; Kamholz, Hayes, Carver, Gullivver, & Perlman, 2006).

The increased tendency to experience anxiety has been linked to individuals' allocation of attentional focus, for example, scanning for and fixating on external environmental or internal thought content of a threatening nature (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & Ijzendoorn, 2007; MacLeod, Mathews, & Tata, 1986). Cognitive affect regulation strategies can involve changing the allocation of attentional focus and thought content (Garnefski, Kraaij, & Spinhoven, 2001; Gross & Thompson, 2007; Kamholz et al., 2006). There are many such strategies intended to alter the affective experiences, some of which are maladaptive in that they are counterproductive in reducing anxious affect (e.g., worry, rumination, and suppression), while others are adaptive, in that they are effective in achieving anxious affect reductions (e.g., reappraisal; Gross & Thompson, 2007).

Distraction and acceptance are two therapeutically recommended cognitive affect regulation strategies (S. C. Hayes, 2004a; Nolen-Hoeksema, 1998, 2000; Orsillo, Roemer, Block Lerner, & Tull, 2004) suggested to lead to an eventual reduction in anxious affect despite marked differences in their allocation of attentional focus. Engaging in effective distraction is proposed to involve focusing attention *away from* threatening stimuli in the environment, the self, one's affective response and associated threat-related thoughts (Augustine & Hemenover, 2009; Gross & Thompson, 2007). In contrast, acceptance is proposed to involve focusing attention *toward* one's affective experience and threat-related thoughts in an open, experiential, non-judgemental way (Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008; S. C. Hayes et al., 2004). The particular focus of attention is an important distinction between distraction and acceptance. It is this distinction that results in different theoretical predictions for the two strategies in relation to their effectiveness in reducing anxious affect. In addition, this distinction in attentional focus between the regulation strategies, the effort to maintain these regulation strategies, and the affect resulting from these strategies, may also temporarily impact on the subsequent ability to perform tasks requiring the control of thought and action (i.e., demonstrate executive control; Eysenck & Calvo, 1992b; Eysenck et al., 2007; Hagger, Wood, Stiff, & Chatzisarantis, 2010; Muraven & Baumeister, 2000).

Three questions have not been convincingly answered in relation to the cognitive affect regulation strategies of distraction and acceptance. These questions are: (1) Do the regulatory strategies of distraction and acceptance regulate affect through altering attentional focus to threat and affect, or via reduced engagement in maladaptive regulatory processes? (2) Are distraction and acceptance effective in reducing anxious affect in anticipation of, experience of, and recovery from the experience of threat? (3) What are the subsequent impacts of distraction and acceptance on executive control when anticipating undertaking high or low ego-threatening tasks? This thesis aims to answer the above three questions.

First, a literature review identifying the current theories and empirical findings relevant to the questions is presented (chapter 2). Following the literature review, chapter 3 outlines the focus of the present research and chapter 4 describes the methodology used to address the research questions. The following three chapters (5, 6 and 7) present the empirical analyses relevant to each one of these research questions. The final chapter (chapter 8) presents a discussion of the findings of the present research in the context of previous research, and proposes a model that integrates several previous theories to provide a unifying explanation of how distraction and acceptance, in altering attentional focus, change anxious affect and influence subsequent executive control.

Chapter 2: Literature Review

This literature review aims to summarise the relevant theory and previous research to assist in explaining the potential impacts that engaging in the cognitive affect regulation strategies of distraction and acceptance may have on: attentional focus and engagement in maladaptive regulatory attempts, anxious affect experienced prior to, during, and following threatening situations, and subsequent executive control. This chapter is divided into three major sections aimed at addressing the pivotal issues in investigating affect regulation effectiveness and its impacts on subsequent executive control. These sections include: (1) the nature of affect and how it arises, including specific discussion of anxious affect and its assessment; (2) affect regulation theory, its relation to affect regulation strategies, and empirical evaluation of theory and strategies, and; (3) how affect regulation, affect and vagal tone may influence executive control.

2.1 Affect: Definitions, Causes and Methods of Measurement

The term "affect" is given to a broad group of emotions that are of a particular valence, specifically, unpleasant/aversive versus pleasant/appetitive (Russel, 1980; Watson, Clark, & Tellegen, 1988). Emotions can also be quantified in terms of level of arousal, which refers to the level of intensity or level of activation versus deactivation experienced (Russel, 1980). Arousal can be quantified physiologically, or subjectively through reporting the experienced level of alertness (M. M. Bradley, Codespoti, Cuthbert, & Lang, 2001). Hence, the two dimensions of valence and arousal encompass the subjective experience, physiological changes and behavioural motivations or actions that characterise particular emotions (Gross & Thompson, 2007; Mauss, Bunge, & Gross, 2007; Moors, 2009).

The contrast between two emotions: misery and fear illustrates how emotions can differ in arousal but not valence. Both emotions have negative valence (i.e., are associated with negative evaluations of a stimulus and are subjectively unpleasant). However, while misery involves low arousal (i.e., low motivation, physiological arousal and activity levels), fear involves high arousal (i.e., increased motivation, physiological responding indicative of increased energetical requirements associated with fight or flight actions). Thus, despite both being of negative valence, the two emotions produce distinguishable subjective experiences. Misery could be classed within a broader category of depressed affect with other such specific emotional states as sadness, emptiness, tiredness, all being negative in valence and of low arousal. Fear can be considered part of the broader anxious affect category, being associated with other feelings such as stress, agitation, nervousness, all being of negative valence and high arousal.

Negative affect is the overarching term used to describe an unpleasant emotional state that is displeasing and often associated with a negatively valenced situation or aversive stimuli. Negative affect can involve the subjective experience of anxiety, tension, and nervousness (P. F. Lovibond & Lovibond, 1995; C. Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983), but can also incorporate anger, guilt, revulsion, self-dissatisfaction and sadness (Watson & Clark, 1984). Particular feelings within negative affect are associated with very specific types of stimuli (M. M. Bradley et al., 2001; Gross & Levenson, 1995). However, more than stimuli themselves, it is the situational interpretations of these stimuli in combination with physiological sensations that influence how individuals label affective states (Schachter & Singer, 1962). Particular affective states may endure over time when evoking conditions/stimuli persist (C. D. Spielberger, 1972). Affective states can also recur when evoked by the same or similar stimuli (M. M. Bradley et al., 2001). Linked to the persisting or recurring stimulus are the terms frequency, intensity, and duration, describing the extent to which the response is experienced. These terms imply that affective states are transient and will inevitably dissipate over time if evoking conditions and stimuli are removed or avoided. The time duration of states can be defined from minute to minute (Marteau & Bekker, 1992), or from week to week (S. H. L. Lovibond, P. F., 1995). Hence, state simply refers to an affective experience that has distinguishing beginning and endpoints.

2.1.1. Anxious Affect: Terminology

The term “anxious affect” in this thesis will denote emotional states such as fear, stress, and anxiety. Anxious affect, as suggested from the preceding discussion is a subtype of negative affect, associated with specific appraisals and stimuli. The terms anxiety, fear and stress are, in this thesis, subordinate to the superordinate term anxious affect, and are *not* interchangeable.

Different stimuli or situations are associated with the different states of anxiety, fear and stress. The term threat refers to an individual’s idiosyncratic appraisal of a particular situation or stimulus as being physically or psychologically damaging (C. D. Spielberger, 1972). Therefore, a threat is any stimulus that an individual appraises to be personally dangerous in the near or somewhat distant future. Threats are associated with the fear and anxiety. In contrast to threats, a stressor is a stimulus that places particular physical or mental demands on an individual in that particular moment and is associated with stress.

Although both fear and anxiety arise from threats, there is a subtle difference between these two emotions. Fear is defined as a basic emotional state of high arousal and unpleasant phenomenological qualities that results from a stimulus that clearly indicates immediate physical danger and clearly defined actions would avoid the harmful stimulus

(Epstein, 1972). In contrast, anxiety refers to a more complex and diffuse emotional reaction, also of unpleasant phenomenological qualities and high arousal involving tension and apprehension, evoked when the individual interprets an anticipated, ambiguous and/or uncertain situation as personally threatening to one's physical or psychological wellbeing (C. D. Spielberger, 1972). Hence, the evoking situation that elicits anxiety may represent a threat to one's positive views of oneself. In addition, anxiety can occur when there is a large degree of uncertainty and ambiguity about the about the nature of the possible threat (Bloom, Houston, Holmes, & Burish, 1977; Epstein, 1972; Lazarus & Averill, 1972), resulting in difficulty in choosing a behavioural response to avoid the harm. Hence, while fear focuses on immediate danger, anxiety is triggered by the perception of future threat, related to the temporal uncertainty and/or the ambiguous nature of the threat.

Stress is an emotion arising from stressors, which are situational (like threats) but, unlike threats, relate to more clear demands of a *current situation* (physical, social or psychological) rather than anticipated uncertain demands. Unlike fear, stress does not refer to immediate physical danger, but rather a performance requirement, internally or externally imposed, that is perceived by the individual to be difficult to meet. Both stress and anxiety occur when the performance required of the individual is perceived by that individual to be challenging (C. Spielberger et al., 1983), manifesting as increased unpleasant subjective feelings of tension and increased physiological arousal. However, stress occurs in the process of attempting to meet the demands of a socially or mentally challenging situation, not in passively anticipating them as in anxiety.

Two additional terms associated with threats and stressors, often used in the context of affect regulation, are "affective reactivity" and "affective repair/recovery". Affective reactivity relates to the magnitude of a person's anxious reaction to a particular situation or stimulus in terms of change from a resting baseline. The term affective repair/recovery relates to the degree to which an affective state disperses, following an encounter with a threatening or stressful situation.

2.1.2. Affect Causation

How stimuli lead to particular affective states is a matter of much discussion (Gross & Thompson, 2007; Izzard, 1993; LeDoux, 1995; Moors, 2009; Schachter & Singer, 1962; Westphal & Bonanno, 2004; Zajonc, 1980). Some theoretical perspectives are based upon the premise that it is an individuals' conscious evaluation of a situation that lead to a particular feeling (Lazarus & Folkman, 1984). An alternative theoretical perspective is that the mind is able to unconsciously evaluate a situation and this unconscious evaluation causes physiological arousal (to prepare the energetical requirements for that situation) before conscious awareness of the emotion arises or a conscious evaluation of the situation has been undertaken (LeDoux, 1995, 2000; Zajonc, 1980). However, most theoretical discussion around the causation of affect agrees that, at some level (conscious or unconscious), the meaning a particular stimulus has to the individual's wellbeing (i.e., the individuals evaluation of the stimulus) will be pivotal determining the subjective feeling that is experienced (Gross & Thompson, 2007; Izzard, 1993; Lazarus & Folkman, 1984; LeDoux, 1995, 2000, 2002; Westphal & Bonanno, 2004; Zajonc, 1980, 2000). Discussed in the following sections are two models of emotion causation that each provide a distinct framework in addressing how affect is caused.

2.1.3. Gross and Thompson's Modal Model of Affect Causation

Gross and Thompson's *modal model* is one model that proposes the necessary preconditions for specific emotions to occur. See Figure 2.1.

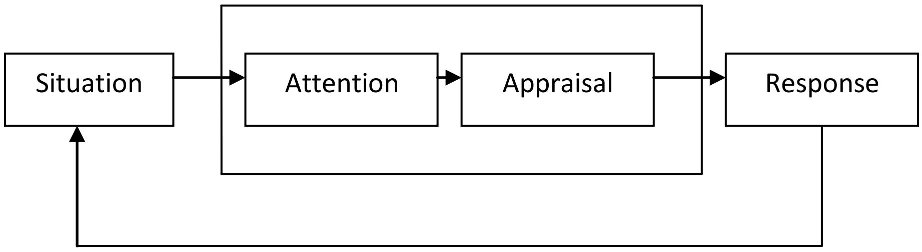

Figure 2.1. The “Modal Model of Emotion Causation”. Taken from “Emotional regulation: Conceptual foundations”, by by J.J. Gross and R. A. Thompson 2007, In J. J. Gross (Ed.), *Handbook of emotion regulation*, P 5. Copyright 2007 Guilford Press.

The modal model, in its simplest form, represents a linear sequence that leads to an affective response. An example of the sequence provided for fear begins with a person being in a situation involving an immediate threat to his or her financial livelihood (e.g., the individual is under a performance review at a workplace looking to downsize their workforce). The person’s attentional focus is towards the present situation and salient stimuli (e.g., the individual starts observing the reviewer’s reactions to his or her job performance data). The situation is subsequently appraised or interpreted in a particular way, to create a particular meaning (e.g., the individual appraises their job performance as inadequate to justify continued employment). Lastly, the meaning that the individual derives from the situation in relation to his or her long- or short-term wellbeing creates a basic affective response (e.g., the individual fears losing his income and housing).

The modal model can also capture multiple iterations resulting in more complex affective responses. In its more complex cyclical form, the generation of an affective response feeds back to the preceding processes in the sequence. Through this recursive feedback loop, it becomes possible for the affective response to become part of the situation (e.g., changes in vocalisations, body language, facial expression in the interview indicating fear), which is then attended to and appraised by the individual having the affective response (e.g., appraisal: “I am showing that I have lost confidence in my ability to do the job and will be considered incompetent") and the appraisal may generate an additional layer to the emotional response (e.g., introjected anger towards one's self).

2.1.4. Control-Process Self-Regulatory Perspectives

Another model of affect causation is based on the self-regulation of behaviour and goal attainment. This perspective is known as the cybernetic models or control-process view of regulated behaviour and affect causation (Carver & Scheier, 1988, 1990). The control process model makes the assumption that people set goals for themselves (short-term and long-term). As people act in accordance with these goals, they self-attentively monitor their actions with reference to their goals. This monitoring provides feedback to adjust their actions to more closely conform to their goals. This monitoring draws attention to any discrepancy between an ideal end-state and the current actual-state. Any discrepancy potentially leads to unpleasant affect due to the evaluative nature of this self-focused attention (Carver & Scheier, 1982, 1988). Hence, attempts to regulate behaviour, and concomitant increased self-awareness may lead to unpleasant affective states (Carver & Scheier, 1988, 1990; Duval & Wicklund, 1972). See Figure 2.2.

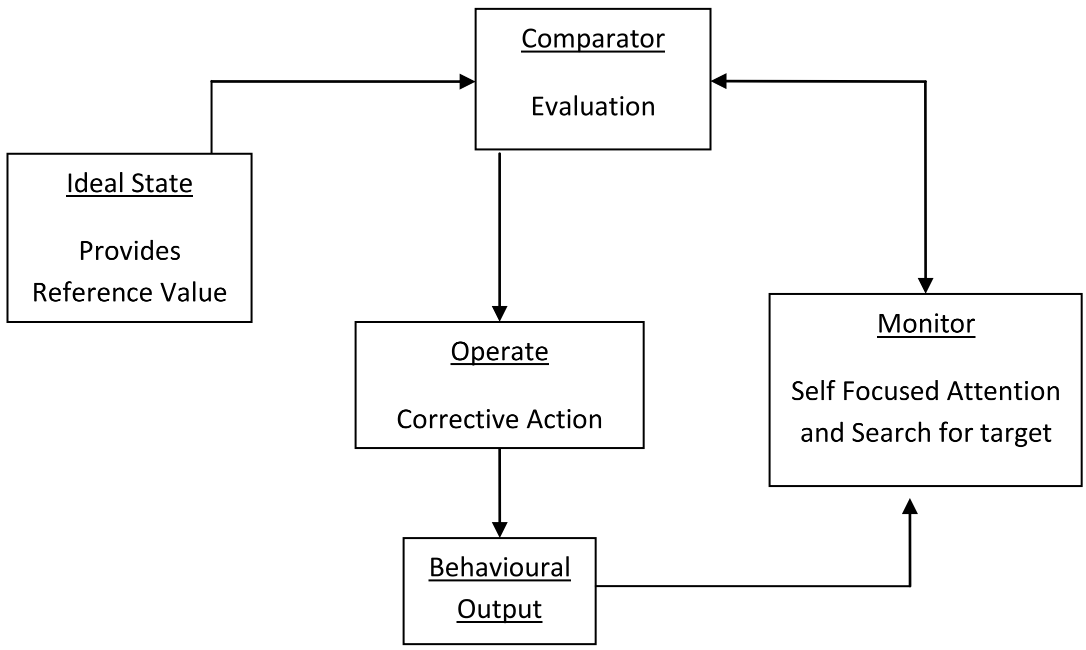

Figure 2.2. Cybernetic or Controlled Process Models. Adapted from “Control theory: a useful conceptual framework for personality-social, clinical, and health psychology”, by C. S. Carver and M. F. Scheier, 1982, *Psychological Bulletin, 92*, p112. Copyright 1982 by the American Psychological Association.

There are a number of steps within the control process model. The first of these involves the comparator component identifying discrepancies between an actual state and an ideal state. If there is a discrepancy, the operate component initiates a search process to identify and select a corrective action to minimise the discrepancy. Once an appropriate action is identified, it is implemented and the corrective action’s subsequent output is monitored (i.e., allocated attentional resources). The result of such corrective action may or may not change the actual state. The actual state is then evaluated by the comparator to determine if the actual state is consistent with the ideal state. If the comparator’s evaluation still identifies a discrepancy then the process begins again.

Similar to Gross and Thompson’s modal model, the comparator component creates an evaluation of the consequences of the current situation for the individual’s future wellbeing, or more specifically in this model, achieving the desired outcome (i.e., the ideal state) through the goal-directed behaviour. Carver and Scheier (1990) suggest that negative affect results if the comparator continually detects a discrepancy between the actual and desired state, with the corrective action being ineffective. Furthermore, negative affect also occurs if the rate of progression in closing the gap between the actual and ideal state is not as fast as expected (Carver & Scheier, 1990).

The control process model has been specifically applied to the occurrence of anxiety (Carver & Scheier, 1988). This model proposes that anxiety occurs when current behaviour is increasing the gap between the actual state and desired state or when control processes are not executed smoothly and easily, due to environmental impediments or conflicting goals (i.e., attainment of one goal may limit progress or diminishes the ability to attain another goal). Hence, this model proposes that experiencing anxiety is primarily due to the difficulty of identifying an appropriate behavioural action to reconcile conflicting goals. This model implies that some potential harm could occur to the individual if such conflicting goals were not in some way reconciled. Hence, the control process model makes the constant motivation to avoid harm and attain goals a central feature of the self-regulation and the experience of affective states.

2.1.5. Measures of Anxious Affect

From the foregoing discussion, affect can be measured through several modalities. Specifically, its subjective component may be assessed through self-report, while its arousal component may be assessed directly through various physiological measures. Theories regarding how affect changes the deployment of attention also suggest that cognitive measures can be used to quantify affective responses. However, choosing measures of anxious affect that are free from experimenter demand, participant expectancy effects, and regulatory attempts is very difficult.

Self-Report Measures

Introspective verbal reports can provide information on the subjective experience of physiological, cognitive, and behavioural indicators of affect (C. D. Spielberger, 1972; C. Spielberger et al., 1983). Self-report measures may ask participants to rate their feelings using particular sets of adjectives describing anxious states (e.g., “nervous”). Participants can report their levels of motivation, behavioural activity, ability to concentrate, and physiological states, such as dryness in the mouth, racing or pounding heart or ability to relax and sleep (Beck & Steer, 1987, 1990; P. F. Lovibond & Lovibond, 1995; C. Spielberger et al., 1983). However, sensitivity of self-report measures to changes in affect can vary from measure to measure when testing the effects of manipulations of threat and regulation. Some self-report measures will show differences where expected, based on individual tendencies to experience affect or situations that are likely to elicit increased affect (Blagden & Craske, 1996; Schmader & Johns, 2003; Wong & Moulds, 2009),and other measures are not sensitive to these differences (Hofmann et al., 2005; Johns, Inzlicht, & Schmader, 2008; Schmader & Johns, 2003). Importantly, it is the self-report measures that have demonstrated this sensitivity to differentiate between participants in different levels of experimental threat (Bloom et al., 1977; Holmes & Houston, 1974; Schmader & Johns, 2003) and to differentiate between individuals meeting a clinical diagnosis for an anxiety disorder (Antony, Bieling, Cox, Enns, & Swinson, 1998; S. H. L. Lovibond, P. F., 1995) that show the best validity in measuring the construct.

The main importance of self-report measurement is that it is the only way of gaining access to the subjective experience of affect and allows for the nuanced differences between different negative affective states to be assessed. It is also relatively economical for both the researcher and the participant in terms of time and resources. Clinically, it is highly relevant because it is often what people with clinical problems want to change. The primary disadvantage of self-report measurement is that of biased reporting. This may occur in either direction as different individuals may be motivated to under- or over-report their affective response in different situations. In the context of intervention, participants may be susceptible to experimenter demand effects and may over-report changes in affect.

Physiological Measures

There are many physiological measures of arousal, some that even provide specific indications of either sympathetic or parasympathetic activity. Physiological measures include heart rate (Hofmann, Heering, Sawyer, & Asnaani, 2009; Low, Stanton, & Bower, 2008; Monat, Averill, & Lazarus, 1972), heart rate variability (Fuller, 1992; Hofmann et al., 2005; S. C. Segerstrom & Solberg Nes, 2007), galvanic skin conductance (Dunn, Billotti, Murphy, & Dalgleish, 2009; Erisman & Roemer, 2010; Monat et al., 1972), and salivary alpha-amylase (Schmader, Forbes, Zhang, & Mendes, 2009). Importantly, such measures indicating changes in autonomic activity may be interpreted as indicating fluctuations in anxious affect when combined with subjectively reported affect change (e.g., I feel anxious/nervous) or in conjunction with consideration of the context in which they occur (Schachter & Singer, 1962).

Heart rate (HR) in beats-per-minute (BPM) is a commonly used measure to provide an objective indicator of physiological arousal[a]. Changes in the activation of autonomic

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[a]Simple HR data is widely used in experimental studies measuring anxious affect, however within psychophysiological studies, heart period (HP), rather than HR has been suggested as more appropriate (Berntson, Quigley, & Lozano, 2007). Heart period is also commonly referred to as either R-R intervals or inter-beat-intervals and is simply a reciprocal of HR. It can be easily calculated

subsystems indicate changes in affective states, particularly their arousal component. However, these changes do not indicate the valence of that affective state being experienced. Increased physiological arousal could either represent increased anxiety (negative valence) or increased excitement (positive valence). Importantly, the primitive functional origins of increased arousal are in preparing an organism for action. Heart rate provides a reasonably rapid indication of the physiological state, and can be assessed in a way that does not disturb an individual's attention, thus providing a useful measure to assess anxious affect.

Two autonomic sub-systems (sympathetic and parasympathetic) determine levels of physiological arousal that is well reflected in HR (Berntson et al., 2007; Grassi et al., 1998). Normal resting HR for an average adult is about 72 BPM. However, if there is a complete absence of parasympathetic activity (e.g., if the vagus nerve is severed) without an increase in sympathetic activity, resting HR increases to around 100-120 BPM (Berntson et al., 2007). This rise would occur due to automatic electrical impulses produced at the sinoatrial (SA) node (the heart's pacemaker) that provides electrical stimulation at this rate in the absence of autonomic control. Hence, the vagus nerve, providing the central parasympathetic influence to the sinoatrial node, inhibits HR acceleration. This means that the parasympathetic system is usually the dominant influence over HR fluctuations from 71-120 BPM (Berntson et al., 2007). Hence, reductions in parasympathetic influences as indicated by decreased vagal tone are consistent with decreases in inhibition or control of anxious affect (Appelhans & Luecken, 2006).

(60000/HR), and is expressed in milliseconds (ms) rather than BPM. The reason for its use within the psychophysiological literature is its proposed superior statistical properties in demonstrating changes in autonomic activity when the interplay between the two autonomic subsystems is non-linear (Berntson et al., 2007). Despite the usefulness of HP, the current thesis will not focus on the interplay between the sympathetic and parasympathetic influences over arousal. Hence, for simplicity only HR in BPM will be referred to in the remainder of this thesis rather than HP.

Heart rate variability (HRV) is proposed to provide a reliable indicator of parasympathetic influences over HR transmitted via the vagus nerve (Akselrod et al., 1981; Berntson et al., 1997; Grassi et al., 1998; Malliani, 1999). Parasympathetic influences transmitted via the vagus nerve indicating rapid, flexible responses to altering arousal as a result of changing environmental demands (Porges, 2001, 2007). Influences over the HR time series that peak at about 0.5 - 1.0 sec on HR are indicative only of vagal influences (the nerve carrying central parasympathetic influences)(Berntson et al., 1997). Two types of HRV analysis are used to identify the rapid changes in HR that are proposed to measure parasympathetic activity. These analyses are frequency (or spectral) analyses and time-based analyses. Using spectral methods, the power ($msec^2$) in particular frequency bands can indicate particular aspects of autonomic activity (Akselrod et al., 1981; Malliani, 1999). Studies involving pharmacological blockade have demonstrated that the frequency band between 0.15-0.4Hz, referred to as the high frequency (HF) band, is indicative of parasympathetic influences over the heart, in particular those resulting from fluctuations in vagus nerve influence. Increased in power within this frequency band suggests increased parasympathetic activity. This frequency band is often contrasted with a lower frequency (LF) band (.04-.15), suggested to reflect slower sympathetic influences over HR, although it has been demonstrated to be contaminated by parasympathetic reflexive responses associated with the short-term regulation of blood pressure known as the baroreflex (Berntson et al., 1997). Another metric of HRV, root-mean-square-of-successive-differences (RMSSD), is a time domain measure that, like the HF band, also reflects the more rapid fluctuations in HR, with increased values representing increased parasympathetic influences or vagal inhibition of HR[b]. Although decreased HRV on the indices indicating

[b] An important consideration with HRV indices is that the rapid fluctuations in HR arising from the vagus nerve can be influenced by respiratory changes including rate and possibly depth (Berntson et al., 1997; Jorna, 1992). The indicators parasympathetic influences by HRV are impacted

vagal tone (parasympathetic influence over HR) often coincides with increased experienced affect, the measure has been suggested to be an indicator of *regulated responding* (Appelhans & Luecken, 2006), rather than affect per se. See section 2.3.8 for more detailed discussion of HRV as an indicator of regulated responding.

The validity of both heart rate variables (i.e., HR and the parasympathetic indicators of HRV) in measuring anxious affect has been demonstrated through their ability to differentiate between different levels of experimental threat (Austin, Riniolo, & Porges, 2007; Grassi et al., 1998; Kudielka, Buske-Kirshbaum, Hellhammer, & Kirschbaum, 2004; Monat et al., 1972; S. C. Segerstrom & Solberg Nes, 2007; Taelman, Vandeput, Spaepen, & Van Huffel, 2008; B. Verkuil, Brosschot, de Beurs, & Thayer, 2009) and naturally occurring threats (Dishman et al., 2000; Fuller, 1992; Pieper, Brosschot, van der Leeden, & Thayer, 2007). Heart rate variables have also been shown to differentiate clinical and non-clinical groups under resting baseline conditions (Cohen et al., 1998; B. H. Friedman & Thayer, 1998; Lyonfields, Borkovec, & Thayer, 1995; Thayer, Friedman, & Borkovec, 1996). Heart rate and HRV can also differentiate between individuals high and low in trait anxiety under rest conditions (L. L. Watkins, Grossman, Krishnan, & Sherwood, 1998), but are particularly sensitive in capturing differences between high and low trait anxious individuals under mental stress (Demaree & Everhart, 2004; Miu, Heilman, & Miclea, 2009; Shapiro et al.,

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by respiration due to a phenomenon known as pulmonary gating. During inhalation, the vagal motor neurons are inhibited, temporarily gating off afferent parasympathetic influences that usually suppress HR, leading to an increase in HR. During exhalation the gating no longer inhibits central parasympathetic activity to the vagal motor neurons, allowing central afferent parasympathetic influences to suppress HR (Berntson et al., 1997). Therefore, slowed respiration can lead to overestimation of the extent of central parasympathetic influences, as it prolongs the gating processes leading to artificially higher peaks and lower troughs in HR. Hence, due to pulmonary gating of central parasympathetic influences to the heart, HRV is a measure of vagally mediated central parasympathetic influences rather than direct central parasympathetic influences (Appelhans & Luecken, 2006).

2000). However, physiological measures also may represent the mental demands of a situation or a regulation strategy engaged in by individuals rather than affect (McLaughlin, Borkovec, & Sibrava, 2007; Taelman et al., 2008) and thus may best be used alongside other measures of affect.

Cognitive Measures of Affect

Some studies have sought to use cognitive attentional measures as indicators of the experience of affect (Egloff, Willhelm, Neubauer, Mauss, & Gross, 2002; Johns et al., 2008). It has been well documented that patterns of responding on cognitive attentional measures indeed differentiate between individuals with and without clinical diagnoses, individuals of high and low level of trait-anxiety, and individuals of high and low state anxiety (Bar-Haim et al., 2007). Reflexive attentional biases to threat-stimuli may co-occur with increased reported anxiety (Bar-Haim et al., 2007) or increased physiological reactivity to stressors (Egloff et al., 2002). Additionally, these measures have often been suggested to measure implicit (or unconscious) experiences of affect (Egloff et al., 2002), thus bypassing the issue of experimenter demand effects when assessing anxiety via measuring conscious experiences of affect via self report. However, such cognitive attentional tasks have also been argued to represent attempts to regulate affect[c] (Bar-Haim et al., 2007;Johns et al., 2008; Koole & Jostmann, 2004). Thus, caution is required when interpreting the results of these cognitive attentional measures as representing affective responding.

Conclusions Regarding Measures of Affect

In conclusion, self-report measures, heart rate variables of HR and HRV, and cognitive attentional measures can distinguish higher and lower levels of affect. Self-report

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[c] For more on different cognitive and attentional processes indicating affect regulation rather than affect, see sections 2.2, through to 2.2.17.

measures of affect are economical and provide a vital indication of subjective states, however, due their susceptibility to be influenced by demand effects, measurement of reported affect should ideally be accompanied by a more objective measure, such as physiological measures or cognitive attentional measures. This should occur so that other sources of data that are not as influenced by the conscious control of the individual can be used to establish the validity of the self-report measure. The reasons for multiple modalities of measurement is not just centred on self-report being possibly influenced by demand effects, but also because physiological measures may represent the mental demands of a situation or affect regulation strategy rather than affect. In addition, although cognitive performance measures can limit the level of conscious control participants have over their responses, they may nevertheless indicate reflexive or spontaneously initiated attempts to regulate affect as well as the affect itself (Johns et al., 2008; Koole & Jostmann, 2004). Hence, each measure has its limitations in gaining an accurate indication of affect under experimental circumstances and, thus, multiple sources should be used to assess affective states.

2.2. Affect Regulation: Attentional Focus and the Adaptive and Maladaptive Strategies

Individuals typically do not merely experience affect passively. Rather, one will automatically and/or spontaneously adjust responding depending upon the situation. Affect regulation can be defined as an individual's deliberate or automatic attempts to alter affective responding (Gross & Thompson, 2007; Mauss et al., 2007). Affect regulation can take many different forms (Carver, Scheier, & Weintraub, 1989; Gross & Thompson, 2007; Kamholz et al., 2006; Mauss et al., 2007). Regulatory attempts can be behavioural (e.g., avoidance or removal of oneself from the situation) or cognitive (i.e., operating via the control of attention or thought). Regulation can be adaptive (i.e., have outcomes that are consistent with an individual’s intentions) or maladaptive (i.e., have outcomes that are inconsistent with an individual’s intentions). Some strategies can be employed before an affective episode occurs and others may occur after affective episode has been initiated. Regulatory attempts may be categorised as avoidance attempts designed to minimise the experience of affect (i.e., behavioural or mental disengagement/distraction/avoidance). Other cognitive and behavioural regulatory attempts may be considered experiential, increasing the awareness, experience, expression and tolerance of affect (e.g., experiential observation, immersion and acceptance).

The element of attentional focus is a key feature distinguishing among the types of affect regulation strategies available. It is the premise behind any regulatory action that in some way an individual has either anticipated or has observed an affect-eliciting stimulus. Therefore, the individual has become aware of a situation that may cause an unpleasant affective episode, has become aware of the experience of unpleasant affect, or has encountered a combination of the above. Hence, all theoretical frameworks attempting to explain the process of affect regulation involve attentional focus and conscious awareness explicitly or implicitly within their frameworks (Greenberg & Paivio, 1997; Gross & Thompson, 2007; Moors, 2009; Power & Dalgleish, 1997; Westphal & Bonanno, 2004). However, there is some disagreement amongst the affect regulation models regarding exactly what role attentional focus and the awareness of affect and affect-eliciting stimuli have on the affect subsequently experienced. Two models that capture the competing arguments are Gross and Thompson’s modal model (2007) and Greenberg and Paivio’s process of a feeling model (1997).

2.2.1. Gross and Thompson's Modal Model of Affect Regulation

In addition to proposing a model of affect causation, Gross and Thompson (2007) also proposed separate regulation categories (modes) relating to each step of the affect generation sequence (see Figure 2.3). These include situation selection, situation modification, attentional deployment, cognitive change (i.e., reappraisal), and response modulation. Gross and Thompson categorised the affect regulation strategies into those that occurred before the affective response (e.g., situation selection, attentional deployment and cognitive change) as antecedent based strategies, and strategies that occurred after the initiation of the affective response (e.g., response modulation) is a response-focused strategy. However, this categorisation seems only appropriate when discussing situations where the simpler linear version of the model applies. When situations involve a number of iterations of the response cycle, some strategies previously categorised as antecedent in the model may be occurring after the affective response has been initiated. For example, the internal processes of attention and appraisal may occur either consciously or reflexively and outside conscious awareness in the first iteration (Gross & Thompson, 2007; Mauss et al., 2007). However, after the first reflexive affective response iteration, these processes of attentional deployment and appraisal may rise into awareness and may come under conscious top-down influences and be altered after the affective response has already been initiated.

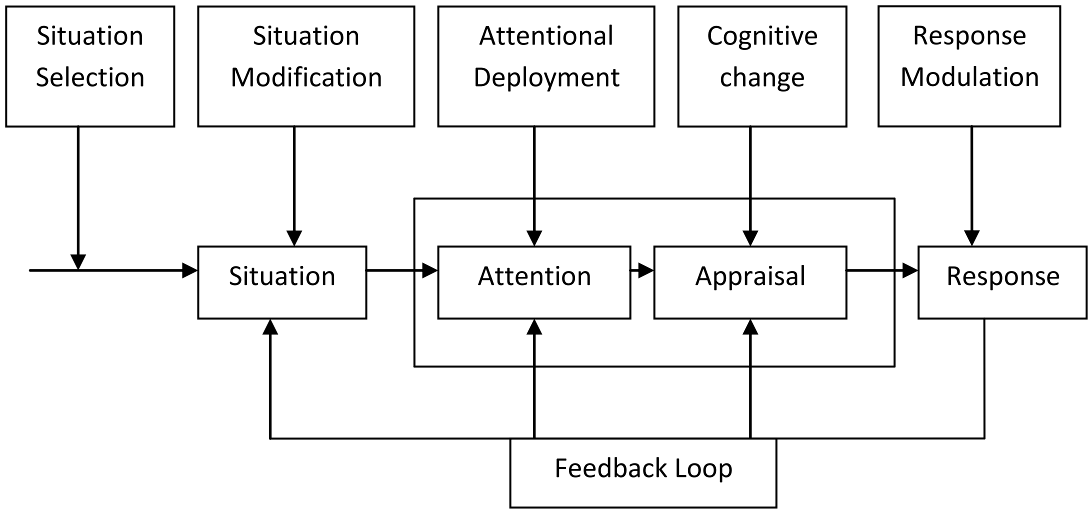

Figure 2.3. Modal Model of Affect and Affect Regulation. Taken from Emotional regulation: Conceptual foundations by J. J. Gross and R. A. Thompson, R. A., 2007, in J. J. Gross (Ed.), *Handbook of emotion regulation*, p. 10. Copyright 2007 by Guilford press.

The modal model proposes two possible mechanisms through which affect may be regulated. The first (in the simple linear form) is that it is possible to alter attentional deployment and appraisal, consciously, before the affective response has been initiated to change the affective trajectory. The second operates via the feedback loop within the modal model, whereby directing attention away from the threat-related stimulus or the initial affective response reduces the likelihood of the presence or continuation of that response, regardless of whether this redirection of attention occurs before or after the affective response has been initiated. Slightly different outcomes would result from each mechanism. The first would result in no affective response in relation to a stimulus that was not attended, whereas the second would result in an affective response which then subsides following regulation.

2.2.2. Greenberg and Paivio's Process of a Feeling Model

The *process of a feeling* model proposed by Greenberg and Paivio (1997), see Figure 2.4, begins with the premise that basic emotions, such as fear, can occur without conscious awareness (LeDoux, 1995; Zajonc, 1980) and that emotions serve a vital role in human functioning, enabling adaptation of behaviour to the external environment and, hence, should not be ignored. Importantly, this model comes from the dialectical-constructivist view of human functioning, which states:

"personal meaning emerges by the self-organisation and explication of one's own emotional experience and optimal adaptation involves an integration of reason and emotion. This integration is achieved by an ongoing circular process of making sense of experience by symbolising bodily felt sensations in awareness and articulating them in language, thereby creating a new experience" (Greenberg, 2004, p. 4)

Hence, this theory suggests that an individual is only able to self-regulate consciously after the affective response has been initiated and that this affective response must have reached *conscious awareness* for it to begin a process towards the response's completion, which is the transformation of an initial affective state to an affective experience of a different valence.

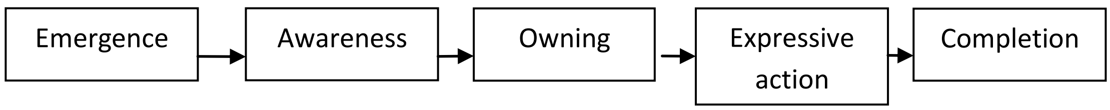

Figure 2.4. The Process of a Feeling Model. Taken from Greenberg, L. S. & Paivio, S. C. (1997). *Working with emotions in psychotherapy*. New York: Guilford press. p 27.

The process of a feeling model focuses on the necessary conditions for the affective response to reach completion. In order to reach completion, according to this model, the affective response must pass through the necessary steps of (1) conscious awareness (rather than unawareness), particularly of the physiological and sensory experiences, as distinct from the subjective experience; (2) ownership of and the integration of such feelings and sensations with cognitive processes, and (3) expressive action involving the articulation of sensations and reason into language rather than through other expressions such as movement (Greenberg, 2004). Importantly, the process of a feeling model is based on increasing conscious experiencing of affect, thereby transforming an unpleasant emotional reaction to an alternative more pleasant, perhaps, less arousing emotional state (Greenberg, 2004). Thus, the process of a feeling model shares some similarities with the behavioural concept of habituation, in that individuals must fully expose themselves to the unpleasant stimulus for distress to reside.

2.2.3. Similarities and Differences Between the Two Affect Regulation Models

Gross and Thompson's (2007) and Greenberg and Paivio's (1997) models have points of similarity. These relate to the roles of attentional processes (i.e., attentional deployment or conscious awareness, respectively) and of evaluative processes (i.e., appraisal and owning respectively). Both theories predict that regulation strategies involving directing attention toward negative affect, coinciding with a negative appraisal of the experience of that affect, is likely to create a more complex affective response. This more complex affective response is likely to be of a similar valence to the initial response and to prolong the experience of negative affect. Based on the modal model, if indeed a fear based response became part of the situation and was evaluated by the individual as unhelpful and unwanted, then this evaluation is likely to lead to more intense and unpleasant affect. Likewise, when considering the process of a feeling model, if an individual becomes aware of an emotional response and evaluates this emotion as unwanted, this would also be predicted to lead to the prolonging and intensification of that emotional response. Furthermore, both theories contain a component within their model regarding the outward and/or internal expression or response of the experienced affect. Both models suggest that inhibiting the expression of an affective response once the affective response has emerged is unlikely to lead to a decrease in the subjective or physiological presence of such affect.

Importantly, however, the modal model and process of a feeling model disagree about the necessity of increased awareness of and attention to the affect-eliciting situation and associated affective response. These disagreements begin with the assumptions about the role of consciousness in the experience of affect (Westphal & Bonanno, 2004). Gross and Thompson’s (2007) modal model allows for the cognitive processes that play a causal role in the initiation of an affective experience to be under the conscious control of the individual. This allowance of the possibility of conscious cognitive processes causing affect results in a range of antecedent strategies that the process of a feeling model does not include that may alter the affective response trajectory. The reason for this lack of antecedent strategies in the process of a feeling model is that this model emphasises that affect occurs without conscious cognitive processes and, therefore, attempts to control attention and thought in relation to affect can only begin after the initiation of an affective response (Greenberg, 2004).

When considering a situation in which an affective response has already been initiated, the modal model predicts that increased attentional focus on the affect-inducing situation, without a change in the way that situation is appraised, will lead to an increased affective response. Furthermore, increased attention to that affective response, without a change in the negative evaluation of that response is predicted to lead to a continuation of a similar but more intense and prolonged affective response of a the same valence.

Moreover, affect expression is also not predicted to be necessarily helpful within Gross's model. In contrast, the process of a feeling model predicts that increased attentional focus on the situation and the associated sensory experience of the resulting affective response will likely integrate the meaning of the situation with the affective response through the articulation of this affective response in language, leading to altered affective state.

In summary, these two models capture two opposing views of (1) the role of consciousness in the causation of affect; (2) at what point in the process affect regulation can take place, and; (3) where attention needs to be focused for affect regulation to be effective. Gross and Thompson predict that decreasing attentional awareness of the situation and the affective experience will lead to a decrease in the affective response. In contrast, Greenberg and Paivio's model predicts that if conscious awareness is reduced by taking attentional focus away from the affective experience, this prevents the affective response reaching completion.

2.2.4. Self-Regulation Theories' Perspective on Affect Regulation

Two self-regulation theories, Carver and Scheier's control process perspective (Carver & Scheier, 1988, 1990) and Duval and Wicklund's (Duval & Wicklund; 1975) objective self-awareness theory, suggest that when individuals are seeking to regulate their outward behaviour, this requires self-focused attention. However, this self-focused attention is proposed to have affective consequences. Duval and Wicklund's objective self-awareness theory states that when individuals view themselves as an object (i.e., direct attention to themselves and observe and monitor their own features and responses) they inevitably find flawed features. This identification of flawed features leads to the experience of negative affect. Rather than seeking to change these self-identified flaws, which may require considerable effort to alter, individuals spontaneously attempt to avoid focusing attention on themselves and avoid situations that may promote self-awareness as an attempt to minimise the experience of unpleasant affect. Situations that may make individuals self-aware include those that place social performance demands on an individual such that they receive direct observation from others, leading the individual to focus on him or herself also. Duval and Wicklund suggest that some individuals may avoid self-awareness by engaging in tasks that focus attention on the external environment, thus limiting attention available to be focused on the self and thus limiting the experience of negative affect. Hence, objective self-awareness theory predicts that when individuals are not in situations that draw attention towards the self, and attention can easily be directed outside of the self, they can maintain a pleasant affective state. However, when either directing attention towards the self, or when in a situation that automatically draws attention to the self, individuals will experience increased negative affect.

In a socially evaluative situation where individuals are suggested to automatically monitor their own responding (Duval & Wicklund, 1972), they may alter their self-presentation in the situation to reduce the chance of this negative evaluation from occurring. Carver and Scheier (1988) suggest that when unable to regulate behaviour to meet such self-presentations standards, attention to discrepancy between the current level of preparedness for the socially evaluative situation and their ideal level of preparedness only increases the experience of anxious affect. Furthermore, both Duval and Wicklund (Duval & Wicklund, 1972), and Carver and Scheier (Carver & Scheier, 1988) suggest that if there are no options to remove oneself from the situation behaviourally then one will automatically, but generally very unsuccessfully, seek to minimise self-awareness, typically through self-distraction, to reduce the experience of unpleasant affect.

2.2.5. Contrasting the Theories of Action Regulation with the Theories of Affect Regulation

The theories of the self-regulation of behaviour differ from those of affect regulation in that they propose a way in which individuals spontaneously regulate affect. Specifically, both Duval and Wicklund (1972) and Carver and Scheier (1988) propose that individuals spontaneously direct attention away from the self and the situation in order to avoid unpleasant affect. This proposed spontaneous tendency is contrary to what the process of a feeling model predicts will lead to effective affect regulation. Furthermore, the theories of the self-regulation of behaviour predict that in threat situations, which naturally facilitate attention to the self and to the situation, individuals will find it difficult to implement spontaneously initiated attempts to minimise attention these foci. This prediction from the action regulation theories challenges the assumption of the modal model that complete and effective attentional redeployment is possible once attention has already been directed to a threat and will be effective in reducing affect. Despite the divergence in predictions, the action regulation theories are also consistent with the modal model in predicting that diverting attention from the self and threats is likely to provide some limited reduction to unpleasant affect experienced and perhaps to maintain more pleasant states in situations of limited threat value.

2.2.6. Conceptualisation of Particular Strategies Within an Affect Regulation Framework

To enable easy comparison, particular cognitive regulation strategies can be conceptualised within the common framework of the affect regulation models. From this, it becomes apparent that different strategies operate on different components deemed necessary in altering an affective episode, specifically: (1) attention to threats; (2) attention towards feelings; (3) the motivation to avoid the experience of affect; (4) increased self-awareness; and (5) reappraisal of affect. The maladaptive strategies of worry, rumination and suppression, and the adaptive strategies of distraction and acceptance are cross-tabulated against these components in Table 2.1.

Table 2.1.

Cross-Tabulation of Cognitive Regulatory Strategies against Regulatory Factors.

		Regulation Strategy				
		Distraction	Acceptance	Worry	Rumination	Suppression
Regulatory factors	Attention to threats	no	yes	yes	yes	yes
	Attention to Feelings	no	yes	yes	yes	yes
	Attempt to Avoid Affect	yes	no	yes	yes	yes
	Self-Awareness	Decreased	Increased	Increased	Increased	Increased
	Reappraisal of Affect	No	Yes	No	No	No

Table 2.1 allows the identification of the model components that distinguish between the particular strategies. The increased intensity and persistence of affect associated with the maladaptive strategies can explained on these factors by both Gross and Thompson's more complex cyclical version of their model and via Greenberg and Paivio's process of a feeling model. Furthermore, Table 2.1 shows how distraction and acceptance differ from each other and from the maladaptive strategies on these same factors. A more detailed description of the affect regulation strategies and how they fit

into the affect regulation models and the dimensions in the Table 2.1 is presented in sections 2.2.7 to 2.2.12 to follow.

2.2.7. Defining the Adaptive Self-Regulatory Processes: Distraction and Acceptance

Different principles regarding the focus of attention support the use of distraction and acceptance for down regulating affect. These differing principles are consistent with the contrasting predictions of Gross and Thompson's (2009) and Greenberg and Paivio's (1997) models. Distraction can be defined as a regulation strategy where one "seeks to avoid the experience of unwanted negative affect by cognitively removing oneself from the cause of that affect, with the overlying purpose to stop thinking about the negative event or emotion" *(*Augustine & Hemenover, 2009; p. 1185). Directing attention towards distracting tasks creates task-related thoughts, thereby, in contrast to the maladaptive self-regulatory attempts, restricting attention to particular content that is self- or threat-focused (Van Dillen & Koole, 2007). More specifically, it is the minimisation of attention to thoughts such as judgmental appraisals (Gross & Thompson, 2007; E. Watkins, 2004), worry (Rapee, 1993), and affect-related ruminations (Van Dillen & Koole, 2007), which are proposed both to initiate (Gross & Thompson, 2007) and maintain unwanted negative affect (Blagden & Craske, 1996; Lyubomirsky & Nolen-Hoeksema, 1993), that results in diminished experience of negative affect. Hence, distraction can be classified as an "*anti-experiencing"* strategy as it removes attentional focus from the self, from the subjective and sensory experience of affect and threat-stimuli. Importantly, distraction shares the characteristic of attempting to avoid or inhibit the experience, similar to the maladaptive strategy of suppression. However, distraction also differs from suppression in that distraction involves shifting attention away from unpleasant experiences and toward alternative foci, whilst suppression involves some monitoring of these unwanted experiences so as to inhibit them with no alternative focus of attention.

In contrast to distraction, acceptance is an “experiencing” strategy and is viewed as a more internally validating strategy that can be defined as: “the way in which present moment awareness is conducted: non-judgmentally, with an attitude of acceptance, openness and even compassion toward one’s experience” (Cardaciotto et al., 2008; p. 205). The sequential process of achieving successful anxious affect regulation using acceptance as a strategy is argued to involve awareness, noticing and observing of negative thoughts and feelings, and allowing the thoughts and feelings to continue, rather than evaluating these thoughts and feelings, attempting to suppress them, or distract oneself from them. It is proposed that attempts to avoid the unwanted negative internal events only prolong and intensify these events (S. C. Hayes, 2004a; S. C. Hayes et al., 2004). Hence, broadly consistent with Greenberg and Paivio’s process of a feeling model, it is argued that an affective episode can reach completion through the awareness of the sensory experience and integrating this experience with the self through articulation and reason, which facilitates the process of an affective state unfolding.

Acceptance is often conceptualised in the literature as what it is not, with several measures of the construct emphasising its opposite (Block-Lerner, Salters-Pedneault, & Tull, 2005), being that of experiential avoidance (R. A. Baer, Smith, & Allen, 2004; Cardaciotto et al., 2008; S. C. Hayes et al., 2004). Conceptual support for acceptance as a strategy comes from Wegner’s ironic processes of mental control (Wegner, 1994), and Borkovec’s worry avoidance theory (Borkovec, Alcaine, & Behar, 2004), which both support the notion that affect regulation strategies involving the avoidance of the experience of negative thoughts and feelings result in prolonging the very state that these strategies seek to avoid. Hence, arguments in support of experiential observation and acceptance are based not so much on why increasing attention to one’s internal experiences reduces affect, but rather why sustained effort to avoid the experience of affect prolongs and intensifies that affect. Evidence for the effectiveness of distraction and acceptance in reducing affect is presented in section 2.2.9.

2.2.8. Conceptualising Distraction and Acceptance within the Affect Regulation Models

From Table 2.1, it can be seen that the strategies, distraction and acceptance, differ on all five dimensions of regulated response. Distraction involves attention away from threats and affect, aiming to reduce unpleasant affect by avoiding its experience and associated thoughts, minimising self-awareness, and not altering the appraisal of an affective response. Conversely, acceptance involves attention to threat-related thoughts and towards feelings with the motivation to fully experience unpleasant affect, to increase self-awareness, and possibly to allow for the reappraisal of the affective response.

The modal model predicts that distraction should be an effective regulation strategy as attention to negative thoughts and feelings is theorised to give rise to and maintain the experience of unwanted negative affect. Thus, diverting attention from negative thoughts and feelings would be expected to extinguish the resulting affect. However, according to the process of a feeling model, engaging in distraction and avoiding thoughts relating to threats and the associated unpleasant affect would not allow for awareness to increase to a level allowing integration of affect with reason, so resurgence of negative affect would be expected.

Acceptance, in contrast to distraction, is conceptualised as leading to increased attention to threat-related thoughts and feelings. The simple version of the modal model would thus predict an increase in anxious affect resulting from this strategy. In contrast, the process of a feeling model would predict an initial increase in affect that should shortly be followed by a marked decrease as affect is integrated with reason and feelings are articulated. However, it may be that "integration with reason" involves the reappraisal of thoughts and feelings from being unwanted and unhelpful to being natural and informative. In this case, the modal model, in its iterative form, would not necessarily predict that acceptance will counterproductive, because affective responding arising from negative evaluations of affective responses should be reduced. Under this interpretation, the modal model would, however, concur with the process of a feeling model in predicting an initial increase in affect, due to the increased attentional focus towards threat-related thoughts and feelings, followed by a dissipation of affect if this affect is appraised non-judgementally.

The behavioural self-regulation theories' perspective of distraction is that it will draw attention away from the self and therefore reduce self-awareness, leading to decreased affect. However, these self-regulatory theories recognise that engaging in distraction may be difficult in high-threat situations as not being able to escape a situation will inevitably lead to attention being drawn to threat-stimuli that promote self-awareness (Carver & Scheier, 1988; Duval & Wicklund, 1972). Hence, distraction is predicted to only offer very minimal reprieve from experiencing unpleasant affect. In contrast, acceptance, involving focusing attention to the self is a strategy that increases self-awareness[d]. Increased self-awareness is predicted by the self-regulation theories to spontaneously lead to evaluative cognitions, rather than acceptance. Hence, this self-focused attention generated by engaging in acceptance is predicted by the self-regulation theories to lead to increased affect.

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[d] Experiential observation and acceptance (mindfulness) has been shown to increase meta-awareness (Hargus, Crane, Barnhofer, & Williams, 2010; Roemer & Orsillo, 2009).

2.2.9. Research on the Adaptive Strategies: Conflicting Evidence for the Two Competing Affect Regulatory Models

Studies investigating distraction's effect on anxious affect have often compared distraction to rumination (Blagden & Craske, 1996; Wong & Moulds, 2009). These studies evaluate the effectiveness of the strategies after a threat event has passed (i.e., how well they promote affective repair/recovery) rather than while the threat event is still anticipated. Some studies have indicated that distraction is not effective in reducing anxiety that occurs in response to an upcoming threat (Houston & Holmes, 1974) whilst others report that distraction does effectively reduce affect (Bloom et al., 1977). Such discrepancies are possibly due to differences in the manipulation of strategies. Van Dillen and Koole (2007) claim that the down-regulation of affect through distraction is proportional to the attentional load imposed by distraction, with maximum load being most effective at reducing affect. Another possible reason offered for why distraction can be ineffective is that threat situations initially draw an individual's attention reflexively towards threat-related self-relevant thoughts (Bar-Haim et al., 2007; MacLeod et al., 1986; Wilson & MacLeod, 2003), therefore, achieving complete unawareness of such threats through distraction would be very difficult in situations of high-threat (Carver et al., 1989; Wicklund, 1975).

Outside of anticipated threat circumstances, distraction has consistently been demonstrated as effective when the attentional diversion co-occurs with the affect manipulation, such as whilst watching a movie (Sheppes & Meiran, 2007) or viewing affect laden picture content (Van Dillen & Koole, 2007). It has also been successful in speeding up affective repair following affect inductions (Augustine & Hemenover, 2009) and threats (Wong & Moulds, 2009). However, the effectiveness of distraction in reducing affect in these studies is often measured relative to a maladaptive strategy (Blagden & Craske, 1996;

Morrow & Nolen-Hoeksema, 1990; Rusting & Nolen-Hoeksema, 1998; Wong & Moulds, 2009). In the circumstances where distraction has outperformed another suggested adaptive strategy (reappraisal), this has occurred with participants self-directing their own distracting content whilst watching affective content (Sheppes, Catran, & Meiran, 2009; Sheppes & Meiran, 2007). Hence, research on experimentally manipulated distraction has had mixed results, but this seems to be attributable to different forms of distraction manipulation, different research paradigms, and the chosen comparison conditions against which the strategy is evaluated.

Research on individuals considered to be well rehearsed in avoiding anxious affect from rising to conscious awareness (i.e., high-anxious repressors) report attending to distracting thoughts in order to minimise attention to affect related content (Bonanno, Davis, Singer, & Schwartz, 1991). However, these high-anxious repressor individuals, although reporting decreased anxiety, show increased physiological arousal in threat circumstances (Asendorpf & Scherer, 1983; Fuller, 1992). This research on high-anxious repressors further supports the notion that distraction during the presence of threats may be ineffective at reducing anxious affect, even for well-rehearsed users of the strategy. Hence, studies of experimentally manipulated and naturally occurring distraction do not suggest that distraction will always lead to reductions in negative or anxious affect.

Support for acceptance in reducing anxious affect has come from studies both using non-clinical (Braams, Blechert, Boden, & Gross, 2012; Dunn et al., 2009; Hofmann et al., 2009; Low et al., 2008) and clinical samples (Campbell-Sills, Barlow, Brown, & Hofmann, 2006; Levitt, Brown, Orsillo, & Barlow, 2004). There are methodological differences in the studies evaluating acceptance in regards to such factors as: how affect is manipulated, time when the strategy is elicited during the affective sequence, for how long the strategy is engaged in, how affect is measured, and if the strategy is evaluated subsequent to its use.

However, understanding when acceptance is found to reduce affect can be best shown when organising the findings of previous research, first into the impacts of acceptance separately in clinical and non-clinical samples, followed by the particularly important factors of time length of strategy engagement and affect modality measured.

Support for acceptance as an effective strategy in non-clinical samples has been found on measures indicating physiological arousal when the strategy has been engaged in for a period more than 10 minutes (Dunn et al., 2009; Hofmann et al., 2009; Low et al., 2008). Low et al.'s (2008) study showed that the beneficial effects of acceptance in reducing anxious affect were found on HR only during a second 10 minute session of engaging in the strategy relative to an evaluative rumination condition. Hofmann et al. (2009) tested acceptance when anticipating, during, and following a socially-evaluative threat-task. This study showed reduced HR in the acceptance condition relative to a suppression condition occurring across all three phases of the experiment, with the total duration of engagement in acceptance being 14 minutes, during which HR was measured. Both the Hofmann et al. and Low et al. studies showed that acceptance did not result in reduced arousal relative to another proposed adaptive conditions (i.e., reappraisal and factual recall) and showed no difference in reported affect from the other experimental conditions. Dunn et al., (2009) showed acceptance reducing electrodermal activity during engagement during a film clip (12.5 minutes in duration) relative to suppression and control condition, but no difference in reported affect. Thus, these three studies provide the support for acceptance on physiological measures relative to a maladaptive comparison condition in non-clinical samples.

In contrast to the aforementioned studies, if acceptance is engaged in for a short period of time in non-clinical samples, its benefits are demonstrated on self-report measures but not on physiological measures. Braam, Blechert, Boden, and Gross (2012) showed that acceptance did not lead to a reduction in arousal when the strategy was engaged in briefly (for a period of less than 2 minutes) during anticipation and receipt of a painful stimulus in comparison to suppression and control conditions. However, participants in the acceptance condition reported reduced affect relative to suppression. Hence, investigations of the effectiveness of acceptance in reducing negative affect show that the beneficial impacts of acceptance on arousal in studies involving non-clinical samples occur over a duration that is longer than 10 minutes, and benefits are usually relative to a maladaptive strategy. In contrast, acceptance reduces self-reported affect in non-clinical samples when acceptance is engaged in for shorter durations of approximately 2 minutes, despite no difference in physiological arousal emerging in this timeframe.

The effectiveness of acceptance among individuals meeting a clinical diagnosis also appears to be influenced by the time period over which it is engaged in and the affect measures employed. Campbell-Sills et al., (2006) demonstrated that acceptance reduced reported negative affect relative to suppression in combination with reduced HR during the exposure to a film clip for 4.5 minutes in a sample of participants meeting diagnostic criteria for an affective disorder. In contrast, Levitt et al. (2004) evaluated acceptance use during 15 minutes of engagement in a feared task (carbon dioxide challenge for panic disordered participants) and showed that the strategy led to reduced reported anxiety relative to suppression and control conditions, but no difference on physiological measures. In addition, those who engaged in acceptance expressed increased willingness (indicative of behavioural approach rather than withdrawal) to attempt the carbon dioxide challenge again relative to the other conditions. Hence, taking these findings together, the effects of time period of engagement on subjective and physiological measures of affect appear to be reversed when observing the impacts of acceptance on clinical samples relative to non-clinical samples. The reason for this is unclear. However, a limiting issue in making any conclusions regarding different results found between clinical and non-clinical samples is the possibility that different clinical populations may respond differently to affect and the affect eliciting situations in which acceptance is evaluated under.

2.2.10. For How Long are Distraction and Acceptance Predicted to show Beneficial Effects?

A pivotal question, if indeed distraction and acceptance can reduce anxiety in an anticipated threat situation, is for how long is each strategy effective? If a strategy is engaged in during anticipation of a threat, but then its engagement is disrupted when the individual encounters the threat and undertakes the threat-task, does the previous engagement in the strategy still influence affective reactivity to the threat? Furthermore, does a strategy engaged in during the anticipation of a threat influence affective repair once the threat has passed? Gross's modal model would predict that a strategy such as reappraisal (engaged in prior to encountering the threat) would start to demonstrate its beneficial effects once the situation had taken on the new, more benign meaning. Assuming that the predominant interpretation of the situation is the new, more benign interpretation of the threat, then benefits from this reappraisal would be predicted to continue when encountering the threat (i.e., reduced threat reactivity) and also during the recovery from the threat (i.e., more rapid affective repair).

Both the modal model and the process of a feeling model predict that engaging in distraction in an anticipated threat circumstance would have entirely different outcomes from reappraisal during the threat-task engagement and the recovery. According to the modal model, distraction may prevent an individual from having worrisome thoughts about the impending threat and temporarily reduce the experience of anxiety. However, when the threat is finally encountered, and cannot be ignored, it is likely that an individual previously using distraction during the anticipation of this threat would show increased reactivity and slower affective repair, relative to those that reappraised the threat. This likelihood is due to the lack of opportunity for that individual to prepare mentally or reappraise the event during its anticipation because of the load that distraction places on attention (Houston & Holmes, 1974; Kamphuis & Telch, 2000).

Results consistent with the predictions from the modal model regarding the latter detrimental effects of distraction relative to reappraisal were noted in claustrophobic individuals when initially introduced to a chamber of limited space (Kamphuis & Telch, 2000). Participants were given a strategy (distract only, reappraise only, combined distraction and reappraisal) before they entered the chamber and which they engaged in once entering it. Participants in the reappraisal conditions were asked to identify a threat related to entering the chamber and encouraged to reappraise this threat whilst in the chamber. The participants in the distraction conditions were asked to rehearse a set of digits whilst in the chamber. Individuals were asked to stay there as long as possible. The results showed that, following time spent in the chamber (i.e., the threat), participants who engaged in distraction showed significantly more elevated levels of fear in regards to returning into the chamber than those who only engaged in reappraisal of the threat associated with the chamber. Hence, both the modal model and previous research are consistent in suggesting that prior distraction in anticipated threat circumstances is likely to lead to increased affective reactivity and slower recovery when the threats are encountered, perhaps because it reduces the chance to interpret the threat in a more benign way (Houston & Holmes, 1974; Kamphuis & Telch, 2000).

In contrast to distraction, the modal model does not make clear predictions regarding the subsequent impacts of acceptance. It is unclear whether individuals would need to continually engage in acceptance whenever they encountered the same threatening situation rather than simply apply the same evaluation of the threat and affect used previously, as with reappraisal. However, the process of a feeling model predicts the effects of engaging in acceptance while anticipating a stressful event to be unambiguously beneficial, both during anticipation and subsequent to the strategy's engagement when evaluated during the undertaking and recovery from a threat-task. As acceptance involves the integration of affect and reasoned thought and the articulation of feelings related to the situation, the affect related to the situation should reduce when encountering and recovering from the threat.

No known study has tested the impacts of acceptance, engaged in only during the anticipation of threatening task, and then evaluated on its subsequent impacts to affective reactivity and recovery from that threat-task. However, Dunn et al., (2009) evaluated the subsequent impacts of acceptance on emotional stimuli unrelated to initial stimuli used to elicit an initial affective response to which participants regulated their responses. Participants first watched a film clip during which they engaged in regulation and acceptance was found to lead to reduced arousal during this period relative to a suppression and control condition. Participants were subsequently shown affect-eliciting pictures. These pictures were used as an assessment of processing of emotional stimuli following regulation. Prior engagement in acceptance was shown to lead to increased physiological reactions, indicated by deceleration of HR over 6 seconds (i.e., freeze response), for all emotion stimulus types (positive, sadness, fear, disgust and neutral) and increased reported negative affect at one week follow up relative to suppression. These results suggest that acceptance limits processing of affective stimuli subsequently encountered following the engagement of acceptance. However, it is unclear if the increased response to the subsequently presented affective stimuli was because these stimuli were unrelated to the initial affective material presented towards which participants were asked to use acceptance. It may have be that participants using acceptance would have subsequently shown less reactivity to affective stimuli if these stimuli were more directly related to the original affect-eliciting stimulus towards which they were originally asked to regulate their responses.

2.2.11. The Maladaptive Processes that Maintain Negative Affect: Worry, Rumination and Suppression

Maladaptive regulation strategies are mental processes that are proposed to unintentionally maintain and intensify negative affect (Borkovec, 1985; Borkovec et al., 2004; Pyszczynski & Greenberg, 1987; Wegner, 1994; Zebb & Beck, 1998). These maladaptive processes typically involve deliberately directing attentional focus towards the affect and internal and external affect-related stimuli in a way that identifies shortcomings of the individual and the individual's responses regarding the current situation (Borkovec et al., 2004; Borkovec, Robinson, Pruzinsky, & DePree, 1983; Pyszczynski & Greenberg, 1987; Wegner, 1994). These maladaptive strategies, despite increasing attention towards affect and towards the self, arise from the individual's motivation to avoid the experience of unpleasant affect.

When the maladaptive processes are conceptualised in terms of either the modal model (Gross & Thompson, 2007), the process of a feeling model (Greenberg & Paivio, 1997), or the action regulation theories (Carver & Scheier, 1988; Duval & Wicklund, 1972) increased affect is always the predicted outcome, although for somewhat different reasons. As it can be noted from Table 2.1, there is considerable overlap between these three maladaptive self-regulatory attempts, which has also been established empirically (S. Segerstrom, Tsao, Alden, & Craske, 2000; Wenzlaff & Luxton, 2003).

Three maladaptive strategies discussed extensively in relation to negative and anxious affect are worry, rumination, and suppression. Worry can be defined as an attempted problem solving process in which “the worry sequence seems to be initiated by a fear stimulus (that may be in the external environment and/or imagined) which elicits mental problem-solving activity designed to prevent the occurrence of traumatic future events and/or to devise coping strategies for such events”, (Borkovec, 1985; pp. 481-482). The coping strategies occur even when no behavioural coping option exists to thwart the event. With some similarities to worry, rumination is defined as “focusing passively and repetitively on one’s symptoms of distress and the meaning of those symptoms without being able to take action to correct the problems one identifies” (Nolen-Hoeksema, 1998; p. 216). Hence, both worry and rumination involve focusing on threats and feelings in attempt to problem solve to avoid the continued experience of unpleasant affect (Pyszczynski & Greenberg, 1987).

Worry and rumination are both perseverative processes, having the distinguishing feature of repetitive thought. They relate either to the reflection on and evaluation of past events, typical of rumination, or to predicting and focusing on possible ambiguous threats that may occur in the future, typical of worry (L. L. Martin & Tesser, 1996). The perseverative processes are often discussed together, as individuals often engage in both rather than one or the other (McLaughlin et al., 2007). Despite the co-occurrence of worry and rumination, the two attempts are distinct strategies (E. Watkins, Moulds, & Mackintosh, 2005). Importantly, both mental processes are different constructs and predict different types of negative affect (Bieling, Antony, & Swinson, 1998; Davey, Hampton, Farrell, & Davidson, 1992; Kelly, 2004; Treynor, Gonzalez, & Nolen-Hoeksema, 2003; Zebb & Beck, 1998). Worry is more predictive of anxiety symptoms, and rumination is more predictive of depressive symptoms (Hong, 2007; McLaughlin et al., 2007). However, both perseverative processes have also been shown to increase depressed mood (S. Segerstrom et al., 2000).

The third maladaptive process, suppression, is the active avoidance of and attempt to inhibit thoughts or feelings experienced internally or expressed externally, with attention directed towards the self, with the intention to dampen the phenomenological experience or inhibit the expressive action (Augustine & Hemenover, 2009; Wegner, Erber, & Zanakos, 1993). Suppression is a separate strategy from the perseverative processes (Kamholz et al., 2006). However, rumination is associated with increased suppression (E. R. Watkins, 2009; Wegner et al., 1993; Wenzlaff & Luxton, 2003) and, like the perseverative processes, suppression has been associated with anxiety and depression (Wegner et al., 1993; Wegner & Zankos, 1994). Hence, there is considerable overlap between the maladaptive strategies and negative affect with the engagement in maladaptive strategies co-occurring such that they facilitate each other.

2.2.12. Conceptualising the Maladaptive Strategies within the Affect Regulation Models and Action Regulation Theories

Gross and Thompson's model conceptualises the maladaptive strategies as occurring after an affective response has been generated and involving attention to the threats in the situation and the affective response, with the appraisal of the affective response as being negative. This combination of factors in the model is predicted to be especially counterproductive, focusing on the threats in the situation and the affective response and evaluating the response as unwanted and negative, only leading to a continued and intensified unpleasant affective response.

Greenberg and Paivio's model offers an alternative explanation of how the maladaptive strategies lead to the maintenance of negative affect. This explanation relates to the motivation behind the maladaptive strategies of avoiding the unpleasant experience of negative affect either through problem solving and evaluating symptoms (i.e., worry and rumination), which take attention away from the sensory experience of the affect, or simply through simply inhibiting the internal experience of it (i.e., suppression). These maladaptive strategies limit attention available for the observation of the sensory experience of feelings and limit integration between the feeling states and reason through expressive language. Hence, the process of a feeling model conceptualises the maladaptive regulatory attempts as disallowing integration of the emotion with the self, thereby preventing an alternative affective state from being experienced.

The action regulation theories of Carver and Scheier and Duval and Wicklund have been specifically applied to the perseverative processes of worry and rumination (Carver & Scheier, 1988; Pyszczynski & Greenberg, 1987). Both theories propose that individuals continually focus attention on the situation and the shortcomings of the self in being unable to take overt action to resolve the discrepancy between the actual state and an ideal state. Carver and Scheier’s control process perspective has also been specifically applied to suppression (Wegner, 1994). It is suggested by Wegner (1994) that individuals self-focus attention with the motivation to detect the presence of an internal event, thought or feeling, with the objective of inhibiting and stifling its presence. However, in order for the search process to detect the unwanted phenomenon, the individual must hold in mind the very unwanted internal experience sought to be eradicated, which inevitably leads to the increased and sustained presence of the unwanted internal events.[e]

2.2.13. Research on the Maladaptive Strategies

The three maladaptive strategies of worry, rumination and suppression as regulatory responses to situations and subsequent affect as conceptualised within both the models of affect regulation (sections 2.2.1. and 2.2.2) are predicted to intensify and

[e]Wells (2009) suggested that such maladaptive regulatory attempts indicate that an individual is not aware of their own thought process and, therefore, could be construed as lacking self-awareness.

prolong unpleasant affect. Due to the various ways in which the strategies focus attention on, yet attempt to avoid the experience of the affect leads to the predictions of increased unpleasant affect. These predictions regarding the perseverative processes are well supported across all research designs investigating the strategies on both self-report and physiological variables. However, unlike the perseverative processes, suppression has not shown the same consistency across research designs and between self-report and physiological measures.

Cross-sectional research investigating individual differences in maladaptive self-regulatory attempts has shown evidence in support of the above predictions, in that worry, rumination and suppression have been shown to be associated with increased naturally occurring negative affect (Borkovec et al., 2004; Hong, 2007; Meyer, Miller, Metzger, & Borkovec, 1990; Nolen-Hoeksema & Morrow, 1991; Roemer, Salter, Raffa, & Orsillo, 2005; Salters-Peneault, Suvak, & Roemer, 2008; S. Segerstrom et al., 2000; Treynor et al., 2003; Wegner et al., 1993). In addition, quasi-experimental studies of individuals with pre-existing tendencies to use maladaptive regulation attempts (including the use of suppression) show that these strategies prolong and intensify affective experiences as measured via self-report and HR when an affective state is experimentally induced (Egloff, Schmukle, Burns, & Schwerdtfeger, 2006; Gross & Levenson, 1993; Morrow & Nolen-Hoeksema, 1990; Trask & Sigmon, 1999; B. Verkuil et al., 2009).

In contrast to studies investigating pre-existing differences, studies using experimental manipulations of the maladaptive regulatory attempts have shown that suppression does not lead to consistent results across affective measures, whilst worry and rumination do. The experimental manipulation of the perseverative processes has been demonstrated to consistently increase the self-report and physiological measures of affect (Blagden & Craske, 1996; Dua & King, 1987; Hofmann et al., 2005; Morrow & Nolen-

Hoeksema, 1990; Trask & Sigmon, 1999; B. Verkuil, Brosschot, Borkovec, & Thayer, 2009; Wong & Moulds, 2009). Experimentally manipulated rumination often results in increased and prolonged self-reported negative affect following the anxious affect induction (Blagden & Craske, 1996; Wong & Moulds, 2009) and induced worry increases levels of self-reported distress (Hofmann et al., 2005). Increased HR is often noted in experimentally induced state worry relative to periods of rest or relaxation (Davis, Montgomery, & Wilson, 2002; Hofmann et al., 2005).

In contrast to the perseverative processes, experimentally manipulated suppression in non-clinical samples can lead to rather inconsistent effects on anxious affect, which vary between self-report measures and physiological measures. Increased affect is often shown on physiological measures but not reflected on self-reports (Dunn et al., 2009; Gross & Levenson, 1997 ; Hofmann et al., 2009; Richards & Gross, 2000). Johns et al. (2008) found no difference in reported affect between suppression and a reappraisal condition. However, Hofmann et al. (2009) showed that suppression led to significantly increased reported anxious affect when compared to reappraisal, despite having a very similar method to Johns et al., (2008). Interestingly, Hofmann et al. (2009) showed that instructed suppression resulted in no difference from instructed acceptance in levels of anxiety reported, but the two conditions were found to differ significantly in HR changes, with acceptance showing lower HR than suppression. Dunn et al. (2009) demonstrated that suppression led to increased arousal (as demonstrated by increased galvanic skin conductivity relative to acceptance during engagement), but no difference on self-reported affect during this period. Hence, suppression is sometimes associated with a divergence of reported affect from physiological arousal, possibly because of self-report measures being influenced by participant demand characteristics or self-presentation concerns in non-clinical samples. This explanation is likely because participants high in social desirability/defensiveness who also report unusually low anxiety levels, suggested to be unconsciously using suppression (i.e., repression), also show a disconnect between self-report and physiological measures of anxiety, reporting decreased affect but demonstrating increased physiological arousal (Asendorpf & Scherer, 1983; Derakshan & Eysenck, 2001a).

2.2.14. An Alternative Mechanism Through Which The Adaptive Strategies may Alter Affect

Despite the difference between distraction and acceptance in regards to attentional focus, it is possible that they may both achieve reductions in unpleasant affect through the same mechanism: minimising the attentional capacity available to engage in maladaptive regulatory strategies. This argument is based on the premise that engaging in a particular cognitive regulation strategy reduces the attentional resources available to support other processes. Evidence has suggested that maladaptive processes are likely to demand online attentional capacity (S. Hayes, Hirsch, & Mathews, 2008; Rapee, 1993; Richards & Gross, 2000), and adaptive strategies also require these same online attention resources (Houston & Holmes, 1974). Therefore, engaging in a strategy that allocates attentional focus to different stimuli from those focal to the maladaptive processes is likely to consume attentional capacity and reduce the level of engagement in these maladaptive regulatory attempts. In addition, engaging in a strategy that involves evaluating affect in a non-habitual way is also likely to consume attentional capacity and thus restrict engagement in maladaptive regulatory attempts.

Distraction has been proposed to operate by focusing attention away from the self and towards task-related stimuli, thereby restricting the capacity available for engaging in perseverative thought (Nolen-Hoeksema, 1998, 2000; Van Dillen & Koole, 2007). Acceptance has been proposed to limit any engagement in strategies that seek to avoid the experience or limit the expression of affect, including the perseverative processes (S. C. Hayes, 2004b), but particularly suppression (Hofmann & Asmundson, 2008) by encouraging increased attention to affect in an experiential, non-judgemental way rather than an inhibitive way. Hence, distraction and acceptance have been recommended within different therapeutic approaches to limit and replace the maladaptive processes that maintain and intensify negative affect (S. C. Hayes, 2004a; S. C. Hayes, Luoma, Bond, Masuda, & Lillis, 2006; Lyubomirsky & Nolen-Hoeksema, 1993; Nolen-Hoeksema, 1991; Orsillo & Roemer, 2005; Roemer & Orsillo, 2009). This consumption of online attentional capacity by adaptive strategies restricting use of maladaptive regulatory strategies provides an alternative avenue for distraction and acceptance to regulate affect that differs from changing the focus of attention. This alternative avenue for regulation is compatible with altered attentional focus, and thus each of these avenues for affect regulation may operate simultaneously.

2. 2. 15. Endogenous and Exogenous Control of Attention: Regulating in the Presence of Sustained Threats

Both distraction and acceptance by definition should involve controlling attentional focus towards particular content. However, threatening circumstances, stimuli and affect have been demonstrated to influence attentional focus too (Bar-Haim et al., 2007; Cornwell et al., 2011; Derryberry & Reed, 2002; Ellenbogen, Schwartzman, Stewart, & Walker, 2002; Eysenck et al., 2007; Koster, Crombez, Verscheuer, Van Damme, & Wierseman, 2006; MacLeod et al., 1986; Wilson & MacLeod, 2003)[f]. This section discusses these circumstantial and affective factors that may influence how effectively distraction and acceptance can be engaged, and their potential to lead to unintended affective consequences in some situation and not others.

[f] Anxiety's impact on attentional control will be discussed in section 2.3.7.

Threatening stimuli have been demonstrated to engage attentional focus over short durations (100-250ms), perhaps indicating the existence of a reflexive response that has evolved for survival purposes (Derryberry & Reed, 2002; Koster et al., 2006). However, when threat-stimuli are present for longer durations (≥500ms), the initial engagement of attention is replaced by attentional diversion (Derryberry & Reed, 2002; Ellenbogen et al., 2002; MacLeod et al., 1986), a process that is likely to be effortful and to require significant cognitive control (Cornwell et al., 2011; Knight et al., 2007; Mather & Knight, 2005; Mogg & Bradley, 1998), be difficult to maintain, but function to minimise unpleasant affect (Carver & Scheier, 1988; Duval & Wicklund, 1972; Mogg & Bradley, 1998). In addition, it has been suggested that stimuli of lower threat have less of an attentional engagement influence (Wilson & MacLeod, 2003) and/or are more easily ignored than stimuli of higher threat (Mackintosh & Mathews, 2003), and hence attempts at attentional diversion from these stimuli may require less controlled processing.

The extent to which threat influences attentional focus has important implications, particularly for distraction as this strategy requires individuals to actively direct their attention away from threat-related information. The higher the threat, the more difficult individuals find it to intentionally override the automatic tendency to focus on the threat (Inzlicht, McKay, & Aronson, 2006; Schmader & Johns, 2003). Hence, it may be that distraction is less effective in diverting attention from threat and, thus, in reducing affect in high-threat circumstances because of the greater difficulty of controlling attention in such high threat and affective circumstances. Thus distraction may be more effective in reducing affect in less threatening circumstances where it is easier to direct attention away from the threats (Wilson & MacLeod, 2003). In contrast to distraction, engaging in acceptance encourages attention to threat-related thoughts and feelings. Focusing on such internal stimuli may be facilitated by high-threat circumstances, where more threat-salient thoughts and more intense feelings are present and likely to capture attention relative to low-threat situations. In circumstances with limited threat, however, more effort may be required to direct attention to inner thoughts and feelings (Carver & Scheier, 1988; Duval & Wicklund, 1972) thus making the strategy more difficult to engage in such circumstances and perhaps less effective in reducing or maintaining low levels of negative affect.

Individuals have been demonstrated to engage in automatic or spontaneous[g] attempts to regulate affect (Ellenbogen et al., 2002; Johns et al., 2008). Both the control processes perspective on anxiety (Carver & Scheier, 1988) and objective self-awareness theory (Duval & Wicklund, 1972) predict that individuals will self-initiate distracting thoughts to minimise attention to threat-stimuli. However, both theories also predict, consistent with evidence regarding an overriding tendency for attention to engage with threats when anxious (Bar-Haim et al., 2007), that this self-initiated distraction and the inhibition of attention towards threats is difficult to maintain, especially if the threats are continually present within the physical environment, resulting in re-engagement of attention to threat information and elevation of affect. Hence, it is likely that in situations that involve the sustained presence of threats, two competing attentional processes are

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[g]The terminology associated with regulatory attempts that have been initiated by an individual without experimental imposition has not been well defined within literature discussing affect regulation. Some researchers will use the term “automatic” to describe spontaneously initiated affect regulation (e.g., Mauss et al., 2007). In cognitive articles, automatic process are considered to be effortless, requiring little attentional focus and carried out with minimal error (Schneider & Shiffrin, 1977). However, the functions of some regulatory strategies, that are automatically initiated, consume attention, and/or require the monitoring of and inhibiting of prepotent affective responses. Despite being automatically initiated, such regulatory acts are indeed effortful and completely inconsistent with a strict cognitive definition of an automatic process. Hence, just because a regulation strategy has been automatically or spontaneously initiated, does not mean that actively engaging in that regulation strategy and the cognitive processes supporting that strategy are not forms of controlled responding. As a result the term “spontaneous” rather than “automatic” is used in this thesis to describe self-initiated attempts to cope with a threat/stressor (Egloff et al., 2006).

occurring: the first being the reflexive engagement of attention with threatening information when anxious (Bar-Haim et al., 2007) and the second being a controlled regulatory attempt to reduce unpleasant affect by inhibiting attention to threatening information (Johns et al., 2008), perhaps through a process of active ignoring (Derryberry & Reed, 2002; Ellenbogen et al., 2002; Koster et al., 2006) or self-distraction (Carver & Scheier, 1988; Duval & Wicklund, 1972).

2. 2.16. Unintended Consequences of Affect Regulation

Several previous sections (e.g., 2.2. 3, 5, 6, 8, and 9) have suggested that, despite both distraction and acceptance being therapeutically recommended, there may be circumstances in which the strategies may actually have unintended negative consequences. The arguments presented include distraction reducing attentional capacity to engage in situation reappraisal (Houston & Holmes, 1974; Kamphuis & Telch, 2000), and difficulties in directing attention away from threats when anxious (Bar-Haim et al., 2007; Wilson & MacLeod, 2003). Additional accounts also provide potential explanations for why distraction and acceptance may have negative unintended consequences in regards to experiencing negative affect.

The first relates to Wegner's (1994) theoretical account, which also predicts that engaging in effective distraction may be difficult in high-threat circumstances because the strategy is one requiring mental control. Wegner (1994) would conceptualise distraction as an effortful process that requires the individual to maintain an attentional load. It has been demonstrated that engaging in a mental control task either requiring the inhibition of unwanted thoughts or feelings or maintenance of a mental load, when already attempting to alter an affective state, ironically leads to the increased presence of the internal phenomenon sought to be avoided (Wegner, 1994; Wegner et al., 1993). Hence, individuals already engaged in effortful processes seeking to avoid unpleasant affect who then engage in a task with an attentional load demanding a participant’s concentration may suffer increases in these unwanted thoughts or feelings that may have otherwise been successfully avoided (Cornwell et al., 2011; Knight et al., 2007; Mather & Knight, 2005; Wegner et al., 1993)[h]. For example, Conwell et al. (2011) demonstrated that engaging in a distracting task impaired spontaneously initiated, effective attentional inhibitory processes that reduced the experience of affect in another condition where no distraction task was used. Hence, distraction may be a double-edged sword, reducing capacity available for adaptive regulatory strategies as well as maladaptive strategies and potentially leading to increased rather than reduced affect and threat-related thoughts in threatening situations.

Like distraction, acceptance may also have unintended consequences. Acceptance involves directing attention towards the self. This self-focused attention may lead to negative evaluations of the self and is likely to increase negative affect, even if little affect is present to begin with (Duval & Wicklund, 1972; Wicklund, 1975). In addition, attention may not be captured and/or held to any great degree by stimuli of lower threat value, and thus are more easily ignored (Wilson & MacLeod, 2003). Engaging in a strategy to focus attention on stimuli that would usually be ignored is likely, at least initially, to be difficult and effortful and affect arousing. Hence, like distraction, acceptance may also have unintended negative consequences.

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[h] Wegner (1994) outlines many situations that may induce ironic effects. Such situations include when one wants to regulate thought or attention in combination with maintaining an imposed attentional load. The argument falls back to Wegner’s assertion that when an individual monitors for the absence of a particular target (e.g., unpleasant thoughts), this search process inevitably activates the very thoughts sought be avoided. If the operate component (see Figure 2.2 in section 2.1.4 aimed at reducing this internal event is impaired due to it being consumed in an alternative control action, such as maintaining an attentional load, the monitoring process (which requires less processing resources) increases the very internal events sought to be avoided.

2.2.17. Summary of Affect Regulation Theory, Strategy and Research

There are two competing views of effective affect regulation. The first view consists of Gross and Thompson's modal model, and the action regulation theories, including the control process perspective and the objective self-awareness perspectives that predict that limiting attention to affect and affect- or threat-related thought will reduce the experience of affect (Carver & Scheier, 1988; Duval & Wicklund, 1972; Gross & Thompson, 2007). The second view, represented by Greenberg and Paivio's (1997) process of a feeling model, is that effective reductions in negative affect are best achieved through increasing attention towards the affective experience. Both adaptive and maladaptive strategies can be conceptualised within each of these models in terms of how they impact on attention, and the intended function of the strategy either to avoid or to experience affect. The proposed adaptive strategies of distraction and acceptance, when placed within the different models, are predicted to lead to different affective outcomes during engagement in the strategies. Distraction involves limiting attention towards affect and towards the self, with the motivation to avoid the affective experience. Acceptance is the reverse combination of the attentional and motivational elements, involving the focus of attention on affect and towards the self with the motivation to immerse oneself fully in the sensory experience of that affect. Hence, the strategies provide a method by which to test the predictions of theories regarding the effects of attentional focus and motivational intent to experience or avoid affect on affect both during and following strategy engagement. An alternative mechanism by which distraction and acceptance may reduce affect is simply restricting attentional capacity available to engage in maladaptive regulatory attempts that may otherwise sustain and intensify negative affect. However, despite the suggested therapeutic benefit of distraction and acceptance, it may be that altering attentional focus effectively is excessively difficult under some circumstances but not others, limiting the utility of the strategies in reducing affect across different circumstances. In addition, altering attentional focus may also have unintended consequences if it disrupts effective and spontaneously initiated regulatory attempts, thereby limiting the extent to which a strategy can be considered useful. However, the influence a strategy has on affect is not the only factor determining how useful that strategy could be.

2.3. The Influence of Affect Regulation on Executive Control

Numerous studies have demonstrated that prior attempts at self-regulation (i.e., the control of attention, thought, affect or behaviour) aimed at altering the experience in one domain (i.e., affect, thought or behaviour), can impair subsequent self-regulatory acts in another domain (Hagger et al., 2010; Muraven & Baumeister, 2000). This section discusses how cognitive affect regulation may temporarily impact on an individual's subsequent capacity to control their attention, thought and behaviour. Three mechanisms are proposed through which affect regulation could have such impacts on later acts of self-control in the cognitive and/or behavioural domains, including an internal resource explanation (Muraven & Baumeister, 2000), an affective explanation of impaired attentional control and capacity (Eysenck & Calvo, 1992a; Eysenck et al., 2007), and a neurological account of sustained vagal inhibition of arousal supporting activation within the prefrontal cortex (Thayer, Hansen, Saus-Rose, & Johnsen, 2009; Thayer & Lane, 2000). However, first a discussion of self-regulation in the cognitive and behavioural domains is presented in relation to the concept of executive functioning. This is followed by a discussion of the three accounts of why previous affect regulatory attempts may impair subsequent attempts at demonstrated control of attention, thought and action.

2.3.1. Executive Functioning

The term “executive functioning” stems from Baddeley’s (1986) highly influential component model of working memory. Baddeley’s original model comprised the central executive and two slave systems (the visuospatial sketchpad and the phonological loop). However, Baddeley did not originally specify the functions in which the central executive was involved, other than in working memory. Later, Baddeley’s (1996) account relied heavily upon Norman and Shallice’s (1986) Supervisory Attention System (SAS) from their theory of control of action and thought selection in defining the functions in which the central executive was involved. Hence, the best way to define executive functioning is through the proposed operations of the SAS.

Shallice, Burgess, Schon and Baxter’s (1989) model of thought and action control involved more components than the SAS to explain controlled behaviour. Such components included schemes (i.e., program-like entities for each qualitatively distinct, well-learned action or thought operation) and contention scheduling (i.e., routine scheduling of schemes). Hence, schemes and contention scheduling epitomise what others have conceptualised as automatic processes, which are considered effortless and require few attentional resources (Schneider & Shiffrin, 1977). When particular schemes or routine scheduling of such schemes is not suitable for the situation, the SAS was proposed to intervene in contention scheduling in order to produce more suitable actions adapted specifically for the situation. Therefore, the SAS was proposed to coordinate appropriate courses of action in novel situations via the modulation of contention-scheduling and by activating or inhibiting particular schemes to create a unique sequence or combination of operating schemes. Hence, the mental acts requiring the use of the SAS are novel or complex acts requiring concurrent attentional resources (Schneider & Shiffrin, 1977) and controlled processes (Carver, 1979; Carver & Scheier, 1982). Such mental functions suggested to require the SAS include planning, decision-making, error detection and correction, generating novel sequences of actions, operations of technical difficulty and overcoming of strong habitual responses (Shallice & Burgess, 1993).

Essentially, these functions that the SAS performed proposed by Norman and Shallice (1986) were suggested to be relevant to Baddeley's central executive component of his working memory model. Thus, planning, decision-making, error detection and correction, novel sequences of actions, operations of technical difficulty and overcoming of strong habitual responses have now become "executive functions". Like the operations of the SAS, executive functions are "top-down" in nature and are characterised as requiring the control of attention to modify thoughts and actions (A. Baddeley, 1996; Norman & Shallice, 1986; Shallice & Burgess, 1993).

At a psychometric level, executive functioning has been simplified into three primary processes that may be used simultaneously or in sequence for the engagement in the more complex sequential functions such as planning or decision making (Miyake et al., 2000). The first of these is the ability to inhibit and override automatic responses. The *inhibition of prepotent responses is* defined as: *"*the ability to deliberately inhibit dominant, automatic, or prepotent responses when necessary" (Miyake et al., 2000; pp. 57-58).

The second executive function is that of *updating and monitoring of working memory representations*. It can be described as:

"coding incoming information for relevance to the task at hand and then appropriately revising the items held in working memory by replacing old, no longer relevant information with newer, more relevant information. ..Importantly, this updating function goes beyond the simple maintenance of task-relevant information in its requirement" (Miyake et al., 2000; p. 57).

The third basic executive function is a shifting function, which involves shifting attention back and forth between multiple tasks or operations sometimes called “attention switching” where the shifting is driven internally rather than through prompts or distractors.

2.3.2. Self-Regulation and Executive Control

Like executive functioning, self-regulation or self-control can be defined as one’s own modification of automatic thoughts, feelings and behaviours (Muraven & Baumeister, 2000). Thus, self-control involves successfully inhibiting harmful behaviours that may undermine that person’s long-term best interests. Muraven and Baumeister (2000), like others discussing executive functioning (Norman & Shallice, 1986; Schneider & Shiffrin, 1977; Shallice & Burgess, 1993; Shallice, Burgess, Schon, & Baxter, 1989) discuss self-control in the context of the distinction between automatic and controlled processes. Automatic processes are efficient and rigid, requiring limited self-focus of attention. In contrast, controlled processes are costly of online attentional resources but allow for flexible responses tailored to suit specific demands of a novel situation (Schneider & Shiffrin, 1977).

Muraven and Baumeister also implicate control processes (described in section 2.1.4) within their conceptualisation of self-regulation. Control processes can be described as conscious mental processes including the control of attention, the active engagement of corrective action and the evaluation of that corrective action required in the regulation of thought and action (Carver, 1979; Carver & Scheier, 1982; Miller, Galanter, & Pribram, 1960). Control process models have been proposed to underlie successful self-control (Carver, 1979; Carver & Scheier, 1982; Carver et al., 1989). Muraven and Baumeister (2000) identify the operate phase (see Figure 2.2) within the sequence as of particular relevance to self-control. The reason for identifying the operate phase as particularly important is that it symbolises the process of reducing a discrepancy between actual behaviour and a desired behaviour and is argued therefore to represent the act of exercising self-control. This operate component cannot only be represented by action but also be represented as inhibiting pre-existing patterns of responses to develop alternative responses.

Notably, there is much consistency between the operations of Norman and Shallice's (1986) SAS, the definition of self-control provided by Muraven and Baumeister (2000) and the engagement of control processes as described by Carver and Scheier (1979; 1982). A key difference in the terminology usage is that the term executive functioning is discussed in reference to neuropsychological studies of individuals with frontal lobe damage (Miyake et al., 2000; Shallice & Burgess, 1993; Shallice et al., 1989), whilst self-control is more often discussed in relation to objective self-awareness (Carver, 1979) and control process theory (Carver & Scheier, 1982) and the experience of affect and engagement in goal-driven behaviour. Schmeichel (2007) brings these highly related constructs of executive functioning and self-control/regulation, together under the term "executive control".

2.3.3. Self-Focus of Attention, and the Subsequent Impacts on Executive Control and the Experience of Affect

Vital in the control process framework is the self-focus of attention. It has been suggested that self-focused attention is vital in regulating actions (Carver, 1979; Carver & Scheier, 1982). In ego-threatening circumstances, increased self-focused attention has been suggested to facilitate mental performance during task engagement (McDonald, 1980; Pulus, Annis, & Risner, 1978) and to lead to superior self-control (Heatherton, Polivy, Herman, & Baumeister, 1993). Hence, self-focusing attention is required in acts of self-control (Carver, 1979; Carver & Scheier, 1982; Duval & Wicklund, 1972; Wicklund, 1975).

However, many studies have demonstrated that previous acts of self-control diminish the ability to perform subsequent acts of self-control (Hagger et al., 2010; Muraven & Baumeister, 2000). This is the focus of the following section, outlining the theory of, and previous research on, the impacts of prior attempts at self-control on subsequent acts requiring self-control.

2.3.4. Depleting Executive Resources: A Theory of Self-Regulatory Strength

Prior regulation in one response domain having a detrimental impact on a subsequent task requiring self-control in another response domain has been demonstrated by many studies (Hagger et al., 2010; Muraven & Baumeister, 2000). Some have measured impacts of spontaneously initiated attempts at coping with situational stressors and threats on the subsequent ability to demonstrated executive control. Such stressors and threats have included: noise (Hartley, 1973), stereotype threat (Inzlicht et al., 2006; Schmader & Johns, 2003), physical threat (Heatherton, Herman, & Polivy, 1991), and social-evaluative threat (Heatherton et al., 1993). Prior control of attention and thought has been manipulated by initial experimental tasks requiring executive control, including the control of attention and thought in affect regulation, and has been shown to reduce performance on subsequent executive control tasks (Schmeichel, 2007; Schmeichel, Vohs, & Baumeister, 2003). Furthermore, a number of studies have demonstrated that prior attempts to regulate can impact on executive control as indicated by behaviours that relate directly to clinical disorders, including overeating (Heatherton et al., 1991; Heatherton et al., 1993), alcohol use (Muraven, Collins, & Nienhaus, 2002; Muraven, Collins, Shiffman, & Paty, 2005), sexual behaviour (Gailliot & Baumeister, 2007) and aggression (DeWall, Baumeister, Stillman, & Gailliot, 2007; Stucke & Baumeister, 2006).

A theory of limited resources—akin to notions of available strength or energy - has been proposed to explain the negative impacts of prior self-control on attempts at subsequent controlled responding (Baumeister, Muraven, & Tice, 2000; Muraven & Baumeister, 2000). The terms “self-regulatory resources” (Muraven & Baumeister, 2000) or “executive resources” (Schmeichel, 2007) are defined as the finite reserves of energy that are required to carry out self-regulatory acts requiring abilities associated with executive functioning, such as inhibiting prepotent (i.e., strong habitual) responses. These executive resources[i] are considered a finite internal reserve that is depleted following acts of self-control[j]. Depletion of these resources has sometimes been indicated via participant reports of increased mental effort being expended during regulation (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Muraven, Tice, & Baumeister, 1998; Schmeichel, 2007; Schmeichel, Demaree, Robinson, & Pu, 2006), but primarily in combination with individuals showing reduced capacity to demonstrate controlled responding (Hagger et al., 2010; Muraven & Baumeister, 2000). Controlling attention, inhibiting behavioural responses, and coping with exposure to threats and stressors have all been identified as depleting reserves of executive resources (Johns et al., 2008; Muraven & Baumeister, 2000; Schmader & Johns, 2003).

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[i]The term executive resources will be used from now onwards due to the acknowledgement by Muraven and Baumeister (2000) that executive capacity is what appears to be temporarily impacted.

[j]Muraven and Slessareva, (2003) and Vohs, Baumeister and Schmeichel (2012) suggest that resource depletion occurs for two reasons: (1) because participants are unable to muster the resources to perform due to exhaustion and fatigue and (2) because participants may be motivated to preserve the limited resources they have remaining on a more meaningful or reinforcing task that follows the experiment.

A physiological explanation has been offered for the executive resource depletion observed after acts of self-control[k]. Specifically, the brain has a high usage of glucose during tasks that are particularly mentally demanding and likely to involve executive functioning/control (Benton, Owens, & Parker, 1994; Gailliot et al., 2007; Scholey, Harper, & Kennedy, 2001). Following this initial self-control, blood glucose levels remain temporarily lower than before undertaking self-control. Consequently, available glucose may no longer be sufficient to supply the energetical requirements for effective self-control, leading to temporary executive control impairments. Gailliot et al. (2007) demonstrated that prior self-regulation led to decreased blood glucose levels, and that decreased blood glucose levels after the first self-control task predicted reduced performance on the second self-control task. Furthermore, Gaillot et al. also demonstrated that providing a glucose-rich drink reversed the depleting effects of prior self-control. Thus, these findings support the causal role of blood glucose in reduced executive resources.

Like other acts of self-control in thought and behavioural domains, particular forms of affect regulation have also been shown to temporarily impair executive control in the form of prepotent response inhibition (Johns et al., 2008; Sheppes & Meiran, 2008) and working memory (Schmader et al., 2009; Schmeichel, 2007). Studies demonstrating these effects all involved non-clinical student samples who initially engaged in an affect regulation strategy (based on experimentally provided regulation instructions), involving altering attention, thought or behavioural responses related to affect, followed by a second

[k] Inzlicht and Schmeichel (2012) have proposed a mechanistic account of the self-regulatory strength (or depletion) model. This mechanistic account, although intriguing, does not directly relate to the concepts tested in this thesis. In addition, has somewhat restricted in explanatory power as indicated by the results of Muraven and Slessareva, (2003) and Vohs, Baumeister and Schmeichel (2012).

task involving self-control in a suggested[I] alternative domain (i.e., cognitive/attentional and/or behavioural response). Prior affect regulation has been shown to diminish performance on tasks measuring global executive control such as reasoning and decision making (Schmader et al., 2009; Schmeichel et al., 2003), fluency or set shifting (Schmeichel et al., 2006), and restraining impulsive behaviours such as eating unhealthy foods in dieters (Heatherton et al., 1993; K. D. Vohs & Heatherton, 2000). Regulating emotions has also been shown to reduce physical stamina (e.g., sustained hand grip) and sustained mental effort (e.g., on unsolvable anagrams) (Baumeister et al., 1998; Muraven et al., 1998). Hence, these studies consistently indicate that affect regulation (akin to other forms of regulation) can deplete executive resources and impair subsequent acts of self-control.

2.3.5. Why Increased Threat Depletes Executive Resources: The Spontaneous Initiation of Control Processes

Like prior acts of self-regulation, the mere presence of threats and stressors has been demonstrated to lead to impaired executive control represented in prepotent response inhibition (Inzlicht et al., 2006) and working memory (Croizet et al., 2004; Schmader & Johns, 2003) tasks. Furthermore, threats have also led to a loss of self-control on a wide range or restrained behaviours including dietary restraint and alcohol consumption (Heatherton et al., 1991; Muraven et al., 2002; Muraven et al., 2005; Wallis & Hetherington, 2004) and aggression (DeWall et al., 2007). Muraven and Baumeister (2000) argue that individuals, when exposed to threats and stressors, spontaneously initiate monitoring and inhibitory responses such as blocking painful thoughts or feelings from

[I] Although affect regulation could be considered to belong in the response domain of emotion, affect regulation strategies can also be conceptualised as simply controlling attention and/or inhibiting and altering behavioural responses, the impacts of such affect regulation strategies are consistent with other self-regulatory acts that involve controlling or inhibiting attention to distracting stimuli or unwanted thoughts leading to similar impairments on tasks requiring executive control (Baumeister et al., 1998; Schmeichel, 2007; Schmeichel et al., 2003).

rising to awareness either through self-distraction (Heatherton et al., 1993) or suppression (Johns et al., 2008) and this regulation of attention uses executive resources. Thus, even though these acts of self-regulation may be *initiated* spontaneously, their engagement may reduce the executive resources available for subsequent acts of self-controlled responding in the same way as imposed regulation (Heatherton et al., 1993; Johns et al., 2008; Muraven & Baumeister, 2000).

2.3.6. Executive Resource Depletion and Controlling Attention: The Importance of Situational Circumstances

The previous two sections discussed the impacts of prior self-control on subsequent control attempts, and the impacts of increased threat on acts of self-control. The extent to which affect regulation depletes executive resources may be influenced by the situational circumstances in which that particular affect regulation strategy is engaged. Studies investigating distraction have demonstrated that if the strategy is engaged during anticipation of a task eliciting unpleasant affect, it depletes executive resources (Alberts, Martijn, Nievelstein, Jansen, & De Vries, 2008; Heatherton et al., 1993), however, distraction does not deplete resources when it is engaged in simultaneously with engaging in the affect-eliciting task (Alberts et al., 2008; Sheppes & Meiran, 2008). Similarly, the extent to which the strategy of reappraisal depletes executive resources has been shown to depend on the circumstances in which it is engaged. If used prior to the exposure to an affect-eliciting stimulus, the strategy preserves executive resources (Johns et al., 2008), but if initiated during an affect-inducing task or exposure to an affect-producing stimulus, the strategy can deplete executive resources (Sheppes & Meiran, 2008).

No published studies, to the author's knowledge, have assessed the impacts of acceptance on subsequent executive control. However, studies investigating increased self-awareness (Heatherton et al., 1993) and meta-cognitive awareness (Schmader et al., 2009) and sensation focus (Alberts et al., 2008), concepts that involve similar attentional foci and thought processes, have been demonstrated to influence subsequent executive control. Importantly, these studies, when taken together, demonstrate that the situational circumstances in which these strategies that increase awareness of thoughts, feelings and behaviour and perhaps the experience of affect are undertaken, influence subsequent executive control. Heatherton et al. (1993) showed that, in high-threat circumstances, increased self-awareness preserved capacity to demonstrate self-control on a dietary restraint task relative to conditions that reduced self-awareness. In addition, Schmader (2009) showed that participants who were part of a minority group, when in stereotype threat situations, demonstrate superior executive control when bringing attention to and altering their interpretation of their affective responses compared to other minority group participants who did not. In contrast, Alberts et al., (2008) showed that concurrent engagement in a painful task whilst focusing attention on muscular sensations resulted in poorer persistence on this painful task than concurrent distraction, but no difference from a prior distraction condition. Hence, these studies support the suggestion that the impacts of acceptance may have different impacts on executive control depending upon the situation in which it is engaged.

Why affect regulation strategies may deplete executive resources in some circumstances and preserve them in others may relate to the difference in reflexive attentional and/or interpretive responses occurring in these different circumstances. When anxious, individuals show attention towards threatening stimuli, proportional to their threat value (Bar-Haim et al., 2007). Hence, strategies (spontaneously initiated or experimentally manipulated) that seek to inhibit these reflexive attentional responses have been suggested to require significant levels of controlled processes and online attentional resources (Cornwell et al., 2011; Knight et al., 2007; Mather & Knight, 2005) and, therefore, are more likely to deplete executive resources. However, if stimuli are not of high-threat value or not present to elicit reflexive attentional engagement, and are thus easier to ignore (MacLeod et al., 1986; Wilson & MacLeod, 2003), the level of inhibition required to prevent attention to them would be minimal. Similarly, if an individual is familiar with a particular stimulus and is comfortable with the affect it elicits, there is limited sustained attentional engagement with it. Therefore, it may be effortful to attend to this familiar stimulus, depleting executive resources in the same way that merely controlling attention would (Schmeichel, 2007; Schmeichel et al., 2003), in comparison to letting attention drift. Hence, it is possible that the reason affect regulation has different impacts on subsequent executive control in different situations relates to the extent to which the regulation strategy must inhibit reflexive or over-learned responses elicited by that particular situation.

2.3.7. Effects of Anxious Affect on Executive Control

Self-regulatory strength theory recognises that some situations that involve self-control, or indeed the act of engaging in self-control, coincide with increased affect. However, self-regulatory strength theory specifically states that it is the resource depleting nature of the previous self-control attempts, not the increased affective state, which causes impaired executive control. However, other studies have suggested increased anxious affect, rather than attempts to regulate, leads to impairments in executive control (Derakshan, Smyth, & Eysenck, 2009; Eysenck, 1985; Lavric, Rippon, & Gray, 2003; MacLeod & Donnellan, 1993; Shackman et al., 2006; Sorg & Whitney, 1992; Tohill & Holyoak, 2000).

Theories suggesting how negative affect can impair executive control are prolific. Easterbrook (1959) suggested that increased arousal narrows attentional focus and, therefore, task-relevant stimuli that may be peripheral fall outside this focus, thus diminishing performance. Hasher and Zacks (1979) suggested that affect temporarily diminishes attentional capacity and, therefore, reduces the ability to retain task-relevant stimuli in memory. Alternatively, Lavric and colleagues (Lavric et al., 2003; Shackman et al., 2006) have suggested that both anxious affect and processes involved in spatial working memory may be lateralised to the right hemisphere, with increased affect-disrupting circuitry involved in controlling attention, retaining and reorganising spatially represented stimuli, and thus specifically impairing spatial working memory (Lavric et al., 2003; Shackman et al., 2006). In contrast to Lavric and Colleagues, Eysenck and Calvo's (1992b) Processing Efficiency Theory (PET) proposes that anxiety leads to worrisome task-irrelevant cognitions, which are retained within the phonological loop, incidentally restricting capacity for task-relevant stimuli and disrupting verbal, rather than spatial, working memory performance. Eysenck and Calvo (1992) further predicted that accuracy would only be disrupted at high-load levels when anxious individuals exceeded their ability to compensate for their reduced capacity by increasing effort. This increased effort was argued to be evident in increased physiological responding and increased reaction times (RT) on correct working memory trials.

In the face of data contradicting the hypothesis of anxiety only specifically impairing verbal working memory or spatial working memory, and with impairments found on tasks involving mainly the central executive (Eysenck, Payne, & Derakshan, 2005), Eysenck et al. (2007) suggested an alternative explanation for the impairments noted to executive control - Attentional Control Theory (ACT). This theory postulates that anxiety impacts on the ability to control attention (i.e., inhibit or shift attention) rather than directly on working memory. This argument regarding attentional control is based on the arguments presented by Engle and colleagues (Engle, 2002; Kane, Bleckley, Conway, & Engle, 2001) suggesting that working memory performance can be explained by combinations of inhibiting and shifting attention. Eysenck et al. (2007) suggest that when anxious, top-down processes are impaired as anxiety prepares the individual for more bottom-up processing, and situational stimuli capture attention and facilitate survival responses to threat-related stimuli. Hence, the top-down processes of attentional inhibition and switching are impaired and any performance decrements noted in working memory were due to the associated impairment in attentional control.

Attentional Control Theory, as proposed by Eysenck et al. (2007) seems to account best for the impacts noted on both spatial (Lavric et al., 2003; Shackman et al., 2006) and verbal working memory tasks (Eysenck, 1985; MacLeod & Donnellan, 1993; Sorg & Whitney, 1992), and also explains how anxiety impacts on attentional inhibition (Inzlicht et al., 2006) and switching tasks (Derakshan et al., 2009). Eysenck et al. (2007) attribute the impairment of attention control, when anxious, to reflexive attentional biases towards threat-based information (Bar-Haim et al., 2007), citing neurological evidence of increased anxiety linked to amygdala activation and the inhibition in the prefrontal cortex, the neuroantomical region suggested to support the control of attention and executive functioning (Davidson, 2002; LeDoux, 2002; Perez-Jaranay & Vives, 1991; Quirk, Likhtik, Pelletier, & Pare, 2003). Section 2.3.8 discusses the interaction between the amygdala and prefrontal activation and executive control.

2.3.8. Neurovisceral Explanations of the Relationship Between Prior Self-control, Affect and Executive Functioning: The Central Autonomic Network

Both the self-regulatory strength and affective explanations of temporary impairments in executive control have been linked with neurological theory relating to prefrontal cortex activation. One neurophysiological theory, which overlaps with components of self-regulatory strength theory, ACT and PET is Thayer and colleagues' neurovisceral account (Thayer et al., 2009; Thayer & Lane, 2000). This theory links cardiac output and executive control to the interplay between the amygdala and the prefrontal cortex. The neurovisceral account makes reference to a network of neuroanatomical structures, the central autonomic network (CAN; see Figure 2.5), and provides wide ranging implications for why increased affect or dysregulated affect coincides with impaired executive control. The pivotal and distinguishing feature of Thayer's neurovisceral account is the role of tonic vagal inhibition of arousal, which influences the activity of the CAN to impact on attentional control, which in turn impacts on the regulation of emotion, thought, and action.

To make the connection between tonic vagal inhibition of arousal and attentional control[m], Thayer's neurovisceral account draws on evidence that the prefrontal cortex (including the many subdivisions within it) supports the ability to control attention, regulate behaviour and thought processes required to adapt to one's environment (Asplund, Todd, Snyder, & Marois, 2010; Dove, Pollmann, Schubert, Wiggins, & von Cramon, 2000; Kane & Engle, 2002; Miyake et al., 2000). Particular subdivisions within the prefrontal cortex are related to particular self-regulated actions. These include the dorsolateral prefrontal cortex in working memory and attentional control and the medial and lateral prefrontal cortex in regulating emotions (Braver, Cohen, Nystrom, Jonides, & Smith, 1997; Lane et al., 2009; Ochsner, Bunge, Gross, & Gabrieli, 2002). Other cortical structures, apart from the prefrontal cortex, including the anterior cingulate cortex, the orbito-frontal cortex and the insula have been suggested to be involved in regulated responding (Braver et al., 1997; Etkin, Egner, Peraza, Kandel, & Hirsch, 2006; Lane et al.,

[m] Thayer and colleagues claim that vagal tone both reflects and influences prefrontal activation. The reason for specification of vagally mediated suppression of HR is related to arguments presented by Porges (2001, 2007) regarding the evolutionary qualities of the vagus nerve and how it promotes flexible and rapid regulation to changing environmental demands relative to the slower parasympathetic or sympathetic responses (Porges, 2001; Thayer & Lane, 2000).

2009; Ochsner et al., 2002). Many anatomical regions that support regulated responding work in parallel (Goldman-Rakic, 1996), however most forms of regulated functioning remain highly correlated with prefrontal cortex activity (Braver et al., 1997) and, therefore, this region is recognised as perhaps the most important part of the brain for regulated responding in the behavioural, cognitive and affective domains (Goldman-Rakic, 1996; Shallice & Burgess, 1993; Shallice et al., 1989; Thayer et al., 2009; Thayer & Lane, 2000). Thayer's neurovisceral account is consistent with this assertion.

Thayer's neurovisceral account is a theory of regulation that draws on findings about the interaction between the medial prefrontal cortex and the amygdala (associated with the experience of fear and anxiety). The medial prefrontal cortex is linked to the amygdala via neural tracts that are mutually inhibitory (Amat, Baratta, Bland, Watkins, & Maier, 2005; Davidson, 2002; Drevets et al., 1997; Simpson, Drevets, Snyder, Gusnard, & Raichle, 2001). Hence, efferent tracts from the medial prefrontal cortex transmit inhibitory signals to the amygdala during activation of the medial prefrontal cortex (Amat et al., 2005; Davidson, 2002; Drevets et al., 1997; Simpson et al., 2001) and activation in the amygdala inhibits activation in the medial prefrontal cortex (LeDoux, 1995; Perez-Jaranay & Vives, 1991; Simpson et al., 2001). Therefore, fearful affect, associated with amygdala activation, results in inhibition of prefrontal activity, associated with controlled responding in affective, cognitive and behavioural domains. Conversely, inhibition in the medial prefrontal cortex leads to increased and prolonged emotional stress (Davidson, 2002; Simpson et al., 2001).

Thayer and colleagues suggest that the interaction between the amygdala and the prefrontal cortex both influences and is influenced by the output of peripheral end-organs, particularly the heart. Thayer and colleagues make this connection between the prefrontal cortex and heart via the neural network of the CAN. This network includes such structures as the prefrontal cortex, cingulate cortex, the insula, orbitofrontal cortex, amygdala, the paraventricular nucleus and lateral hypothalamus the periaqueductal gray and cells in the brain stem, such as nucleus of the solitary tract, motor nucleus of the vagus nerve and sympathetic neurons of the intermediolateral column. It is these final brain stem structures that have a direct influence on fluctuations in HR, whilst the cortical structures are suggested to have an indirect influence. However, these brain stem structures and thalamus are also suggested to relay information back to the prefrontal cortex, influencing prefrontal cortex activity. Hence, a key aspect of the neurovisceral account is that signals are suggested to flow bi-directionally throughout the CAN so that both top-down influences of the cortical structures on the peripheral end-organs and bottom-up influences of the peripheral end-organs on cortical activity are explained, a notion supported by others (Brodal, 2010; Clark, Boutros, & Mendez, 2005).

Given that both top-down and bottom-up processes influence activity on particular structures within the network, two possible scenarios could explain why individuals may show impaired executive control. First, Thayer and colleagues suggests that cortical (particularly prefrontal) activity “tonically inhibits cardioacceleratory circuits” (Thayer et al., 2009 pp. 144). Thus, if individuals attend to internal or external stimuli, this activates the amygdala, leading simultaneously to inhibition of the prefrontal cortex resulting in impaired responding in affective, cognitive and behavioural domains and the deactivation of the parasympathetic nervous system, leading to reduced vagal tone over HR (i.e., a top-down influence). The second scenario is that vagally mediated output from the heart is fed-back through the sub-cortical structures to the prefrontal cortex (i.e., the circuit’s origins) and this feedback influences activation of the prefrontal cortex (i.e., a bottom-up influence). The increased tonic inhibition of HR should sustain increased activation within the prefrontal cortex, inhibit amygdala activation and allow regulated responding in cognitive and behavioural domains. In contrast, increased output from the heart, resulting from decreased vagal tone over HR, is proposed to eventuate in a decreased activation in the prefrontal cortex, thus impairing executive control.

In summary of Thayer's neurovisceral account and proposed interaction arising from the CAN, the changes in beat-to-beat fluctuations in the output from heart that are vagally mediated are suggested to be indicative of the interactions between the prefrontal cortex and the amygdale, with decreased vagal tone associated with decreased prefrontal activity and increased amygdale activity. From a top-down perspective, activation in the amygdala due to a threat would inhibit the medial prefrontal cortex, resulting in vagal disinhibition of HR (i.e., reduced HRV and increased HR) and impaired regulated responding in cognitive and behavioural domains. From a bottom-up perspective, when vagal inhibition of HR is low, this reduced vagal tone is fed back through the CAN to bring about a decrease in activity within the prefrontal cortex and impair regulated responding in cognitive and behavioural domains.

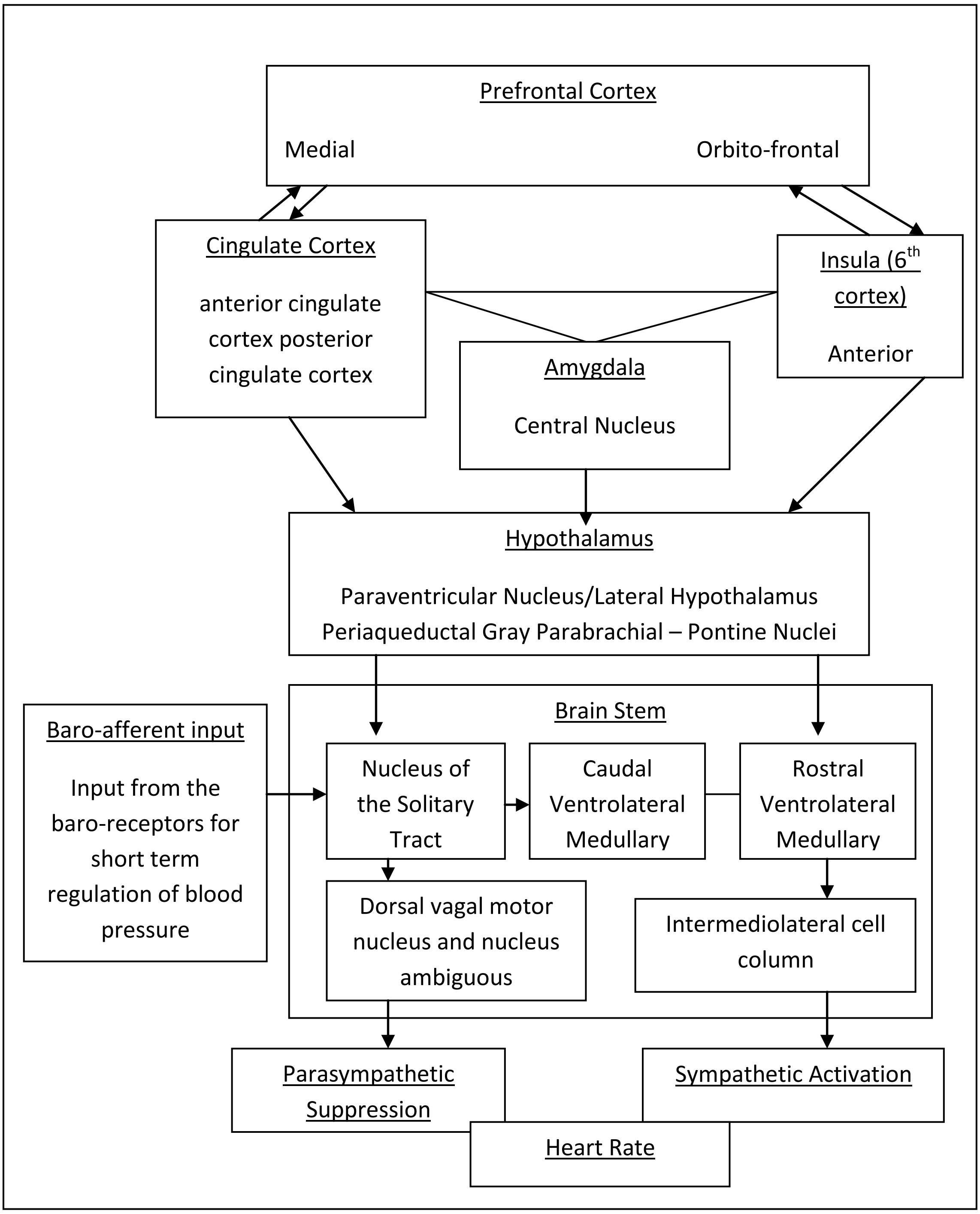

Figure 2.5. A Schematic Diagram of the Central Autonomic Network. Adapted from "Claude Bernard and the heart-brain connection: Further elaboration of a model of neurovisceral integration" by Thayer et al., 2009, *Neuroscience and Biobehavioral Reviews, 33,* p. 143. Copyright 2009 by Elsevier.

2.3.9. Evidence Supporting Thayer's Neurovisceral Account

The suggestion that increased vagal tone over HR (i.e., increased HRV) is associated with superior regulated responding in the domains of thought and behaviour has received support from many different research designs using behavioural measures. Neuro-imaging evidence has also supported the notion that HRV may be a marker for regulated responding derived from the frontal neuroanatomical structures, particularly the prefrontal cortex (Lane et al., 2009). Indices of vagally mediated central parasympathetic activity, including the .15-.5Hz or high frequency (HF) band and RMSSD, have been associated with superior regulated responding across cognitive, behavioural and affective domains (Croizet et al., 2004; Demaree, Pu, Robinson, Schmeichel, & Everhart, 2006; Demaree, Robinson, Everhart, & Schmeichel, 2004; Hansen, Helge, & Thayer, 2003; Hansen, Johnsen, Sollers, Stenvik, & Thayer, 2004; Hansen, Johnsen, & Thayer, 2009; S. C. Segerstrom & Solberg Nes, 2007).

Croizet et al. (2004) showed that decreased power within the HF band of HRV or a lower RMSSD score during the performance of an executive task accompanies impaired executive control relative to those with increased HF-HRV or RMSSD. Furthermore, individuals with increased resting HRV (RMSSD or HF) have demonstrated superior executive control under normal testing situations (Hansen et al., 2003) and under the threat of electric shock (Hansen, Johnsen, & Thayer, 2009), relative to those with lower HRV at resting baseline. This result has been replicated in a mental persistence task (solving anagrams) with increased HRV associated with more persistence (S. C. Segerstrom & Solberg Nes, 2007). Demaree et al. (2004) showed that increased HRV at rest was associated with a better ability to modulate behavioural expressions of affect when individuals were instructed to exaggerate emotional responses. Furthermore, Demaree and colleagues (2006) showed that when asked to watch an affect-inducing video, those with greater resting HRV displayed less facial expression of negative emotion when exposed to negative content in comparison to those with lower HRV. Moreover, it has been demonstrated that those who increase their resting vagally mediated HRV by undertaking an aerobic exercise program show improvements in executive control whilst those who do not improve their resting vagally mediated HRV do not show improvements in executive control (Albinet, Boucard, Bouquet, & Audiffren, 2010; Hansen et al., 2004).

Converging with the behavioural evidence, neuro-imaging evidence from a study by Lane, McRae, Reiman, Chen, Ahern and Thayer (2009) showed support for the proposed association between medial prefrontal cortical activity and vagally mediated fluctuations in HR. Using the simultaneous measurement of HR (with an electrocardiogram) and cerebral blood flow (with positron emission tomography), neutral, positive and negative affective states were induced in participants. Participants were encouraged to maintain a particular affective state (which arguably demands affect regulation). Under emotion-provoking conditions, HF-HRV was positively correlated with increased activity in medial prefrontal cortex, dorsolateral prefrontal cortex, anterior cingulate cortex, the left insula, thalamus, the periaqueductal gray, and the caudate nucleus. The fact that participants were encouraged to maintain a particular affective state explains why such neuroanatomical structures usually involved in controlling attention and maintaining representations in memory, such as the dorsolateral prefrontal cortex, were activated (Braver et al., 1997; Lane et al., 2009; Ochsner et al., 2002). A similar study was undertaken by Gianaros, van der Veen, and Jennings (2004), showing a similar positive associations between HRV and activation of the same neuroanatomical structures when participants were undertaking difficult working memory tasks. Hence, the results of Lane et al. (2009) and Gianaros et al. (2004), when taken together, suggest that the same neuroanatomical structures are active when attempting to regulate affect (in this case specifically prolonging affect) as when undertaking an executive function task involving updating and maintaining mental representations.

Shapiro et al., (2000), showed additional evidence for the relationship between HRV and activation of the prefrontal cortex . This study showed that among individuals who perceived stimuli as threatening when under mental stress, increased HR and decreased HRV coincided with reduced blood flow within the prefrontal cortex to a greater extent than among those who perceived stimuli as less threatening. Hence, like the previous studies, vagally mediated reductions in HRV were associated with reduced blood flow in the prefrontal cortex. Thus, neuro-imaging studies, using several different manipulations, have shown the relationship between medial prefrontal activity and tonic vagally mediated HRV.

Activation (indicated by increased blood flow) in the dorsolateral and ventromedial prefrontal cortex, according to previous research, should support superior performance on working memory and attentional control tasks (Braver et al., 1997; Lane et al., 2009; Ochsner et al., 2002). Hence, these neuroimaging studies, when taken together with behavioural studies, provide evidence to suggest that the link between increased vagally mediated HRV and the superior regulated responding in central executive tasks, and in emotional regulation, is due to overlapping influences that the prefrontal cortex has on all forms of regulated responding.

2.3.10. Attentional Focus, Distraction and Acceptance, and the Impact on the CAN: Predictions from the Neurovisceral Account

Based on the two scenarios via which the connection between vagally mediated fluctuations in HR and executive control may occur, predictions can be made regarding how the focus of attention to different stimuli and the level of situational threat will influence vagal tone and, therefore, executive control. The impact on the CAN when attempting to direct attention away from threat-related stimuli and affect via distraction could vary depending on how effectively attention was diverted from threat-stimuli. If attention is successfully diverted from threatening information, this would inhibit amygdala activation and sustain prefrontal activation, preserving capacity to demonstrate executive control and increased HRV. However, if distraction does not successfully limit attention to threat then the opposite would be predicted (i.e., impaired executive control and decreased HRV).

Although acceptance increases attention to threat-related information, it has been demonstrated to reduce HR (Hofmann et al., 2009; Low et al., 2008), which is more proximally related to the CAN and thus more relevant to predictions derived from the neurovisceral account. If this reduction in HR represents tonic vagal inhibition then this increased vagal tone would be expected to be fed back through the network to support increased activation in the prefrontal cortex and inhibition of amygdala activation, leading to superior executive control.

2.3.11. Comparing Predictions of the Self-Regulatory, Affective and Neurovisceral Accounts Regarding Executive Control

From the previous sections presenting the self-regulatory, affective, and neurovisceral accounts, it can be seen that there are both consistencies and inconsistencies among the theories' predictions for what situations are likely to influence executive control. For a summary of the different predictions of each of the accounts see Table 2.2.

First, the different theoretical accounts are consistent in their predictions that increased threat will impair executive control relative to lower threat. However, each account has a different reason to offer for why these performance decrements may occur. For the self-regulatory strength explanation, the effect of threat is attributable to spontaneously initiated inhibitory regulatory attempts. For the affective theory of ACT and the neurovisceral account, the effect is attributed to increased amygdala activation, resulting in increased affect and dysregulated responding.

Second, each theoretical account provides different explanations for differences in executive control amongst individuals using alternative affect regulation strategies. Each theoretical account requires certain preconditions to be met in order for to provide a valid explanation of differences noted in executive control. The self-regulatory strength theory requires that individuals engaging in the different regulatory strategies will differ in their perceived investment of mental resources during affect regulation - conditions showing impaired executive control will report greater investment of mental resources during regulation. In contrast, PET or ACT require that individuals undertaking different regulatory strategies should differ in their levels of anxious affect in the period prior to and during executive task performance, with greater affect associated with poorer performance. The neurovisceral account of impaired executive control requires differences amongst the regulatory conditions in vagal tone, either during task performance or immediately before undertaking the executive task. In addition, the neurovisceral account requires that the regulation strategies or threat circumstances resulting in poorer executive control should also coincide with reduced vagal tone.

For the self-regulatory strength theory to be a valid explanation of the differences in executive control, differences in executive control after regulation must still exist when affective variables, measured during and immediately preceding the executive task, are controlled. For the affective theories of PET or ACT to explain impairments in executive control after regulation, controlling for affect should eliminate differences in executive control between regulatory strategies or threat circumstances. Lastly, for the neurovisceral account to explain impairment in executive control, controlling for vagal tone should eliminate differences in executive control amongst threat circumstances or regulation strategies.

Table 2.2.

Predictions from Self-regulatory Strength, ACT and PET, Neurovisceral Account on The Impact of Threat, Prior Regulation, Affect, and HRV on Executive Control.

	Theoretical Predictions		
Effect on Executive Control	**Self-regulatory Strength Predictions**	**ACT and PET predictions**	**Neurovisceral Predictions**
Decrease when under threat	Yes	Yes	Yes
Decrease following prior regulation	Yes	Only if regulation leads to differences in affect	Only if regulation leads to differences in HRV
Negative correlation with mental exertion during regulation	Yes	No Prediction	No Prediction
Negative correlation with concurrent affect	No	Yes	Yes
Controlling for affect reduces effects of threat and prior regulation	No	Yes	No
Negative correlation with concurrent HR	No	Yes	Yes
Controlling for HR reduces effects of threat and prior regulation	No	Yes	Yes
Positive correlation with concurrent HRV	No	Yes	Yes
Controlling for HRV reduces effects of threat and prior regulation	No	Yes	Yes

2.4. Summary of Literature Review

This literature review has introduced many concepts relating to affect regulation. The starting point for the literature review was a definition of affect, its causes and methods by which affect can be measured. The focus was particularly on anxious affect and how it is distinguishable from other forms of negative affect, due to its unique combination of high arousal and of negative valence experienced in the presence of an anticipated threat or stressor. Anxiety it was identified as a complex emotional reaction associated with subjective feelings, behavioural motivation, and physiological responding that ideally should be assessed through multimodal measurement of both subjective and objective indicators. Following this review of anxious affect, theories relating to affect causation were discussed and contrasted. This discussion focused on the necessary factors (common to all models of affect causation), including external (threats and/or stressors) and internal (attention and appraisal) factors necessary for the elicitation of anxious affect to arise.

Following the discussion of affect, the concept of affect regulation was reviewed, primarily with regards to regulatory attempts that alter attention and thought (i.e., cognitive affect regulation) to change affect. The possible mechanisms by which particular cognitive affect regulation strategies may influence the experience of anxious affect were discussed via Gross and Thompson's modal model and Greenberg and Paivio's process of a feeling model, and their competing predictions regarding different foci of attention, thought content and processes in leading to reductions in affective responses. The two cognitive regulation strategies of distraction and acceptance were discussed in relation to how the strategies should influence attentional focus, thought content and processes, and how this related to strategy conceptualisation within each of these models. It was suggested that distraction provided a good test of the modal model's predictions, and acceptance a test of the process of a feeling model's predictions regarding attaining reductions in affect. Maladaptive strategies were also conceptualised within each of the affect regulation models. A separate, but not incompatible, alternative pathway for affect regulation was presented centring on the argument that the adaptive strategies of distraction and acceptance may limit attentional capacity to engage in maladaptive strategies, and thus reduce affect. The evidence for the theories and strategies were evaluated and several factors were identified that may influence how effective particular strategies are. These factors included: the threat circumstances in which regulation is undertaken, when the strategy is engaged in relation to the anticipation, presence or removal of an affect eliciting stimulus, for how long the strategy is used, if the strategies' subsequent impacts are evaluated and what affective variables are used to evaluate its effectiveness. It was suggested that some affect regulation strategies may show utility in reducing affect in some situations and circumstances but may be ineffective or counterproductive in others.

The last major concept that this literature review discussed was the concept of executive control and the importance of this concept to optimal functioning across many domains in situations that may require affect regulation. It was established that both prior acts of self-control (including affect regulation) and increased threat have led to temporary impairments in executive control. The literature review presented arguments for why particular regulation and threat circumstances may result in impaired executive control. Theories considered vital included the impact of affect regulation strategies on executive control via reductions in the internal reservoir of resources required for acts of executive control (i.e., self-regulatory strength theory). Alternatively, the possibility that regulation strategies may have an indirect influence on executive control through variations to how the strategies influenced anxious affect (i.e., PET and ACT) and vagal tone (i.e., the neurovisceral account) was also considered. The competing predictions for each theory were set out with the evidence that would be required for these theories to provide explanations for impaired executive control. It was suggested that affect regulation strategies may show utility in preserving executive control in some circumstances but may be counterproductive in others and this may be relevant to distraction and acceptance.

In summary, the present literature review showed that the evaluation of the utility of affect regulation strategies is a complicated domain of research. Particularly, it was argued that there are many factors to consider when evaluating the utility of strategy, regarding both in reducing affect and preserving executive control. Although it was recognised that a strategy that leads to increased affect may result in impaired executive control, the possibility that increased affect may also co-occur with preserved capacity to demonstrate executive control remains. Hence, the above literature review provided detailed analysis of the key factors worthy of consideration in investigating affect regulation, and suggested that no one affect regulation strategy may be suitable for all circumstances and objectives.

Chapter 3: The Present Research

Three major research questions were identified as the focus of this thesis, and were discussed in relation to the relevant theory and previous research within chapter 2. The first research question concerned how the regulatory strategies of distraction and acceptance alter the affective experience. Two possible pathways exist: the strategies may alter attentional focus and/or they may reduce the level of engagement in maladaptive regulatory processes. Despite many previous studies investigating the impacts of distraction and acceptance on affect no studies, to the author's knowledge, have measured the extent to which these strategies alter attentional focus in anticipated threat circumstances or reduce maladaptive regulatory attempts. Thus, answering this question may provide answers to why and when the strategies are likely to be most effective.

The second research question builds upon the first question, centring on how effective the strategies of distraction and acceptance are in reducing anxious affect. The strategies' effectiveness in reducing anxious affect can be assessed in the anticipation of, engagement in, and recovery from socially evaluative tasks of high and low ego-threat. An extensive literature search did not find a study that directly compared distraction and acceptance's influence on affect during the anticipation of high- and low-threat-tasks, or that compare their influences on affective reactivity to and recovery from threat-tasks. Answering this question in combination with the first will provide unique test of affect regulation theory and will further understanding on the effectiveness and limitations of the strategies.

The third question concerns the subsequent impacts distraction and acceptance may have on executive control. No studies could be identified that have evaluated the impacts of engaging in acceptance on subsequent executive control. In addition, no studies could be identified that rule out physiological measures of affect explaining the impacts distraction on executive control. It may be that the regulatory strategies, as acts requiring control of attention, deplete an internal reservoir of resources required for acts of executive control, thus impairing performance in subsequent tasks requiring executive control. If affect regulation does impair executive control, it may also be that the effort demanded by the strategy varies according to level of ego-threat, rather than particular strategies imposing consistent demands across situations. Alternatively, if executive control is impaired, it may be increased residual affect and/or reduced vagal tone, rather than a depletion of internal resources that causes these impairments. Answering these questions will aid understanding of when to use particular strategies to sustain optimal functioning and the mechanisms by which regulation may preserve executive control.

Each of the empirical chapters (chapters 5, 6 and 7) involve the testing of competing plausible answers to the research questions presented in literature review. To answer the research questions, a single, large experimental study that manipulates both threat circumstance and regulation strategy is used. A mind-wandering control comparison condition is utilised in order to test the impacts of distraction and acceptance that involve controlling and altering attentional focus. The strategies are evaluated both during active engagement in circumstances of anticipated threat. The subsequent impacts of the affect regulation strategies are also evaluated regarding affective reactivity during engagement in a threat-task and affective recovery following the threat-tasks. Executive control is assessed directly after engaging in regulation but prior to the threat-task. Participant attentional focus, engagement in maladaptive regulatory attempts, and understanding of regulatory instructions are assessed subsequent to all experimental manipulations and phases. Each chapter draws on relevant data from the one large experimental study.

3.1. Hypotheses Tested in Chapter 5

Chapter 5 tests three hypotheses relating to the question of how the strategies of distraction and acceptance may influence affect. The first hypothesis concerns the different attentional focus of distraction and acceptance, distraction predicted to divert attention from threat-related information and affect (Morrow & Nolen-Hoeksema, 1990; Nolen-Hoeksema, 1991; Van Dillen & Koole, 2007), and acceptance predicted to direct attention towards threat-related information and affect (Cardaciotto et al., 2008; Orsillo & Roemer, 2005). Hence, this first hypothesis predicts that individuals engaging in distraction will report less attentional allocation to threatening information and to affect relative to acceptance and to control conditions (i.e., an effective distraction hypothesis).

The second and alternative hypothesis to the first relates to the effect of threat level on attentional focus within the strategies. There is an automatic response tendency for higher level threats to draw attention when individuals are experiencing anxious affect (Bar-Haim et al., 2007). The sustained presence of such threats have been proposed to lead to spontaneous attempts at self-distraction (Carver & Scheier, 1988; Duval & Wicklund, 1972), or attentional diversion (Derryberry & Reed, 2002; Koster et al., 2006; Koster, Verscheuer, Crombez, & Van Damme, 2005). Imposing an attentional load on individuals during such a time when individuals are spontaneously seeking to alter their feelings and thoughts in a situation may have paradoxical effects, leading to an increase in the very experience sought to be reduced (Knight et al., 2007; Mather & Knight, 2005; Wegner et al., 1993). Hence, it is hypothesised that the ability to effectively engage in distraction may be impaired in high-threat circumstances, and individuals engaging in tasks facilitating the use of distraction should report more attention to threatening information than individuals in the mind-wandering condition that does not involve an attentional load task (i.e., a disruptive distraction hypothesis).

The third hypothesis tested in chapter 5, relating to how the strategies alter affect, is based on two premises. The first premise is that maladaptive regulatory attempts are spontaneously initiated in response to threats (Lazarus & Folkman, 1984). The second is that engaging in an adaptive strategy restricts the attentional capacity to undertake a maladaptive regulatory attempt (Hofmann & Asmundson, 2008; Van Dillen & Koole, 2007). Hence, the third hypothesis is that individuals engaging in either distraction or acceptance will report lower levels of engagement in maladaptive regulatory attempts than individuals in the control group.

3.2. Hypotheses Tested in Chapter 6

Chapter 6 tests several hypotheses drawn from the modal model and the process of a feeling model concerning the effectiveness of distraction and acceptance in reducing anxious affect. The literature review identified that both the situation and the time period under which distraction and acceptance were evaluated could influence how effective a strategy is at reducing affect. Hence, the second research question has three parts: (1) How effective are distraction and acceptance at reducing anxious affect during anticipation of a threat when the strategies are being actively engaged in? (2) Under what level of threat circumstances will the strategies be effective? (3) What subsequent impacts will engaging in distraction and acceptance have on affective reactivity and repair, when encountering and recovering from the threats?

As suggested in chapter 2, distraction and acceptance are likely to differ in the impacts they have on anxious affect during their engagement. Firstly, it may take time for an individual to effectively consume themselves in a distracting task and, therefore, based on the predictions of the modal model, it is hypothesised that distraction would result in reduced affect, during its engagement, after a period of 10 minutes, relative to acceptance and control conditions (i.e., effective distraction hypothesis). In contrast, based on the predictions of the process of a feeling model, engaging in distraction may disrupt the sequence of steps for affect to reach completion and therefore is predicted to lead to increased affect relative to acceptance and control conditions (i.e., disruptive distraction hypothesis). In contrast to distraction, the process of a feeling model predicts that acceptance will lead to an initial increase in affect as the individual attends to their experience, but that this allows for integration threat-related thoughts and affect with reasoning (Greenberg, 2004) resulting in a decline in affect after 10 minutes (i.e., the effective acceptance hypothesis).

In chapter 2 it was also recognised that the impacts that distraction and acceptance have on affect may be influenced by the threat/affective circumstances they are engaged in. This recognition produces competing hypotheses to those predicting uniform impacts of distraction and acceptance across different situations. Regarding distraction, directing attention away from threat-stimuli is likely to be difficult and ineffective, particularly in high-threat circumstances (Carver & Scheier, 1988; MacLeod et al., 1986; Wilson & MacLeod, 2003) when already experiencing increased affect (Bar-Haim et al., 2007), but be effective in low-threat circumstances where re-directing attention away from threats is not difficult. Thus, distraction is hypothesised to be less effective in high-threat circumstances, but more effective in low-threat circumstances relative to mind-wandering (i.e., susceptible distraction hypothesis). In contrast, acceptance (which is likely to increase self-awareness), may be a strategy that requires high levels of affect to be experienced for it to demonstrate beneficial effects in reducing anxious affect, as it involves the process of integrating affective sensory information with reason (Greenberg, 2004). If only limited affect exists, the integration process may not be initiated appropriately and the increased attention to threats and to the self is likely to increase affect during threat anticipation (Gross & Thompson, 2007; Wicklund, 1975). Hence, acceptance is hypothesised only to reduce anxious affect in high-threat circumstances, relative to distraction and the mind-wandering control condition, but to lead to increase affect in low-threat circumstances relative to distraction and the mind-wandering control condition (i.e., susceptible acceptance hypothesis).

In chapter 2 distraction and acceptance were also suggested to differ in their effects on affective reactivity and recovery from threat-tasks. Once engagement in distraction strategy has ceased, as the individual has not had the opportunity to mentally prepare or reappraise the threat (Houston & Holmes, 1974) it is hypothesised that distraction will lead to increased reactivity and slower recovery from engagement in a threat-task relative to the control condition. In contrast, once engaging in acceptance has ceased, if affect has been integrated, acceptance is hypothesised to limited affective reactivity and quicker affective repair when encountering the anticipated threats relative to distraction and control conditions.

3.3. Hypotheses Tested in Chapter 7

Chapter 7 investigates the impacts the regulation strategies, undertaken in different threat circumstances, have on subsequent executive control and compares some alternative explanations for these effects. The first plausible pathway tested is that temporary impairments in executive control are related to the concept of a limited reserve of energy (i.e., executive resources) that facilitates individuals demonstrating executive control. It is predicted that different regulation strategies may have different impacts on these executive resources and thus subsequent executive control. Specifically, distraction, due to the load it imposes on attention and the requirement to inhibit the tendency for attention to be drawn to threat-stimuli in high-threat circumstances when participants are anxious (Bar-Haim et al., 2007; MacLeod et al., 1986; Wilson & MacLeod, 2003), and to disallow attention to wander in low-threat circumstances (Muraven & Baumeister, 2000) is predicted to be mentally effortful. Therefore, distraction is hypothesised to deplete executive resources irrespective of threat level (i.e., disruptive distraction hypothesis) relative to conditions that do not involve inhibiting reflexive responding (i.e., mind-wandering in low-threat circumstances).

In contrast to distraction, in chapter 2 it was suggested that acceptance's impact on executive resources would differ depending upon the threat level in which it is undertaken. At a high-threat level, where participants would experience increased anxiety, attention will reflexively engage with threats (Bar-Haim et al., 2007) and physiological changes. Therefore, attention to these threats and physiological changes, that is facilitated when engaging in acceptance, should not diminish executive resources (Heatherton et al., 1993). Thus, acceptance is hypothesised to result in superior executive control, in high threat conditions, relative to strategies that inhibit this attentional focus (i.e., distraction). However, engaging in acceptance in low-threat circumstances, which would involve focusing attention on threats or on the self in a situation that involves little anxious affect and limited social evaluation and thus not facilitating self-awareness or attention to threats, is predicted to be effortful and require the control of attention. Therefore, acceptance in low threat circumstances is predicted to lead to decrements in later executive control relative to mind-wandering, which does not require the control attention (Muraven & Baumeister, 2000; Schmeichel, 2007; Schmeichel et al., 2003). These predictions together form the susceptible acceptance hypothesis.

The second plausible pathway via which different regulatory strategies might give rise to differences in executive control is via their impact on affect experienced (i.e., PET and ACT affective hypothesis), as both threat circumstances and affect regulation are likely to lead to systematic differences in affect. Furthermore, the extent to which the strategies influence vagal tone (i.e., neurovisceral account hypothesis) provides a third alternative explanation for differences in executive control between distraction and acceptance undertaken in the different threat circumstances. In summary, chapter 7 tests the self-regulatory strength, affective (ACT and PET), and neurovisceral accounts' predictions in an attempt to answer the question of what mediates the effect of affect regulation strategies of distraction and acceptance on subsequent executive control.

Chapter 4: Method

This chapter describes the methods used in the large single experimental study to gather the data presented in chapters 5, 6 and 7. Each of these following chapters analyses a subset of the measures employed.

4.1. Participants

The sample size of 180 participants was chosen based on the calculations of the effect size reported by studies using similar experimental designs and measures involving university student samples randomly allocated to experimental conditions. These calculations were carried out with the G*Power Software calculator (Erdfelder, Faul, & Buchner, 1996), with an anticipated effect size of d = .5 on measures of executive control comparing individuals who had subsequently engaged in a effortful regulation task versus those who had not (Schmeichel, 2007). The distraction focused studies using self-report measures of affect have reported effect sizes d = .046-.95 (Augustine & Hemenover, 2009). For HRV RMSSD data, an effect size of d = 1.15 has been noted for studies of self-regulation of behaviour, but a size effect of d = 1.47 has been demonstrated for those involving a threat manipulation (S. C. Segerstrom & Solberg Nes, 2007). The effect sizes were much smaller for studies investigating acceptance's impact on HR, with some studies reporting effect sizes as small as d = .30 (Hofmann et al., 2009) and others reporting d = .91 (Low et al., 2008). As a result, a sample of 156 participants (26 per cell) or above, providing actual power of .91, was considered to be adequate to show the impacts self-regulatory effects of affect regulation on HRV and executive control.

Participants were university undergraduates, 18 years of age or older, with fluent English language skills, and with normal or corrected to normal vision. One hundred and eighty-one students volunteered to take part, of whom 180 completed the experiment. Of those who completed the experiment, 49 were male[n]. The sample mean age was 24.90 years (*SD*= 8.67), with ages ranging from 18-60. Participants were recruited through posters, and flyers handed out to students in tutorials, in addition to the Murdoch University School of Psychology's Subject Pool website. Psychology student participants were provided with 2.5 hours of subject pool credit, and non-psychology participants were given four free hot drink vouchers in exchange for their time.

4.2. Design

A mixed design was used. This involved two between-subjects factors. Threat level, the first factor, comprised two levels: high and low. Regulation-strategy, the second factor, comprised three levels: distraction, acceptance and control. Threat level was manipulated by introducing two different anticipated tasks. The high-threat level used an anticipated impromptu speech task to induce anxious affect. This task has been shown to be highly effective at increasing anxiety (self-reported, behavioural, and autonomic) in individuals of both high and low social anxiety (Mauss, Wilhelm, & Gross, 2003, 2004). The participants in the low-threat condition anticipated watching a film clip on UK tax law, intended to be of lower threat. Regulation strategies (distraction and acceptance) were manipulated through a combination of techniques used in previous studies including: instructions (Hofmann et al., 2009; Richards & Gross, 2000), completing guided mental activities by following audio taped instructions (Arch & Craske, 2006; Levitt et al., 2004), and writing on a set topic (Low et al., 2008; Schmeichel, 2007). Distraction was manipulated by diverting attention towards relatively affect-neutral stimuli (Van Dillen & Koole, 2007). Acceptance was manipulated by

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[n] Males and females were distributed evenly amongst the cells, with separate randomisation sheets for each gender.

encouraging participants to engage in a mindful meditation activity. All strategy conditions, including the control group, were played on audio files that were designed both to facilitate strategy adoption and assist participants in the subsequent writing task. The writing tasks were on topics aimed to demonstrate participants' understanding of and compliance with the regulation strategy instructions.

There were three types of dependent variables measured, the first being the physiological data (heart rate, heart rate variability and respiration rate). The second was self-reported (affect level, attentional focus, maladaptive regulatory attempts and perceived mental demands of regulation), and the third - executive control (prepotent response inhibition and working memory). Heart rate (HR) measurements were taken at six time points: (1) baseline, (2) when the threat was revealed, (3) during the regulation period , (4) during the performance the executive control tasks (Stroop test and Letter-Number-Sequencing, (5) during the threat-task (i.e., speech or movie), and (6) during recovery from threat or control task. The regulation period included a thinking and a writing phase, enabling both reliable measurement of heart rate without movement and, subsequently, a manipulation check. The thinking period within the regulation period (3) was further split into three separate 5-minute epochs in order to test Greenberg and Paivio's process of feeling prediction. Heart rate variability was calculated during baseline (1), regulation epochs (3), and during threat-task recovery (6). HRV was not calculated during revealing of the threat, during the executive control tasks, or during the performance of the threat-task, due to increased movement artifacts influencing the ECG signal during these periods. As respiration rate was relevant only to HRV analyses, it was only computed during the HRV epochs. The self-report measures were taken with reference to: (1) baseline, (3) post regulation, (4) each executive control task, (5) during the threat-task, and (6) following the engagement in the threat-task. See Figure 4.1 for a flow diagram of the design and procedure.

4.3. Materials and Apparatus

Several different types of experimental material were used. These include (1) pre-experimental questionnaires; (2) physiological equipment, materials and data collection software; (3) materials used in threat manipulation; (4) executive control measures; (5) self-reported affect measures used in the experimental procedure; (6) manipulation check quizzes and items.

4.3.1. Self-Report Measures in Pre-experimental Questionnaire

Several self-report questionnaires were administered before participants began the experiment. In order of presentation, the measures assessed the typical extent to which the following maladaptive affect regulation strategies were used: (1) suppression, (2) worry, and (3) rumination. Additionally, pre-existing negative affect including trait anxiety, state depression, anxiety and stress were measured. The scales' descriptions and psychometric properties are presented below.

Suppression: The *White Bear Suppression Inventory* (WBSI; Wegner & Zankos, 1994) is a 15-item questionnaire that measures thought suppression. It has been previously shown to have excellent internal reliability (α = .88) in a student sample. The scale also has excellent temporal stability, with correlations ranging from .69 over 3 months to .92 over a 1 week period. Furthermore, the WBSI has been found to be related to obsessional thinking and depressive and anxious affect (Wegner & Zankos, 1994).

Trait Worry: The *Penn State Worry Questionnaire* (PSWQ; Meyer et al., 1990) is a 16-item questionnaire that measures an individual's predisposition to worry. The questionnaire measures worry as a single factor structure and has good internal reliability α= .94 and concurrent validity with a student sample, showing positive correlations with other measures of anxiety, low thrill seeking and low self esteem.

Rumination: The *Ruminative Response Scale* (RRS; Nolen-Hoeksema, 1991), is a 22-item scale with the entire scale shown to have a high internal consistency (α= .89) and a test-retest correlation of .67 in undergraduate students. Higher scores on this measure has been demonstrated to be associated with increased negative affect (Nolen-Hoeksema, Parker, & Larson, 1994) and experience of a depressive episode (Just & Alloy, 1997).

Pre-existing Negative affect: The *Depression Anxiety and Stress Scale* (DASS-21; P. F. Lovibond & Lovibond, 1995) is a 21-item questionnaire that assesses depression, anxiety and stress over the last week. The questionnaire has a three factor structure, assessing each construct separately. Internal reliability was α= .94 for depression, α= .87 for anxiety and α=.91 for stress and good concurrent validity (Antony et al., 1998) with a mixed sample clinical and non-clinical respondents.

Trait Anxiety: The State- Trait Anxiety Inventory (STAI; C. Spielberger et al., 1983) form Y2 measures trait anxiety with 20 items. The measure has an internal reliability α= .92 for males and females aged from 19 to 49 in the working adult population, .90 for males college students and .91 for females college students. Furthermore, the test retest reliability for college students was high for both 20 days (males .86 and females .76) and 104 days (males .73 and females .77). The trait scales also showed high to medium range correlations with other trait anxiety measures for college males and females, demonstrating good concurrent validity. Moreover, those with diagnosed neuropsychiatric disorders, including anxiety and depression, showed higher mean trait anxiety than college student or working adult samples.

4.3.2. Physiological Equipment Material and Data Collection Software

A BIOPAC Systems, Inc MP 100 was used to receive the input for both heart and respiration rate from two pre-amplifiers.

Electrocardiogram Preamplifier: A Biodata Physiological Amplifier 300 was connected to the Biopac set on Electrocardiogram (ECG), with resistance (gain) set to 50 mV. Skintact Esitabs sensors attached to alligator clips were used to sample the QRS signal (representing ventricular contraction).

Respiration Preamplifier: A Biopac AC systems RSP 100 preamplifier was used to measure respiration rate.

Physiological software: Acqknowledge 3.9.0 software was used to collect physiological data, with the ECG channel set to a sampling rate of 1000 per second.

4.3.3. Materials Used for the Threat and Regulation Manipulations

The high-threat manipulation involved using a video camera, mounted on a tripod, to make a recording of participants speaking on an academic topic. A red light at the front of the camera indicated when the camera was recording. Two envelopes with the titles “Question 1” and “Question 2” contained the questions on which participants were instructed to speak.

The low-threat manipulation involved the film clip *UK tax explained by former tax inspector Adrian Huston. Today…Offshore money….The New disclosure Opportunity in depth* and can be accessed from http://www.youtube.com/watch?v=JHnPq7wHvRI accessed 07/04/2010.

Audio files including recordings of instructions to facilitate the use of particular regulation strategies were created. Two writing sheets (see Appendix A) with instructions at the top of the page reminding participants of the writing topic were used, with the sheets having 10 number and 10 symbols around the edges of the writing area[o].

To present the film clip and audio files, a Laptop with a 16” screen was used and audio content projected using external speaker.

4.3.4. Executive Control Measures

Inhibition of Prepotent Responses: The *Stroop Test* original paper/card version (Stroop, 1935) measures prepotent response inhibition (N. P. Friedman & Miyake, 2004; Miyake et al., 2000) by asking participants to name aloud the colour of the print (i.e., the ink colour) in which colour words inconsistent with the ink colour were printed (incongruent colour word trials). To determine the interference effect, neutral control stimuli consisted of strings of “X’s” (e.g., XXX) that were matched in length to the colour words (e.g., an XXX string matched for the colour word “GREEN” would be “XXXXX”). All stimuli were printed in Calibri size 13 font. Three trials of both XXX strings and incongruent colour words with 40 stimuli in each trial were used, with the first trial treated as practice. The colours of the trials and the colours that participants were instructed to name were red, green, blue, purple and brown. The Stroop test has been demonstrated to be a reliable measure (Siegrist, 1997) with a test-retest reliability of .86 for incongruent colour words, and .84 for “XXX” strings, within a short time period between trials. In addition, the Stroop task has been demonstrated to correlate more highly with other tasks measuring prepotent response inhibition than with other executive functions (Miyake et al., 2000).

Updating Representations in Working Memory: The second executive control task was *Letter-Number Sequencing* from the Wechsler Intelligence Scales (Wechsler, 1997),

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[o] These originally were for a recognition memory task subsequently demonstrated to be of limited sensitivity.

which is designed to measure the executive function updating and maintaining working memory. It involves the reordering of auditorily presented stimuli that are random numbers and letters, into first numbers from lowest to highest, then letters in alphabetical order. There are seven item levels, each containing a set of three trials of the same length, with every successive set of items the load increased by one digit or letter, starting from a load of two, and ending at eight. The test-retest coefficient for individuals 16-54 years of age is r = .71 and a split-half reliability of .82.

4.3.5. Self-Reported Anxious Affect Measures Used During Experimental Procedure

Affect Measures: A self-report measure of anxious affect used by Johns, Inzlicht and Schmader (2008) comprising six adjectives: agitated, anxious, nervous, uneasy, and worried, asked participants to report how they felt on a 7-point scale anchored by "*not at all* "(1) and "*very much"* (7). Johns et al. report good internal reliability (α = .86). See Appendix B for scale and instructions provided to participants.

4.3.6. Manipulation Check Quizzes and Items

Three separate quizzes, one for each regulation strategy, tested participants' memory of the content presented in the audiotaped instructions. These quizzes comprised questions involving both short answer and yes/no responses, similar to those used in previous studies (e.g., Levitt et al., 2004). See Appendix C for the three quizzes and corresponding answers). Examples of questions are: *"Were you asked to let go of efforts to change your thoughts and feelings?"* (acceptance item), or, "*Were differences in food consumption mentioned?"* (distraction item), or, *"Did somebody mention something about going to work?"* (mind-wandering item).

Effort and Difficulty Manipulation Checks: Two items were administered asking participants to report their perceived effort expended, and the difficulty of the regulation thinking task on a scale from one (indicating low effort or difficulty) to seven (indicating high effort and difficulty). See Appendix D for items.

Attentional Focus, Cognitive Evaluations and Attempts at Controlling Thoughts or Feelings : Twenty-one items (see Appendix E for items) were used to measure participants' perception of their mental activity during the regulation strategy manipulation thinking task. The first three items (1-3) were aimed at measuring participants' level of attention to the upcoming threat-task, followed by three items (4-6) that assessed participants' evaluation of the threat. Next were three items aimed assessing the extent of allowing the experiencing of unpleasant thoughts and feelings (7-9). There were three items that related to thoughts about poor future performance during the threat-task (items 10-12). Three items assessed evaluations of thoughts, feelings, and reactions experienced (items 13- 15) that were based on the RRS by Nolen-Hoeksema (1991). Three items assessed the participant's attempts to inhibit his or her thoughts or feelings (items 16-18). The last three items (19-21) asked of the extent to which participants were mentally engaged in the experimental setting reflecting items taken from the ICARUS mental disengagement scale by Kamholz, Hayes, Carver, Gullivver, and Perlman (2006).

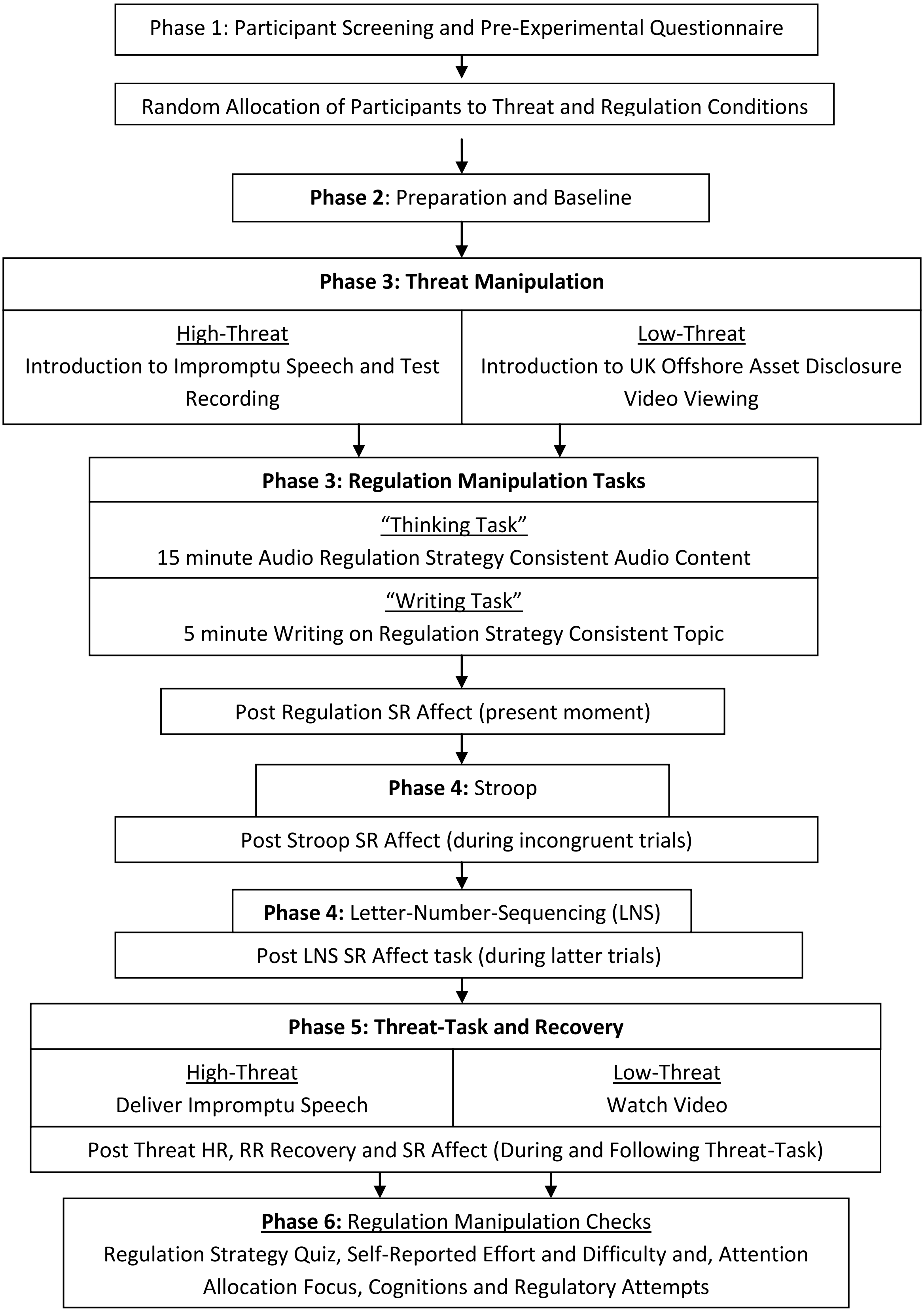

Figure 4.1. Flow Diagram of Procedural Phases

4.4. Procedure

The procedure can be split into six phases: (1) recruitment and pre-experimental questionnaires, (2) participant preparation and baseline, (3) threat and regulation manipulations, (4) executive control testing, (5) engagement in and recovery from threat-tasks, and (6) manipulation checks and debrief. It took participants about 20 minutes to complete the questionnaires. The time taken to administer the experimental procedure was approximately two hours for each participant.

4.4.1. Phase 1: Recruitment and Pre-Experimental Questionnaire

Potential participants were informed of the need for volunteers to participate in a study focused on the relationship between stress and performance on creative versus assessment-based tasks, providing a cover story that did not draw attention to the experimental manipulations (see Appendix F for advertisement). Volunteers were told that they were likely to experience some stress when taking part in the experiment, but no information about the affect manipulations was provided, consistent with Wong & Moulds's (2009) procedure, to reduce demand awareness. Participants were asked to refrain from consuming caffeine for six hours before taking part, and to abstain from alcohol and nicotine on the day of testing to reduce confounds that may influence HR and HRV. Participants were asked to complete the questionnaire on their predispositions to experiencing particular types of affect or engaging in particular regulation strategies (presented as personality questionnaires) before attending the experimental session. Participants were randomly assigned to each of the six between-subjects conditions before entering the experimental session, based on randomisation sheets developed for the experiment.

4.4.2. Phase 2: Preparation and Baseline

Testing occurred in a well-lit room maintained at 21-25 degrees Celsius. Participants' QRS signal was gathered by placing the Skintacts on the outside of the upper arm, with a ground placed on the inside of the left ankle after the skin site was cleaned using an alcohol-based mediswab. A 7-minute baseline measurement of heart and respiration rate was taken, and was followed by a self-report of participants' present affective state.

4.4.3. Phase 3: Threat and Regulation Strategy Manipulation

Participants in the high-threat condition were notified that, as part of the assessment-based task (consistent with the cover story), they would be asked to deliver an impromptu speech at some point in the middle of the experiment. To enhance the efficacy of the threat manipulation,[p] the experimenter conducted a test run of the video recording equipment targeting the participant. This was used to ensure that participants were convinced of the impending threat's occurrence so that increased anxious affect resulted. Participants were told that the speech would be on an important academic topic, and high performance would demonstrate understanding of this core academic topic. Participants were notified that their speech would be videotaped and shown to university staff who would rate their speech on clarity of presentation, correctness of points, and level of detail provided. To make the induction more believable, participants were presented with two envelopes and told that they contained two slightly different speech questions from which they were to pick one. Both envelopes actually contained the same question. The speech question asked "*what are the possible ways investigators might establish that an*

[p] Piloting of the threat manipulation showed that mere presentation of the threat was insufficient for participants to exhibit an increased arousal response, presumably because they did not believe it would eventuate.

event or construct causes another event or changes in another construct? Give examples and give a description of such methods." Participants were then instructed to hold onto the envelope on their desk and not to open it until the time came to do the speech. This envelope remained with them during all the following tasks to remind them of the upcoming threat until recovery period following the speech. The quick test run of the video recording equipment, which included an initial recording of the participants reporting their year of study and what they were studying, was used to increase the believability of the likelihood of the experiment involving an upcoming speech.

Participants in the low-threat condition were told that in the middle of the experiment they would be watching a short film clip on UK tax law, stating there was some interest in their physiological responses to it. Furthermore, participants were reassured that they would not be assessed on their knowledge of UK tax law or tested on any of the information presented in the film clip[q]. The participants were read a description of the content of the film clip so they knew what to expect and were asked if they had any further questions about the film clip and if they had any interests in UK tax law (see Appendix G for instructions for both high- and low-threat manipulations).

Following this information, participants were asked to engage in one of the regulation strategies, which were disguised as creative writing tasks with a prior 15 minutes to think about the topic while listening to a set of audio-taped instructions designed to assist them prepare for the topic. Each regulation condition had its own initial set of instructions (see Appendix H for initial instructions). To help the participants to sustain

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[q] This reassurance was added during piloting to limit the perceived level of threat this task. Although pilot participants reported that this task was not obviously threatening, some reported that they anticipated a surprise in the video, or a test. Despite the reassurance provided the information regarding the video was considered ambiguous to many participants to create a lower level of threat.

their focus during a regulatory period[r], they listened and followed along to a set of audio tape instructions consistent with their conditions (Levitt et al., 2004). Furthermore, to ensure participants understood the concept of acceptance, participants in this condition were given good, bad and improved examples of written stream of consciousness (see Appendix I). To maintain equivalence among the conditions, the distraction and control participants also received example scripts that represented appropriate performance of the particular regulation strategy they were to undertake. These examples and were matched for length and themes for each strategy.

The distraction condition instructions asked participants to concentrate their thought on generating as many different uses as possible for donkeys, ponies and horses[s]. The acceptance condition instructed participants to be aware of and to accept all naturally occurring thoughts, feelings and sensations. Meanwhile, the control group was instructed to let their minds wander whilst the sounds of a waiting area in a university library foyer were playing. The acceptance audiotape instructions were based on several scripts presented in Roemer and Orsillo (2009, pp. 120-121, 123-124, 126-127) asking participants firstly to notice their sensations, including their breathing and to slow and deepen their

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[r] During piloting some initial difficulties were encountered in eliciting participants' consistent use of distraction and acceptance when instructed. A lack of understanding of the concept of acceptance was also a problem. Following extensive piloting, manipulation procedures were modified to rectify these issues. Hence, including a mindfulness activity to facilitate the engagement of acceptance showed that participants better understood, and made use of, the strategy of acceptance, as indicated on their performance on the writing task.

[s]This particular distraction manipulation was used, rather than other more commonly used distraction manipulations, such as; a card sorting task (Blagden & Craske, 1996), reading (Bloom et al., 1977; Houston & Holmes, 1974), or a typical working memory task (Kamphuis & Telch, 2000; Van Dillen & Koole, 2007). This manipulation was chosen so that the manipulation formats of both distraction and acceptance could be identical on a number of salient dimensions that could confound results. These included the physical task demands (both involving sitting still, listening and writing), stimulus materials used (both involving audio instructions and writing sheets) and the period of time (together, the thinking and writing tasks lasted for a duration of 20 minutes).

breath, then to notice and accept their negative thoughts and feelings. Distraction instructions were matched to the acceptance instructions for length and number of words, and mimicked the acceptance instructions in terms of imagining particular content - in this case donkeys, ponies and horses, in particular settings. Each audio file went for approximately 15 minutes. See Appendix J for audiotape instructions for regulation conditions.

This thinking task was immediately followed by the writing task, used to provide tangible evidence that participants demonstrated actual engagement in the intended strategy. Participants were asked to write continuing on from the thinking task. Participants were given a brief reminder of the instructions (see Appendix K), verbally and in print at the top of the writing pages. Participants were instructed to write for the entire 5-minute period even if they had to repeat what they had previously written, consistent with (Low et al., 2008). Blind coders then categorised these responses, as a manipulation check. Following the writing task, participants were asked to self-report their current affective state.

4.4.4. Phase 4: Executive Control Testing

In this phase, participants completed two executive control tasks (Stroop, and Letter Number Sequencing) after each they retrospectively self-reported their affective states during the performance of the task.

Stroop Task: Participants were first asked to name aloud the colour that the XXX strings were printed in, as quickly as possible, but without making mistakes. After completing three trials (the first being a practice), participants were asked to the same for the incongruent colour words (see Appendix L for instructions). Responses were verbal and were recorded manually by the experimenter. Completion time and errors were recorded for each trial.

Working Memory (LNS) task: Participants were verbally presented random numbers and letters that were to be reordered by the participant: numbers in order from lowest to highest, followed by letters in alphabetical order. The task began after five practice trials used to ensure participants understood the task. Responses were made verbally and were recorded manually by the experimenter. Accuracy and reaction time (using a stop watch) was noted for each item. Instructions and stimuli were sourced from Wechsler (1997).

4.4.5. Phase 5: Engagement in and Recovery from Threat-Tasks

Following this, participants either delivered the impromptu speech or watched the film clip on UK tax law for five minutes (see Appendix M for instructions regarding threat-tasks). This was immediately followed by a recovery period of five minutes, where participants were instructed to sit still for five minutes, during which HR and RR were measured. Two versions of the self-reported affect measures were administered, the first asking how the participants felt during the speech or film clip, the second asking how they felt right at the present moment.

4.4.6. Phase 6: Manipulation Checks and Debrief

A separate 10-question quiz on the regulation audio instructions, specific to each strategy was administered. Next, two manipulation check items related to the amount of effort, and the difficulty of the thinking task were administered, followed by the 21 remaining items asking the participants to report what mental activity (attentional focus and thought content) they perceived themselves to be engaged in during the thinking phase while the audio files were playing.

Finally, participants were debriefed by providing feedback on their HR levels and cognitive task performance and were provided an internet link that provided strategies for how to handle stress during assessment. Participants were told that the full extent of the experiment's focus would be revealed to them via the School of Psychology website once data collection was completed. Participants were requested not to discuss or reveal the procedure or tasks used in the experiment or their purpose to others, consistent with procedures used by (Bloom et al., 1977).

4.5. Data Preparation and Hypothesis Testing

All forms of data went though several preliminary transformations. The steps behind these preliminary analyses are outlined below.

4.5.1. HR and HRV: Raw QRS Voltage Data to Change Scores

Several steps had to be taken to convert the raw QRS signal to scores to be used in the inferential analysis.

QRS voltage signal data were recorded and stored initially as Acqknowledge files 3.9.0. Using AcqKnowledge 3.9.0. Data were manually edited to remove errors from movement artefacts and ectopic beats before HR and HRV calculations were obtained (Berntson et al., 1997; Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996).

Heart rate variability index calculation began through the calculation of R-R intervals, achieved in Acqknowledge to millisecond accuracy. The intervals were then saved as a text file that was subsequently uploaded into the HRV analysis software, Kubios HRV version 2.0 (Tarvainen & Niskanen, 2008), http://kubios.uku.fi, developed by the Biosignal Analysis and Medical Imaging

Group, Department of Physics, University of Kuopio, Finland. Root-Mean-Square-of-Successive-Differences (RMSSD) was calculated within this program.

4.5.2. Respiration Data: From Voltage Fluctuations to Respiration Rate Change Scores

Due to technical issues with the Pneumotrace respiration strain gauge, the representation of the raw voltage data in *Acqknowledge 3.9.0* contained significant degrees of noise. Therefore, respiration rate was not able to be calculated using an automated process. However, the period at which inhalation had peaked was clearly detectable for most breaths when inspected visually. Hence, each breath was counted via visual inspection of the respiratory peaks in the raw voltage signal to within approximately half a breath. The frequency of breaths for each 5-minute period was converted to breaths per minute. Respiration rate data were converted to change scores from baseline for each time period (epoch of interest RR minus the baseline RR).

4.5.3. Data Screening: Outliers

Before conducting the inferential analyses to test the hypotheses, all dependent variables were screened for missing values and outlying cases. The criterion for determine outlying cases was +/- 3 standard deviations for the mean. Outliers were only deleted if their inclusion altered whether an inferential test met significance (Field, 2009; Tabachnick & Fidell, 1996) for that particular dependent variable.

4.6.2. Inferential Test Statistics; Alpha Levels, Assumptions, and Hypothesis Testing

The alpha criterion to reject the null hypothesis was set at .05 for inferential statistics. Many of the ANOVA used involve mixed designs. When dependent variables were in violation of the assumption of sphericity, multivariate tests were used because they do not depend on this assumption (Field, 2009). Hotelling's trace was chosen as the appropriate multivariate test due to the robustness of this test when in violation of Box's statistic when cell sizes are equal (Field, 2009; Tabachnick & Fidell, 1996).

Chapter 5: The Effects of Distraction and Acceptance on Attentional Focus and the Engagement in Maladaptive Self-Regulatory Attempts

We have seen from chapter 2 that there are many different mental acts involving the control of attention and thought that aim to reduce unpleasant affect (Gross & Thompson, 2007; Kamholz et al., 2006; Lazarus & Folkman, 1984). These mental acts are referred to as cognitive affect regulation strategies (Garnefski et al., 2001) and are the most commonly used coping option when encountering threats that cannot be behaviourally removed or avoided (Lazarus & Averill, 1972; Lazarus & Folkman, 1984). Some of these cognitive regulatory attempts are effective in reducing unwanted affect (i.e., adaptive). However, other strategies are not effective, and some are even counterproductive (i.e., maladaptive). The attentional focus required for a particular strategy is suggested to dictate a the strategy's effectiveness (Borkovec et al., 2004; Greenberg & Paivio, 1997; Gross & Thompson, 2007; Pyszczynski & Greenberg, 1987; Wegner, 1994). This chapter focuses on the therapeutically recommended regulation strategies of distraction and acceptance, and the impacts that these regulation strategies have on: (1) the focus of attention and (2) the concurrent capacity available to engage in spontaneously initiated maladaptive regulatory attempts.

Gross and Thompson's (2007) modal model predicts that attention towards situational threats and associated affect will result in the maintenance and intensification of unwanted affect. In contrast, Greenberg and Paivio (1997, 2004) theorise that increased attention to affect and affect-related thoughts will lead to an integration of this experience with reason so as to create an alternative affective experience. However, the situational threat level may influence how effectively attentional focus can be altered as ignoring, or disengaging attention from threat-stimuli when anxious may be more difficult if such stimuli are of high-threat value relative to low-threat value (Bar-Haim et al., 2007; Mogg & Bradley, 1998; Wilson & MacLeod, 2003). Additionally, the attentional focus of an adaptive strategy (e.g., distraction, acceptance) may also impose a load on attentional capacity (Richards & Gross, 2000) and, therefore, the ability to effectively engage in concurrent maladaptive regulatory attempts (Lyubomirsky & Nolen-Hoeksema, 1993; Van Dillen & Koole, 2007).

Distraction and acceptance differ in regards to where the individual focuses his or her attention. The strategy of distraction has been defined as reducing attention to both internal and external stimuli that cause and sustain unwanted affect (Gross & Thompson, 2007; Van Dillen & Koole, 2007). The diversion of attentional focus from these affect-inducing stimuli (i.e., distraction) is encouraged through engagement in an attention consuming task (Blagden & Craske, 1996; Lyubomirsky & Nolen-Hoeksema, 1993; Nolen-Hoeksema, 1991; Van Dillen & Koole, 2007). The control of attention to divert attention may be more difficult in highly threatening circumstances (Carver & Scheier, 1988; Wicklund, 1975), possibly due reflexive engagement with threats when anxious (Bar-Haim et al., 2007). However, when individuals have prolonged time periods to respond to threats they will make attempts to actively ignore high-threat-stimuli (Derryberry & Reed, 2002; Koster et al., 2006), possibly in a spontaneous attempt to regulate their experience (Mogg

& Bradley, 1998). Imposing an attentional load during concurrent attempts to control one's experience (i.e., to inhibit attention to threat-related thoughts or feelings) has previously been found to result in increased occurrence of the very experiences sought to be avoided (Knight et al., 2007; Mather & Knight, 2005; Wegner et al., 1993). Hence, although imposed distraction may be a strategy that attempts to reduce attention towards threatening and emotive stimuli, its effectiveness may be limited due to difficulties in controlling attention in the circumstance and may actually disrupt spontaneously initiated attempts that are effective in reducing attention to threatening stimuli.

In contrast to distraction, acceptance is a strategy that brings attention towards an affective response. Roemer and Orsillo (2009) and Greenberg (2004) suggest that it is through this continual attention to the affective response and the adoption of a non-judgmental or non-reactive interpretation of that response that an individual can integrate the sensations and the thoughts with reason to produce an alternative affective response. Hence, acceptance should encourage increased attention towards affect and threat-related thoughts.

Aside from the proposed difference in attentional focus of the two strategies, distraction and acceptance have both been suggested to restrict the use of maladaptive regulatory attempts (Hofmann & Asmundson, 2008; Lyubomirsky & Nolen-Hoeksema, 1993). This suggestion is based on the premise that one particular regulatory strategy precludes the use of another. It has been demonstrated that regulation reduces online attentional capacity (S. Hayes et al., 2008; Rapee, 1993; Richards & Gross, 2000; Sheppes & Meiran, 2008), implying that engaging in one regulatory activity limits the ability to effectively engage in another regulatory activity (Knight et al., 2007; Mather & Knight, 2005; Wegner et al., 1993). From such previous findings, one may hypothesise that initiating an adaptive strategy reduces attentional capacity, thereby restricting the level of continued engagement in a maladaptive regulatory strategy (Lyubomirsky & Nolen-Hoeksema, 1993; Morrow & Nolen-Hoeksema, 1990; Nolen-Hoeksema, 1991, 2000). Furthermore, the initiation of an adaptive strategy (e.g., emotional expression) that involves objectives that conflict and interfere with the goal of a maladaptive strategy (e.g., expressive suppression) is also a possible mechanism to limit the impacts of such maladaptive regulatory attempts (Hofmann & Asmundson, 2008; Lyubomirsky & Nolen-Hoeksema, 1993; Morrow & Nolen-Hoeksema, 1990; Nolen-Hoeksema, 1991). Therefore, in addition to attentional resource restriction, competing and interfering regulatory actions can limit the engagement in maladaptive regulatory attempts.

Maladaptive cognitive regulation strategies known to prolong and intensify anxious affect include worry, rumination, and suppression (Borkovec et al., 2004; Gross & Levenson, 1993; Pyszczynski & Greenberg, 1987; Wegner & Zankos, 1994; Wong & Moulds, 2009). These self-focused maladaptive strategies are initiated when a situation is appraised as threatening, and no clear action is available for removing that threat (Lazarus & Folkman, 1984). Worry is a perseverative process that has been defined as a constant focus towards an impending threat and the initiation of problem solving attempts to remove the threat (Borkovec, 1985; Borkovec et al., 2004). In many threat situations there is no clearly identifiable avenue to remove the threat without avoiding the situation, making threat removal problem solving attempts fruitless. Hence, worry has been demonstrated to be a counter-productive strategy in reducing unwanted affect (Davis et al., 2002; Hong, 2007; Pieper et al., 2007; S. Segerstrom et al., 2000; Thayer et al., 1996). Furthermore, engagement in worry has been suggested to focus attention on threats while seeking to avoid attention to affect (Borkovec et al., 2004), suggesting it would be incompatible with a strategy that seeks to fully experience an affect. In addition, worry has been demonstrated to limit concurrent attentional capacity (S. Hayes et al., 2008), suggesting that it requires and competes for attentional capacity along with other regulatory strategies and processes.

Rumination, is a maladaptive regulatory attempt that is also perseverative, similar to worry. It has been defined as focusing on a situation and trying to understand how it came about, and analysing why one tends to react in particular ways (Nolen-Hoeksema, 1991; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Like worry, rumination provides no obvious solution or direct action to remedy the situation (Pyszczynski & Greenberg, 1987). Hence, rumination is also counter-productive in reducing negative affect (Blagden & Craske, 1996; Hong, 2007; Lyubomirsky & Nolen-Hoeksema, 1993; Morrow & Nolen-Hoeksema, 1990; S. Segerstrom et al., 2000; Trask & Sigmon, 1999; Wong & Moulds, 2009). Like worry, the attentional focus is towards the threat and how it came about accompanied by an evaluation of how unhelpful the emotional response is. To the extent that rumination is a perserverative response similar to worry, it is likely that it also restricts attentional capacity.

Suppression is different from the two perseverative regulatory attempts. Suppression can be split into two components: (1) thought suppression (Wegner & Zankos, 1994) and (2) affect suppression. Suppression of affect can involve the subjectively felt internal responses and observable external behavioural responses (Gross & Levenson, 1997; Gross & Thompson, 2007). Attention is directed towards the self, with attempts to detect the presence of the unwanted thoughts or feelings that are subsequently inhibited (Gross & Levenson, 1997; Wegner, 1994). Despite suppression representing an attempt to reduce the presence of the unwanted thoughts or feelings, evidence suggests that suppression results in the increased presence of the very thoughts (Wegner, 1994) and affective physiological arousal intended to be inhibited (Egloff et al., 2006; Gross & John, 2003; Gross & Levenson, 1997). The focus of attention in suppression is towards threat-related thoughts and associated affective responses (Wegner, 1994) and has been demonstrated to restrict online attentional capacity (Richards & Gross, 2000).

Previous research utilising well-validated measures of the maladaptive regulation strategies, such as the Penn State Worry Questionnaire (Meyer et al., 1990), Ruminative Response Styles (Nolen-Hoeksema & Morrow, 1991), and the White Bear Suppression Inventory (Wegner & Zankos, 1994) has supported the conceptual distinctions among the maladaptive strategies, with each of the maladaptive regulatory attempts shown to be separate regulatory processes (Fresco, Frankel, Mennin, Turk, & Heimberg, 2002; Kamholz et al., 2006). However, this research has also shown that the maladaptive strategies have a moderate level of interrelatedness (Crowe, Mathews, & Walkenhorst, 2007; Erskine, Kvavilashvili, & Kornbrot, 2007; Fresco et al., 2002). Individuals high in reported worry often also report increased rumination (Fresco et al., 2002; Hong, 2007; McLaughlin et al., 2007) and suppression (Crowe et al., 2007). There is a moderate positive association between the self-reported usage of the strategies: correlations being .52-.62 between worry and rumination, .50-.36 between suppression and rumination, and .62 between worry and suppression (Crowe et al., 2007; Erskine et al., 2007; S. Segerstrom et al., 2000). It has been suggested that thought suppression fuels further perseveration, giving rise to positive associations between thought suppression and worry and thought suppression and rumination (E. R. Watkins, 2009; Wenzlaff & Luxton, 2003). Hence, it is possible that all of these maladaptive attempts occur within a short period and do not necessarily compete with each other for attentional resources, as each of these maladaptive attempts promote the engagement in the other.

Distraction and acceptance may limit particular maladaptive regulatory attempts. Distraction is proposed to limit engagement in the perseverative attempts by limiting self focused attention to internal thoughts and feelings regarding the threatening situation

(Lyubomirsky & Nolen-Hoeksema, 1993; Nolen-Hoeksema, 2000). In contrast, acceptance is proposed to limit suppression through attention to the affect and associated thoughts in a non-reactive, non-judgmental way, allowing the experience and expression of these negative thoughts and feelings (Hofmann & Asmundson, 2008). Hence, for worry and rumination, the attentional focus towards thoughts is considered to be the problem and is remedied by providing an alternative attentional focus. Similarly, attentional focus is also an issue with suppression, although in suppression it is the monitoring of the unwanted experiences so that they can be inhibited that leads to those unwanted experiences being held within consciousness, paradoxically increasing the extent to which they are experienced (Abramwitz, Tolin, & Street, 2001; Wegner, 1994). Hence, it is suggested that these unwanted thoughts and feelings may be best reduced by individuals attending to such thoughts and feelings and experiencing and expressing them (Hofmann & Asmundson, 2008). As such, the success of the therapeutically recommended strategies is predicted to rely on the assumption that the limited attentional capacity of the individual restricts his or her ability to engage in strategies involving attentional processes that are inconsistent with the recommended strategy. Hence, distraction involves altering attentional focus in a way that is inconsistent with worry and rumination, but consistent with the avoidance and inhibition of thoughts involved in suppression. In contrast, the attentional focus of acceptance is to unpleasant thoughts and feelings, similar to worry and rumination; however, unlike all the maladaptive strategies, especially suppression, acceptance actively encourages the experience of these thoughts and feelings in a non-evaluative way and is thus likely to engage inconsistent cognitive processes than the maladaptive strategies.

The present study uses an experimental design to investigate the proposed effect of distraction and acceptance on attentional focus. In addition, the present research tests the extent to which distraction and acceptance alter the engagement in the maladaptive regulatory attempts. As a part of the process of investigating the impacts of distraction and acceptance on the engagement in maladaptive regulatory attempts, this study also will validate experimental scales (ES) consisting of items designed to measure maladaptive regulatory attempts within an experimental threat situation. These ES will then be used to demonstrate the impacts of distraction and acceptance on the level of engagement in the maladaptive regulatory attempts of worry, rumination and suppression. In this investigation both threat level (high and low) and the adaptive regulation strategy (distraction and acceptance) are manipulated. To establish the impacts of the distraction and acceptance strategies on attentional focus and amount of engagement in maladaptive regulatory attempts, the strategies will be compared to a control condition consisting of a mind-wandering (a mental state that does not involve a particular attentional focus).

Based on the literature discussed above, the following hypotheses are proposed for the regulatory period. First, participants in the high-threat circumstances in the mind-wandering conditions will report less attentional diversion from threats and feelings than participants in low-threat circumstances. Second, those in the distraction condition will report less attentional focus towards their feelings and thoughts relating to the threats than individuals who engage in acceptance and those in the mind-wandering control condition. However, when taking into consideration of the threat level that the strategies employed, in high-threat circumstances distraction is predicted to lead to more reported attention to threat-related thoughts than in low-threat circumstances. In contrast to distraction, acceptance should increase attentional focus to affective responses and to the thoughts about threats relative to the control condition. Third, the items and resulting scales intended to measure maladaptive regulatory attempts (experimental scales; ES) should show moderate positive associations (highest between worry and rumination). In addition, ES[t] will correlate most strongly with their corresponding parent subscale (e.g., worry experimental subscale with Penn State Worry Questionnaire). Fourth, increased use of the maladaptive strategies should occur in the high-threat conditions relative to the low-threat conditions. Fifth, those who engage in distraction and acceptance will self-report less use of the maladaptive regulatory attempts than those in the control conditions. Specifically, distraction should result in less reporting of worry and rumination than the control condition, and acceptance should result in less reporting of suppression than the control condition.

5.1. Method

The experiment involved the manipulation of two independent between-subjects variables. The first was threat level with two levels: high and low[u]. The second was regulation strategy with three levels: distraction, acceptance and control. Thirty participants were in each condition. The dependent measures were the self-report attentional focus and regulatory attempt items, and regulation task instruction memory quiz administered at the end of the experiment. The self-report items asked the participants how much they perceived themselves to be engaging in particular mental activities of having particular thoughts during the thinking task (i.e., the 15-minute regulatory period) on a scale from one to seven. Although there were 21 items, 11 items

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[t] Scales formed to measure the maladaptive strategy use are referred to as "experimental" because they are developed with wording specific to the experimental procedure.

[u] Participants in the low-threat level were under a very low level of threat. Participants in the low-threat level did show a significant increase in HR when the threat-task was revealed to them (see Chapter 6, section 6.6.2.2 for affect manipulation checks) and thus can not be accurately to referred to as a neutral or non-threat condition. In addition, considering that participants were told the experiment was on stress and performance this information most likely created a low level of threat before the experiment began. Hence, all participants would have experienced some level of threat.

were selected[v] for analysis (Items 2 and 3 for attentional focus; item 2 being, "I concentrated on some other topic and task rather than how I felt", and item 3 being "I thought about things other than the impromptu speech/ short film clip" and Items 10-18 measuring the maladaptive regulatory attempts of worry, rumination and suppression) due to their relevance to the hypotheses outlined above (see Appendix E for wording of the items used). A pre-experimental questionnaire was also administered to the participants including the Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990), the Ruminative Response Styles (RRS; Nolen-Hoeksema & Morrow, 1991), and the White Bear Suppression Inventory (WBSI; Wegner & Zankos, 1994). The regulation task instruction quiz was used to assess their compliance with the regulatory thinking. The quiz asked questions regarding the content of the 15-minute audio recording played during the thinking task and was scored out of 10. Subsequent to the completion of the experiment, a random sample of 10 participants' written responses from each regulatory condition (total of 30), were submitted to two blind coders. The coders were given the instructions for each writing task, and provided with photocopies of the written responses, and asked to sort the written responses into the categories that they thought best fitted the instructions. See Appendix N for materials and instructions provided to the blind coders. See Figure 5.1, showing the phase during which the data presented in this chapter were collected. See Chapter 4 for more details regarding the method, materials and the procedure.

[v]The manipulation check items measuring participants' mental activity during the thinking audio was originally developed with the intention of measuring seven commonly used regulation strategies with 21 items creating seven experimental scales of three items each to measure each strategy. However, many of the scales had low internal consistency, demonstrating low validity in measuring the constructs of interest and hence data from these scales and items were not used in an inferential analysis.

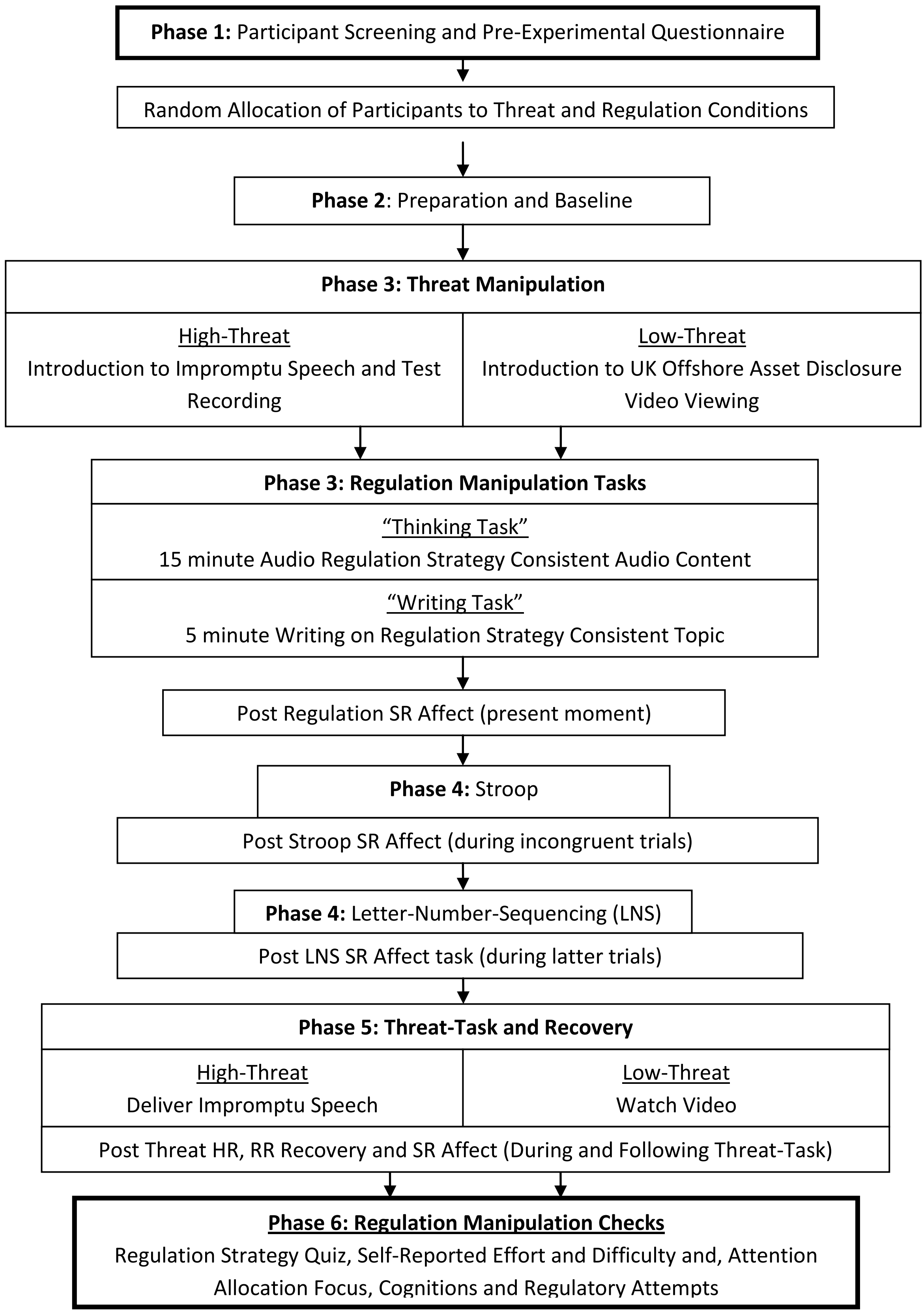

Figure 5.1 Flow Diagram of Procedural Phases with phase 6 highlighted.

5.2. Results

To test the hypotheses regarding the focus of attention, comparisons between conditions are required for each item of the attentional focus items. The means and SE for each of the conditions for both attentional focus items are presented in Figures 5.2 and 5.3, with higher numbers indicating less attention to feelings (item 2) and to thoughts about the speech/video (item 3).

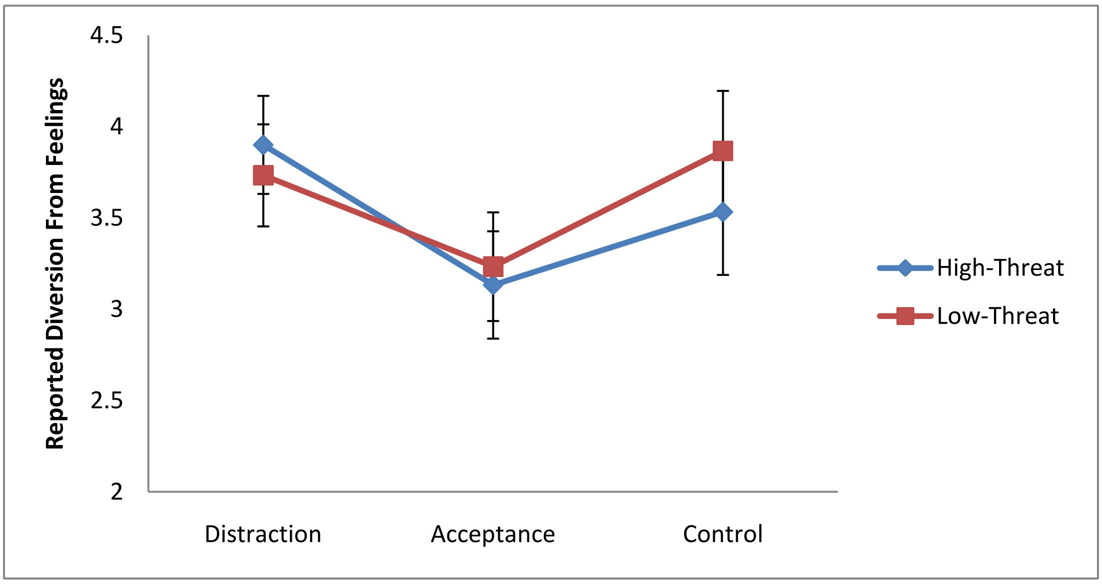

Figure 5. 2. Mean reported attentional Diversion from Feelings. Error bars indicate SE.

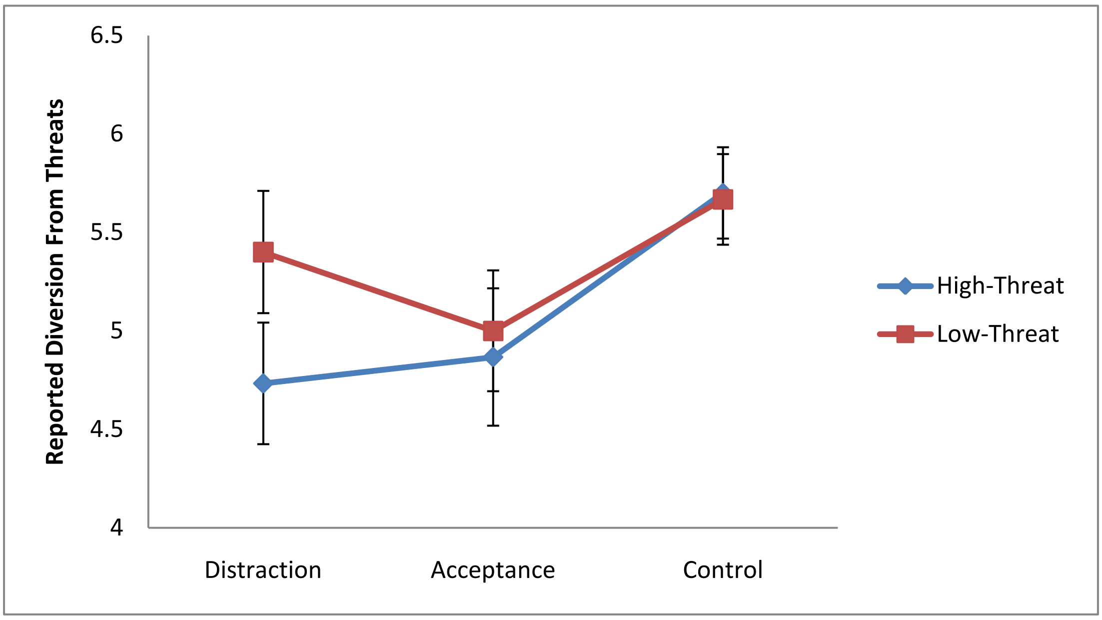

Figure 5.3. Mean reported attentional Diversion from threat-related thoughts. Error bars indicate SE.

Focus of Attention: According to the hypotheses, distraction conditions should divert attention away from feelings more than the acceptance and control conditions, whilst acceptance would increase attention towards feelings. To test the effectiveness of the regulation strategies in altering the attentional focus, a 2 (threat level: high and low) X 3 (regulation strategy: distraction, acceptance and control) between subjects ANOVA was used to analyse participants' scores from item 2; "I concentrated on some other topic and task rather than how I felt". Results showed no significant effects ($F < 1$, *ns)* of threat or interaction between threat and regulation. Furthermore, there was no simple main effect of threat within the control conditions, $t(58) = -.70$, $p = .49$, $d = -.18$. The main effect of regulation strategy trended towards significance, $F(2, 174) = 2.47$, $p = .088$, $\eta_p^2 = .028$. Least significant difference (LSD) post hoc tests showed that those in the distraction condition rated significantly more attentional diversion from feelings than those in the acceptance condition, $p = .038$, mean difference = .63, $SE = .30$. There was no difference between distraction and mind-wandering undertaken by the control condition, $p = .92$, mean difference = .11, *SE* = .30. There was a non-significant trend towards a difference between participants in the acceptance and the control conditions in the direction predicted, with the acceptance conditions reporting less diversion of attention from feelings than the control, *p* = .088, mean difference = .-52, *SE* = .30. Hence, the post hoc analyses did not support the prediction that participants engaging in distraction diverted their attention away from their feelings, but that acceptance led to increased focus towards feelings.

A 2 X 3 ANOVA was used on participants' scores from item 3; "I thought about things other than the impromptu speech/ short film clip" to test the prediction that individuals engaging in the distraction task would divert their attention away from the upcoming threat-related thoughts and to other topics more than the acceptance and control conditions. Results showed no significant main effect of threat level, $F(1, 174) = 1.14$, $p = .29$, $\eta_p^2 = .007$, and no interaction between threat level and regulation($F < 1$, *ns)*. The simple main effect of threat within the mind-wandering conditions was not significant, $t(58) = .1$, $p = .92$, $d = .02$. There was a significant main effect of regulation strategy $F(2, 174) = 3.74$, $p = .026$, $\eta_p^2 = .041$. Contrary to the predictions LSD post hoc tests showed that those in the distraction condition did not report significantly more attentional diversion from threats than acceptance, *p* = .65, mean difference = .13, *SE* = .29, and reported significantly less diversion of attention to threat than the control condition, *p* = .036, mean difference = .-62, *SE* = .29. The acceptance conditions also self-reported less diversion of attention away from threat-related thoughts than the control conditions, *p* = .011, mean difference = -.75, *SE* = .30. Hence, distraction was not effective at reducing participants' attention to threat-related thoughts relative to acceptance and the control condition. Rather, when observing the results across both threat levels, it was the control conditions that attended away from the threat-related thoughts. When testing the impacts of the regulatory strategies within the each threat level, it was demonstrated that the impacts of distraction on threat-related thoughts came mainly from the high-threat level, with distraction reporting less attention diversion from threat-related thoughts relative to control in the high-threat level, $t(58) = -2.50$, $p = .015$, $d = -.49$, however, no difference between the distraction and the control condition was noted in the low-threat level, $t(58) = -.69$, $p = .49$, $d = -.18, -.49$.

Validity of Items Reflecting Regulation Strategies: The nine items representing the maladaptive strategies, formed three ES, consisting of three items each (worry, items 10-12; rumination, items 13-15; and suppression, items 16-18. The internal consistency of each of the maladaptive experimental scales was, worry, $\alpha = .89$; rumination, $\alpha = .76$; and suppression, $\alpha = .74$. The items for each subscale were averaged to produce a composite score.

The composite scores for each of the ES were correlated with each other and with their parent scales to provide some evidence of validity of the measures. It was predicted that the ES representing the maladaptive regulation strategies of worry, rumination and suppression would show a moderate positive correlation with each other, the strongest being between worry and rumination. Each of the maladaptive ES was also predicted to correlate most strongly with its respective parent scale, and the same pattern of correlations amongst the experimental scales was expected within the parent scale (i.e., suppression ES should correlate most highly with the WBSI). The predictions were supported with the correlations between the ES in the pattern predicted (highest correlation between worry and rumination) and the correlations between the ES was highest with their respective parent scales[w] (see Table 5.1). Hence, these results provide

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[w] Items in the worry and suppression experimental scales did not overlap with the parent scales of, PSWQ and the WBSI respectively. However, the items forming the rumination

good evidence to suggest the ES show convergent validity, and therefore provide reasonable measures of the constructs of worry, rumination and suppression used during the regulatory period.

Table 5.1.

Correlation Coefficients Between the Items Reflecting Maladaptive Regulatory Attempts.

Items	1.	2.	3.	4.	5.	6.
1. Worry (ES)						
2. Rumination (ES)	.57**					
3. Suppression (ES)	.46**	.39**				
4. PSWQ	.29**	.28**	.25**			
5.RRS	.23**	.31**	.24**	.48**		
6. WBSI	.25**	.21**	.30**	.62**	.51**	

** indicates *p*<.01.

Distraction and Acceptance effects on Maladaptive Regulatory Attempts: To test the threat and regulatory hypotheses in influencing engagement in the maladaptive strategies, comparisons between the conditions are required. The means and standard error for each of the between group conditions are presented in Figures 5.4., 5. 5. and 5.6.

experimental scale did directly overlap with Items 5, 10 and 16) in the RRS. Correlations involving the RRS were undertaken with these items removed.

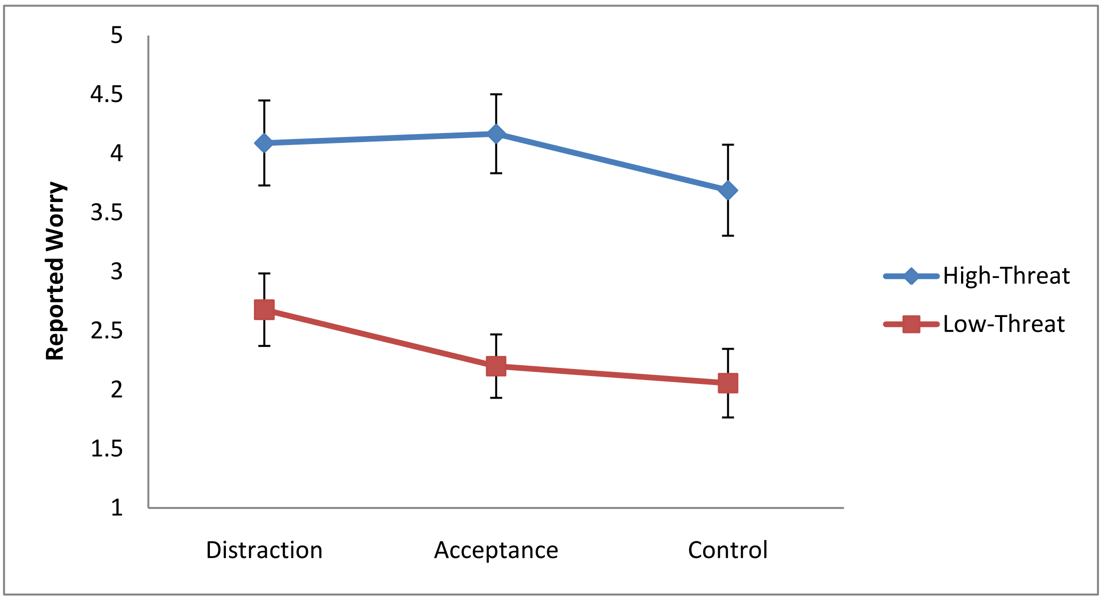

Figure 5.4. Mean Reported Worry on ES (error bars represent SE).

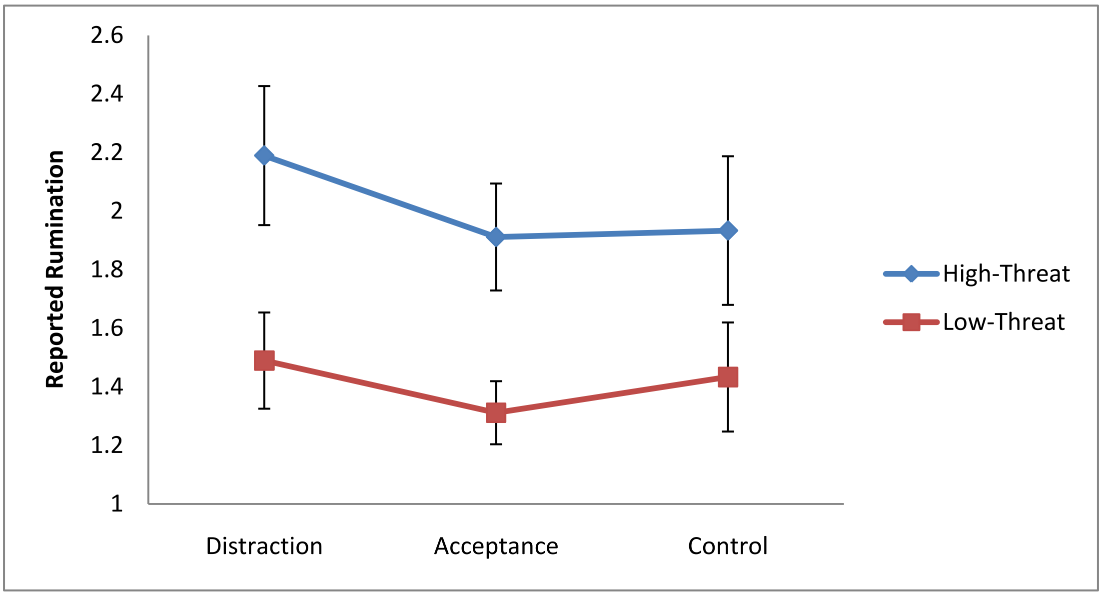

Figure 5.5. Mean Reported Rumination on ES (error bars represent SE).

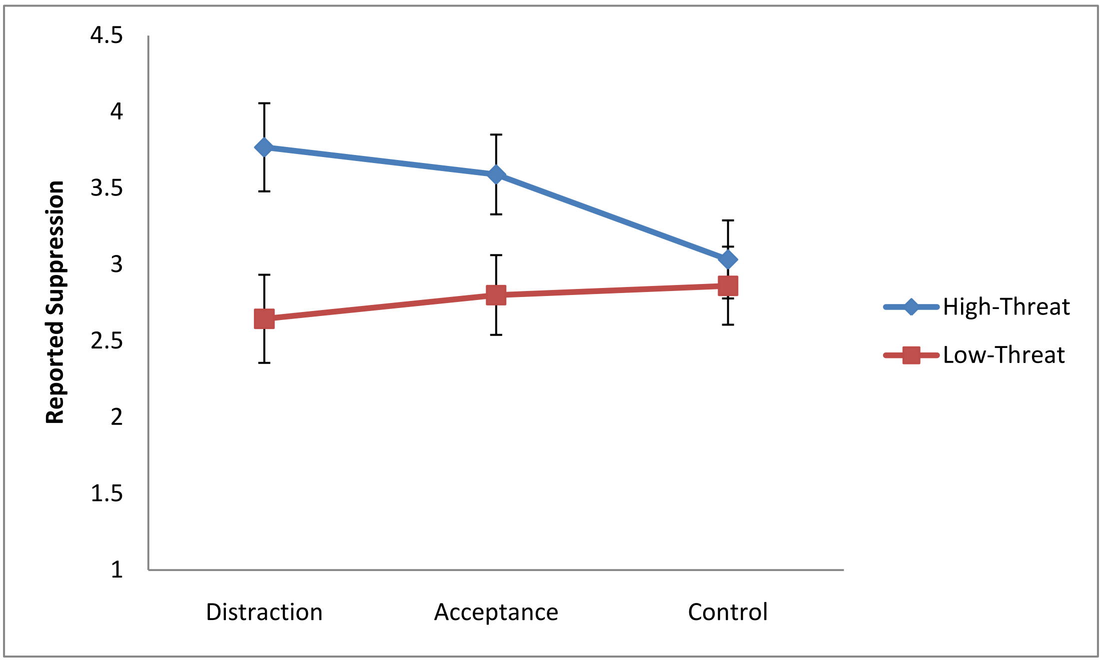

Figure 5.6. Mean Reported Suppression on ES (error bars represent SE).

The hypotheses stated that distraction in particular would minimise the occurrence of thoughts that were reflective of the engagement in worry. To test this hypothesis, a 2 (threat level) x3 (regulation strategy) ANOVA was conducted on participants' scores from the experimental worry subscale. The result showed a main effect of threat only $F(1, 174) = 39.17$, $p < .001$, $\eta_p^2 = .184$. As predicted, the high-threat conditions reported increased worry. The hypothesised main effect of regulation did not occur, $F(2, 174) = 1.24$, $p = .29$, $\eta_p^2 = .014$, nor did the interaction between threat level and regulation strategy, $F(2, 174) = .37$, $p = .69$, $\eta_p^2 = .004$. Hence, the results showed that only threat level influenced engagement in worry, and the regulation strategies of distraction and acceptance had no effect on the level of engagement in worry.

It was hypothesised that distraction would particularly limit engagement in rumination. To test this hypothesis, a 2 X 3 ANOVA was used on participants' scores from the experimental rumination subscale. Results showed only a significant main effect of threat level, $F(1, 174) = 14.17$, $p < .001$, $\eta_p^2 = .075$. As predicted, the high-threat conditions reported increased ruminative thoughts. Contrary to the predictions, there was no significant main effect of regulation strategy, $F(2, 174) = .71$, $p = .49$, $\eta_p^2 = .008$, or interaction between threat level and regulation strategy $F(2, 174) = .13$, $p = .88$, $\eta_p^2 = .002$. These results showed that the predominant influence on rumination was threat level, and that the regulation strategies of distraction and acceptance had little influence over the extent to which rumination was reported by participants.

A third hypothesis predicted that acceptance would limit the engagement in attempts to suppress thoughts and feelings. To test this hypothesis, participants' self-reports from the experimental suppression subscale were subjected to the same 2 X 3 ANOVA. The results showed a only significant main effect of threat level, $F(1, 174) = 9.92$, $p = .002$, $\eta_p^2 = .054$. As predicted, the high-threat conditions reported increased use of suppression of feelings. The hypothesised main effect of regulation strategy was not significant, $F(2, 174) = .59$, $p = .56$, $\eta_p^2 = .007$, nor was the interaction between threat level and regulation strategy $F(2, 174) = 1.59$, $p = .21$, $\eta_p^2 = .018$. These results show that threat increased efforts to suppress feelings and the regulation strategies of distraction and acceptance did not significantly reduce the level of engagement in suppression.

Blind Coder Classification: Coders each correctly classified 97% of the cases (kappa's coefficient = .90), of which 100% of distraction and mind-wandering cases were correctly classified. In contrast 90% of the acceptance cases were correctly classified, with each coder incorrectly classifying a different case as representing the mind-wandering condition.

Regulation Instructions Quiz: The quiz assessed whether the regulation instructions were followed. This allowed us to assess whether the above results regarding limited impact of the regulation conditions on the level of engagement in maladaptive regulatory attempts reported by participants was attributable to participant non-compliance with the regulation instructions. Because each strategy had a different quiz (and these were not equated for difficulty), the only valid comparisons were across threat levels. Threat level was the primary predictor of the engagement in maladaptive regulatory attempts. To rule out the threat level impeding the participants' ability to follow the regulation instructions, a 2 (threat level) X 3 (regulation strategy) ANOVA (ignoring the main effect of regulation strategy) was used to assess whether the threat level impacted on the ability of participants to follow the regulation instructions. See Table 5.2 for means and standard deviations for each condition).

Table 5.2.

Mean Quiz Performance for Each Condition

	Threat Level		
	High-Threat	**Low-Threat**	**Regulation Total**
Distraction	9.50 (.77)	9.43 (.94)	**9.47 (.85)**
Acceptance	8.44 (1.29)	8.58 (1.40)	**8.51 (1.33)**
Control	6.53 (1.55)	6.63 (1.59)	**6.58 (1.55)**
Threat Total	**8.16 (1.74)**	**8.21 (1.77)**	

Figures in parentheses indicate *SD*

It can be seen from Table 5.2 that both distraction and acceptance conditions averaged a score above 8, with the quiz consisting of 10 questions, suggesting a high level of accuracy in remembering the regulation instructions. Results from the ANOVA showed that there was no main effect of threat level, $F(1, 174) = .08$, $p = .77$, $\eta_p^2 < .001$, and no interaction between threat level and regulation strategy, $F(2, 174) = .10$, $p = .90$, $\eta_p^2 = .001$.

These results suggest that the threat level had no influence on any of the regulatory conditions in being able to remember the regulation instructions.

Follow-Up Analyses: It is possible that a significant number of the participants in the distraction and acceptance conditions were not complying with the regulatory instructions due to increased engagement in maladaptive regulatory attempts. To test this possibility, the scores for the three ES measuring the maladaptive regulatory attempts were correlated with the regulation strategy quiz scores within distraction and acceptance conditions. The results showed that none of the items significantly correlated with quiz performance, $r < .15$, *ns*, showing no support for the possibility that the engagement in the maladaptive regulation attempts influenced participants' compliance with the regulation thinking task instructions.

It is possible that participants in the distraction conditions were not focusing on the audio regulation instructions during the thinking period, as participants had reported not diverting their attention away from thoughts about the threats (results from item 3). To rule out this possibility, the distraction participants' scores from item 3 were correlated with their quiz performance scores. If participants were thinking about the threat, particularly those doing the speech, to the detriment of following along to the regulation instructions then there should be a significant positive correlation between participants' self-reported attention diversion from threat-related thoughts and their performance on the regulation thinking period quiz. The results showed, a weak non-significant positive correlation, $r(60) = .11$, $p = .42$, that was stronger in the high-threat level $r(30) = .26$, $p = .16$, therefore suggesting the possibility that participants in the distraction condition were having difficulty sustaining attentional diversion from threats that impacted on their ability to listen the distracting audio content.

5.3. Discussion

The current study tested the extent to which distraction and acceptance altered attentional focus. It also validated groups of items that formed scales representing spontaneously initiated maladaptive regulatory attempts during the experiment. These items were then used to test the extent to which distraction and acceptance reduced the engagement in these maladaptive regulatory attempts.

Firstly, it was hypothesised that increased threat would lead to less ignoring of threat-related thoughts and feelings, and that this would primarily be noted within the two control conditions. However, threat level had little influence on attentional diversion from threats across regulatory conditions and the control conditions did not demonstrate increased threat leading less attentional diversion. These results suggest that threat level does not alter the extent to which attention is diverted from these anticipated threat-tasks over an extended duration.

Secondly, distraction was predicted to reduce attention towards the affective response and that acceptance would increase attention to the affective response relative to the mind-wandering control condition. The results showed that, as predicted, participants in the distraction condition self-reported significantly less attention to their affective response than those in the acceptance condition. However, there was no difference between distraction and control conditions. These results suggest that distraction did not necessarily decrease attention towards the affective experience. Furthermore, the participants in the acceptance condition reported attending to their feelings more than the control condition, yet this difference only trended towards significance. Hence, the results supported the conceptualisation of distraction, acceptance and mind-wandering as differing in attentional focus. However, distraction did not decrease attention to the affective response relative to the mind-wandering control condition. Rather, it was most likely that acceptance was effective in increasing attention towards the affective response.

Thirdly, the distraction condition was hypothesised to focus attention on thoughts that were unrelated to the anticipated threats more than the acceptance and control conditions. Contrary to this hypothesis, the distraction group reported focusing on thoughts unrelated to the threats to the same extent as the acceptance group. Furthermore, the distraction group also reported significantly less attention to thoughts unrelated to threats than the control group. Participants within the distraction condition were instructed to focus on generating responses for the upcoming writing task and yet there was no evidence that their thoughts about this task displaced thoughts regarding the upcoming threats. Unexpectedly, the control condition focused attention away from the threats more than the distraction condition. Thoughts about the anticipated speech task drew greater attention than the anticipated film clip in the distraction condition. Further analyses were conducted to determine whether participants' increased attention to anticipated threat-task-related thoughts within the distraction condition were due to a failure to assimilate the regulation instructions. Performance on the regulation task quiz was lower among those reporting poor compliance with the instruction to divert attention away from the up-coming event. These results suggest that, although the distraction task created an alternative attentional focus, participants may have had difficulty sustaining attention to the distraction task and were drawn to thoughts about the anticipated threats. Additionally, the alternative focus and associated thoughts were not sufficient to replace thoughts about the threats any more than the acceptance or the control conditions. Rather the opposite occurred, with the distraction task leading to more threat-related thoughts, suggestive of a paradoxical effect (Wegner, 1994) or disruptive effect (Knight et al., 2007; Mather & Knight, 2005). These paradoxical or disruptive effects were inferred on the basis that the control conditions across both high and low levels of threat were already effectively actively diverting attention from the impending threat-tasks. Imposing an attentional load concurrently with these spontaneously initiated attentional diversion process, that were likely to require significant cognitive control to be effective (Knight et al., 2007; Mather & Knight, 2005), disrupted these spontaneous attentional diversion process, resulting in paradoxical effects of increased attention to threats.

These results oppose the conceptualisation of distraction, as the engagement in a task with an alternative attentional focus that imposes a cognitive load (Van Dillen & Koole, 2007), as an effective means of diverting attention in situations where there is natural tendency for attention to engage or be continually drawn to threats. Previous research evaluating distraction has not asked participants to self-report their perceived level of attention to threats. Although some previous studies had some indication of the level of performance in the distraction tasks (Bloom et al., 1977; Van Dillen & Koole, 2007), this performance did not directly indicate whether or not participants' attention to task-related thoughts limited their attention to threat-related thoughts and thus limit the reliability of these studies' claims about why those engaging in distracting tasks may have resulted in reduced reported affect.

The ES constructed to measure maladaptive regulatory attempts during the regulatory period were validated through assessing their association with each other, and with previously well-validated measures of individuals' predisposition to engage in maladaptive regulatory attempts. Based on previous studies that used well-validated trait measures of the constructs and investigated the association between the maladaptive strategies, it was hypothesised that there would be a moderate positive association between the scales used to measure the maladaptive regulatory attempts of worry, rumination and suppression. This hypothesis was confirmed with results showing highly significant positive correlations that were of moderate strength between each of the ES reflecting the maladaptive strategies. As predicted, the highest correlations were between the worry and rumination scales, followed by the thought and feeling suppression scales. Furthermore, each of the ES correlated most highly with their respective parent scale, even when items sharing similar wording were removed. Moreover, the same pattern of correlations shown by the ES was reflected in the parent scales. The results from both the ES and parent scales were consistent with other studies (Crowe et al., 2007; Erskine et al., 2007; Fresco et al., 2002) and support the validity of the ES in reflecting the maladaptive regulatory attempts.

Distraction and acceptance have been proposed to achieve reductions in unpleasant affect by counteracting and limiting the use of the maladaptive regulatory attempts (Hofmann & Asmundson, 2008; Lyubomirsky & Nolen-Hoeksema, 1993; Van Dillen & Koole, 2007). Contrary to these predictions, the regulation strategies of distraction and acceptance had limited influence over the extent to which participants engaged in the maladaptive regulatory attempts of worry, rumination or the suppression of thoughts and feelings. These results challenge the notion that distraction reduces perseverative responses (Lyubomirsky & Nolen-Hoeksema, 1993; Van Dillen & Koole, 2007), and that acceptance reduces attempts at suppression (Hofmann & Asmundson, 2008). Importantly, as the threat level was the sole determinant of engagement in the maladaptive regulatory attempts, the results were supportive of Lazarus and Folkman's (1984) prediction that the threat level dictates engagement in the maladaptive regulatory attempts. Further analyses were used to test the possible explanation that threat reduced the participants' ability to engage in the manipulated regulation strategies of distraction and acceptance. However, participants in the high- and low-threat conditions did not perform differently in the regulation quiz testing the memory and understanding of the regulation instructions. These results suggest that threat did not undermine participant performance of the manipulated regulation strategies.

There are two possible explanations for distraction and acceptance not limiting the use of the maladaptive regulatory attempts. The first is that the imposition of a threat is usually spontaneously accompanied by maladaptive regulatory attempts (Johns et al., 2008; Lazarus & Folkman, 1984) and these attempts may not consume significant online attentional capacity (Geisler, Vennewald, Kubiak, & Weber, 2010). Therefore, initiation of adaptive strategies that require online attentional capacity cannot restrict engagement in the maladaptive strategies that do not require this online attentional capacity. Nevertheless, some previous studies have demonstrated that these maladaptive strategies do limit online attentional capacity (S. Hayes et al., 2008; Rapee, 1993; Richards & Gross, 2000), which undermines this interpretation. The second and more likely explanation is that the spontaneous attempts to divert attention from threats undertaken in the mind-wandering condition in the high-threat level required a large quantity of online resources to control attention (Knight et al., 2007; Mather & Knight, 2005), similar to imposed regulation strategies, and thus restricted engagement in maladaptive regulatory attempts to a similar extent to the imposed regulatory strategies.

From a methodological perspective, there are two possible explanations for why previous studies have not falsified the claim that experimentally imposed adaptive strategies limit maladaptive regulatory attempts. The first is that previous studies evaluating the effectiveness of distraction have used other procedures to manipulate and induce affect, such as a movie (Sheppes & Meiran, 2007) or music (Blagden & Craske, 1996) or pictures (Van Dillen & Koole, 2007) and these affect manipulations may not spontaneously initiate these maladaptive attempts. Therefore, the reductions in affect noted in earlier studies evaluating distraction may not necessarily have been due to the engagement in a distraction task limiting the engagement in the maladaptive strategies. The second methodological explanation is that other studies evaluating the regulation strategies typically manipulate engagement in the strategies after the threat event has passed, effectively investigating whether a strategy promotes recovery (Low et al., 2008; Wong & Moulds, 2009) in contrast to the present study, which has evaluated the strategies during the anticipation of a threat. Anticipated threats are likely to result in spontaneously initiated maladaptive regulatory attempts (Lazarus & Folkman, 1984). However, where the threat event has passed (Low et al., 2008; Wong & Moulds, 2009), the spontaneously initiated maladaptive regulatory attempts may be less likely to be actively maintained and, thus, more easily replaced with more adaptive strategies. Hence, the means via which the strategies promote affective recovery when a threat event has passed may be different from the means by which the strategies achieve a reduction in anxious affect when a perceived threat remains.

The current study has several methodological limitations. Firstly, all participants' self-reports were retrospective and therefore may not have been as accurate as reporting their attentional focus or engagement in maladaptive regulatory attempts during the thinking regulatory period itself. In addition, the small number of items used to measure attentional focus and maladaptive regulatory engagement may also contributed to sub-optimal measurement. These problems in measurement may have made it more difficult to detect differences amongst the regulatory conditions.

Importantly, the distraction task employed to facilitate the diversion of attention away from threat-related thoughts may not have demanded sufficient attentional resources to completely divert participants' attention. Van Dillen and Koole (2007) demonstrated that when participants completed more complex arithmetic problems requiring greater working memory capacity whilst simultaneously viewing affect-inducing pictures, they reported experiencing less negative affect than when completing problems requiring less working memory capacity. Similarly, Blagden and Craske (1996) demonstrated that when participants had to navigate their way around a room to complete a card sorting task, they reported less anxiety than those who completed the task without having to move around the room. Hence, both studies suggest that making the distraction task more complex and demanding of working memory capacity would make the manipulation, and therefore the strategy, more effective. The current study did not use a typical working memory task, with a known high level of task load, or ask the participants to move around (due to the confounds this may have on physiology) and may not have provided the most effective form of distraction.

In conclusion, these results provide unique insights on issues that have not been explored to date regarding the influence distraction and acceptance have on attentional focus and the engagement in maladaptive regulation strategies. There was support for distraction reducing attention towards affective responses relative to acceptance, but not in reducing attention to threat-related thoughts. However, there was support for acceptance increasing attentional focus towards affective responses relative to distraction and to a lesser extent mind-wandering. These results are important because they suggest that distraction and acceptance create different enough impacts on attentional focus so as to test the predictions of theories claiming that experiencing affect and integrating such affect with reason is necessary for eventually reducing the experiencing of affect (Greenberg, 2004; Greenberg & Paivio, 1997). The items and resulting ES, developed to measure use of the maladaptive strategies of worry, rumination and suppression, showed convergent validity with each other and their parent scales. Most significant was the finding that neither distraction nor acceptance instructions had any measurable influence over reported engagement in maladaptive regulatory attempts. Future research, undertaken in chapter 6 of this thesis, will evaluate both distraction and acceptance under threat circumstances to determine if, despite the strategies not limiting the engagement in the maladaptive regulatory attempts, they are indeed effective in reducing anxious affect.

Chapter 6: To Distract or to Accept: Which Strategy is More Effective in Reducing Anxiety?

As discussed in chapter 2, many situations can invoke anxiety and stress. Such situations include a job interview, an examination, public speaking or asking a romantic interest out for a date. Due to the possibility of rejection or negative evaluation by others, these situations challenge and threaten positive self-perceptions (i.e., represent ego-threat). Due to the uncontrollability and uncertainty of the outcomes when entering these situations, the behavioural actions available may not prevent or remove the possibility of negative outcomes. Importantly, the anxious response that these threats generate can coincide with self-focused attention (Carver & Scheier, 1988) and appraisals of such affective responses as inappropriate and/or unhelpful (Heimberg & Becker, 2002). This self-focused attention and evaluative appraisal of affective responses can undermine attempts to achieve positive interpersonal outcomes in such situations (Lyubomirsky & Nolen-Hoeksema, 1995) and exacerbate the anxious affect experienced (Heimberg & Becker, 2002). Behavioural avoidance strategies may limit an individual in pursuing their personal goals. In contrast, adopting particular mental approaches, involving the control of attention and thought (i.e., cognitive regulation strategies) may enable effective reductions in anxious affect (Garnefski et al., 2001; Gross & Thompson, 2007; Kamholz et al., 2006; Lazarus & Folkman, 1984) whilst maintaining the ability to pursue personal goals in ego-threatening environments.

There are many different cognitive regulation strategies available that may reduce anxious affect (Garnefski et al., 2001; Gross & Thompson, 2007; Kamholz et al., 2006; Lazarus & Folkman, 1984). Some of these strategies have been promoted as effective in reducing anxious affect (i.e., adaptive) and others have been demonstrated to be counterproductive (i.e., maladaptive). The allocation of attentional focus has been identified as a way of contrasting both adaptive and maladaptive strategies, with attentional focus away from threats and affect sometimes promoted as adaptive (Gross & Thompson, 2007; Lyubomirsky & Nolen-Hoeksema, 1993; Morrow & Nolen-Hoeksema, 1990; Nolen-Hoeksema, 1991; Pyszczynski & Greenberg, 1987; Wegner, 1994). However, other researchers have conceptualised the attempt to avoid the experience of unpleasant affect as maladaptive (Borkovec et al., 2004; Greenberg, 2004; Greenberg & Paivio, 1997; S. C. Hayes, 2004a). Hence, there are opposing theoretical positions on how effective a strategy will be if attention is focused away from affect (i.e., attentional diversion through distraction) as opposed to focusing attention towards these internal experiences (i.e., experiential observation and acceptance). The focus of this chapter is to test whether attention towards or away from an affective experience during the anticipation of a threat is more effective in reducing anxious affect.

6.1. The Affect Regulation Theories

There are two affect regulation theories that make opposing predictions regarding the optimal focus of attention for the effective self-regulation of unwanted affect. Both theories have been applied to a range of affective experiences, including anxiety and stress. The first is Gross and Thompson's modal model (2007), presented in, section 2.2.1. This model conceptualises affect regulation in a way that can be applied to many situations and affect regulation strategies. The modal model makes the prediction that removing one's attentional focus from affect-eliciting stimuli can reduce sustained unpleasant affect. The modal model predicts that, for an affective response to be initiated, a situation that may cause anxiety must first be consciously attended to and then appraised as harmful. Thus, attention deployment is a necessary precondition for any affective response to be initiated. Over time, a situation may elicit several affective responses; moreover, the first, or primary, affective response can form part of the situation. Hence, this affective response can also be attended to by the individual and appraised as either harmless or harmful. If the affective response is appraised as harmful, and is continually attended, then this deployment of attention can lead to the continuation or intensification of affective responses that are of similar valence to the primary affective response. Furthermore, if the initial stimulus that caused the primary affective response is continually attended to and perceived as harmful, this is also likely to lead to the continuation and intensification of anxious affect. However, if the threatening stimulus and the associated affective response are not attended, then there is no opportunity for the threatening stimuli and associated affective response to be perceived as harmful. The key premise behind the modal model is that if attention is not deployed to the stimuli (i.e., external events, or internal thoughts and feelings) that are causing or sustaining the affective responses, then the possible trajectory of continuation or intensification of that affective response is thwarted.

The second affect regulation model is Greenberg and Paivio's (2004; 1997) process of a feeling, previously presented in section 2.2.2. In contrast to the modal model, the process of a feeling model emphasises the need for increased conscious awareness and attention towards the affective experience in order for an unwanted affective response to reach completion. Completion, according to Greenberg and Paivio would mean that affect is integrated with reason and language resulting in an alternative affective state of a different valence. Greenberg and Paivio (1997) predict that the increased experience of affect and integrating this affect with one's knowledge and expression of themselves will achieve the completion of that affective response. Hence, the process of a feeling model predicts that avoiding attending to the emergence and presence of an affective response would impede the affective experience from reaching completion, and thus only perpetuate unwanted affect.

Both the modal model and the process of a feeling model have empirical support for when increased or reduced affect may occur. Studies providing empirical support for the predictions of the modal model regarding the focus of attention have used experimentally manipulated regulation strategies. This typically involves a manipulation to induce affective arousal followed by the engagement in a regulation strategy. The distraction condition provides participants with an attention-consuming task suggested to facilitate the allocation of attention away from thoughts and feelings related to the affective response or affective material, following the exposure to an affect eliciting stimulus. This distraction condition is typically contrasted with a strategy that involves participants focusing on their feelings and analysing why they feel they way they do and why they tend to react this way (i.e., the strategy of rumination) rather than a control condition with no attentional focus instructions (Blagden & Craske, 1996; Lyubomirsky & Nolen-Hoeksema, 1993; Rusting & Nolen-Hoeksema, 1998; Trask & Sigmon, 1999). Such studies typically show that those engaging in a distraction task report less unpleasant affect and show reduced physiological arousal than those engaging in the rumination task. Other studies supporting the use of distraction have manipulated attentional focus at the same time that the affect induction occurs (watching content whilst doing math problems or thinking of alternative topics), and this condition is compared to control condition that involves no instructed attentional focus (Van Dillen & Koole, 2007), or a proposed adaptive condition, with such studies finding that distraction reduces reported affect and results in decreased arousal (Sheppes et al., 2009; Sheppes & Meiran, 2007). These, more recent studies showing support for distraction did not evaluate distraction in anticipated threat circumstances. An older study by Bloom, Houston, Holmes and Burish (1977) evaluating distraction under anticipated threat circumstances showed beneficial results for distraction relative to a reappraisal condition (i.e., reinterpreting the threat as less harmful). However the manipulation of regulation in this study involved an imbalance in the physical and social demands placed on participants that may have reduced the validity of the results.

In contrast to the modal model, evidence in support of the process of a feeling model regarding awareness and attention to affect is provided mostly by studies using samples of individuals who are anxious repressors. Individuals who are high-anxious repressors *report* low levels of anxiety and also report trying to present as socially desirable (Crowne & Marlowe, 1960; Derakshan & Eysenck, 2001a), however, they also respond to threats with increased physiological arousal and parasympathetic withdrawal (Derakshan & Eysenck, 2001a, 2001b; Fuller, 1992). Anxious repressor individuals thus show limited conscious awareness or willingness to recognise that they are experiencing particular affective responses. This interpretation of limited conscious awareness is based on the discrepancy high-anxious repressors show between physiological responding indicators of anxious responding and their self-reported anxious responses during stressful events in contrast to high-anxious and truly low-anxious controls (Asendorpf & Scherer, 1983; Derakshan & Eysenck, 2001a), whose physiological response is consistent with their self-reported response. Similar discrepancies have been noted between behavioural/facial expression of emotions and reported affect by high-anxious repressors (Asendorpf & Scherer, 1983). These discrepancies between response types were suggested to result from decreased attention towards their affective responses occurring even under experimental manipulations designed to encourage repressor individuals to focus their attention on their affective responses (Derakshan & Eysenck, 2001b). Such suggestions have been further supported with repressors reporting actively self-initiating attention to distracting thoughts in a dichotic listening task rather than attending to affective stimuli, presumably in an unconscious effort to avoid the experience of unpleasant affect (Bonanno et al., 1991).

A further test of the process of a feeling model comes from the cognitive regulation strategy of experiential acceptance. This strategy involves the allocation of attention towards the affective experience (Hofmann & Asmundson, 2008). Unlike rumination or suppression, experiential acceptance is defined as involving the allocation of attention towards the affective response in a non-judgemental, non-reactive way (S. C. Hayes, 2004a; Roemer & Orsillo, 2009). Thus, the strategy of acceptance appears to achieve reductions in anxious affect in the opposite way to attentional diversion (i.e., via increased attention and awareness rather diverted attention and reduced awareness). As acceptance brings attention towards affect without judgement, it is more likely that this will facilitate a process of integrating the affective experience with reason, a process that is predicted to lead to the completion of affective response by the process of a feeling model. Hence, the strategy of acceptance provides the opportunity to test the predictions of the process of a feeling model against another strategy that also has possible therapeutic effects in threat situations - distraction.

Studies investigating the effectiveness of the strategy of acceptance using student samples have found that those engaging in acceptance show reduced heart rate (HR) relative to comparison conditions that encouraged the use of pre-identified maladaptive regulatory strategies and showed equally reduced HR to pre-identified adaptive approaches such as reappraisal (Hofmann et al., 2009; Low et al., 2008). Furthermore, consistent with the predictions of the process of a feeling model, Low et al.'s study showed that acceptance took more than 10 minutes of engagement to show reductions in HR relative to a condition in which participants were asked to engage in evaluative thoughts.

Both Hofmann et al.'s and Low et al.'s studies measured subjective (i.e., self-reported) affect and showed that acceptance did not differ from the maladaptive regulation conditions, following the strategies engagement (Low et al., 2008), or during engagement in the different experimental phases (anticipation, speech, recovery; Hofmann et al., 2009). Hence, these studies show discrepancies between measures, with HR showing reductions consistent with the process of a feeling model, but self-reported affect not decreasing, complementing the repression studies (physiology consistent self-report inconsistent). One reason for this discrepancy between HR and self-report measures of affect is that acceptance involves focusing on affective states, so it is likely that participants are increasingly aware of their feelings and, therefore, report higher levels than expected based on their physiology.

6.2. Why Might the Circumstance Under Which Regulation is Undertaken Influence the Effectiveness of the Strategy?

It has been demonstrated that situations involving the continued presence of high-threat often result in steadily increasing affect (Fuller, 1992; Monat et al., 1972). High levels of threat have been demonstrated to limit the ability to successfully divert attention whilst moderate level threats have been demonstrated as more easily ignored (Wilson & MacLeod, 2003). Despite such difficulty in controlling attention away from threats when anxious (Bar-Haim et al., 2007), most healthy individuals spontaneously seek to inhibit their awareness of threats (Derryberry & Reed, 2002; Ellenbogen et al., 2002; Koster et al., 2006; MacLeod et al., 1986) to avoid experiencing unpleasant affect (Mogg & Bradley, 1998). This attentional diversion has been suggested to be achieved by spontaneously mentally disengaging and initiating self-distraction (Carver & Scheier, 1988; Wicklund, 1975).

The direction to engage in the strategy of distraction and the provision of an attention-consuming task may facilitate the process of self-initiated mental distraction, rather than merely eliminate the opportunity to engage in worry or rumination. Despite this suggestion, it has been demonstrated that individuals who simultaneously try to reduce attention to affect-causing stimuli (Cornwell et al., 2011; Knight et al., 2007; Mather & Knight, 2005) or to reduce negative affect (Wegner et al., 1993), whilst maintaining threat-irrelevant stimuli within working memory, show impaired attentional diversion from affective stimuli such that attention reverts to the very stimuli sought to be inhibited and increased affect results. Thus, diverting attention from threats and affect via undertaking an attention-consuming task may actually disrupt effective spontaneously initiated attentional diversion regulatory attempts that are moderately effective in ignoring threat-related information and reducing affect.

Regarding acceptance, it may be assumed by the process of a feeling model that for a feeling to reach completion, there must be significant affective arousal present that can be detected and attended to (Greenberg, 2004; Greenberg & Paivio, 1997). Hence, it may be that acceptance may only show reduced affect in circumstances of pre-existing significantly increased affective arousal, as opposed to situations of little affective arousal. Furthermore, it has been suggested that increased attention to the self can lead to increased unpleasant affect, due to automatically initiated evaluation of aspects of the self that are less than ideal (Duval & Wicklund, 1972; Wicklund, 1975). Hence, individuals engaging in acceptance in circumstances of little threat where only low levels of anxious affect may be initially present, may actually only demonstrate increased affect as these individuals become more self-aware.

6.3. Limitations of Previous Research in Investigating Distraction and Acceptance

Although there is research demonstrating support for the competing predictions of the modal model and the process of a feeling model, there are four limitations of this previous research. These limitations include: (1) a lack of regulatory manipulations free from confounds such as differences in social and physical demands of the regulation task (particularly in the older studies evaluating the effectiveness of distraction); (2) the threat circumstances under which regulation is undertaken, (3) choice of suitable comparison conditions, and (4) the subsequent impacts of the strategies once they are no longer actively engaged in.

Of the first limitation, older studies investigating the effectiveness of distraction in anticipated threat situations (Bloom et al., 1977; Houston & Holmes, 1974) have had methodological flaws in the way that the regulation strategies were manipulated. Houston and Holmes (1974) created an imbalance amongst the conditions regarding the physical and social demands imposed, with a distraction condition involving reading aloud with performance requirements versus a condition involving sitting still and using reappraisal. Bloom et al. (1977) created imbalance in physical demands with a condition involving reading quietly to facilitate the distraction versus a condition involving writing to facilitate reappraisal. Hence, these differing levels of social and physical demands of the manipulations of the regulation strategies, rather than a difference in the focus of attention or thinking, may have influenced the affective results as social and physical demands are known to increase the arousal of individuals (Berntson et al., 1997; Gramer, 2006).

Secondly, a common issue that studies evaluating regulation strategies typically overlook is the circumstances under which the strategy is adopted. Many studies supporting the effectiveness of distraction in reducing anxiety, that are free from regulation manipulation confounds, have evaluated the effectiveness of distraction in reducing the residing affect once the affect inducing event has passed (Blagden & Craske, 1996; Rusting & Nolen-Hoeksema, 1998; Wong & Moulds, 2009), or during the passive exposure to an affect eliciting stimulus (Sheppes et al., 2009; Sheppes & Meiran, 2007; Van

Dillen & Koole, 2007). Thus, these studies have not assessed distraction's effectiveness in anticipated threat circumstances or where some performance requirement is anticipated in response to the affective stimulus. Furthermore, the beneficial effects of distraction and acceptance in reducing unpleasant affect have predominantly been demonstrated under highly affective arousing circumstances (Blagden & Craske, 1996; Hofmann et al., 2009; Low et al., 2008; Van Dillen & Koole, 2007; Wong & Moulds, 2009). Acceptance, has been recommended for a multitude of circumstances (S. C. Hayes, 2004b; Roemer & Orsillo, 2009). However, the effectiveness of the strategies in less affectively arousing circumstances have not been established.

Thirdly, of the studies supporting the use of distraction or acceptance, many have used a maladaptive strategy as one of the comparison conditions (Blagden & Craske, 1996; Hofmann et al., 2009; Low et al., 2008; Trask & Sigmon, 1999; Wong & Moulds, 2009). However, studies with the primary comparison condition involving a maladaptive strategy may be overstating the usefulness of distraction or acceptance as a strategy, as the strategies have not showed effectiveness relative to a neutral control condition or to an alternative strategy that may also be perceived as providing some benefit in reducing affect. Many of the acceptance studies do evaluate acceptance relative to a comparison condition that may be considered as adaptive (Dunn et al., 2009; Hofmann et al., 2009; Low et al., 2008). Of the studies investigating distraction, only two studies (Sheppes et al., 2009; Sheppes & Meiran, 2007), which did not have an identified imbalance in physical or social demands of one regulatory condition, compared distraction to an alternative strategy that was expected to be beneficial (reappraisal). Although these two studies did show supportive results for distraction in reducing affect, they evaluated the extent to which distraction reduced sadness in response to a film clip, and not to anxiety reduction in an anticipated threat situation.

The fourth limitation of previous research relates to the evaluation of the strategies being limited to the time period during which individuals are directly engaging in them. Limiting evaluation only to the directed regulation period does not capture possible detrimental after-effects of the affect regulation strategies. A study by Dunn et al., (2009) assessed the longer term consequences of engaging in acceptance during a film clip and noted that participants in the acceptance condition showed increased reactivity to novel picture stimuli following engagement and reported increased affect at one week follow up. However, it was unclear if these detrimental effects of acceptance were due to the subsequently presented picture stimuli not being related to the film clip content participants were asked to regulate their responses towards. A study by Kamphuis Telch (2000) investigated the impacts of distraction engaged in during exposure to a feared situation, rather than in the anticipation of a stressful task. This study suggested that distraction subsequently led to substantial more fear when reintroduced to the feared situation for a second time. In contrast, a study by Trask and Sigmon (1999) suggested that prior distraction can protect against the impacts of subsequent engagement in rumination on negative affect, but this was in relation to depressed affect rather than anxious affect. Thus, the potential counterproductive distal consequences of engaging in distraction and acceptance during the anticipation of threats may only become evident when actually encountering those threats.

6.4. Selection of Measures of Affect and Affect Regulation: HRV as a Indicator of Flexible Affect Regulation

Objective and theoretically relevant measures to evaluate the effectiveness of the strategies are vital in determining their utility. Although self-report measures of affect are economical and represent the subjective component of affect, they are susceptible to experimental demand effects and social desirability effects (Asendorpf & Scherer, 1983; Derakshan & Eysenck, 2001a). Hence, there is an important role for objective measures of affect, such as indicators of arousal including HR. However, it is sometimes difficult with regard to some objective measures (including autonomic and cognitive), to determine if they best represent affect or affect regulation (Appelhans & Luecken, 2006; Bar-Haim et al., 2007; Johns et al., 2008). Importantly, measures of affect regulation may complement measures of affect in suggesting the mechanism by which reductions in affect are achieved.

Ideally, an adaptive regulation strategy is one that supports a flexible and effective autonomic mechanism to inhibit arousal. The most flexible system that can rapidly control physiological anxious arousal is the parasympathetic nervous system via the vagus nerve (Porges, 2001, 2007). Unfortunately, heart rate alone does not necessarily represent just one autonomic system. However, central parasympathetic influences via the vagus nerve can be reflected through the beat-to-beat fluctuations of the heart, that is, heart rate variability (Berntson et al., 1997; Thayer et al., 2009). Increased vagal tone can be indicated by increased heart rate variability (HRV) on such metrics as root-mean-square-of-successive-differences (RMSSD) indicating most rapid fluctuations in HR, occurring over about 2.40-6.70 seconds (Berntson et al., 1997). HRV metrics have been suggested to provide an index of regulated emotional responding as they indicate the inhibition of fight or flight responding (Appelhans & Luecken, 2006; Thayer et al., 2009; Thayer & Lane, 2000). Supporting this suggestion is evidence showing that individuals predisposed to increased anxiety demonstrate lower vagal tone indicated by low HRV at rest relative to healthy controls (Austin et al., 2007; B. H. Friedman & Thayer, 1998; Lyonfields et al., 1995; Thayer et al., 1996; Weinberg, Klonsky, & Hajcak, 2009). Similarly, decreases in HRV have been demonstrated in individuals in threatening situations relative to those individuals who are not under threat, with individuals who show greater HRV also demonstrating superior performance in tasks requiring self-control in cognitive and behavioural domains (Croizet et al., 2004; S. C. Segerstrom & Solberg Nes, 2007). Hence, HRV has been used to provide an indication of rapid and flexible regulation of arousal (Berntson et al., 1997; Berntson, Cacioppo, & Quigley, 1991; Thayer et al., 2009; Thayer & Lane, 2000), and the extent to which participants demonstrate effective self-control (Demaree et al., 2004; S. C. Segerstrom & Solberg Nes, 2007).

A neurophysiological interpretation of HRV has been presented by Thayer and colleagues (Thayer et al., 2009; Thayer & Lane, 2000). They specifically implicate a group of neuroanatomical structures (e.g., orbito-frontal cortex, amygdala, hypothalamus, thalamus brainstem), referred to as the central autonomic network (CAN), that link the activity in the prefrontal cortex to the output of the heart, particularly HRV. Thayer and colleagues suggest that signals in this system flow bidirectionally. The first direction of influence is top-down, with prefrontal cortex activity suppressing amygdala activation resulting in increased vagal tone and the inhibition of arousal. The second direction is bottom-up, with vagal inhibition and levels of arousal being relayed back to the prefrontal cortex (via the thalamus) increasing the level of activation in the prefrontal cortex.

The ways in which distraction and acceptance impact the CAN may be reflected in HRV. Individuals prone to experiencing anxiety have difficulty in ignoring even moderate threats and may continually focus on such threats, which leads to increased amygdala activation, decreased prefrontal cortex activation and decreased vagal tone (Thayer et al., 2009; Thayer & Lane, 2000). Hence, distraction, if successful in limiting attention to threats and physiological responding, may sustain activity in the prefrontal cortex by limiting continued attention to threats, which would inhibit amygdala activation, leading to sustained vagal tone and reduced arousal. In contrast, Thayer and Lane (2000) suggest that emotional awareness and emotional monitoring aid emotional processing, assisting individuals in making sense of the situation, and acting in a regulated way. Therefore, if distraction led to decreased attention to feelings this may lead to dysregulation (decreased vagal tone). If acceptance leads to increased emotional awareness this would be predicted to lead to increased integration of emotional information to the prefrontal cortex and lead more regulated responding to the environment (i.e., increased vagal tone).

Despite the promise of HRV in evaluating the adaptiveness of a strategy, HRV indicators of vagal tone can be confounded by respiratory influences. The respiratory influences are particularly pertinent when observing HRV changes, as such changes could be due to changes in central parasympathetic activation or withdrawal (i.e., vagal tone) but might equally be due to changes in the pulmonary gating of central parasympathetic influences to the heart occurring due to changes in respiration (Berntson et al., 1997; Berntson, Cacioppo, & Quigley, 1993). During inhalation, the efferent parasympathetic influences towards the heart (i.e., vagal inhibition of HR) is temporarily gated off and are subsequently reinstated during exhalation. Slower, deeper breathing increases HRV, not because it changes vagal tone, but due to the phasic process of slowed gating. A slower gating process, as noted in slowed breathing, allows for higher peaks in HR (due to prolonged gating off of vagal inhibition of HR during longer inhalation) and lower troughs in HR (due to prolonged vagal inhibitive influence over HR with longer exhalation). This slowed gating can lead to the misinterpretation of HRV as indicating increased vagal tone (an increased parasympathetic influence) when there are only systematic differences in respiratory activity amongst experimental conditions (Berntson et al., 1997). Hence, respiration activity requires measurement to rule out respiratory changes confounding changes in HRV and changes being misattributed (Berntson et al., 1997). In addition, respiration can also be influenced by emotional states (Bloch, Lemeignan, & Aguilera, 1991; Wientjes, 1992). Previous research on HRV has treated respiratory variables as separate psychophysiological variables first that are then regressed on HRV changes to remove HRV fluctuations due to respiratory changes before comparing experimental conditions

(Althaus, Mulder, Mulder, van Roon, & Minderaa, 1998; Berntson et al., 1994; Wientjes, 1992).

6.5. The Present Research

The present research aims to extend the understanding of the role attentional focus, towards affective responses, in effectively reducing anxious affect by answering six questions. First, is attentional focus away from anxious affect (i.e., distraction) more effective at reducing anxious affect than attentional focus towards anxious affect (i.e., acceptance)? Second, are the strategies effective in reducing affect during the period when participants actively engage in them while anticipating an imminent threat? Third, does the threat circumstance impact on the effectiveness of these strategies during their engagement? Fourth, does previous strategy engagement, during anticipation, influence affective reactivity and repair during the subsequent periods when participants encounter the threats and recover from them? Fifth, do distraction and acceptance have a different impact on different measures of affect (arousal, as indicated by HR versus the subjective experience of anxiety, as indicated via self-report). Sixth, do distraction and acceptance alter parasympathetic influences (i.e., HRV) over arousal? These questions are answered in two studies: study 6.1, investigating the influence of the strategies, during active engagement when anticipating threats, and; study 6.2, investigating the subsequent impacts of the strategies on affective reactivity and recovery from threats.

6.6. Study 6.1: The Effectiveness of Distraction and Acceptance in Reducing Anxiety when Anticipating a Threat

This study will evaluate the effectiveness of the regulatory strategies while participants anticipate engaging in one of two tasks designed to be perceived as high (i.e., deliver an impromptu speech) or low (i.e., watch a film clip about UK tax law) ego-threat. Participants will engage in either distraction, acceptance, or mind-wandering (a control condition with no attentional focus) strategies for 15 minutes, giving them time to absorb themselves in the strategy. This 15-minute period will be split into three 5-minute epochs[x] to test the effects of the strategies over time. Change from baseline scores will be used to demonstrate the impacts threats and regulation has on the affective variables.

Firstly, there are three predictions regarding the impacts of threat. Firstly, increased threat is predicted to decrease HRV, increase HR, and increase reported affect independent of the regulatory strategies, throughout anticipation period. Secondly, that the control condition, in the high-threat condition, should show a gradual increase in HR over each successive 5-minute epoch, as the threat draws closer (Fuller, 1992; Monat et al., 1972). Thirdly, the control condition in low-threat condition should show gradually reducing affect as the mind drifts and ignores the low level threat (Wilson & MacLeod, 2003).

There are a number of predictions regarding the impact of regulation, particularly in regard to the modal model. Firstly, the modal model predicts that, individuals in the distraction condition, assuming effective reducing attention to threats and affective responses, should show greater HRV than the mind-wandering control condition throughout regulation, in high-threat circumstances. Secondly, it predicts that engaging in distraction will lead to gradual decreases in HR over each successive 5-minute epoch in both threat levels. Lastly, the modal model predicts that distraction condition will report

[x] Five minutes is the recommended time period to calculate HRV indices (Berntson et al., 1997; Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996).

less anxious affect than the control condition. Together these predictions from the modal model will be referred to as the "effective distraction hypotheses".

In contrast to the modal model, the process of a feeling model predicts that the diversion of attention from an affective response to a distracting task should result in lower HRV throughout regulation, relative to acceptance and the control condition. Furthermore, distraction should result in a gradual increase in HR across successive epochs resulting in an increasing discrepancy in HR between it and the acceptance and control conditions. Lastly, according to the process of a feeling model, participants in the distraction condition should report more anxious affect following regulation than those in the acceptance and control conditions. Together these predictions from the process of a feeling model will be referred to as the "disruptive distraction hypotheses".

In addition, the process of a feeling model predicts that the acceptance condition will show greater HRV than the distraction and control conditions. Moreover, the pattern of HR results shown by the participants in the acceptance condition is predicted to start at a moderate level of HR, escalating to a peak, significantly above the control condition when participants are fully consumed in the strategy and asked to focus on unpleasant thought and feeling (i.e., occurring between 5-10 minutes), then subsiding to a lower level after 10 minutes, so that the acceptance condition will show significantly lower HR than the distraction and control conditions in the last epoch. Participants in the acceptance condition are predicted to self-report less affect following regulation than the participants in the distraction and control conditions. Together, these predictions from the process of a feeling model will be referred to as the "effective acceptance hypotheses".

When taking into account the threat situation that the affect regulation strategies are undertaken in, the strategies are predicted to have different impacts on affect in each threat circumstance. In the high-threat level, distraction is predicted to be less effective at reducing negative affect due to an individuals' ability to ignore threat-relevant information and the ironic process associated with mental control and, therefore, should lead to increased affect relative to the other conditions. The impact ironic processes in low-threat levels should be reduced due to the improved ability to ignore even moderately threatening stimuli and therefore leading to improved effectiveness of distraction. Hence, in low-threat levels distraction should not differ from the control condition. In contrast, as it is assumed that a reasonable level of affect arousal is present first in the process of a feeling model, acceptance is predicted to eventually lead to decreased affect in the high-threat level, but not be especially effective in reducing affect in the low-threat level, where the increased self-awareness, as a result of engaging in acceptance, is predicted to lead to increased affect relative to a control condition (i.e., a susceptible acceptance hypothesis).

6.6.1. Method

This study presents results from the HR, RR, HRV and SR affect measures taken during the baseline and regulation phases of the experimental procedure described in full detail in chapter 4. The phases under which the data were collected are highlighted in Figure 6.1. The design of the experiment involves three independent variables. The first independent variable is between subjects and involves the imposition of threat, consisting of two levels: high and low. The second independent variable manipulated between subjects is regulation strategy consisting of three levels: distraction, acceptance and mind-wandering control. The third independent variable was time (a within subjects variable), where the regulatory period was split into three 5-minute epochs. Thus, these manipulations created a 2 (threat level) x3 (regulation strategy) x3 (time) mixed design. One hundred and eighty university students were randomly allocated to each of the six between-subjects conditions. Analyses to determine pre-existing difference in affect were undertaken on the Strait-Trait Anxiety Inventory, Trait Version (STAI-T; C. Spielberger et al., 1983) and the Depression Anxiety and Stress Scale, 21 item versions (DASS-21; S. H. L. Lovibond, P. F., 1995), administered before the start of the experiment, and HRV, HR and self-reported affect measured during resting baseline. Analyses establishing the effectiveness of the threat manipulations focus on the measurement of HR when participants were exposed to the threat manipulation, where participants were either told that they would be delivering an impromptu speech (high-threat), or watching a short film clip about UK tax law (low-threat). A majority of the analyses focus on when participants are played an audio file providing regulation instructions that promoted the use of these regulation strategies[y]. Measurements of anxious affect during the thinking regulation period included; (HRV, RR and HR), and immediately prior to the regulation tasks (self-reported affect measured on a scale from one to seven). Self-report measure of affect was taken from Johns et al. (2008), but see appendix B for example. Participants in the distraction condition were given a visual imagery task (see appendix C). Acceptance was manipulated through a mindfulness mediation audio-tape exercise of first noticing bodily sensations (first regulatory epoch) and slowing respiration (first and second regulatory epoch), noticing negative thoughts and feelings (second regulatory epoch) and finally accepting and watching these negative thoughts and feelings pass using imagery (third regulatory epoch). See appendix C for full acceptance instructions.

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[y] The physical demands of the writing task, used to provide evidence of participants understanding and active engagement in the strategies, made this phase of the experiment unsuitable for the measurement physiological variables and thus were not used to evaluate the strategies.

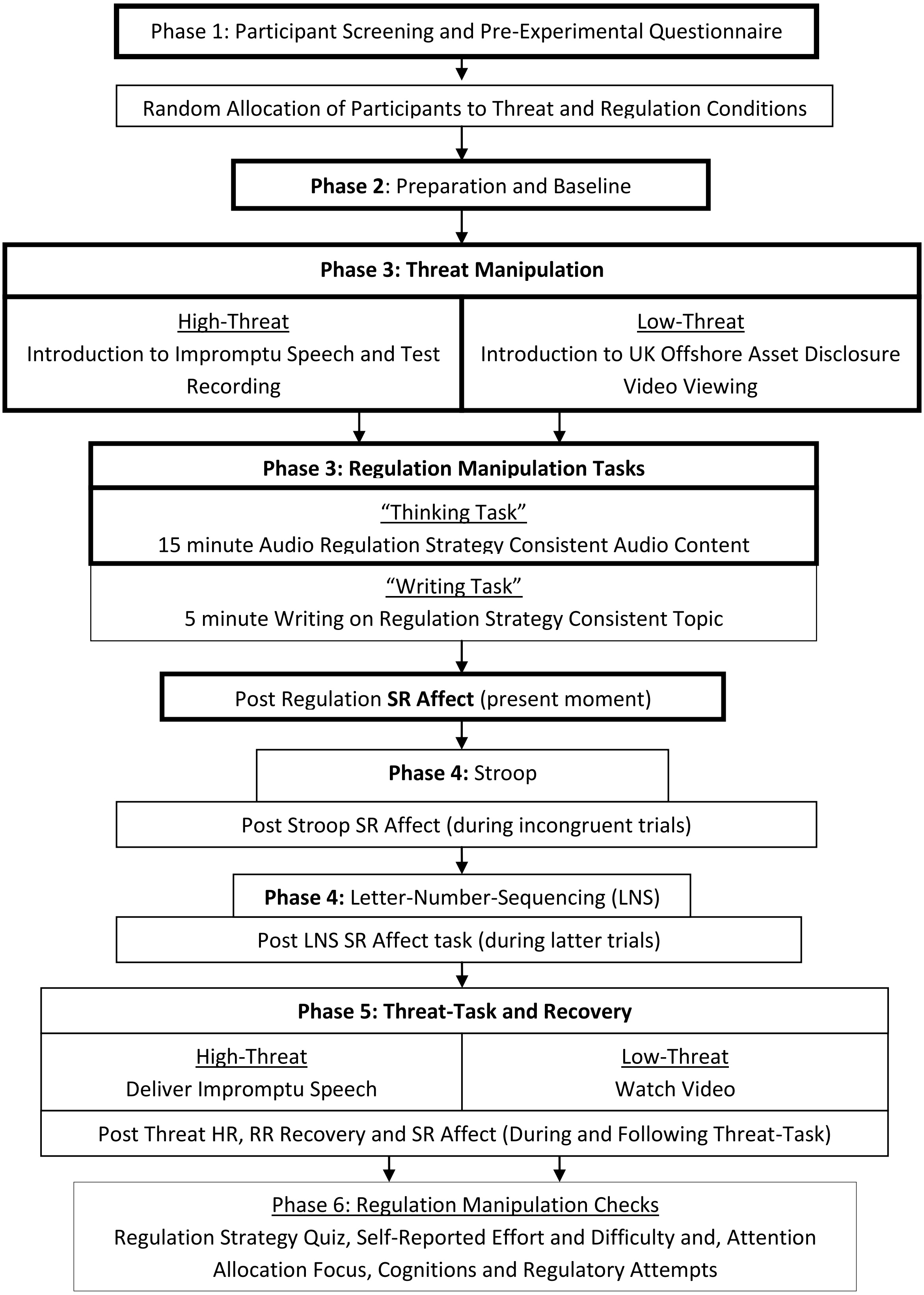

Figure 6. 1. Flow Diagram of Procedural Phases with Data Taken from Phases 2 and 3 (Highlighted).

6.6.2. Results

Physiological data, including HRV, RR and HR were taken during the regulatory period. Based on the "law of initial values" (Lacey, 1956; Wilder, 1962) all data (including self-reported affect) were converted to change scores (period of interest-baseline) for "base-free" measure of anxious arousal. Baseline, although representing participant's initial states soon after entering the laboratory, did not necessarily represent a state participants may have been expected to return to during the experiment, due to baseline measurement occurring in the context of a novel situation where stressful cognitive performance tasks were anticipated. Thus the zero point value is not particularly meaningful, with positive and negative values simply indicating increases and reductions, respectively, relative to the start of the experiment. The base-free change scores were used primarily to remove the noise created by individual differences existing between subjects and thus increasing the likelihood of detecting the impacts of between subjects' experimental manipulations.

6.6.2.1. Checks for Group Differences at Baseline

A series of factorial 2 (threat level) X 3 (regulation strategy) ANOVAs were used to check for differences on affective and autonomic variables amongst the experimental conditions before experimental manipulations occurred. See Table 6.1 for means and standard deviations for the measures analysed. Participants' tendency to experience affect according to their scores on the STAI-T and the DASS-21 scales, was shown not to differ significantly amongst the experimental conditions (Fs < 1.7, *ns*.). Furthermore, there were no significant differences between the experimental conditions at baseline for the measures of HRV, HR, and reported affect (Fs < 1.5, *ns*.). Hence, results of baseline checks raise no concerns about pre-existing differences in affect-related measures before participants were subjected to the experimental manipulations.

Table 6.1.

Mean and standard deviations of participants' predisposition to experience affect and affective state before experimental manipulation.

	Threat Level							
	High-Threat				Low-Threat			
	Dis	**Acc**	**Con**	**Tot**	**Dist**	**Acc**	**Con**	**Tot**
STAI	42.63	43.87	42.40	**42.97**	44.40	40.37	43.23	**42.67**
	(7.46)	(10.09)	(8.91)	**(8.81)**	(9.58)	(8.81)	(10.90)	**(9.84)**
DASS-D	4.87	5.70	4.03	**4.87**	5.43	4.17	4.67	**4.75**
	(3.46)	(4.83)	(3.42)	**(3.97)**	(4.75)	(3.57)	(4.38)	**(4.25)**
DASS-A	4.57	4.10	4.10	**4.26**	4.70	3.00	3.53	**3.74**
	(3.52)	(3.77)	(3.51)	**3.57)**	(3.65)	(3.10)	(2.94)	**(3.29)**
DASS-S	8.40	8.10	7.70	**8.07**	9.00	7.60	7.53	**8.04**
	(4.22)	(4.55)	(2.79)	**(3.90)**	(4.68)	(4.34)	(4.13)	**(4.39)**
HRV	41.31	32.06	34.71	**36.03**	34.06	31.78	34.06	**33.30**
	(23.75)	(17.49)	(16.36)	**(19.65)**	(19.07)	(16.01)	(21.37)	**(18.76)**
HR	76.74	76.23	79.07	**77.35**	78.93	77.33	79.43	**78.56**
	(11.48)	(8.85)	(11.94)	**(10.31)**	(10.64)	(12.61)	(12.52)	**(11.85)**
SR	1.69	1.59	1.73	**1.67**	1.61	1.56	1.76	**1.64**
	(.66)	(.66)	(.63)	**(.65)**	(.75)	(.79)	(.94)	**(.83)**

Figures in parentheses indicate SD. Dist = distraction; Acc = Acceptance, Con = Control, Tot = Total. HRV= RMSSD, HR= beats-per-minute, SR= self-reported affect. The DASS-21 scale scores indicated by the letters, D= depression, A= anxiety, and S= stress) indicate the subscale scores.

6.6.2.2. Manipulation Checks

Two further basic assumptions require testing. The first assumption is that the threat manipulation was effective. Specifically, the participants in the high-threat condition should show a greater increase in HR from baseline (equally across all regulatory conditions) than the participants in the low-threat condition during the revelation of the threat activity. The second manipulation check relates to differences in respiration rates amongst the regulation conditions. Participants in the acceptance conditions, adhering to a mindfulness meditation script that instructs individuals to slow their breathing during the first two periods of regulation, should show lower RR than the distraction and control participants during these periods of regulation.

Manipulation of Anxious Arousal: HR taken during the threat revelation was used to test the assumption that the threat manipulations would alter the degree of anxious arousal experienced before engaging in the regulation strategies. A 2 (threat level: high and low) X 3 (regulation strategy: distraction, acceptance and mind-wandering) between subjects ANOVA was conducted on the HR change scores from the threat revelation period. The means and standard deviations are presented in the Table 6.2.

Table 6.2.
Heart Rate (Beats Per Minute) Mean Change Score for Each Condition Over the Threat Revelation Period.

	Threat Level		
	High-Threat	**Low-Threat**	**Regulation Total**
Distraction	5.86 (4.42)	1.77 (3.16)	**3.74 (4.31)**
Acceptance	5.31 (4.88)	1.79 (2.89)	**3.52 (4.34)**
Control	5.81 (6.19)	1.07 (3.58)	**3.44 (5.55)**
Total	**5.66 (5.18)**	**1.54 (3.20)**	

Figures in parentheses indicate *SD*.

The results revealed that the threat manipulation was successful across all regulation conditions. As predicted, the high-threat conditions showed significantly greater increase in HR relative to the low-threat conditions, $F(1, 173) = 39.88$, $p < .001$, $\eta_p^2 = .19$. As expected, neither the main effect of regulation strategy, $F(2, 173) = .12$, $p = .89$, $\eta_p^2 = .001$, nor the interaction between threat level and regulation strategy, $F(2, 173) = .30$, $p = .75$, $\eta_p^2 = .003$, was significant. These non-significant results indicate that there were no pre-existing differences in HR among regulation conditions and that participants in each regulation condition responded similarly to the threat manipulation.

A paired samples *t*-test showed that the high-threat condition's HR increased significantly from baseline ($M = 77.35$, $SD = 10.31$) to threat revelation ($M = 83.10$, $SD = 10.73$), $t(89) = 10.63$, $p <.001$, $d = .55$. The low-threat conditions also showed a significant increase in HR from baseline ($M = 78.56.$, $SD = 11.85$) to threat revelation, ($M = 80.11.$, $SD = 11.26$), $t(89) = 4.57$, $p <.001$, $d = .13$. Thus, both the revelation levels of both high- and low-threat led to increased affect, but the effect was considerably stronger for the high than the low-threat.

Manipulation of RR: Participants within the acceptance condition were asked to slow their breathing during the first regulatory epoch. To confirm that respiration rate was significantly lower in the acceptance conditions than the distraction and control conditions during, a 2 (affect level: high and low) X 3 (regulation strategy: distraction, acceptance and mind-wandering) X 3 (five minute regulatory epochs) mixed design ANOVA was conducted on the respiration change scores (period of interest-baseline). Initial data screening identified two outliers; both from the low-threat control condition, and these were removed from the following analysis. The means and standard error for each condition for each regulatory epoch are shown in Figure 6.2.

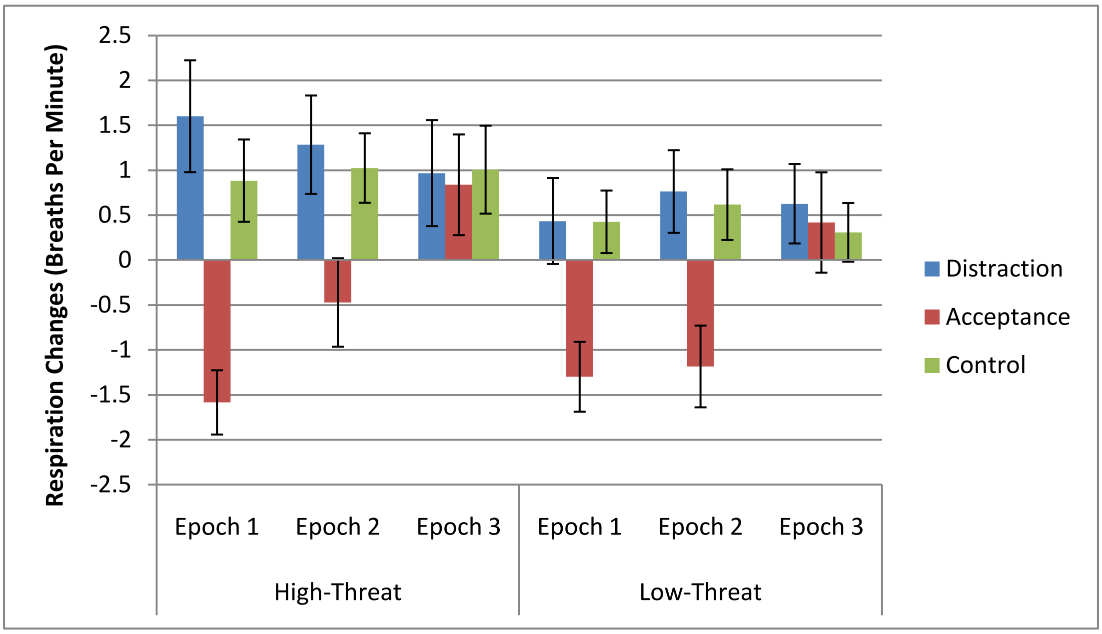

Figure 6. 2. Respiration rate (breaths per minute) change score means (error bars indicate SE) for experimental conditions during epochs of regulatory period.

The results showed no significant main effect of threat level, $F(1, 172) = 2.00$, $p = .16$, $\eta_p^2 = .012$. The main effect of regulation strategy was significant, $F(2, 172) = 7.15$, $p = .001$, $\eta_p^2 = .070$. Planned contrasts showed that acceptance led to greater reductions in respiration rate changes from baseline during the regulatory period than the distraction and control conditions, $t(175) = -3.76$, $p < .001$, $d = -.60$, which did not differ, $t(175) = .53$, $p =.59$, $d= .1$. There was a main effect of epoch, $F(2, 171) = 6.95$, $p = .001$, $\eta_p^2 = .075$, with the first epoch showing the greatest decrease in respiration rate from baseline, which then diminished significantly for each subsequent epoch. Importantly, the predicted two-way interaction between regulation strategy and epoch was significant, $F(4,340) = 11.37$, $p < .001$, $\eta_p^2 = .12$, showing that, consistent with the effectiveness of the manipulation, the differences between the regulation strategies changed over time.

As direct instruction to slow respiration rate was given in the acceptance condition during the first two phases of the regulatory period, it was predicted that participants in the acceptance condition would show a lower respiration rate than those in the distraction and control conditions during these regulatory epochs. To test this prediction, three 2 (threat level) X 3 (regulation strategy) univariate ANOVAs corresponding to each 5-minute epoch were used. The results showed a significant main effect of regulation strategy for the first, $F(2, 172)= 17.18$, $p < .001$, $\eta_p^2 = .17$, and second ,$F(2, 172) = 9.79$, $p < .001$, partial $\eta^2 = .102$, regulatory epochs. As predicted, and consistent with the pattern of results across all three of the regulatory epochs, pairwise comparisons showed that the acceptance condition mean RR change from baseline was significantly lower than the distraction and control conditions *(p* <.001 for epoch 1 and 2), with no difference between the distraction and control conditions ($p = .43$ for epoch one and $p = .66$ for epoch 2). However, the third regulatory period showed no significant main effect of regulation strategy, $F(2,172) = .07$, $p = .94$, partial $\eta^2 = .001$. These results confirmed that the acceptance manipulation slowed respiration during the initial two epochs of the regulatory period but that respiration rate returned to a level not significantly different from the other conditions once it was no longer directly manipulated via the audio instructions.

6.6.2.3. Heart Rate Variability

Removing Respiratory Effects from HRV: The systematic differences in respiration rate change noted above confound the interpretation of HRV change scores (Berntson et al., 1997). Therefore, variance due to respiratory changes was removed from HRV change scores using regression analyses and saving residuals scores (Berntson et al., 1994). A linear regression of RMSSD change scores on respiration rate change scores was conducted for each of the three regulatory epochs[z]. This analysis provided the degree of variance in RMSSD change scores (regulatory epoch - baseline) attributable to respiratory changes during the same epochs. Results are presented in Table 6.3.

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[z] A quadratic model was also tried however this did not account for more variance.

Table 6 .3.

Regression ANOVA Results of RMSSD change scores on respiration change scores for each regulatory epoch.

Epoch	R^2	*B*	*SE B*	β	*t*	*P*
1^{st}	.129	-.18	.035	-.36	-5.14	< .001
2^{nd}	.059	-.12	.036	-.24	-3.34	.001
3^{rd}	.075	-.15	.040	-.27	-3.80	< .001

Table 6.3 shows that the respiration difference scores accounted for a small but statistically significant amount of the variance for each epoch.

Effects of Regulation and Threat on HRV: Nine outliers were detected in the HRV RMSSD residual change score data. Three outliers were from the high-threat acceptance condition, two from the high-threat distraction condition, and one outlier from each of the other four conditions. To test the competing regulatory hypotheses, a 2 (threat level) X 3 (regulation strategy) X 3 (regulatory epoch) mixed design ANOVA was used on the RMSSD change score residuals. The means and standard error for each condition and each epoch are summarised in Figure 6.3.

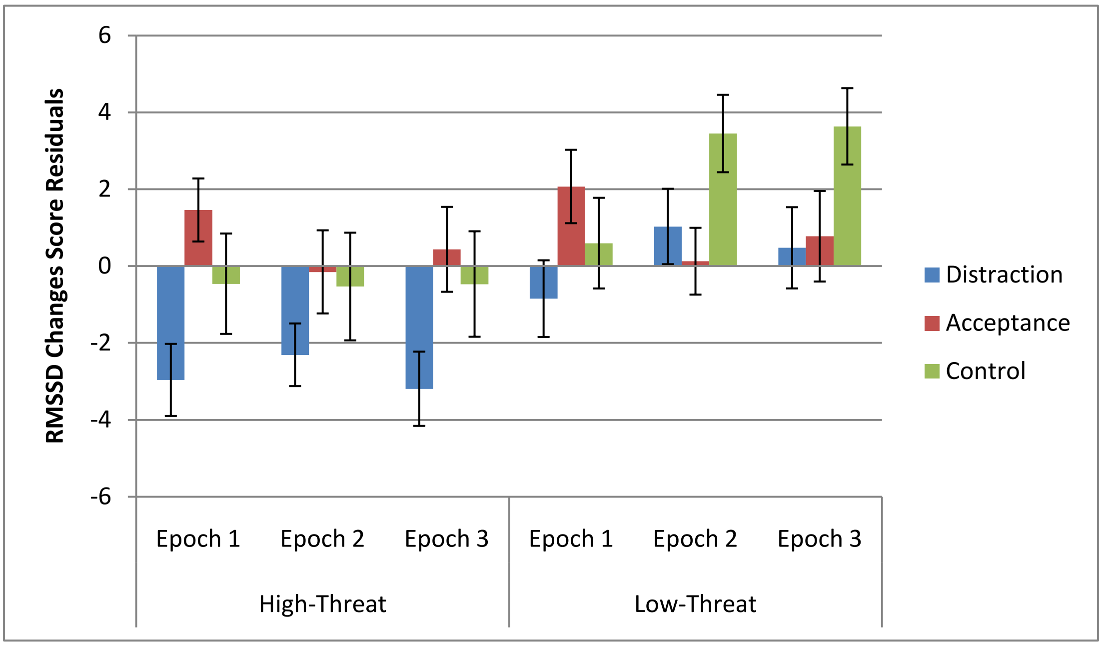

Figure 6.3. Mean residual RMSSD change scores (regulatory epoch - baseline) with respiration changes statistically controlled. Error bars indicate SE.

The results showed a significant main effect of threat level, $F(1,165) = 7.99$, $p = .005$, $\eta_p^2 = .046$, confirming that the low-threat level conditions had higher HRV than the high-threat conditions throughout the regulatory period[aa]. The main effect of regulation strategy was significant, $F(2,165) = 3.75$, $p =.026$, $\eta_p^2 = .043$. Post hoc LSD tests showed that distraction led to significantly lower HRV than acceptance, $p = .028$, mean difference = -2.09, $SE = .94$, and control conditions, $p = .013$, mean difference = -2.34, $SE = .93$. The difference between the acceptance and control conditions were not significant, $p = .79$, mean difference = -.25, $SE = .94$. There was no significant effect of epoch, $F(1, 164) = .32$, $p = .73$, $\eta_p^2 = .004$. There was a significant interaction between regulation strategy and epoch,

[aa] Two independent samples *t*-tests were used to test if the effect of threat was present between the two mind-wandering control conditions, across the entire regulatory period and in the final regulatory epoch. The t-tests showed that the high-threat level led to significantly lower HRV during the entire regulatory period, $t(56) = -2.02$, $p = .048$, $d = -.53$, and within the third regulatory epoch, $t(56) = -2.42$, $p = .019$, $d = -.64$. These analyses are relevant to the interpretation of the executive control results in chapter 7.

$F(4, 326) = 5.14$, $p < .001$, $\eta_p^2 = .05$, showing changes in the relative effects of regulation strategies on HRV over time. The interaction between threat level and regulation strategy was not significant, $F(2, 165) = .11$, $p = .90$, $\eta_p^2 = .001$, showing that the threat level did not moderate the regulation strategies' effects on HRV. The three-way interaction between threat level, regulation strategy and epoch was not significant, $F(4, 340) = 1.73$, $p = .14$, $\eta_p^2 = .02$.

Despite the lack of interaction between threat and regulation strategy, analysis examining regulation strategy within each threat level was undertaken to test the regulatory hypotheses taking into account the differential levels of affect induced by the threat levels[bb]. The results from the first 3 (regulation strategy) X 3 (epoch) ANOVA within the high-threat level showed a main effect of regulation strategy approaching significance, $F(2,81) = 3.07$, $p = .052$, $\eta_p^2 = .070$. There was no main effect of epoch, $F(2,81) = .22$, $p = .80$, $\eta_p^2 = .005$, or interaction between regulation strategy and epoch $F(4,158) = 1.40$, $p = .24$, $\eta_p^2 = .034$. It was hypothesised that the influence of the strategies would be most prevalent towards end of regulation and because there were no respiratory differences between the regulatory conditions in the third regulatory epoch, it was chosen test the impacts of regulation. A one-way ANOVA showed a significant effect of regulation $F(2,81) = 3.43$, $p = .037$, $\eta_p^2 = .078$. Within the third regulatory epoch post hoc LSD tests showed that those in the distraction condition had significantly lower HRV than those in the acceptance condition, $p = .011$, mean difference = -5.86, *SE* =2 .25, and somewhat lower than the control condition, but this difference did not reach significance, $p = .13$, mean difference = -

[bb] *To allow comparison with previous studies (e.g., Dunn et al., 2009; Hofmann et al., 2009; Low et al. 2008) that evaluate regulation strategies within only one threat level, this study evaluates the effectiveness of regulation within each threat level separately, despite the interaction between threat level and regulation not reaching significance. Due to the limited significance of the three-way and two-way interactions, caution should be used in the interpretation of these results.*

3.37, *SE* = .13. Acceptance showed no significant difference from the control condition *p* = .27, mean difference = 2.49, *SE* = 2.23.

The results from the corresponding 3 (regulation strategy) X 3 (epoch) ANOVA within the low-threat level showed no main effect of regulation strategy, *F*(2,84) = .1.80 , *p* = .17, η_p^2 = .041 and no significant main effect of epoch *F*(2,83) = 1.81, *p* = .17, η_p^2 = .042. There was a significant two-way interaction between regulation strategy and epoch, *F*(4,164) = 3.28, *p* = .001, η_p^2 = .11. A one-way ANOVA within the second regulatory epoch (the period in was hypothesised to lead to increased affect, showed an effect of regulatory strategy, *F*(2,84) = 3.24 , *p* = .044, η_p^2 = .072. Post hoc (LSD) analyses showed that acceptance resulted in significantly lower HRV relative to the control condition, *p* = .016, mean difference = -3.23, *SE* = 1.35. The distraction condition did not differ from the acceptance condition, *p* = .51, mean difference = .90, *SE* = 1.35 and the difference between the distraction and the control condition trended towards significance, *p* = .077, mean difference = -2.42, *SE* = 1.35, with distraction showing lower HRV.

The regulatory hypotheses also both predicted differences amongst regulatory strategies in the final regulatory epoch as participants took time to consume themselves in the strategy. A one-way ANOVA testing these hypotheses in the low-threat level during the third regulatory epoch showed the effect of regulation strategy trending towards significance, *F*(2,84) = 2.61, *p* = .079 η_p^2 = .059. Post hoc (LSD) analysis demonstrated that there was no difference between distraction and acceptance, *p* = .85, mean difference = -.29, *SE* = 1.53. The distraction condition showed a lower HRV than the control condition, *p* = .042, mean difference = -3.16, *SE* = 1.53. Furthermore, the acceptance condition showed somewhat lower HRV than the control condition, but the difference only trended towards significance, *p* = .064, mean difference = -2.86, *SE* = 1.53.

6.6.2.4. Heart Rate

Effectiveness of Regulation: Initial data screening detected three HR change score (epoch HR – baseline HR) outliers. Two participants were from the high-threat distraction condition and one from the high-threat acceptance condition. These outliers were deleted from the subsequent HR analysis. The means and standard error for each condition and epoch are presented in Figure 6.4.

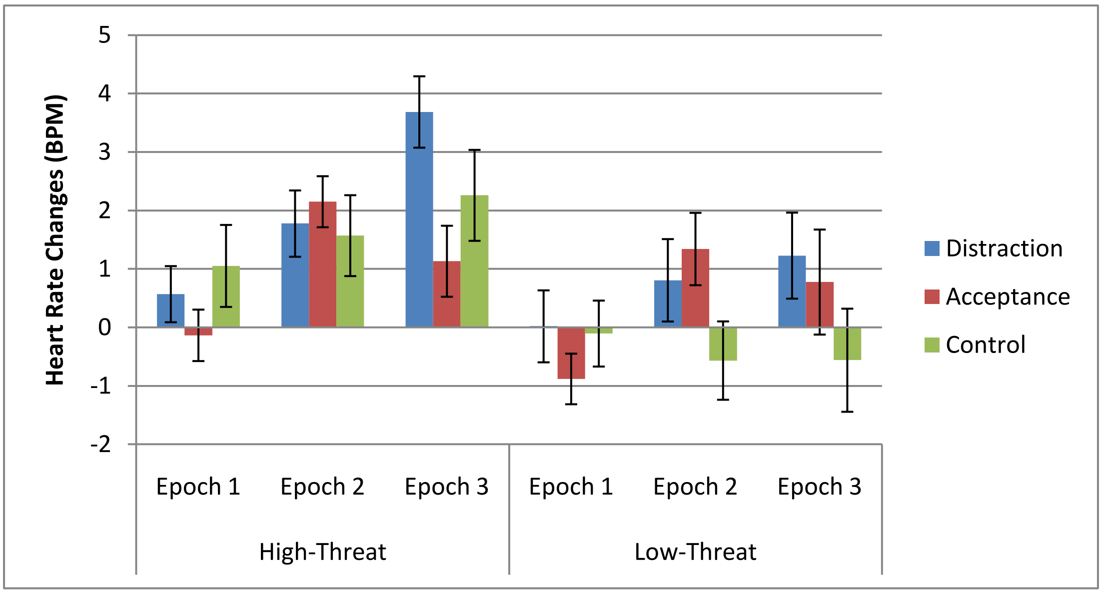

Figure 6.4. Mean heart rate change scores relative to baseline (error bars indicate SE).

To test the competing regulatory hypotheses, a 2 (threat level: high and low) X 3 (regulation strategy: distraction, acceptance, mind-wandering) X 3 (epoch: first, second, and third regulation epoch) mixed design ANOVA was conducted on the HR change from baseline scores, with threat and regulation strategy being the between subjects factors, and epoch being the within subjects factor.

As expected, the results showed a main effect of threat level, with the high-threat level showing a greater increase in HR relative to the low-threat level, $F(1, 171) = 7.96$, $p = .005$, $\eta_p^2 = .044$. The main effect of regulation strategy was not significant, $F(2, 171) = .93$, p

= .40, η_p^2 = .011. There was significant main effect of epoch, $F(2, 170) = 27.55$, $p < .001$, η_p^2 = .245, showing increasing HR with each epoch. However, this main effect of epoch was moderated by the significant interaction between regulation strategy and epoch, $F(4, 338)$ = 13.41, $p < .001$, η_p^2 = .137, showing that regulation strategies influenced HR differently over time. Figure 6.4 shows that the distraction condition evinced progressive increases in HR over time. Furthermore, Figure 6.4 shows that the acceptance conditions show elevated HR in the second epoch relative to the first, followed by decreases in the third epoch. The interaction between threat level and epoch approached significance, $F(2, 170) = 2.46$, p = .088, η_p^2 = .028[cc]. There was no significant interaction between threat level and regulation strategy, $F(2, 171) = .66$, $p = .52$, η_p^2 = .008, nor was the three-way interaction between threat level, regulation strategy and time significant, $F(4,338) = 1.21$, $p = .31$, η_p^2 = .017.

6.6.2.4.1. Testing the Impacts of the Strategies Across Threat Level and Across the Regulatory Epochs

As the predicted interaction between regulation strategy and epoch was confirmed, further tests were undertaken to test which of the regulatory hypotheses were supported. Planned comparison *t*-tests were used to test the effective acceptance hypotheses prediction that acceptance would lead to increased HR relative to the control condition during the second regulatory epoch (when participants were asked to attend to their thoughts and feelings). This prediction received marginal support, with the acceptance condition showing a greater HR relative to the control condition that approached significance, $t(117) = 1.97$, $p = .051$, $d = .36$.

[cc] Three, 2 (threat level) X 3 (regulation strategy) univariate ANOVAs on HR change scores for each epoch showed the main effect of threat only approached significance in the first epoch, $F(1, 171) = 3.03$, $p = .071$, η_p^2 = .019, but was significant in the second, $F(2, 171) = 6.54$, $p = .011$, η_p^2 = .037, and third, $F(2, 171) = 9.30$, $p = .003$, η_p^2 = .052. Hence, the impact of threat became greater with each successive epoch.

The regulatory hypotheses predicted differences in arousal amongst the regulatory conditions during the third regulatory epoch. A 2 (threat level X 3 (regulation strategy) ANOVA within the third regulatory epoch showed a significant main effect of threat persisting, F (1, 171) = 9.30, p = .003, η_p^2 = .052, and a main effect of regulation strategy trending towards significance, F (2, 171) = 2.82, p = .062, η_p^2 = .032. Due to the hypothesised main effect of regulation being close to the significance threshold post hoc comparisons were undertaken but should be interpreted with caution. Post hoc comparisons showed that the acceptance condition demonstrated lower HR relative to the distraction condition which trended towards significance, p = .055, mean difference = -1.46, SE = .76, and no difference with the control condition, p = .89, mean difference = -.10, SE = .75. The distraction condition showed greater HR relative to the control condition, p = .039, mean difference = 1.56, SE = .75.

6.6.2.4.2. Differences Between Strategies within Each Threat Level

A high level of threat was hypothesised to be necessary to demonstrate differences in strategies' effectiveness. An analysis within each threat level was used to test the competing regulation hypotheses. The first analysis, within the high-threat level, involved a 3 (regulation strategy) X 3 (epoch) mixed design ANOVA. The results showed no significant main effect of regulation strategy, F(2, 83) = .79, p = .46, η_p^2 = .019. However, there was a significant main effect of epoch, F (2, 83) = 27.42, p < .001, η_p^2 = .398, that was moderated by a significant two-way interaction between regulation strategy and epoch, F(4 , 164) = 7.36, p < .001, η_p^2 = .152. A one-way ANOVA was used to compare regulation conditions within each epoch. Only the third epoch showed a significant main effect of regulation strategy, F (2, 84) = 3.53, p = .034, η_p^2 = .078. Post hoc LSD tests showed that the distraction condition showed significantly greater HR than the acceptance condition, p = .010, mean difference = 2.52, SE = .96. Distraction also showed nominally greater HR than the control condition which did not reach significance, p = .14, mean difference = 1.43, SE = .95. Similarly, although the acceptance condition exhibited nominally lower HR than the control condition, the difference between acceptance and the control condition did not reach significance, p = .24, mean difference = -1.13, SE = .95.

A parallel 3 (regulation strategy) X 3 (epoch) ANOVA was used to test the competing regulatory hypotheses within low-threat condition. The results showed no main effect of regulation strategy, $F(2, 87) = .80$, $p = .45$, $\eta_p^2 = .018$. There was a significant main effect of epoch, $F(2, 86) = 6.97$, $p = .002$, $\eta_p^2 = .14$, showing that the first epoch had smaller HR increases from baseline relative to the second and third epochs, which did not differ. This main effect of epoch was moderated by a significant two-way interaction between regulation strategy and epoch, $F(4, 170) = 6.45$, $p < .001$, $\eta_p^2 = .13$. To test the regulatory hypotheses within each threat level, one-way ANOVAs were used within each epoch. The results did not show any significant differences between the strategies in either the second, $F(2, 87) = 2.19$, $p = .12$, $\eta_p^2 = .048$[dd], or third regulatory epoch, $F(2,87) = 1.28$, $p = .28$, $\eta_p^2 = .029$, where significant differences were hypothesised. Hence, the interaction was not due to significant differences in HR change amongst regulatory conditions in particular epochs. Rather it was due to within subject effects with different regulation conditions leading to different patterns of increases or decreases in HR over time.

6.6.2.4.3. Impacts of Regulation Strategies on HR Over Time

A series of 2 (threat level: high and low) X 3 (regulatory epoch: one, two and three) repeated measures (regulatory epoch) ANOVAs, were used within each regulatory condition to follow up the significant interactions between regulation strategy and epoch

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[dd] Acceptance did show significantly increased HR relative to the control condition, $t(58) = 2.09$, $p = .041$, $d = .54$ in the second regulatory epoch.

and near significant interaction between threat level and epoch. In addition, these ANOVA's were used test the regulatory hypotheses that predicted different patterns of arousal (HR) over time, and the extent to which threat level influenced the impact of regulation overtime.

The 2 (threat) X 3 (regulatory epoch) ANOVA on HR in the distraction condition showed the main effect of threat level did not reach significance, $F(1, 56) = 2.71$, $p = .10$, $\eta_p^2 = .046$. There was a significant effect of time, $F(2, 55) = 15.14$, $p < .001$, $\eta_p^2 = .36$. Pairwise comparisons showed that each successive regulatory epoch showed significantly increased HR than the previous one, $t(57) = 3.77$, $p < .001$, and $t(57) = 3.40$ $p = .001$, respectively. The interaction between threat and epoch was significant, $F(2, 55) = 3.16$, $p = .05$, $\eta_p^2 = .103$. The high-threat led to significant increased HR relative to the low-threat level within the third regulatory epoch $t(56) = 2.55$, $p = .014$, $d = .67$, but not the first and second regulatory epochs, (*t*s < 1.1).

The 2 (threat) X 3 (regulatory epoch) ANOVA within the acceptance condition showed the effect of threat was *ns*, $F(1, 57) = .76$, $p = .39$, $\eta_p^2 = .013$. There was significant effect of epoch, $F(2, 56) = 35.84$, $p < .0015$, $\eta_p^2 = .56$. Pairwise comparisons showed that HR increased significantly from the first epoch to the second epoch, $t(58) = 8.42$, $p < .001$, and then decreased significantly from the second epoch to the third, $t(58) = -2.48$, $p = .016$. The interaction between threat level and regulatory epoch was not significant, $F(2, 56) = .25$, $p = .78$, $\eta_p^2 = .009$.

The 2 (threat) X 3 (regulatory epoch) ANOVA within the control conditions showed a significant effect of threat, $F(1, 58) = 4.87$, $p = .031$, $\eta_p^2 = .078$, with increased threat showing elevated HR relative to low-threat[ee]. There was s no effect of epoch, $F(2, 57) = .40$, $p = .67$, $\eta_p^2 = .014$. The interaction threat level and regulatory epoch did not reach significance, $F(2, 57) = 2.34$, $p = .11$, $\eta_p^2 = .076$. The high-threat control condition did show an elevation in HR across the epochs, and the HR difference between first regulatory epoch to the third epoch trended towards significance, $t(29) = -1.82$, $p = .08$. The nominal decrease in the low-threat mind-wandering condition noted from the first regulatory epoch to the third epoch was not significant ($t < 1$).

6.6.2.5. Self-Reported Affect

To test the regulatory hypotheses regarding self-reported anxious affect, participant responses from Schmader and Johns' (2003) affect scale were converted to change scores (post regulation - baseline). Eleven outliers were identified. Within the high-threat conditions, one from acceptance, three from distraction and two from the control condition were identified. Within the low-threat condition, two outliers were from the distraction condition, and the remaining three were from the control condition. These cases were removed for the subsequent analysis. To test the competing regulatory hypotheses and the distinguishing threat hypothesis, a 2 (threat level: high and low) X 3 (regulation strategy: distraction, acceptance and mind-wandering) between subjects ANOVA was conducted on the change scores. Means and standard errors are presented for each condition in Figure 6.5 and see Figure 6.6 for the reported affect raw scores.

[ee] An independent samples *t*-test was used to determine whether the impacts of threat on HR were present within the mind-wandering control conditions during the third regulation epoch. The results showed that increased threat led to increased HR in the third regulatory epoch, $t(58) = 2.40$, $p = .020$, $d = .62$. This analysis is relevant to the interpretation of the executive control results in chapter 7.

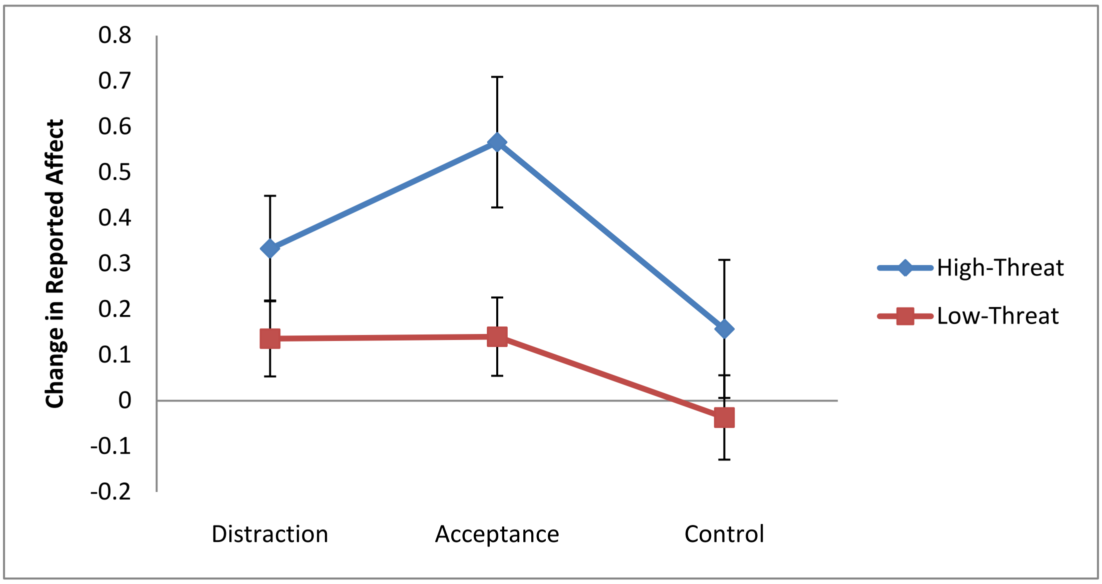

Figure 6.5. Mean post regulation self-reported anxious affect rating expressed as change scores from baseline (error bars indicate SE).

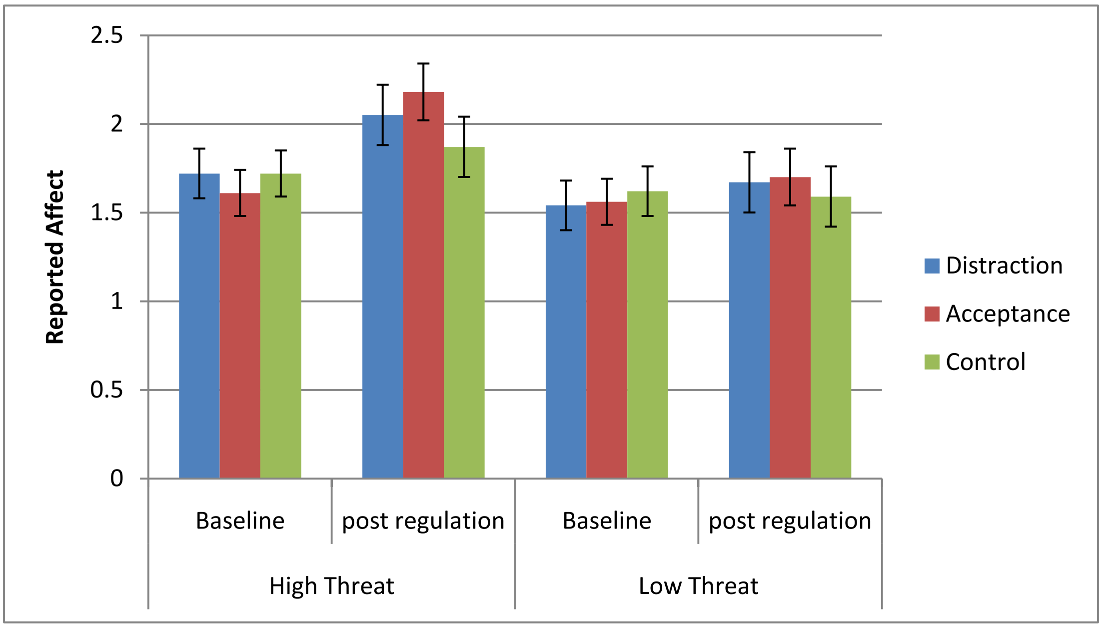

Figure 6.6. Mean self-reported anxious affect rating raw scores for the baseline and post regulation phases (error bars indicate SE).

Results showed that there was a significant main effect of threat level, F (1, 163) = 8.40, p = .004, η_p^2 = .049. As expected, the high-threat conditions self-reported greater anxious affect relative to the low-threat conditions[ff]. There was also a significant effect of regulation strategy, F (2, 163) = 3.30, p = .040, η_p^2 = .039. Post hoc (LSD) analyses showed that this main effect was attributable to the acceptance condition self-reporting significantly greater anxiety than the control condition, p = .013, mean difference = .29, SE = .11. Although the distraction condition had a lower mean level of reported anxious affect than the acceptance condition, the difference between the conditions was not significant, p = .31, mean difference = -.12, SE = .11. The distraction condition reported nominally increased anxious affect relative to control condition, however this difference did not meet the threshold of significance, p = .14, mean difference = .17, SE = .12. There was no significant interaction between threat level and regulation strategy, F(2, 163) = .68, p = .51, η_p^2 =.008.

6.6.3. Discussion

Study 6.1 sought to test the effectiveness of distraction and acceptance in reducing anxiety in circumstances of high- and low-threat. Before assessing the effectiveness of the strategies, some assumptions were checked. First, it was established that there were no baseline differences between the experimental conditions (threat or regulatory) on levels of affect, suggesting that participant randomisation was effective. Second, two manipulation checks were used to assess the effectiveness of the threat and regulation manipulations. The threat revelation was effective at producing greater anxious arousal (reflected by increases in HR) in the high-threat level relative to the low-threat level. This

[ff] An independent samples t-test was used to test the impacts of threat between the mind-wandering control conditions alone. It showed that, despite the higher nominal values of affect expressed by the participants in the high-threat level, the difference was not significant, t(53) = -1.09, p = .28, d = .30.This analysis is relevant to the interpretation of results in chapter 7.

increase in anxious arousal occurred equally across the regulation conditions. In addition, both threat conditions showed increased arousal during the threat revelation relative to baseline showing both had some threat value. The results showed that the acceptance manipulation was successful in reducing respiration rate in participants in the acceptance condition relative to the distraction and control conditions. This was consistent with the regulation instructions that directly instructed participants in the acceptance group to slow their breathing during the first two regulatory epochs. No differences in respiration were detected in the final epoch. Thus, no significant group differences at baseline on the dependent variables were present to confound the results, and the threat and regulation manipulations had the intended effects on HR and RR respectively.

It was predicted that threat would increase HR and reported affect, and decrease HRV during regulation. All results were consistent with the expected impact of increased threat: when averaging across each of the three regulatory epochs, high-threat led to significantly lower HRV and significantly higher HR, and directly after regulation, significantly greater reported affect than low-threat. The impacts of threat were also significant when the mind-wandering control conditions were compared, leading to lower HRV and increased HR, showing the effects of threat without the influence of imposed regulation. Hence, threat led to increases in arousal levels during the anticipation period, whilst participants were attempting to regulate.

The effective distraction hypothesis predicted that those engaging in distraction would show increased HRV, decreased HR and decreased reported affect relative to the control condition. The disruptive distraction hypothesis predicted the opposite (i.e., decreased HRV, increased HR, and increased reported affect). Consistent with the disruptive distraction hypothesis, the distraction conditions, together, demonstrated reduced HRV relative to the mind-wandering control condition and acceptance condition, when averaged across epochs. Furthermore, during the third regulatory epoch when the potential confound of group differences in RR was not present, the pooled distraction conditions showed increased HR in comparison to the acceptance and control conditions, further supporting the disruptive distraction hypothesis. This was further confirmed with the distraction condition leading to increased HR over each successive regulatory epoch. Following regulation, the distraction condition reported nominally elevated affect relative to the control conditions that trended towards significance, with this elevation being consistent with the disruptive distraction hypothesis. Hence, the evidence based on all measures, was overwhelmingly inconsistent with the effective distraction hypotheses, and mostly consistent with the disruptive distraction hypotheses.

The effective acceptance hypothesis predicted that acceptance would lead to increased HRV, decreased HR and less reported anxious affect than the distraction and control conditions towards the end of regulation. Pooling across threat level and epoch, including the periods where systematic differences in respiration were present, with these influences controlled statistically, the acceptance condition showed significantly higher HRV than the distraction condition, but was not significantly different from the control condition. This evidence suggests that acceptance did not elevate HRV or provide a more rapid and flexible way of regulating than the spontaneous attempts to regulate that participants in the control condition were using. Hence, these differences between the regulatory conditions only partially support the effective acceptance hypothesis.

The effective acceptance hypothesis also predicted that acceptance would lead to temporarily increased arousal relative to the control condition, as participants were asked to observe and notice negative thoughts and feelings. This prediction was confirmed: the acceptance condition showed elevated HR during the second regulatory epoch relative to the control condition. Acceptance was also predicted to lead to a decrease in arousal in the final regulatory epoch. The HR results showed that, averaged across both threat levels, acceptance led to lower HR during the third regulatory epoch relative to distraction, but not relative to the control conditions. Therefore, analysis averaged across threat level only provided partial support for the effective acceptance hypotheses. An analysis over time demonstrated that only the acceptance conditions showed a decline in HR from the second to the third regulatory epoch, which occurred after a significant initial increase in HR from the first to the second regulatory epoch. Acceptance did lead to significantly higher HR than the control conditions and this result was consistent with the process of a feeling model that acceptance may require initially increased arousal for the strategy to demonstrate its effectiveness in reducing arousal. Nevertheless, the initial increase did not result in lower HR than control, suggesting limit support for this hypothesis.

Taking into account that high and low levels of initial affect may demonstrate the effectiveness of the strategies differently, and the sustained impact of threat throughout, further analyses comparing the regulatory conditions were undertaken within each threat level. Amongst the high-threat level groups, where the effective acceptance effects were predicted to be most pronounced, acceptance showed significantly increased HRV and decreased HR in the third regulatory epoch, relative to the distraction condition, consistent with both the effective acceptance and disruptive distraction hypotheses. However, although acceptance showed somewhat increased HRV and decreased HR relative to the control condition, these differences were not significant, and therefore only provided limited support for the effective acceptance hypotheses. Hence, the results from comparisons made between regulatory conditions within the high-threat level still only provided limited support for the effective acceptance hypotheses and the predictions of the process of a feeling model, with acceptance outperforming distraction but not the mind-wandering control condition.

The results from the low-threat level were inconsistent with the effective acceptance hypothesis. These results showed that acceptance led to both lowered HRV and increased HR particularly during the second and to a lesser extent the third regulatory epoch relative to the control condition. Acceptance did not differ from the distraction condition on HRV or HR during these latter two epochs, suggesting that acceptance was just as counterproductive in reducing arousal as distraction in the low-threat level.

Furthermore, contrary to the effective acceptance hypothesis, participants in both acceptance conditions reported significantly increased anxious affect relative to the control conditions, yet were not different from the distraction conditions. Hence, the reported affect results were also inconsistent with the effective acceptance hypotheses, predicting that acceptance would lead to lower levels of affect in all circumstances.

Based on the results of study 6.1, two interpretations have some support: the process of a feeling model, and theories of anxiety and attention (Mogg & Bradley, 1998) and self regulatory theory (Carver & Scheier, 1988), including objective self-awareness theory (Duval & Wicklund, 1972). The results indicating that (a) distraction led to increased affect, and (b) acceptance led to increased and then decreased arousal, and are each supportive of the process of a feeling model. However, the process of a feeling model also predicted that acceptance would lead to significantly decreased arousal relative to the mind-wandering control condition and this was not demonstrated in the results. Furthermore, the process of a feeling model predicted that participants in the mind-wandering control condition would report increased affect relative to acceptance, yet they reported significantly decreased affect. Considering that chapter 5 showed that the mind-wandering control conditions reported the least attention towards threat information and affect, the results showing comparisons with the control conditions from the present study are more consistent with the predictions of motivational theories of attention and anxiety

(Mogg & Bradley, 1998) and objective self-awareness theory (Duval & Wicklund, 1972). Both these theories claim that individuals have a natural tendency to avoid unpleasant affective experiences, and a condition encouraging individuals to engage in mind-wandering would likely support this natural tendency. Increasing attention towards threats and towards the self, including unpleasant feelings, is likely to result in increases in unpleasant affect or at least individuals becoming more subjectively aware of their experience of anxious affect.

If acceptance increases self-awareness then it should lead to increased affect relative to an individual's natural attempt to decrease self-awareness, at least in the short-term. Based on comparisons between acceptance and the mind-wandering control conditions, acceptance led to increased arousal during the second regulatory period. In the low-threat level this increased arousal was still present in the third regulatory epoch. Moreover, if participants naturally seek to avoid the experience of affect, imposing an attentional load (without specific instruction that this is to assist you distract from your thoughts and feelings regarding threats) would only disrupt these spontaneously initiated regulatory attempts and lead to increased affect (Cornwell et al., 2011; Knight et al., 2007; Mather & Knight, 2005; Wegner et al., 1993) as noted from the impacts of distraction.

The theories of anxiety and attention and objective self-awareness provide plausible interpretations of the attentional focus results of chapter 5 and the findings from the present study regarding the increased affect occurring in acceptance relative to mind-wandering. However, the fact that acceptance led to a decrease in arousal after sustained engagement, a finding that these theories do not predict, suggests that the process of a feeling model may still be a plausible explanation. Acceptance was suggested to facilitate participants altering their affective states via increased awareness and integration of affect, consistent with the predictions of the process of a feeling model. If acceptance does utilise this process, and the process of a feeling model provides the best explanation for how anxious affect can be reduced, prior engagement in acceptance during anticipation of threat should lead to decreased affective reactivity to and a rapid recovery from the actual threat relative to distraction and control conditions. This hypothesis is tested in study 6.2.

6.7. Study 6.2: Does Undertaking Distraction and Acceptance During Anticipation of Threat Influence Later Affective Reactivity and Recovery?

Study 6.2 assesses the effects of prior use of the regulatory strategies on affective reactivity while undertaking a threat-task and on affective repair when recovering from the task. Previous studies investigating the effectiveness of distraction have demonstrated it to facilitate affective repair and recovery from a affect-inducing event when engaged in the strategy following a threat or stressor, reducing both physiological arousal and reported affect (Neumann, Waldstein, Soller, Thayer, & Sorkin, 2004; Wong & Moulds, 2009). However, none of the studies have investigated whether engaging in distraction during the anticipation of a threat influences participants' subsequent affective reactivity to the threat and their recovery from it. An older study by Houston and Holmes (1974) demonstrated that imposing an attentional load during the anticipation of a threat decreased the opportunity participants had to mentally prepare and reappraise the harmfulness of a threat. A more recent study investigating the use of distraction during a stressful event showed that when participants were subsequently reintroduced to the stressful event they demonstrated a significant return of fear relative to a reappraisal condition (Kamphuis & Telch, 2000). From this previous research, and the predictions from both the modal model and the process of a feeling model, it is hypothesised that distraction used during the anticipation of a threat will lead to increased affective reactivity and slower affective repair when engaging in and recovering from threat-tasks.

Two studies have investigated the impacts of acceptance in changing experimental circumstances. These two studies (Hoffman et al. and Dunn et al.) have produced contrasting results; possibly due to the methodological differences relating to instruction provided to participants and the level of relatedness affective stimuli have to previous phases in the experiment. Hofmann et al. (2009) demonstrated that acceptance led to lower HR across the experimental phases of anticipating a threat-task (delivery of an impromptu speech), threat-task engagement and recovery, relative to an affective suppression condition. Participants were given one minute to focus on using the strategy whilst sitting quietly during anticipation of delivering the speech. Importantly, participants were asked to handle their feelings in a manner that was consistent with the strategy during delivery of the speech and during recovery. It may be due to these instructions to continually regulate in a consistent way throughout the experiment that acceptance resulting in lower arousal across all three phases (anticipation, threat and recovery). Similar to Hofmann et al., Dunn et al. (2009), found that the active engagement in acceptance, although during exposure to video footage of horrific traffic accidents, led to lower arousal (reduced electrodermal activity) relative to a suppression condition. However, in contrast to Hofmann et al., participants in the Dunn et al study were later assessed on their affective reactivity to a set of affective inducing pictures of content *not related* to the film clip. Additionally, participants were *not instructed* to continue to engage in the strategy used previously whilst exposed to the subsequently presented pictures. The results indicated that participants who had subsequently used acceptance (and had previously shown lower arousal during this engagement) showed increased affective reactivity during picture viewing and slower affective repair following the experiment at one week follow up relative to the suppression condition. There are two reasons why the beneficial effects of acceptance were not found following engagement in acceptance in the Dunn et al. (2009).

The first is participants were not encouraged to actively continue engaging in acceptance (like the Hoffman et al.) and this active engagement is necessary for reductions in affect to be sustained. The second is that the picture stimuli were not related to the content in which participants were instructed to regulate their responses toward. If this latter were true, without the first being a necessary precondition, it would be expected that if the picture stimuli were related to the initial affective stimulus participants regulated toward, this would have led to reduced affective reactivity and more rapid affective repair for those in the acceptance condition.

The current study tests the above two possibilities by slightly differing from the Hofmann et al. and Dunn et al. studies. First, unlike the Hofmann et al. study, participants are only directed to engage in the specified affect regulation during anticipation and are therefore free to respond naturally during and following the threat-task. Second, unlike the Dunn et al. study acceptance will be used during the anticipation of a threat-task, and thus participants will be later exposed to stimuli that are related to content they have been encouraged to regulate their responses towards, rather than towards unrelated/unanticipated stimuli. Thus, the current study provides a unique test of the subsequent impacts of acceptance on affective reactivity and recovery to threat-stimuli that participants have anticipated and have had an initial regulatory response towards.

Study 6.2 uses the same between subjects experimental design as Study 6.1: threat level (high and low) and regulation conditions (distraction, acceptance and mind-wandering). The time periods of interest, however, are during the threat-task (speech or movie), and after the threat-task. Heart rate and reported affect are measured during the threat-task. HRV and respiration could not be measured appropriately during the speech because participants adopt different postures and are also inclined to gesture when speaking, which disrupts the respiratory and ECG signals to an extent that RR and HRV can no longer be reliably calculated. Nevertheless, RR, HRV, HR and self-reported affect were measured during recovery.

Based on the predictions of the process of a feeling model and previous research, it is hypothesised that prior engagement in distraction during anticipation of threat will result in increased affective reactivity to the threat-tasks and slower affective repair during recovery from the threats demonstrated by increased HR, lower HRV, and increased reported affect than the acceptance and control conditions (i.e., the disruptive distraction hypothesis). In contrast, based on the predictions of the process of a feeling model and the findings from study 6.1, acceptance is hypothesised to support reduced arousal regarding threats resulting in reduced affective reactivity during the threat-task and a quicker recovery (i.e., increased HRV, decreased HR and less reported affect) relative to the distraction and control conditions. As in Study 6.1, the high-threat condition is hypothesised to show greater HR and reported affect during the threat-task and decreased HRV, increased HR and increased reported affect during threat-task recovery than the low-threat condition.

6.7.1. Method

A 2 (threat level: high and low) x3 (regulation condition: distraction, acceptance and control) X 2 (time: threat-task and recovery) design was used. The participants were the same as those in study 6.1. Figure 6.6 indicates (with highlighted sections) the phase of the experiment during which the data were gathered for the present study. Participants had completed a series of executive control tasks following their engagement in the regulation task described in Study 6.1. After completing the two executive control tasks, participants were told that it was now time to deliver the speech (high-threat) or watch a video clip (low-threat) that they had been anticipating since the threat revelation. Participants in the high-threat condition were instructed to talk as much as they could about the topic. Participants in the low-threat condition were asked to concentrate on the film clip for the whole five minutes. Both tasks were to take around five minutes. When the five minutes were complete, participants were instructed to face away from the camera and sit still for five minutes (i.e., recovery period). Dependent variables were HR, RR, HRV and SR affect. Respiration rate and HR were taken throughout these tasks. Participants reported the level of anxiety they experienced during the threat-task and during the recovery period retrospectively at the end of the recovery period. See Section 4.4.5 in chapter 4 for the complete details of what occurred during these tasks (phase 5 of in the experiment).

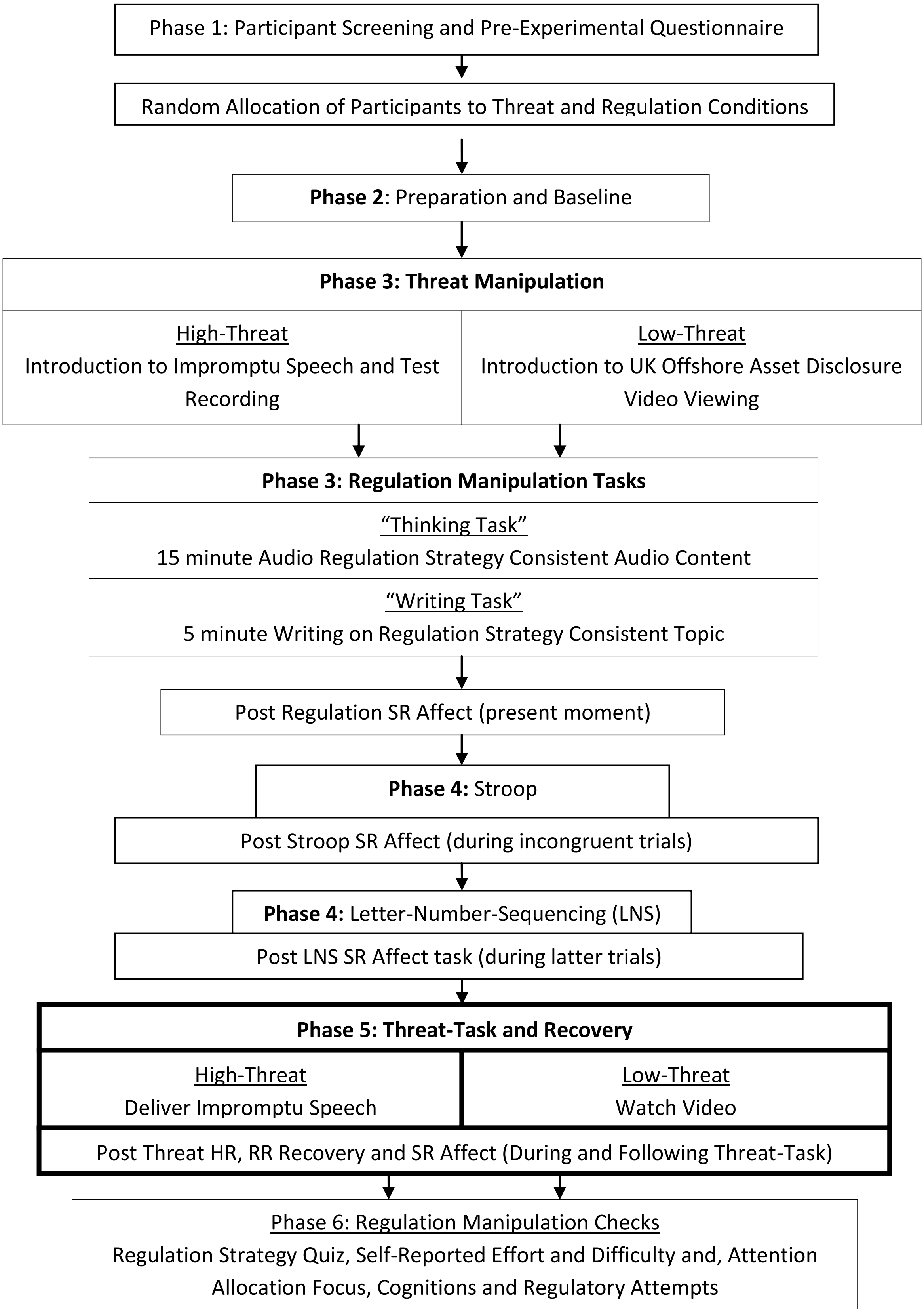

Figure 6.7. Flow Diagram of Procedural Phases with Data Taken from Phase 5 (Highlighted)

6.7.2. Results

Respiration Rate: One outlier was detected in the respiration rate data (breaths per minute change from baseline scores) from the high-threat distraction condition and was removed from the subsequent analysis. For the means and standard error of respiration change scores see Figure 6.7.

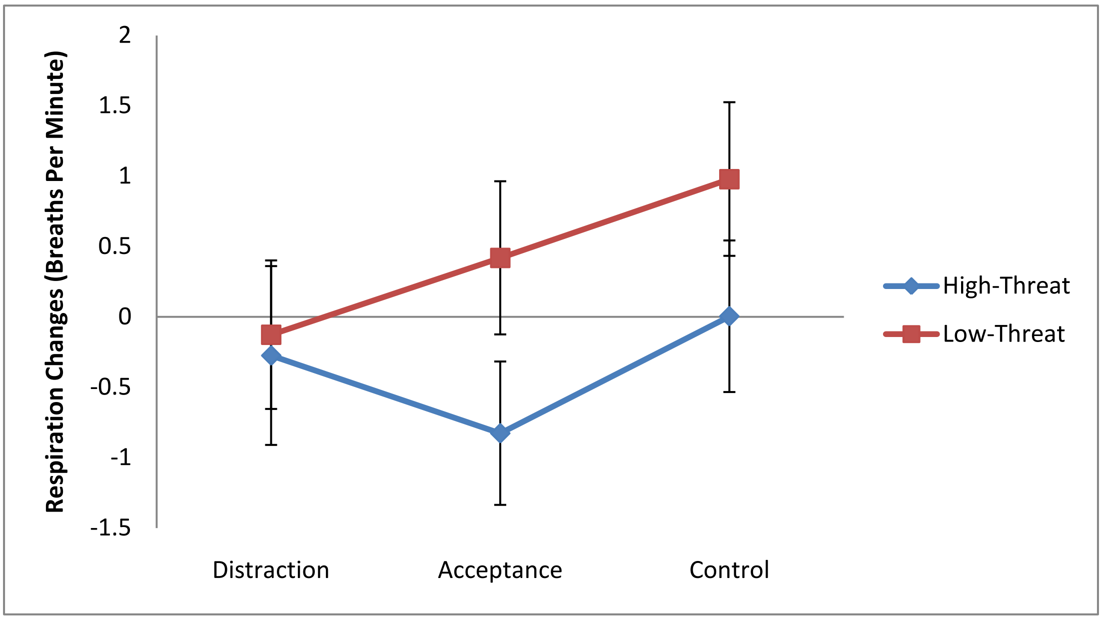

Figure 6.8. Mean change in respiration rate (breaths per minute) from baseline to the recovery period (error bars indicate SE).

A 2 (threat level) x3 (regulation strategy) was used to detect differences amongst the threat and regulatory conditions' respiration rate change scores. The main effect of threat trended towards significance, $F(1, 173) = 3.06$, $p = .082$, $\eta_p^2 = .014$, with increased threat showing nominally decreased respiration. The main effect of regulation was not significant, $F(1, 173) = 1.05$, $p = .35$, $\eta_p^2 = .012$, nor was the interaction between threat level and regulation strategy, $F < 1$, ns.

Controlling for respiratory influences in HRV change scores. A linear regression was used to examine the extent to which changes in respiration rate influenced changes in HRV.

The results showed that changes in respiration did not account for a significant portion of the variance in HRV change at recovery, $t(179) = -.87$, $p = .39$, $R^2 = .004$, $\beta = -.065$. A quadratic function was also tried however a linear equation best accounted for the variance in HRV changes. Nevertheless, to remove any variations due to respiratory changes, the HRV change score residuals were calculated for use in all subsequent HRV analyses.

HRV: RMSSD change score residuals' mean and standard error for each of the conditions are presented in Figure 6.8.

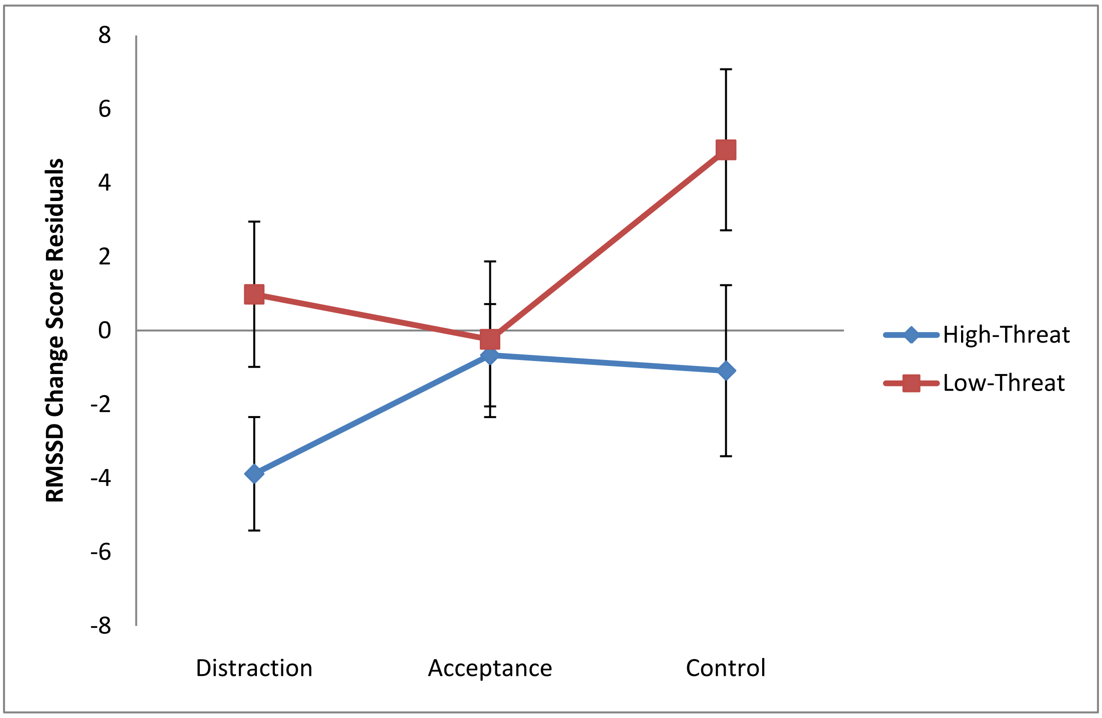

Figure 6.9. Five minute recovery period mean HRV (RMSSD) change from baseline scores residuals (error bars indicate SE).

A 2 (threat level: high and low) x3 (regulation strategy: distraction, acceptance and control) ANOVA was used to test the effects of threat and regulation strategy on HRV changes from baseline. The results showed a main effect of threat level, $F(1, 174) = 5.60$, $p = .019$, $\eta_p^2 = .031$, with a greater decrease in HRV shown within the high-threat level. There was no main effect of regulation strategy, $F(2, 174) = 1.56$, $p = .21$, $\eta_p^2 = .018$, or interaction between threat level and regulation strategy, $F(2, 174) = 1.14$, $p = .32$, $\eta_p^2 = .013$, suggesting little influence of regulation strategy on HRV during this period.

Heart Rate and Self-reported affect: Change scores from baseline were calculated for HR and SR affect both during the threat-tasks and during the recovery from the threat-task (see Figures 6.9 and 6.10 for means for each condition).

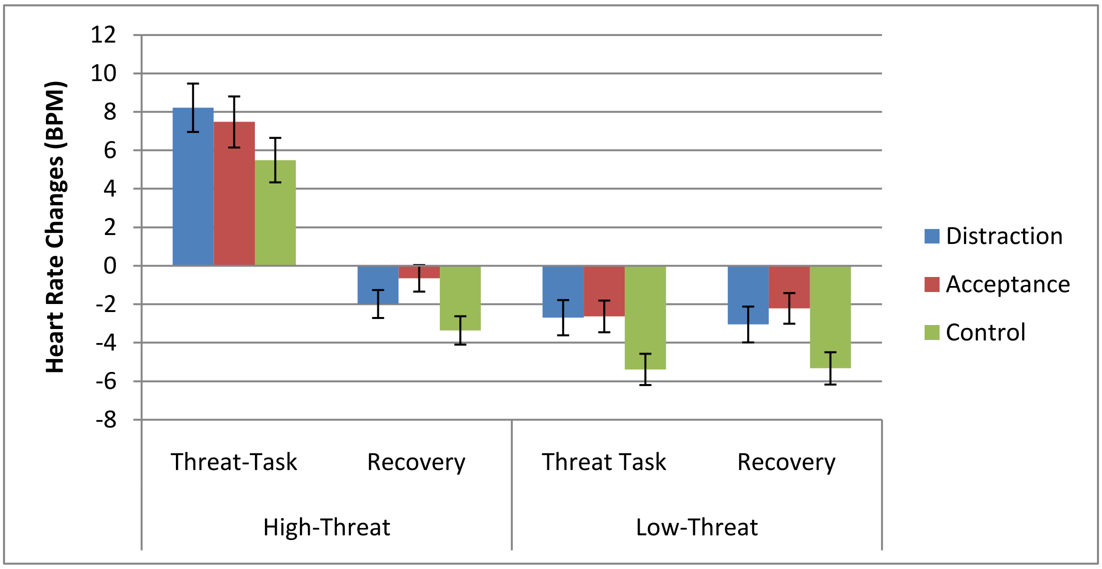

Figure 6.10. Mean Heart Rate Change Scores (error bars indicate SE).

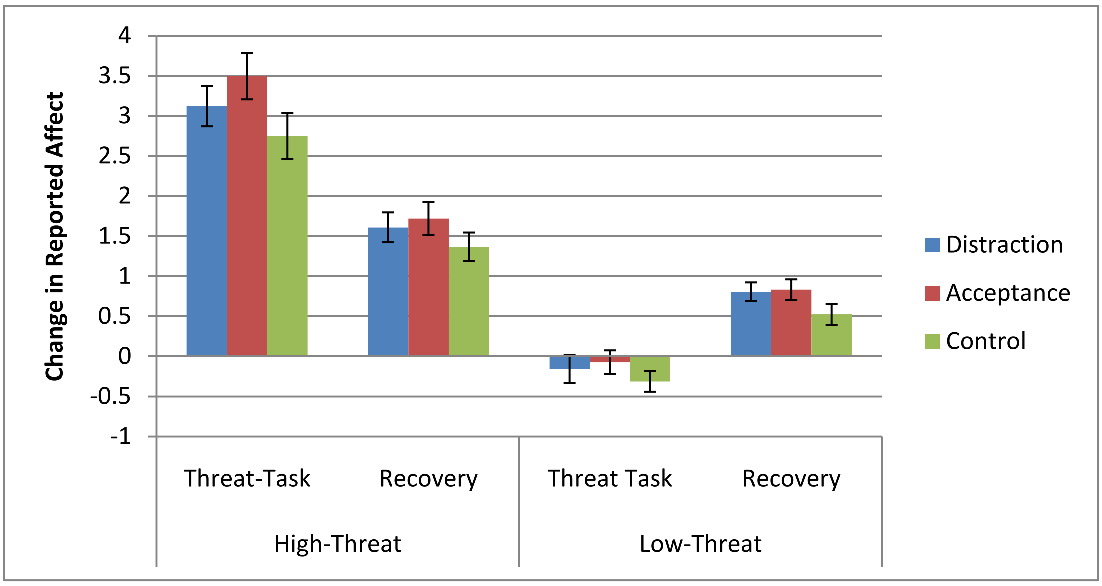

Figure 6.11. Mean Self-Reported Affect Change Scores (error bars indicate SE).

A 2 (threat level) X 3 (regulation strategy) X 2 (time: threat-task and recovery) repeated measures MANOVA, with HR and SR affect change scores as the dependent variables, was used to test the threat and regulatory hypotheses. The between subjects multivariate test, Hotelling's trace, showed a significant main effect of threat level, $F(2, 173) = 133.01$, $p < .001$, $\eta_p^2 = .61$, with the high-threat level showing increased affect. There was also a significant main effect of regulation strategy, $F(4, 344) = 4.09$, $p = .003$, $\eta_p^2 = .045$.

The univariate between subjects tests showed that there was a main effect of threat level for both HR, $F(1, 174) = 81.69$, $p < .001$, $\eta_p^2 = .319$, and self-reported affect, $F(1, 174) = 201.28$, $p < .001$, partial $\eta^2 = .536$. There was a main effect of regulation strategy on HR, $F(2, 174) = 6.01$, $p = .003$, $\eta_p^2 = .065$. Post hoc (LSD) comparisons were used to establish the effectiveness of the regulatory strategies averaged across both time periods and both threat levels, in reducing HR. Results showed that the distraction conditions did not differ from acceptance conditions, $p = .71$, mean difference = -.38, *SE* = .99. However, the distraction conditions showed significantly elevated HR relative to the control conditions, *p*

= .023, mean difference = 2.26, *SE* = .99. Furthermore, acceptance showed significantly increased HR relative to the control condition, $p = .008$, mean difference = 2.64, *SE* = .99.

On SR affect, the main effect of regulation trended to significance, $F(2, 174) = 2.72$, $p = .068$, $\eta_p^2 = .030$. Least significant difference post hoc comparisons evaluating the regulatory strategies' effects on self-reported affect, averaged across threat levels and over both time periods, showed that distraction did not significantly differ from acceptance, $p = .40$, mean difference = -.15, *SE* = .18. Although the distraction groups showed nominally higher reported affect, the difference between the distraction and control group was not significant, $p = .14$, mean difference = .26, *SE* = .18. The acceptance group reported nominally higher affect than the control group, and the difference met significance, $p = .022$, mean difference = .41, *SE* = .18.

There was no significant interaction between threat level and regulation strategy, $F < 1$, ns. The within subjects multivariate tests showed a main effect of time, $F(2, 173) = 81.79$, $p < .001$, $\eta_p^2 = .49$. There was also a significant two-way interaction between threat level and time, $F(2, 173) = 248.03$, $p < .001$, $\eta_p^2 = .74$. This interaction was due to participants in the high-threat level showing a significantly greater increase in affect during the threat-task relative to the recovery period, on HR, $t(89) = 13.43$, $p < .001$, and SR, $t(89) = 15.67$, $p < .001$, whilst in the low-threat level there was no difference between the two time periods on HR, $t(89) = -.13$, $p = .90$, however, participants self reported being significantly less anxious during the movie than during the recovery period, $t(89) = -12.42$, $p < .001$. The two-way interaction between regulation strategy and time was not significant, $F(4, 344) = 1.11$, $p = .35$, $\eta_p^2 = .013$, suggesting that there were no changes to the pattern of differences amongst the regulatory conditions over the two time periods. Lastly, the three-way interaction between threat level, regulation strategy and time also did not reach significance, $F < 1$, *ns*.

6.7.3. Discussion

Study 6.2 tested the subsequent impacts of distraction and acceptance. Based on the process of a feeling model and previous research showing distraction limits the opportunity to reappraise threats, it was predicted that distraction would lead to increased affective reactivity and slower recovery (i.e., disruptive distraction hypothesis). In contrast, based on the predictions of the process of a feeling model, it was predicted that acceptance would lead to reduced affective reactivity and more rapid affective recovery due to previous regulation altering an individual's affective disposition to the situation (i.e., effective acceptance hypothesis).

The results from study 6.2 were supportive of the disruptive distraction hypothesis, yet were inconsistent with the effective acceptance hypothesis. Evidence supporting the disruptive distraction hypothesis, and refuting the effective acceptance hypothesis came from HR and reported affect across both periods (threat-task and recovery). Heart rate and, to a lesser extent, the self-reported affect results demonstrated effects of both threat and regulatory strategies during the threat-task and the recovery from the threat-task. The prior engagement in either of the affect regulation strategies, distraction and acceptance, were counterproductive in reducing affective reactivity to threat-tasks and promoting subsequent affective repair relative to the mind-wandering control conditions. These detrimental impacts of the regulation strategies were demonstrated when averaging the results across both threat levels.

Heart rate variability was only calculated during the recovery period and showed no effect of regulation. However, consistent with study 6.1, threat level influenced HRV recovery, with increased threat leading to decreased HRV, demonstrating that threats that had passed still influenced vagal inhibition of HR. Interestingly, changes in respiration rate did not significantly predict the changes in HRV, suggesting that the phasic influences over

HRV were reduced during this threat-task recovery period and that changes in HRV were primarily due to changes in vagal tone, possibly as a result of increased influence by central parasympathetic in the hypothalamus. This would indicate that neurological influences over HR during recovery were different from those during the regulatory period.

Aside from the HRV results, the HR and SR affect results suggested that both acceptance and distraction were counterproductive in preparing participants to undertake the threat-tasks in a way that reduced affective experience relative to the mind-wandering control condition. As acceptance did not show continued lowered affect as demonstrated by Hofmann et al., (2009), but rather increased affective reactivity and slower affective repair, the results of study 6.2 are inconsistent with the process of a feeling model.

6.8. General Discussion

The present research investigated the effect on arousal and anxious affect of engaging in distraction and acceptance when anticipating high and low levels of ego-threat. Study 6.1 tested the effectiveness of the strategies while anticipating the threats, when the strategies were actively engaged in. Study 6.2 tested the longer term consequences of the strategies, regarding the level of affective reactivity when undertaking the threat-tasks and the subsequent speed of affective repair when recovery from the threat-tasks. Study 6.1 tested hypotheses relating to the usefulness of the regulation strategies including the effective distraction, disruptive distraction and effective acceptance hypotheses. Study 6.1 also tested the predictions that both distraction and acceptance may be more effective in some threat/affective situations more than others. Distraction was predicted to be more effective in low-threat circumstances and acceptance would be more effective in high-threat circumstances but only lead to increased affect in low-threat circumstances (i.e., susceptible acceptance hypothesis). Study 6.2 tested two hypotheses. Neither theory nor previous research suggested that prior engagement in distraction in the anticipation of a threat would result in reduced affect. Therefore, the effective distraction hypothesis was dropped but the prediction that distraction would be counterproductive in reducing anxious affect (i.e., the disruptive distraction hypothesis) was retained. In addition, based on the process of a feeling model previous research (Hofmann et al., 2009) suggesting that acceptance may have benefits when encountering and recovering from threats and that acceptance would lead to reduced anxious affect (i.e., the effective acceptance hypothesis). These hypotheses were tested based on participants' affective reactivity and recovery/repair to the threat-tasks.

The following discussion will present an overview of the present findings on the effects of the threat levels and the regulation strategies on affect and vagally mediated parasympathetic influences over arousal. This discussion will include the consistency of these finding with the hypotheses made, and how the findings compare to previous research. Integrating the findings of the present chapter with those of chapter 5 and previous research, the issues of why and when strategies are effective, are discussed with reference to the theories of affect regulation.

6.8.1. An Overview of the Findings in the Context of Previous Research

In both Study 6.1 and 6.2, the threat manipulation had effects on HRV, HR and reported affect in a way that was especially consistent with previous research. Study 6.1 was consistent with previous studies in showing that anticipated high-threat leads to decreased HRV and increased HR (Croizet et al., 2004; Fuller, 1992; S. C. Segerstrom & Solberg Nes, 2007), nominally increased RR (Bloch et al., 1991) and increased reported affect (Inzlicht et al., 2006; Schmader & Johns, 2003). In study 6.2, the same participants in the high-threat circumstances showed lower HRV, and higher HR and reported affect, both during the threat-task and following the threat-task, mirroring the decreased HRV they demonstrated in during the anticipation of the threat-tasks in study 6.1. Thus, the threat manipulations were effective in elevating affect, and the imposed regulation strategies were not powerful enough to eliminate these effects of threat.

The strategy of distraction resulted in lower HRV in study 6.1, higher HR in study 6.1 and 6.2, and generally nominally higher reported affect results in both studies relative to the control condition. These results are inconsistent with previous studies supporting the effectiveness of distraction (Blagden & Craske, 1996; Van Dillen & Koole, 2007; Wong & Moulds, 2009). However, this previous research only supports distraction as an effective affective repair strategy where the attentional diversion occurs after the stressful event, rather than during anticipated threat circumstances. The only previous study showing support for the use of distraction in anticipated threat situations was from Bloom et al., (1977), which involved regulatory manipulation confounds, thus reducing the likelihood that imposed distraction could be suggested as effective in anticipated threat circumstances. Furthermore, most previous research on distraction, involving an imposed attentionally consuming task, supports the use of distraction as opposed to rumination (Blagden & Craske, 1996; Neumann et al., 2004; Wong & Moulds, 2009). In contrast, the present research has tested distraction in comparison to a control condition during the anticipation of a threat and found that, unlike engaging in distraction following threat/affect induction, distraction led to greater affect during and following engagement both when undertaking a threat-task and when recovering from that threat-task.

The HRV and HR results from the distraction conditions shown in the present research, are consistent with the high-anxious repressor studies, individuals who report using distraction (Bonanno et al., 1991), showing decreased HRV and increased HR relative to true low-anxious individuals and high-anxious individuals (Asendorpf & Scherer, 1983;

Derakshan & Eysenck, 2001a; Fuller, 1992). The only inconsistency the current shows with these studies investigating repressors is that participants in the distraction condition in the current study did not report significantly less anxious affect as high-anxious repressors do (Derakshan & Eysenck, 2001a). The pattern of HRV and HR results from those in the distraction conditions and the high-threat control conditions in study 6.1 showed gradual increases in HR and decreases in HRV as the anticipated threat drew nearer. This escalating arousal found in the distraction and mind-wandering control conditions in high-threat levels in study 6.1 mirrors the results previous studies that have involved either naturally occurring (Fuller, 1992) or experimentally manipulated threat (Monat et al., 1972). Lastly, when considering that both the threat levels led to increased arousal from baseline, distraction may also have been similar to imposing an attentional load while participants were already trying to reduce their affect, disrupting this process of spontaneously down regulating affect (Duval & Wicklund, 1972; Johns et al., 2008; Knight et al., 2007; Mather & Knight, 2005; Mogg & Bradley, 1998) and leading to ironic effects where the affect sought to be reduced is actually elevated (Wegner et al., 1993).

Study 6.1 also extended previous research by demonstrating that acceptance conditions did not show this pattern of gradual increased HR and decreased HRV as anticipated stressful events draw nearer. Both acceptance conditions showed rapid peak in arousal (i.e., increased HR and decreased HRV in the second epoch) followed by a marked decrease (decreased HR and increased HRV in the third epoch). This pattern of arousal suggests that acceptance creates a different affective trajectory from distraction and unfocused attention conditions of a temporally certain threats (Fuller, 1992; Monat et al., 1972). Evidence that the beneficial impacts of acceptance should be noted only after a the strategy has been engaged for some time has been demonstrated by Low et al., (2008), who found that lower arousal among those engaging in acceptance, relative to a ruminative condition, occurred only during the second session of two 10-minutes sessions. Study 6.1 of the present research was consistent with this, showing the beneficial effects of acceptance only after sustained engagement (i.e., after 10 minutes of sustained engagement), even relative to what can be construed as a maladaptive distraction condition. Study 6.1 also shows considerable consistency with Hofmann et al., (2009), showing supporting evidence for the use of acceptance in affectively arousing circumstances (i.e., in high-threat circumstances) with acceptance leading to decreased HR compared to a suppression condition. Furthermore, the acceptance conditions in both the Hofmann et al and Low et al showed no difference from a comparative condition that may be construed as adaptive (i.e., factual observation; Low et al., 2008) and the known adaptive strategy of reappraisal (Hofmann et al., 2009). Hence, in study 6.1, like previous research, acceptance was found to be of some benefit in high-threat circumstances and to lead to an eventual reduction physiological arousal while it was actively engaged in relative to a maladaptive condition, which in the present research was distraction.

In study 6.1 and 6.2, however, acceptance, relative to the mind-wandering control condition, was shown to have negative unintended consequences. The results of study 6.1 showed that engaging in acceptance can lead to decreased HRV and increased HR during the course of the affective trajectory with both acceptance conditions (high- and low-threat) demonstrating increased HR (while focusing on negative thoughts and feelings in the second regulatory epoch) and reporting increased anxious affect relative to the mind-wandering control condition following regulation. Furthermore, study 6.1 also demonstrated that in the low-threat condition, acceptance, relative to the mind-wandering control condition, decreased HRV, increased HR during latter periods of regulation and in study 6.2 (during threat-task engagement and recovery), led to increased HR. Acceptance also led to increased affect in study 6.2, when averaged over the threat-task and recovery periods.

These results showing the negative impacts are acceptance are inconsistent with those of Hofmann et al., (2009) who demonstrated the beneficial impacts of acceptance on HR across all time periods (anticipation, threat-task and recovery). In contrast to the present study, Hofmann et al. encouraged participants to continue to undertake their assigned strategy throughout each of the experimental phases. The present study only encouraged participants to use the strategies during the anticipation of the threat. Taking the results of the two studies together suggests that acceptance may be a strategy that must be continually maintained in order to note lasting beneficial effects when confronted with a highly threatening situation.

Dunn et al. (2009), like the present research, found evidence that acceptance can reduce arousal when engaged in but have negative unintended consequences regarding affective reactivity and repair following its use. The Dunn et al. encouraged participants to use acceptance, suppression or their natural responses, in response to a graphic film clip of 12. 5 minutes about road traffic accidents. Following the film clip participants were also exposed to still pictures (unrelated to the content of the film clip) consisting of positive, sad, disgusting and neutral content, whilst not actively encouraged to continue using the strategy they had been provided. The results of this study showed that during active strategy engagement, whilst watching the film clip, acceptance showed reduced electrodermal activity (i.e., reduced arousal) relative to suppression. However, following strategy engagement, during the exposure to the pictures participants who engaged in acceptance exhibited increased affective reactivity, showing rapid HR deceleration, whilst exposed to pictures of all content, and reported increased affect after one week relative to suppression. The present research extends the findings of Dunn et al., in that even when acceptance was used in relation to an anticipated threat, and even when the reactive content is related to content in which affect regulation was used, this did not reduce affective reactivity or facilitate affective repair.

When taking the results of previous research with the current, acceptance can have negative impacts -- particularly that it escalates affect experienced during engagement, and leads to increased affect following its engagement. However, beneficial effects of acceptance may occur in threat circumstances after more than 10 minutes of engagement and perhaps if continually engaged in as the situation changes. In contrast, distraction engaged in during the anticipation of a threat only leads to increased affect during its engagement and has negative consequences following its engagement. Thus neither strategy appears to be suitable for all circumstances, rather are perhaps suited for some situations and not for others.

6.8.2. Theoretical Implications

The present research tested primarily two theoretical positions regarding the effective regulation of anxious affect. The first was the modal model, which claimed that decreased attention to threat-related thought and affective responding would lead to decreased affect. The second was the process of a feeling model that predicted that increased attention to thoughts and feelings regarding threats would lead to an initial escalation in affect yet an eventual sustained decreased affective response to the situation. It was predicted that the threat level under which the regulation strategy was engaged in may influence how effective the strategy is. This recognition was based on (1) evidence that suggests individuals, when anxious, reflexively direct attention to high-threat-stimuli (Bar-Haim et al., 2007), and such stimuli may be difficult to ignore if of high-threat value once reflexively attended to (Wilson & MacLeod, 2003), and (2) the assumptions of increased affective arousal being necessary in the process of a feeling model for increased awareness of such affect leading to effective regulation of that affect. Lastly, in contrast to these affect regulatory theories, an alternative perspective arising from theories of anxiety and attention (Mogg & Bradley, 1998) and self regulatory theories (Carver & Scheier, 1988) including objective self-awareness theory (Duval & Wicklund, 1972), suggests that individuals spontaneously initiate controlled attempts to divert attention from threats and to limit self-awareness in order to avoid experiencing increased unpleasant affects.

If, like other studies, the present study assumed that the current distraction task led to successful attentional redeployment, then the present findings suggest that there is no support for the modal model, with distraction leading to increased, not decreased, affect. However, the results of chapter 5 suggest that distraction actually had a paradoxical effect, increasing attention to threat-related thoughts (Wegner, 1994). The paradoxical effects noted on attention, would have also been likely to influence affect according to the modal model (Gross & Thompson, 2007), resulting in distraction increasing affect, noted in the present study. Both cognitive motivational theories of anxiety (Mogg & Bradley, 1998) and attention and self-regulatory theory (Carver & Scheier, 1988), including objective-self-awareness theory (Duval & Wicklund, 1972), predict that individuals will spontaneously divert attention from threat-stimuli when anxious. Chapter 5 demonstrated that the mind-wandering control condition, a condition likely to elicit people's spontaneous response to a threat situation, showed increased attentional diversion from threats (i.e., self-distraction) from upcoming threat-tasks and associated affect, and also minimised self-awareness of affective responding. Taking into account the results of chapter 5, there is substantial support for the modal model, with the control conditions showing lower levels of anxious affect based on at least one of the affective measures relative to distraction and acceptance at some point during regulation. Hence, taken together, spontaneously self-initiated attentional diversion may be more effective in reducing affect than providing an attentional load, as this load disrupts this effective attention diversion (Knight et al., 2007; Mather & Knight, 2005) leading to increased affect (Ellenbogen et al., 2002).

The support for the process of a feeling model, represented by the effective acceptance and disruptive distraction hypotheses, received partial support in study 6.1, showing acceptance eventually led to reduced arousal, relative to distraction but not significantly affect less than the control condition. The process of a feeling model was contradicted in study 6.2, with the control conditions leading to reduced affect relative to acceptance. The support for the process of a feeling model from the effective acceptance hypothesis was limited to; (1) patterns of arousal during the strategies' engagement, and; (2) from the pattern of group differences in HRV and HR in the high-threat level at the end of regulation strategy engagement. The pattern of HR results noted within the acceptance condition showed increased arousal followed by a decline in arousal, consistent with process of a feeling model. This pattern contrasts with the distraction conditions that show elevated arousal throughout each regulatory epoch and the high-threat control condition which showed nominally the same pattern as the distraction conditions. Hence, the pattern of steadily increasing arousal in these conditions, which limited attention to feelings, is consistent with the predictions of the process of a feeling model, with the lack of awareness of affect limiting the affective response reaching completion. The pattern of group differences in affect was also partially supportive of the process of a feeling model where acceptance showed lower affect than distraction, prominent in the high-threat circumstances. Hence, these different patterns in affective responding suggest that acceptance thwarts the usual affect trajectory, particularly in high-threat situations where there is significant affective arousal to be regulated. However, this was the limit to the evidence for the process of a feeling model.

The process of a feeling model did accurately predict that distraction would lead to increased affect. However, when considering the findings from chapter 5 that distraction did not only limited awareness of affect, but actually increased attention towards threats, relative to the mind-wandering control condition, alternative explanations are more plausible. If indeed participants were already regulating to avoid and inhibit the experience of anxious affect (Carver & Scheier, 1988; Derryberry & Reed, 2002; Duval & Wicklund, 1972; Ellenbogen et al., 2002; Koster et al., 2006; Koster, Rassin, Crombez, & Naring, 2003; MacLeod et al., 1986; Mogg & Bradley, 1998), an alternative explanations regarding the disruptive effects of an attentional load or the paradoxical effects mental control (Wegner, 1994; Wegner et al., 1993) provide more accurate explanations. Hence, the results from distraction, when taking into account that individuals were spontaneously regulating, by diverting attention from threats and affect in the mind-wandering control condition suggest that the process of a feeling model did not account for the findings from the comparisons made between the distraction and control conditions, and may be better accounted for by other explanations.

Evidence contradicting the predictions of the process of a feeling model was demonstrated in both study 6.1 and 6.2 from comparisons made between the acceptance and control conditions. In study 6.1 the acceptance condition reported increased affect following regulation. In study 6.2 prior engagement in acceptance led to greater increases in anxious arousal, relative to the mind-wandering control conditions. Hence, the predictions of the process of a feeling model regarding acceptance leading to an eventual sustained effect of limited anxious affect during the latter periods and subsequent to its engagement was contradicted by several results.

A possible alternative explanation for the results relates to the attentional load that both acceptance and distraction could create. The results from study 6.2 showed that both strategies requiring the control of attentional focus engaged in during the anticipation of the threat led to increased affective reactivity and slowed affective recovery relative to conditions that do not impose a control of attention. This suggests that sustaining an attentional focus during anticipation of threat impairs an individual's ability to cope when eventually engaging in the threat-task, and slows affective repair. A potential explanation for the results from both distraction and acceptance is that engaging in strategies that require an attentional focus restricts attentional capacity for engaging in reappraisal of threat information that may better prepare individuals to undertake threat-tasks relative to a condition that does not have this same attention load, as shown in previous studies investigating either distraction or acceptance (Dunn et al., 2009; Houston & Holmes, 1974). Hence, both strategies could disrupt an individual's usual mental preparations for undertaking a threat-task that may prepare them more appropriately for the threat.

However, even if acceptance does indeed reduce participants' mental preparation, the Hoffman et al. suggests that, if it is continually engaged, the strategy is nonetheless able to reduce affective reactivity and promote affect recovery. Therefore, it may be important to consider the process of a feeling as a more cyclical model, such as the modal model, where continued experiential awareness and acceptance is required in an ever changing situation, and ever changing affective responses, for reduced affect to be sustained.

6.8.3. Limitations and Avenues Future Research

There are several limitations that are worth some consideration in this chapter (other limitations are also identified section 8.3). The first possible limitation in the study is the manipulation of distraction. Although the manipulation of distraction needed to be consistent (in terms of mental and physical activity and length of time) with the manipulation of acceptance, the distraction task was somewhat different from those used in previous studies, which showed beneficial results (Blagden & Craske, 1996; Van Dillen & Koole, 2007). Previous research has manipulated distraction through the use of tasks that involve sorting stimuli (Blagden & Craske, 1996), answering arithmetic questions (Van Dillen & Koole, 2007), or letting the mind drift onto a topic participants prefer (Sheppes et al., 2009; Sheppes & Meiran, 2007), whilst others have used a mix of behavioural and cognitive tasks (Augustine & Hemenover, 2009). Although there is considerable variance in the kinds of distraction tasks that have demonstrated effectiveness, cognitive distraction tasks requiring the mental manipulation of provided stimuli have been shown to lead to decreased reported affect in anxiety eliciting situations (Blagden & Craske, 1996; Van Dillen & Koole, 2007). The current task involves a response generation task where the stimuli provided are to be expanded upon to create a series of unique responses to an unusual topic and therefore deviates from the previous studies investigating the effectiveness of cognitive distraction. It has been previously shown that distraction tasks need to be of high intensity or attentional loading and activity level to keep participants' attention diverted and towards task related thoughts (Van Dillen & Koole, 2007). Therefore, the current distraction task may not have required sufficient attentional resources to divert attention away from affect maintaining thoughts and threat-related physical stimuli. Thus, future research should test distraction tasks, evaluated in previous studies and suggested to be effective in reducing affect when used under situations that did not involve an anticipated threat, against other supposed effective strategies in anticipated threat circumstances.

A second limitation of the present research is the standard to which respiration was measured. Although many studies do not measure or remove respiratory influences from HRV, failing to account for respiratory changes can lead to the misinterpretation of HRV as a measure of vagal tone or central parsasympathetic influence over HR (Berntson et al., 1997). Important additions including tidal volume measurement and cycle analysis, which are part of the recommended standard associated with respiration measurement and analysis (Wientjes, 1992), were not included due to the limits of the hardware used to measure respiration. However, as respiration rate (RR) is typically considered the critical respiration indicator in HRV measurement standards (Berntson et al., 1997), and with HRV being the dependent measure of interest, respiratory changes were only of interest to regressing these fluctuations from HRV (Althaus et al., 1998). Tidal volume can also have an impact on HRV and it was not measured appropriately to remove its possible influences. Hence, respiratory effects on HRV may have not completely eliminated and it remains possible that differences between conditions on HRV could be due to differences in tidal volume, rather than central parasympathetic influences. Thus, all future studies investigating the impacts of threats and regulatory manipulations on parasympathetic indicators of HRV should consider removing the respiratory influences (Berntson et al., 1997). Furthermore, respiration, if measured and analysed to the appropriate standards could have also been used an alternative measure of emotion (Bloch et al., 1991; Wientjes, 1992), and should be considered for use in future research.

A third limitation is that, during the recovery phase (study 6.2) the regulation strategies may have had a quadratic, rather than liner, effect on arousal, similar to that of study 6.1. By evaluating the strategies on the average arousal level over one 5 minute epoch during the recovery phase, the present study may have overlooked the possibility that some strategies may have initially resulted in increased affect soon after the threat task completion (e.g., within the first minute). However, those with high arousal in the first minute of recovery may by the end of the recovery phase (the final fifth minute) have had lower arousal than those in other conditions that did not initially have high arousal. This possibility should be investigated in future analyses on the current data set.

Lastly, further research should also seek to eliminate alternative explanations regarding why distraction may be ineffective during the anticipation of a threat. The process of a feeling model and ironic process of mental control are not the only explanations of why distraction may have led to increased affect. Another is that imposing an attentional load or alternative attentional focus to the threat may prevent reappraisal of, or the mental preparation of engaging in an ego-threatening task. This explanation may be examined by asking participants, using well validated self-report measures, the extent to which they visualised themselves doing the task, or how they were thinking about the task to minimise or damage to their own positive self-perceptions.

6.8.4. Conclusions

The present research extends the findings of previous studies investigating distraction and acceptance in several different ways. First, it demonstrates that providing a distraction task is counterproductive when undertaken in anticipated threat circumstances and also subsequently leads to increased reactivity when undertaking threat-tasks and slower recovery in comparison to spontaneous attempts to regulate. Second, the present research shows that acceptance has limited effectiveness in reducing anxious arousal, only showing beneficial effects when engaged in during threat anticipation and only reducing physiological arousal after sustained engagement (more than 10 minutes). Third, the present research shows that acceptance leads to a different time course of arousal from distraction and mind-wandering in high-threat circumstances: notwithstanding its eventual reduction of arousal, acceptance can lead to the increased perception of anxious affect relative to unfocused attention. Fourth, it demonstrates that acceptance, when engaged in under low-threat circumstances does not lead to reduced affect or increased regulated responding, and is actually counterproductive. Fifth, acceptance, like distraction, can result in subsequent negative unintended consequences increasing affective reactivity to the threat-tasks, and slowed affective repair during recovery when compared to spontaneous regulatory attempts in the mind-wandering control conditions, despite it showing reduced affect during engagement. Lastly, when taken together with previous research (Dunn et al., 2009; Hofmann et al., 2009), the present research suggests that acceptance is beneficial mainly high-threat circumstances and requires continual engagement as the situation changes for the strategy to lead to reduced physiological arousal.

Chapter 7: Does Anxious Affect or Affect Regulation Explain Diminished Executive Control? A Comparison of Distraction and Acceptance in High- and Low-Threat Situations

Many circumstances require controlled responding in behavioural, cognitive or affective modalities (i.e., self-regulation). Controlled responding could be restricting consumption of food or drink, limiting spending behaviour, persisting with an activity in circumstances of physical or mental exhaustion, or limiting expression of emotions in socially inappropriate circumstances. At least two factors lead to impaired controlled responding. The first is the imposition of a threat or stressor, and the second is the prior attempt to inhibit prepotent responses (Muraven & Baumeister, 2000). Previous research has shown that threats or the imposition of stressors lead to temporary impairments in restraining calorie intake (Heatherton et al., 1991; Herman, Polivy, Lank, & Heatherton, 1987; Wallis & Hetherington, 2004), refraining from alcohol consumption (Muraven et al., 2002; Muraven et al., 2005) and success on tests of academic achievement (Ben-Zeev, Fein, & Inzlicht, 2005; Tohill & Holyoak, 2000), intellectual capability (Croizet et al., 2004) and physical persistence (Inzlicht et al., 2006). Similarly, previous research has shown that previous inhibition of prepotent responses, across response modalities (thought, behaviour and emotion), leads to temporary impairments in restraining aggression (DeWall et al., 2007; Stucke & Baumeister, 2006) and sexual behaviour (Gailliot & Baumeister, 2007), and in reductions in both persistence and performance on tasks requiring either physical stamina (Muraven, Baumeister, & Tice, 1999; Muraven et al., 1998) or mental effort (Baumeister et al., 1998; K. D. Vohs & Heatherton, 2000).

Cognitive affect regulation aims to alter the experience of affect via the control of attention and thought (Garnefski & Kraaij, 2006; Garnefski et al., 2001; Gross & Thompson, 2007). Acts of cognitive affect regulation may involve inhibiting prepotent responses to threats or stressors such as inhibiting the initial reflexive tendency for attention to engage with threats when anxious (Bar-Haim et al., 2007). Distraction and acceptance are two such affect regulation strategies that primarily involve the control of attentional focus. These strategies may be used in the presence of a threat or stressor in order to reduce anxious affect. The current chapter seeks to establish the impacts of the cognitive affect regulation strategies of distraction and acceptance on subsequent attempts to regulate thought and action.

7.1. Self-Regulation and Executive Functioning

Self-control requires individuals to monitor their current responses and detect when these responses (thoughts, actions or affect) are deviating from the ideal responses for that situation (Carver, 1979; Carver & Scheier, 1982). Similarly, executive functioning can be defined as an interrelated set of higher order cognitive abilities that involve the control of attentional focus and thought, in the pursuit of a determined goal in a novel situation (Miyake et al., 2000; Norman & Shallice, 1986; Shallice & Burgess, 1993). Thus, executive functions can be considered to support the ability to demonstrate self-control and, hence, Schmeichel (2007) introduces the term “executive control” that attempts to encapsulate both concepts. Importantly, self-regulated acts or acts requring executive control are effortful, non-automatic acts that often involve inhibiting and altering prepotent responses.[gg]

Two executive functions are pivotal in assisting in regulated responding. The first is the ability to inhibit prepotent responses. Prepotent response inhibition is the capacity to override automatic[hh] thoughts or actions (Miyake et al., 2000). The inhibition function is particularly important in exercising self-control and being able to perform future acts of self-control (Muraven & Baumeister, 2000). A second executive function crucial to regulated responding is updating and maintaining representations in working memory (Schmeichel, Volokhov, & Demaree, 2008), defined earlier as the active retention and selective abandonment and manipulation of internally represented stimuli (A. D. Baddeley, 1986; Miyake et al., 2000). Performing working memory tasks has been suggested to involve a variety of functions that are important in controlling responding (Engle, 2002; Kane et al., 2001) such as successfully suppressing outward signs of emotion (Schmeichel et al., 2008). Importantly, engaging in an initial activity that involves response inhibition or the use of working memory has been shown to lead to a temporary impairment in subsequent activities requiring regulated responding (Schmeichel, 2007). There are many possible reasons for temporary impairments in executive control, of which three will be investigated in relation to how the strategies of distraction and acceptance may differ in the extent of their influence on the capacity to demonstrate executive control.

[gg] Self-regulatory acts may be initiated spontaneously in order to control or inhibit a prepotent response. Such spontaneous acts initiated by the individual can also be considered as effortful (Muraven & Baumeister, 2000).

[hh] Automatic due to prior learning, over-learning or due to evolutionary reflexive reasons.

7.2. Self-Regulatory Strength Theory and the Use of Executive Resources

The first possible explanation for temporary impairments in executive functioning seen in previous research comes from the self-regulatory strength model (Muraven & Baumeister, 2000). This model suggests that self-regulated responding requires the use of a limited reservoir of resources (i.e., executive resources) vital in the performance of executive control tasks (Johns et al., 2008; Schmeichel, 2007). Like a muscle, self-regulation can be impaired due to previous effortful mental activity (Muraven & Baumeister, 2000). Gailliot, Baumeister, and De Wall, (2007) demonstrated that executive resources may be represented physiologically through blood glucose, with decreased blood glucose indicating depleted resources. Importantly, particular affect regulation attempts that involve inhibiting affective expression or inhibiting thoughts (i.e., suppression) have been suggested to deplete executive resources leading to subsequent impairment of executive control (Baumeister et al., 1998; Johns et al., 2008; Muraven et al., 1998; Schmeichel et al., 2003).

Ego-threats (i.e., situations that are socially evaluative and may challenge positive self-perceptions) have similar executive resource-depleting effects to previous acts of self-regulation (Ben-Zeev et al., 2005; Croizet et al., 2004; Inzlicht et al., 2006; Johns et al., 2008; Schmader & Johns, 2003). Muraven and Baumiester (2000) propose that an imposed threat or stressor results in persistent monitoring of this undesired stimulus requiring the control of attention and inhibition of attention to the experience of affect. They also state that such situations may result in spontaneous, automatic and persistent self-regulatory attempts that require inhibiting negative emotions as noted by (Johns et al., 2008). Inhibiting initial reflexive attentional engagement with threatening stimuli (Bar-Haim et al., 2007) has also been found (Derryberry & Reed, 2002; Koster et al., 2006; Koster et al., 2003; MacLeod et al., 1986) and suggested as a spontaneously initiated controlled process to regulate affect (Bar-Haim et al., 2007; Cornwell et al., 2011; Ellenbogen et al., 2002; Mogg & Bradley, 1998). Individuals in ego-threat situations often show increased anxious affect coinciding with the decreased executive control (Croizet et al., 2004; Inzlicht et al., 2006; Schmader & Johns, 2003). Importantly, in these studies, decrements in executive control are attributed to the requirement of individuals in such circumstances to override reflexive attentional engagement, and inhibit thoughts and emotional reactions, rather than to increased anxious affect that is measured and reported. Such attributions are particularly intriguing as there is much research on affective states' influence executive control (Eysenck & Calvo, 1992b; Eysenck et al., 2007) indicating that the reasons for diminished executive control deserve more thorough investigation.

Another issue in understanding the mechanisms behind temporary impairments in executive control relates to the length of time over which impairments can be found. The length of time between regulation and executive resource assessment has been under-investigated or under-reported (Hagger et al., 2010). Earlier research has suggested that the effects of prior regulation on performance diminish as participants continue to engage in a mentally effortful task that required the control of attention[ii] (Hartley, 1973). However, Hartley (1973) also demonstrated that persistent stressors (i.e., noise) when participants were performing the executive control task had additive effects, suggesting that the longer the stressor remains, the more of an impact it has on performance. In addition, Hartley (1973) demonstrated that previous mental activities had diminished effects the longer time between when individuals engage in the prior regulation task to the when executive control is measured. Hence, these results suggest that the impacts of regulation may

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[ii] The task used in the experiment was likely to have involved both attentional inhibition and switching (both executive functions) however, terminology of executive tasks did not exist when this study was undertaken and hence has not been described as measuring executive functioning.

diminish, especially in the presence of persistent stressors. However, within Hartely's (1973) study it was unclear whether the impacts of the persistent stressor were due to increasing arousal caused by the stressor or due to the fatiguing nature of regulating one's attention to ignore the presence of that stressor.

7.2.1. Affect Regulation, Reflexive Attention, Self-Awareness and Executive Resources

Affect regulation strategies aiming to alter the experience or expression of emotion may either preserve or diminish the temporary capacity to demonstrate executive control. Johns, Inzlicht and Schmader (2008), and Schmeichel, Vohs and Baumeister (2003) have demonstrated that the strategy of suppression (i.e., inhibition of the external emotional expression or internal occurrence of unwanted thoughts), leads to impaired executive control . Johns, Inzlicht and Schmader (2008) showed that those engaging in suppression in response to a threat performed worse than those engaging in reappraisal (i.e., changing the meaning of a stimulus previously interpreted as harmful), which is a strategy argued not to require the inhibition of responses if adopted before an affective response is initiated (Johns et al., 2008; Richards & Gross, 2000; Sheppes & Meiran, 2008). The reasoning explaining why such a difference in executive control existed between suppression and reappraisal is that early engagement in reappraisal (unlike suppression) does not require an individual to inhibit a response because the strategy has occurred before the initiation of an affective response, whilst suppression occurs after the affective response is initiated and does involve inhibiting the prepotent affective response. It is this difference in the level of inhibition required by the strategies that is proposed to determine the level of effort demanded and the impact on subsequent executive control (Muraven & Baumeister, 2000).

However, the same regulatory strategies/tasks, can lead to different impacts on executive control when undertaken in different circumstances. Reappraisal, which has previously been shown to preserve executive control when initiated before exposure to threats and affect (Johns et al., 2008), has alos been demonstrated to lead to impaired executive control when the strategy is initiated during an already present affective response relative to distraction (Sheppes & Meiran, 2008). In addition, distraction has been demonstrated to preserve executive control when used concurrently with being exposed to unpleasant stimuli (Sheppes & Meiran, 2008), but not when anticipating engaging an unpleasant task (Alberts et al., 2008). This combination of findings suggests that different situations may elicit different reflexive responses, and that the same regulation strategy may therefore involve inhibition of a reflexive response in one circumstance but not in another circumstance.

Different regulatory tasks or instructions may also result in similar levels of inhibition of reflexive responses in similar circumstances, resulting in equivalent impacts on subsequent executive control (Heatherton et al., 1993; Johns et al., 2008). Johns, Inzlicht and Schmader (2008) showed that participants in a suppression condition did not show impairment in executive control relative to a control condition that was designed to elicit individuals' spontaneous response in that threat situation. However, both conditions showed impaired executive control relative to a reappraisal condition. To explain the similar levels of impairment in executive control demonstrated by both suppression and control conditions relative to the reappraisal condition, Johns et al. suggested that, in threatening circumstances, individuals spontaneously initiate the inhibition of outward and internally experienced anxious affect and that this inhibition (participant initiated or experimenter imposed) depletes executive resources.

Consistent with the Johns et al., Heatherton, Polivy, Herman and Baumeister (1993), reported similar performance impairments for an experimenter-assisted affect reduction task (providing distracting, neutral, video content to watch) and experimental control condition, relative to a condition that increased self-awareness (looking at video of themselves). They, too, suggested that the similar levels of impaired performance demonstrated by the distraction and control groups was due to participants spontaneously avoiding or inhibit self-awareness of unpleasant affect in threat circumstances. Engaging in a task that increases self-awareness was argued not to involve such attempts at inhibition of awareness (Duval & Wicklund, 1972), and therefore to preserved self-control.

Distraction and acceptance can be conceptualised as affect regulation strategies that require the control of attentional focus: distraction away from the self via the imposition of an attentional load, and acceptance towards the self with an attitude of openness, which arguably could also be mentally demanding. As a regulatory strategy, distraction is conceptualised as avoiding the experience of anxious affect. Specifically, distraction is defined as the diversion of attention from unpleasant affect and threat-related stimuli by engaging in a task that consumes attentional focus (Augustine & Hemenover, 2009) or working memory capacity (Van Dillen & Koole, 2007). Both inhibiting attention and maintaining mental representations in working memory can lead to decrements in controlled responding (Schmeichel, 2007; Schmeichel et al., 2003). Furthermore, individuals' attention may reflexively engage with, and be used to monitor, threatening stimuli (Bar-Haim et al., 2007), and attentional diversion from these threat-stimuli has been suggested to require significant cognitive control (Cornwell et al., 2011; Knight et al., 2007). Hence, if self-regulatory theory is correct, distraction (directing attention away from reflexively attended threats) is likely to require high levels of attentional control and response inhibition in high-threat circumstances, and therefore to diminish executive resources. In low-threat circumstances it has been suggested by Duval and Wicklund (1972) that there is a natural tendency for the mind to wander, with others also suggesting that this tendency may possibly constitute an automatic attempt to maintain pleasant affect (Koole & Jostmann, 2004; Mauss et al., 2007) and/or to avoid experiencing negative affect (Duval & Wicklund, 1972; Mogg & Bradley, 1998). Distraction tasks involve updating and maintaining representations in working memory (Van Dillen & Koole, 2007), which would inhibit this natural tendency for the mind to wander (Muraven & Baumeister, 2000), and therefore distraction in low-threat circumstances is also likely to deplete executive resources.

In contrast to distraction, acceptance involves allocating attention towards the self and affective responses and threat-related thoughts in a way that does not allow for avoidance or inhibition of unpleasant experiences (S. C. Hayes, 2004a; Roemer & Orsillo, 2009). The conceptualisation of acceptance is very similar to self-awareness in that the strategy involves increased attention towards threats and one's own responding. Therefore, the use of acceptance would be likely to increase attention to threats and increase self-awareness. Both theories of attention (Mogg & Bradley, 1998) and self-regulation (Carver & Scheier, 1988; Duval & Wicklund, 1972) state that socially evaluative or ego-threatening circumstances reflexively facilitate attentional engagement with threats when anxious, a notion well supported by empirical evidence (Bar-Haim et al., 2007). The self-regulation theories suggest that this attention to threats inevitably leads to increased self-focused attention or self-awareness. Based on these assertions, engaging in acceptance should be less effortful and should preserve the ability to sustain self-regulated responding better than seeking to inhibit attention to threats and self-awareness in these high-threat circumstances. Both theories of attention (Mogg & Bradley, 1998) and self-regulation (Duval & Wicklund, 1972) would also predict that situations of low-threat do not facilitate attention towards the self, therefore engaging in a strategy that does increase self-focused attention (e.g., acceptance) would be more effortful and reduce the capacity to demonstrate executive control relative to a strategy that allowed more reflexive attentional responses.

7.3. Affective Theory of Impaired Executive Control (ACT and PET)

The second reason to expect distraction and acceptance to differ in their effects on executive control relates to theories that implicate anxious affect in causing temporary deficits in executive control. The regulation of anxious affect can, unsurprisingly, lead to differences in experienced anxious affect (Blagden & Craske, 1996; Hofmann et al., 2009); indeed, this is the very point of self-regulation. Importantly, the imposition of threats, the induction of anxious affect or increased anxious affect, and the predisposition to experience anxious affect all coincide with poorer executive control (Eysenck, 1982; Eysenck & Calvo, 1992b; Eysenck et al., 2007). Aside from self-regulatory strength theory (section 7.2), anxious affect has itself been proposed to be the cause of the systematic differences noted in executive control (Derakshan et al., 2009; Eysenck, 1982; Eysenck & Calvo, 1992b; Eysenck et al., 2007; Tohill & Holyoak, 2000). Indeed, studies that attributed executive control differences to depletion in executive resources resulting from previous attempts to regulate also demonstrated that those under increased threat show increased anxious affect (Ben-Zeev et al., 2005; Croizet et al., 2004; Inzlicht et al., 2006; Schmader & Johns, 2003). Hence, research on the depleting influences of affect regulation strategies on executive control should seek to rule out anxious affect disrupting executive control as a factor in the executive control difference between regulatory conditions.

There are two prominent anxious affect theories explaining the influence of anxious affect on executive control: Attentional Control Theory (ACT; Eysenck et al., 2007) accounting for impairments in response inhibition, and Processing Efficiency Theory (PET;

Eysenck & Calvo, 1992b) accounting for impairments in working memory. PET relies heavily upon Baddeley's (1986) working memory model consisting of a central executive and two slave systems; the phonological loop and the visuo-spatial sketch pad. The central executive in a crude form could be described as attentional capacity and the ability to control attention (i.e., attentional inhibition and attentional switching) and the two slave systems could simply be described as short term memory stores for different forms of information. Eysenck and colleagues (1992b) proposed that the high level of worrisome thoughts during the experience of anxiety are the primary cause of working memory performance decrement because they consume capacity within the working memory system, particularly the phonological loop, predicting that verbal working memory, rather than spatial working memory would be impaired. PET specifies that with increased effort (indicated by increased physiological responding during task performance), anxious participants can maintain similar performance to less anxious individuals as long as working memory load (i.e., number of items held within the working memory system) is low. However, Eysenck et al. (1992) proposes as the working memory load increases, the load imposed by worrisome cognitions begins to impact on performance and to decrease response accuracy as effort reserves become no longer adequate to meet the demands of the task.

Several studies investigated the impacts of anxiety on working memory and support was found for anxiety impacting specifically on verbal working memory (Eysenck, 1985; MacLeod & Donnellan, 1993; Sorg & Whitney, 1992), although several studies found that anxiety impacted on spatial working memory performance (Lavric et al., 2003; Shackman et al., 2006) or only on the central executive rather than the slave systems (Eysenck et al., 2005). To address the evidence clearly contradicting the predictions of PET, that verbal working would primarily be impaired, Eysenck and colleagues developed

Attentional Control Theory (ACT; Eysenck et al., 2007), which no longer focused on anxiety influencing the interaction between the central executive and the phonological loop. Rather, ACT specifies the functions of the central executive that should be affected when individuals are anxious, namely the attentional control functions of inhibition and set shifting. This lost ability is attributed to two factors. The first factor is an extension of PET: the innate and automatic tendency for attention to engage with threatening stimuli – either internal (worrisome thoughts) or external (threatening stimuli within the environment). The second factor is that an anxious state shifts the balance of attention away from internal top-down goal-oriented processes and towards the stimulus-driven processes used to scan the immediate environment for upcoming threats that may require a response. These two factors may temporarily limit the attentional resources available to the individual for performing tasks that require top-down processes (i.e., executive control tasks). Hence, ACT proposes that anxiety temporarily reduces ability to control attention, resulting in decrements in the executive functions of prepotent response inhibition and working memory.

Although the theoretical cause of the impairment to executive control differs between affective theory (i.e., PET and ACT) and self-regulatory strength theory, the empirical predictions regarding the impact of threat are remarkably similar. Self-regulatory strength theory claims that automatically initiated self-regulatory attempts in response to stressors temporarily impair subsequent attempts at controlled responding (Muraven & Baumeister, 2000), reflected in response inhibition (Inzlicht et al., 2006) and working memory performance (Schmader & Johns, 2003). In contrast, the affective theories suggest that executive control impairments (working memory for PET and response inhibition and set switching for ACT) result from the increased anxious affect (or worrisome thoughts for PET) that is experienced due to those stressors or threats.

7.4. Neurovisceral Account of Impairments in Regulated Responding

Another explanation of temporary impairments to executive control is Thayer and colleagues' neurovisceral account (Thayer et al., 2009; Thayer & Lane, 2000). This theory is a neurophysiological account of the impacts that disinhibited arousal can have on executive control. The neurovisceral account specifies that vagally mediated parasympathetic influences over heart rate (i.e., vagal tone) are associated with a network of both central and autonomic structures, where the interactions between these structures can either facilitate or impair executive control.

Thayer and Lane (2000) argue that the inhibition of arousal, as demonstrated by the vagal inhibition of heart rate (HR), is associated with rapid interactions occurring between the prefrontal cortex and the amygdala. The structures involved in the connection between the heart and the amygdala and prefrontal cortex are together referred to as the central autonomic network (CAN). The CAN comprises cortical structures including the insular cortex, the prefrontal cortex, the amygdala, the periaqueductal gray, the nucleus of the solitary tract and the nucleus ambiguous and lastly the peripheral end-organs, including the heart.

Thayer and colleagues (Thayer et al., 2009; Thayer & Lane, 2000) suggest that the CAN operates with both top-down influences and bottom-up input, meaning that signals are bidirectional throughout the network. Arguments for the top-down influences within the system linking vagal tone and executive control are based on evidence of interactions between the prefrontal cortex, known to support executive control, and the amygdala, which is activated during fear (Davidson, 2002; LeDoux, 1995, 2000, 2002). This research shows that the neural fibres between the prefrontal cortex and the amygdala are mutually inhibitory, whereby increased activity within one reduces activity in the other. An example of the top-down influence is activation in the amygdala leading to inhibited activity in the medial prefrontal cortex, leading to both impaired executive control and decreased vagal tone (i.e., inhibition of HR). The argument for bottom-up influences in the CAN stems from evidence cited in Thayer et al (2009) that parasympathetic influences over peripheral end-organs are relayed back to the prefrontal cortex via the thalamus. If high levels of vagal inhibition still exist over arousal, this would increase activity within the prefrontal cortex, and support acts of executive control. Hence, increased activation within the prefrontal cortex could be maintained via limited attention to threats (top-down), or via increased resting vagal tone resulting from practiced meditation (Satyapriya, Nagendra, Nagarathna, & Padmalatha, 2009) or aerobic training (Hansen, Johnsen, Sollers, Stenvik, & Thayer, 2009).

Thayer and colleagues have demonstrated several times that greater vagal tone (suggesting increased parasympathetic influences) among individuals at rest is directly related to better executive control, particularly on attentional control and working memory tasks (Hansen et al., 2003; Hansen et al., 2004; Hansen, Johnsen, & Thayer, 2009). In addition, interventions to increase vagal tone, (e.g., aerobic training) have led to superior executive control (Hansen, Johnsen, Sollers, et al., 2009). It is plausible that particular regulation strategies and particular circumstances may support increased vagal inhibition and therefore support increased activity within the prefrontal cortex, leading to superior executive functioning.

The neurovisceral account makes predictions that partially overlap with the other affective theories, PET and ACT. Like PET and ACT, increased arousal, particularly decreased vagal inhibition of arousal, immediately before undertaking the executive control task, is predicted lead to impaired executive control. However, unlike PET and ACT, the neurovisceral account also predicts that increased arousal and decreased vagal tone, measured during executive task performance (therefore representing increased amygdala activation inhibiting sustained activity within the prefrontal cortex), will coincide with impaired executive control. In contrast, ACT and PET predict the increased arousal and decreased vagal inhibition (representing increased mental effort) during executive task performance should coincide with superior executive control.

7.5. Summary of the Theoretical Predictions

The potential impacts of threat level and engagement in different regulation strategies on executive control can be predicted by self-regulatory strength theory, the affective theories of PET and ACT, and the neurovisceral account. However, the reasons for the impacts on executive control are different according to each of the theories. Each of the three theories predicts that increased threat should lead to impaired executive control relative to situations of lower threat: Self-regulatory strength, due to the fatiguing nature of trying to cope with the threat; PET and ACT, due to the increased affect arising from the threat; and, the neurovisceral account, due to the reductions in parasympathetic control of heart rate when under threat conditions. Study 6.1 established that distraction and acceptance led to different affective and parasympathetic control outcomes. Hence, if executive control impairments are noted between distraction and acceptance, each of the theories already has a plausible explanation for performance differences as the evidence exists in study 6.1.

In the present research, for a self-regulatory strength interpretation of performance differences between regulatory conditions to be plausible, there should be a co-existing of difference in perceived mental exertion invested by individuals in engaging in a strategy. Furthermore, affect experienced during executive task performance or during affect regulation should not covary with such performance differences.

Self-regulatory strength theory also predicts that because some strategies may be more difficult in particular situations that executive resource depletion and diminished executive control should follow. Based on the definitions and conceptualisations of distraction and acceptance, each strategy should place different demands on executive resources in different levels of threat. Due to its requirement to override the automatic tendency to focus on affective responses and threat-related thoughts, and involving extensive use of the working memory system, a distraction strategy should be more effortful and impair executive control more than acceptance and control. In contrast, as the strategy of acceptance involves directing attentional focus towards stimuli reflexively attended to in high-threat situations, it is predicted to conserve executive resources, relative to distraction and control conditions in which participants are seeking to inhibit the experience of negative thoughts and feelings in such circumstances (Duval & Wicklund, 1972; Heatherton et al., 1993; Johns et al., 2008).

In low-threat circumstances, controlling attention and undertaking working memory tasks have been demonstrated to lead to subsequent impairment in controlling response (Schmeichel, 2007; Schmeichel et al., 2003). Hence, distraction in low-threat circumstances is predicted to lead to impairments in executive control. In addition, attention towards the self and to threat is not facilitated in low-threat circumstances (Duval & Wicklund, 1972; Mogg & Bradley, 1998) and, hence, engaging in a strategy that increases self-awareness may be effortful to maintain and therefore lead to impairment in executive control. Therefore, acceptance is predicted to deplete executive resources in low-threat circumstances, leading to significant impairments in executive control relative to mind-wandering in low-threat circumstances, but preserve executive resources in high-threat circumstances, leading to superior performance to distraction and mind-wandering in high-threat circumstances.

7.6. The Present Research

The present research uses a complex experimental study to test the impacts of the regulation strategies of distraction and acceptance on executive functioning under different levels of ego-threat. These strategies are compared with mind-wandering control conditions (one in each threat level) that involve no directed focus of attention. Measures of executive resource depletion include (1) reports of perceived mental resources required when engaging in the regulation strategies (study 7.1), (2) inhibition of prepotent response (study 7.2), and (3) working memory capacity (study 7.3). Additionally, the present research seeks to evaluate alternative explanations of executive control differences amongst the regulatory conditions to the self-regulatory strength theory , including: (a) executive control differences resulting from differences in affect experienced and effort invested during the executive control task (study 7.4), and (b) executive control differences resulting from differences in parasympathetic influences on variations in heart rate (i.e., vagal tone) during earlier affect regulation and affect experienced during the regulation period (study 7.5).

7.7. Study 7.1 Perceived Mental Demand of Affect Regulation

Study 7.1 aims to test the self-regulatory strength theory's predictions regarding participants' perceived expenditure of executive resources during the regulatory tasks. Self-regulatory strength theory predicts that differences in perceived mental demands should exist amongst the regulatory conditions. Increased threat depletes objectively measured executive resources due to automatically initiated regulatory attempts (Johns et al., 2008; Lazarus & Folkman, 1984; Muraven & Baumeister, 2000). However, increased threat should not influence the *perceived* demand on executive resources of mind-wandering, as in both conditions individuals are likely to be doing what they spontaneously initiate, which they are unlikely to perceive as effortful. However, the mental resources demanded by an experimentally manipulated regulation strategy will differ from mind-wandering and may depend upon the threat level under which it is undertaken.

The self-regulatory hypothesis predicts that the perceived investment of mental resources (i.e., effort invested and perceived difficulty[jj]) will differ amongst the regulatory strategies. As the mind-wandering control conditions do not explicitly require the focus of attention, these are predicted to be perceived as the least mentally demanding, regardless of threat level. The participants in the distraction conditions are expected to report increased perceived investment of mental resources relative to the respective mind-wandering control condition in their threat level. The effects of acceptance on perceived mental effort are predicted to differ according to threat level. In the high-threat level, those in the acceptance condition are predicted to perceive investing similar mental resources to the mind-wandering control condition, but less than the distraction condition. However, in the low-threat level, acceptance is hypothesised to lead to increased perceived investment of mental resources relative to the control. Lastly, it is predicted that acceptance in high-threat circumstances (being consistent with reflexive attentional focus in that circumstance) would be perceived to be as mentally effortless as mind-wandering in low-threat circumstances, and less effortful than acceptance in low-threat circumstances (being inconsistent with reflexive responding in that circumstance).

[jj]Regulation strategies that are hypothesised to require executive control involve inhibiting prepotent responses. Hence, such strategies should be perceived and rated as more difficult than those strategies that do require this same inhibition. Therefore, task difficulty is considered a proxy for efforts at self-regulation (Schmeichel, 2007; K. Vohs & Schmeichel, 2003).

7.7.1. Method

The method is described in chapter 4 in more detail. A brief overview of the relevant variables is provided (see Figure 7.1 for summary of procedure with highlighted section indicating when data was gathered for study 7.1). As discussed earlier in chapter 4, there were two between-subject independent variables: the first was threat, with two levels (low and high). The second independent variable, regulation strategy, had three levels (distraction, acceptance, and control), yielding six participant groups. One hundred and eighty university students were randomly allocated to one of the six groups (i.e., 30 participants in each). Participants were told of the threats (deliver an impromptu speech or watch a film clip) then to engage in the affect regulation tasks of thinking and then writing. Participants were asked to indicate the perceived level of effort that they invested in the regulatory tasks, and how difficult they perceived the regulation tasks to be. Ratings were provided on a scale from one (no effort or not difficult) to seven (used all effort or was very difficult).

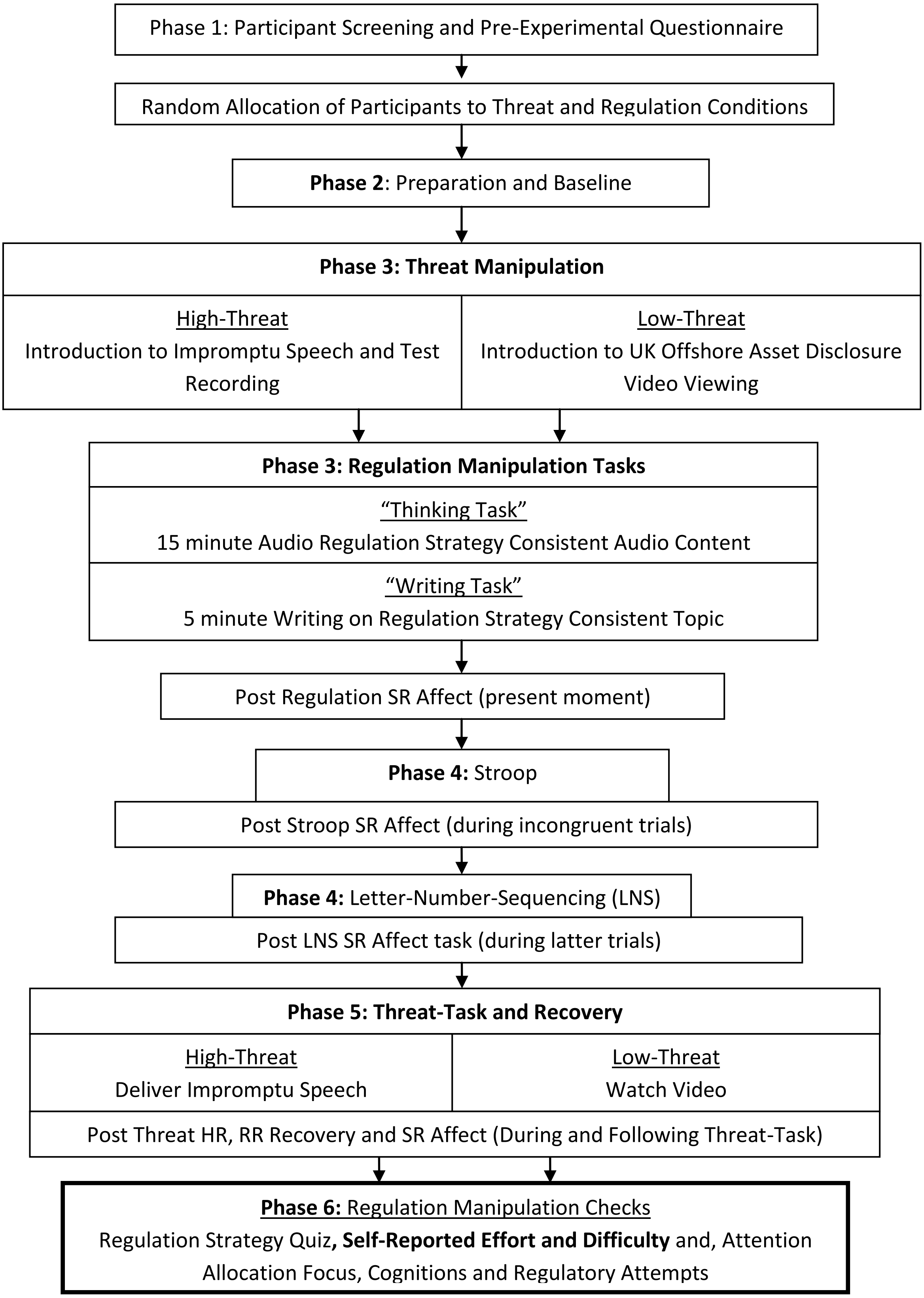

Figure 7. 1. Flow Diagram of Procedural Phases with Phase 6 (Data Collection Point) Highlighted.

7.7.2. Results

Self-Reported Regulation Effort and Difficulty Ratings: Initial data screening of both effort and difficulty ratings detected two outliers, one each in the high-threat and low-threat acceptance conditions and these were removed from the subsequent analysis. Separate 2 (threat level: high-threat and low-threat) X 3 (regulation strategy: distraction, acceptance and mind-wandering) ANOVAs were used to test the hypotheses, on effort and difficulty variables. Figures 7.2 and 7.3 show the mean and SE for each item for each condition.

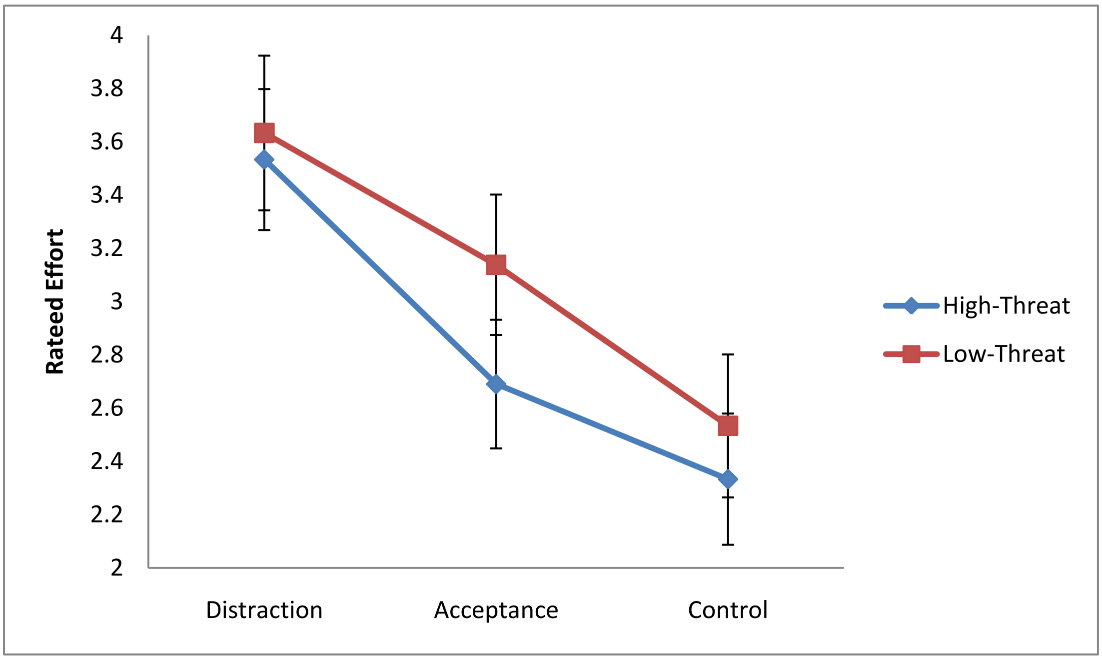

Figure 7.2. Mean and Standard Error of Reported Effort of Regulation.

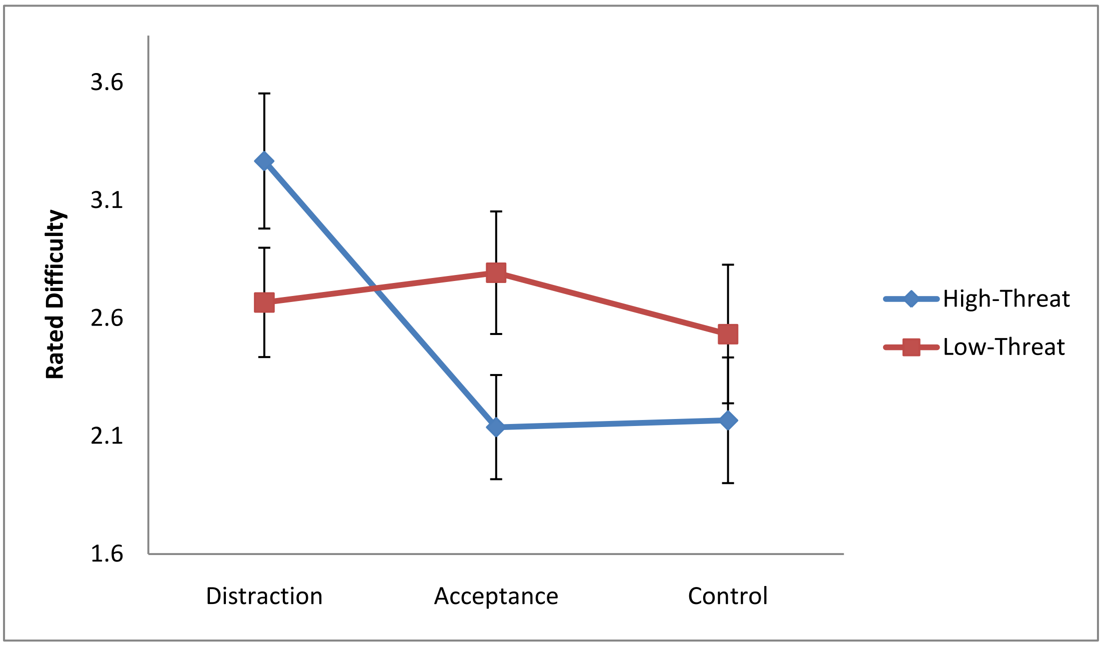

Figure 7.3. Mean and Standard Error of Reported Difficulty of Regulation.

The results from the effort item showed no main effect of threat level, $F(1, 172) = 1.34$, $p = .25$, $\eta_p^2 = .008$. There was a significant main effect of regulation strategy, $F(2, 172) = 9.72$, $p < .001$, $\eta_p^2 = .10$. Least significant difference pairwise post hoc tests showed that distraction was rated as significantly more effortful than acceptance, $p = .012$, mean difference = .67, $SE = .26$, and more effortful than mind-wandering undertaken by the control condition, $p < .001$, mean difference = 1.15, $SE = .26$. Acceptance was rated to be nominally more effortful than mind-wandering and this difference approached significance, $p = .07$, mean difference = .48, $SE = .26$. The interaction between threat level and regulation strategy was not significant, $F(2, 172) = .23$, $p = .78$, $\eta_p^2 = .003$.

Because different patterns of mental investment were predicted across the regulatory strategies within each threat level, separate analyses were conducted within each threat level. A one-way ANOVA within the high-threat level showed a significant effect of regulation strategy, $F(2, 86) = 5.09$, $p = .010$, $\eta_p^2 = .101$. Post hoc LSD comparisons showed that distraction was rated to be significantly more effortful than acceptance, $p =$

.033, mean difference = .84, *SE* = .39, and mind-wandering, *p* = .003, mean difference = 1.20, *SE* = .39. There was no difference between acceptance and the control condition, *p* = .36, mean difference = .36, *SE* = .39. A one-way ANOVA within the low-threat level showed a significant effect of regulation strategy, $F(2, 86) = 4.84$, $p = .010$, $\eta_p^2 = .101$. Post hoc (LSD) comparisons showed there was no difference between distraction and acceptance, *p* = .17, mean difference = .50, *SE* = .36. However, distraction was rated as significantly more effortful than mind-wandering, *p* = .003, mean difference = 1.10, *SE* = .35. In addition, acceptance was rated to be nominally more effortful than the mind-wandering control however the difference did not reach significance, p = .094, mean difference = .60, SE = .36. An independent samples *t*-test showed that acceptance in high-threat circumstances did not differ from mind-wandering in low-threat circumstances, $t(57) = .43$, $p = .67$, $d = .12$.

The 2 X 3 ANOVA on the difficulty item showed no significant main effect of threat, $F(1, 172) = .43$, $p = .51$, $\eta_p^2 = .003$. The main effect of regulation strategy was significant, $F(2, 172) = 3.16$, $p = .045$, $\eta_p^2 = .035$. Least significant difference post hoc comparisons showed that distraction was rated to be nominally more difficult than acceptance and this difference approached significance, *p* = .06, mean difference = .50, *SE* = .26. Distraction was rated to be significantly more difficult than mind-wandering undertaken by the control conditions, *p* = .02, mean difference = .62, *SE* = .26. There was no difference between acceptance and the mind-wandering control conditions. There was a significant interaction between threat level and regulation strategy, $F(2, 172) = 3.15$, $p = .045$, $\eta_p^2 = .035$, showing that a different pattern existed amongst the regulatory conditions depending on threat level (see Figure 7.3).

A one-way ANOVAs was conducted to compare regulation strategies within each threat level. The one-way ANOVA within the high-threat level showed a significant effect of regulation strategy, $F(2, 86) = 6.12$, $p = .03$, $\eta_p^2 = .125$. Post hoc (LSD) comparisons showed that distraction was rated as significantly more difficult than acceptance, p = .003, mean difference = 1.12, SE = .37, and mind-wandering, p = .004, mean difference = 1.10, SE = .37. There was no significant difference between acceptance and mind-wandering, p = .94, mean difference = .03, SE = .37. The one-way ANOVA within the low-threat level showed no effect of regulation strategy, $F(2, 86) = .24$, $p = .78$, $\eta_p^2 = .006$. An independent samples t-test showed that those in the high-threat acceptance condition found the regulation task somewhat less difficult than the those in the low-threat acceptance condition, and this difference approached significance, $t(56) = -1.92$, $p = .060$, $d = -.50$.

7.7.3. Discussion

The research question for study 7.1 asked whether the regulation strategies were perceived differently in terms of demand for mental resources, and whether the threat level in which the regulation strategy is undertaken influenced these perceptions. The results were supportive of the self-regulation hypothesis in that the regulatory strategies influenced perceived mental demands. The demanding distraction hypothesis was supported, within both threat levels, with those engaging in distraction perceiving greater mental demands to the acceptance and mind-wandering control conditions.

At neither threat level was acceptance perceived to demand more mental resources than the mind-wandering control condition. However, the influence of threat level on acceptance was demonstrated when assessing the regulation strategies under each threat level separately. The results from the high-threat level were the same as those across both threat levels. However, under low-threat circumstances, acceptance was perceived as requiring similar levels of mental effort to distraction. Furthermore, acceptance was perceived as nominally more effortful than mind-wandering, although these results only approached significance. Moreover, acceptance under low-threat circumstances was rated as nominally more difficult than acceptance under high-threat circumstances, although this difference also only approached significance. Furthermore, acceptance in high-threat circumstances was perceived to be as effortless as mind-wandering in low-threat circumstances but less effortful than acceptance in low-threat circumstances. The reason for results only approaching significance may have been due to large error variance associated with self-report variables and with more power such nominal differences may have reached significance.

Despite the lack of power issue, these results together support tentatively the notion that focusing attention towards the self and to low-threat-stimuli in low-threat circumstances is more difficult that letting attention wander, but relatively effortless when in high-threat circumstances. These findings suggest that the perception of how mentally demanding a strategy is depends on the reflexive responses occurring in the circumstances in which it is engaged in (Alberts et al., 2008; Sheppes & Meiran, 2008).

Overall, these results showed that the regulatory strategies were perceived to differ in the quantity of mental resources used, thereby supporting the self-regulatory hypotheses. Hence, self-regulatory strength theory would predict differences in executive control, as this perceived investment is likely to correspond to the depletion of executive resources. However, participants' perception of a task as particularly mentally demanding does not necessarily imply that it is objectively executive resource depleting (Muraven & Baumeister, 2000; Muraven et al., 1998). The impact of the regulation strategies on executive resources is the focus of study 7.2.

7.8. Study 7.2: Do Distraction and Acceptance Deplete Prepotent Response Inhibition: Does Threat Level Matter?

Study 7.2 aims to extend the findings of study 7.1 by establishing whether differences in perceived demands for mental resources correspond with depleted executive resources, as indicated by disrupted prepotent response inhibition. Hence, study 7.2 aims to test the predictions of the self-regulatory strength theory, that regulating attention towards particular stimuli (a top-down process) may preserve executive resources in circumstances where those stimuli would have been allocated attentional focus based on bottom-up reflexive processes, and that this same top-down regulation would deplete executive resources if counter to bottom-up attentional processes elicited by another situation. Consistent with self-regulatory strength theory, predictions based on the affective theory of ACT are that increased threat should have a detrimental impact on participants' ability to inhibit prepotent responses.

The chosen measure of the prepotent response inhibition was the colour word Stroop task (Stroop, 1935), well established as measuring this particular executive function (Miyake et al., 2000). Both reaction time (RT) and uncorrected errors have been used previously to demonstrate executive resource depletion effects (Inzlicht et al., 2006; Johns et al., 2008). The longer it takes, or the more errors made, to name the colour of the print of colour words that do not match the colour in which they are printed (e.g., the word "red" printed in blue) relative to naming colours of "XXX" strings indicates increased Stroop interference (i.e., difficulty in inhibiting attention towards the word).

Based on the predictions of ACT (Eysenck et al., 2007), and self-regulatory strength theory, it is hypothesised that increased threat, particularly in the conditions not directly providing an attentional focus, will disrupt the ability to exercise response inhibition (i.e., threat hypothesis). Secondly, based on a self-regulatory hypothesis, it is predicted that undertaking a regulatory strategy that involves inhibiting reflexive responses should temporarily impair the subsequent ability to inhibit automatic responses. Consistent with the results of study 7.1, a distraction strategy is expected to deplete executive resources, and therefore will diminish performance for both threat levels. The hypotheses regarding the importance of threat circumstances for the impacts of acceptance on executive resources hypothesis are also retained from study 7.1, predicting that acceptance will be protective of executive resources under high-threat circumstances and depleting under low-threat circumstances.

7.8.1. Method

The design, procedure and participants are identical to study 7.1, as it was part of the same overarching experiment. After completing a self-report of affect following regulation, participants undertook the Stroop task (Stroop, 1935). This involved naming the colour of the print that XXX strings and colour words were printed in. The words were colour names, which were incongruent with the print colour in which they were printed. The neutral XXX string trials were completed first followed by the Stoop incongruent colour word trials. Both RT and uncorrected errors were recorded from both XXX trials and incongruent colour word trials. To derive a measure of inhibition, the time taken to name the colour of the print of XXX strings was subtracted from the time taken to name the colour of the print of colour words that did not match the colour of they were printed in (Inzlicht et al., 2006). This study uses data collected from phase 4 in procedure (see highlighted section of Figure 7. 4 giving an overview of the procedure. See chapter 4 for more details of procedure.

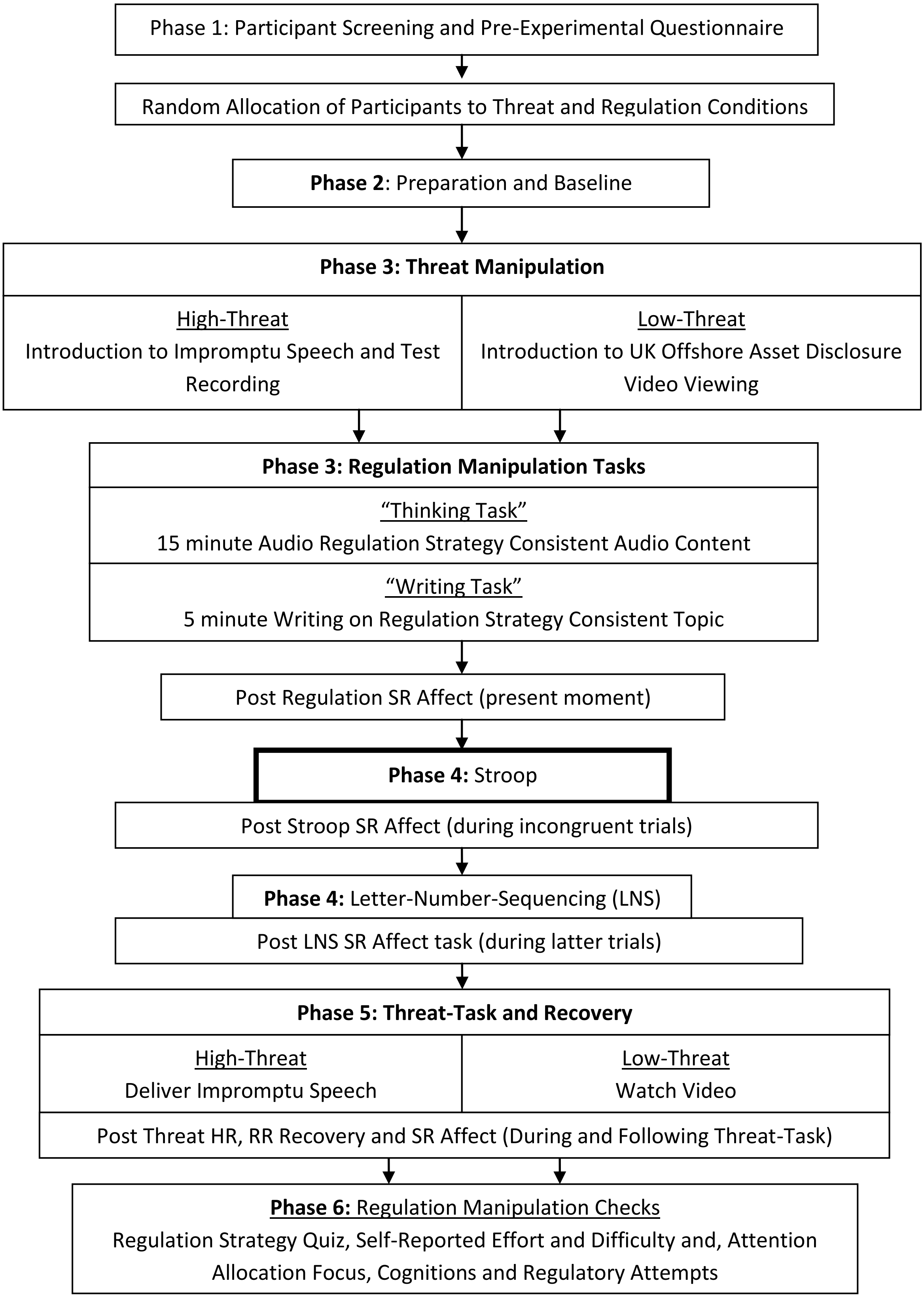

Figure 7. 4. Flow Diagram of Procedural Phases with the relevant Data Collection Period, Phase 4, Highlighted.

7.8.2. Results

Stroop RT: Stroop interference scores were calculated as time taken on incongruent trials minus time taken on XXX string trials (Inzlicht et al., 2006). Five participants were detected as outliers (+/- 3 *SD* from the *M*))[kk]. Three were from the high-threat acceptance condition and the other two were from the low-threat control condition. These cases were removed from the subsequent analysis. A 2 (threat level: high and low) x3 (regulation strategy: distraction, acceptance and control) ANOVA on Stroop Interference scores was used to test the regulatory and affective hypotheses. The means and standard error for each condition and are presented in Figure 7. 5. The figure shows that the pattern of results varies across regulation strategy when comparing each threat level.

[kk]Analysis to control for a potential speed accuracy trade off utilising the same 2 X 3 analysis, including planned comparison t-tests, presented here on the RT difference scores (interference) was undertaken using accuracy rate difference scores (incongruent trial accuracy score/RT - XXX trials accuracy score/RT). Accuracy rate difference scores were negative with increasingly negative accuracy rate scores indicating increased interference. Results were almost identical to the analysis presented of the RT difference scores (only that interference scores were reversed), with the interaction between threat level and regulation strategy being significant, $F(2, 169) = 8.05$, $p < .001$, $\eta_p^2 = .087$ (see Appendix O for means of Stroop accuracy rate difference scores). Reaction time difference scores are presented here to remain consistent with previous self-regulatory strength research (Inzlicht et al., 2006) followed by the uncorrected error difference score results (Johns et al., 2008).

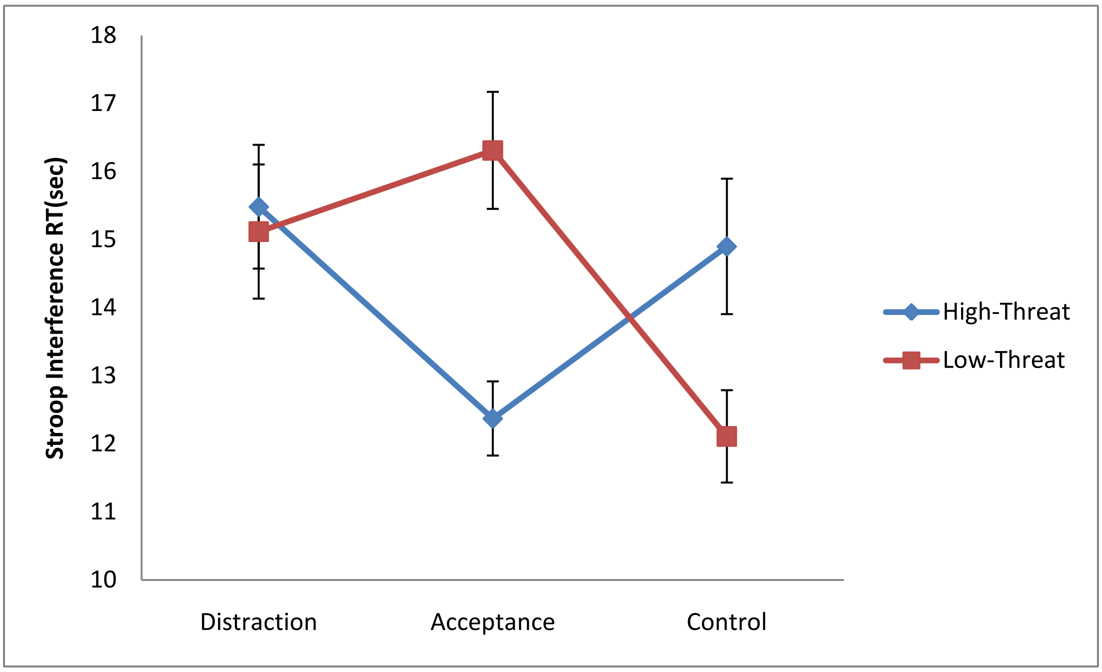

Figure 7. 5. Stroop RT (sec) Mean Difference (Interference) Scores (error bars indicate SE).

The results showed no main effect of threat level $F(169) < 1$, ns. The main effect of regulation strategy was not significant, $F(2, 169) = 2.22$, $p = .11$, $\eta_p^2 = .026$. Importantly, this main effect of regulation strategy was superseded by the predicted significant interaction between threat level and regulation strategy, $F(2, 169) = 7.76$, $p = .001$, $\eta_p^2 = .084$, showing that the threat level altered the pattern of differences amongst the regulatory conditions.

The two control conditions were compared to determine whether the threat level influenced executive control, independent from imposed regulation. An independent samples *t*-test showed that the participants under high-threat showed a larger Stroop interference effect than the participants under low-threat, $t(56) = 2.29$, $p = .026$, $d = .52$.

A simple main effects analysis using two one-way ANOVAs tested the regulatory hypotheses separately within each threat level. The results showed that there was an effect of regulation strategy within both the high, $F(2, 84) = 3.59$, $p = .032$, $\eta_p^2 = .079$, and low, $F(2, 85) = 6.24$, $p = .003$, $\eta_p^2 = .13$, threat levels. Post hoc (LSD) comparisons within the high-threat level demonstrated that participants who engaged in distraction showed a larger Stroop interference effect than those who engaged in acceptance, *p* = .013, mean difference = 3.11, *SE* = 1.23. There was no significant difference between distraction and control, *p* = .63, mean difference = .58, *SE* = 1.19. Acceptance showed less Stroop interference relative to the control condition, *p* = .042, mean difference = -2.53, *SE* = 1.23. Within the low-threat level, unlike the high-threat level, there was no significant difference between distraction and acceptance, *p* = .32, mean difference = -1.19, *SE* = 1.20. Participants in the distraction condition exhibited a significantly larger Stroop interference effect than controls, *p* = .016, mean difference = 3.01, *SE* = 1.22. Acceptance also showed significantly larger Stroop interference than the control condition, *p* = .001, mean difference = 4.20, *SE* = 1.22. In addition, an independent samples *t*- test showed that the acceptance conditions were significantly different, with the high-threat level, showing significantly smaller Stroop interference effects than the low-threat level, $t(48.33^{\|}) = -3.87$, $p < .001$, *d* = -1.01. A final independent samples t-test showed there was no difference between the high-threat acceptance and low-threat control conditions, $t(53)= .30$, *p*= .76, *d*= .08.

To check that these RT results were not due to a potential speed accuracy trade-off, uncorrected error difference scores (incongruent trials-XXX trials) were calculated for each trial. If the pattern of results suggested that increased errors were associated with participants responding more rapidly, this result would indicate a speed accuracy trade-off. The same 2 (threat level) X 3 (regulation) univariate ANOVA was conducted on the mean of the uncorrected error difference scores. See Figure 7.6 for the error difference scores made within each condition, with higher scores indicating worse performance.

[‖] Fluctuation in *df* due to equality of variance assumption violated.

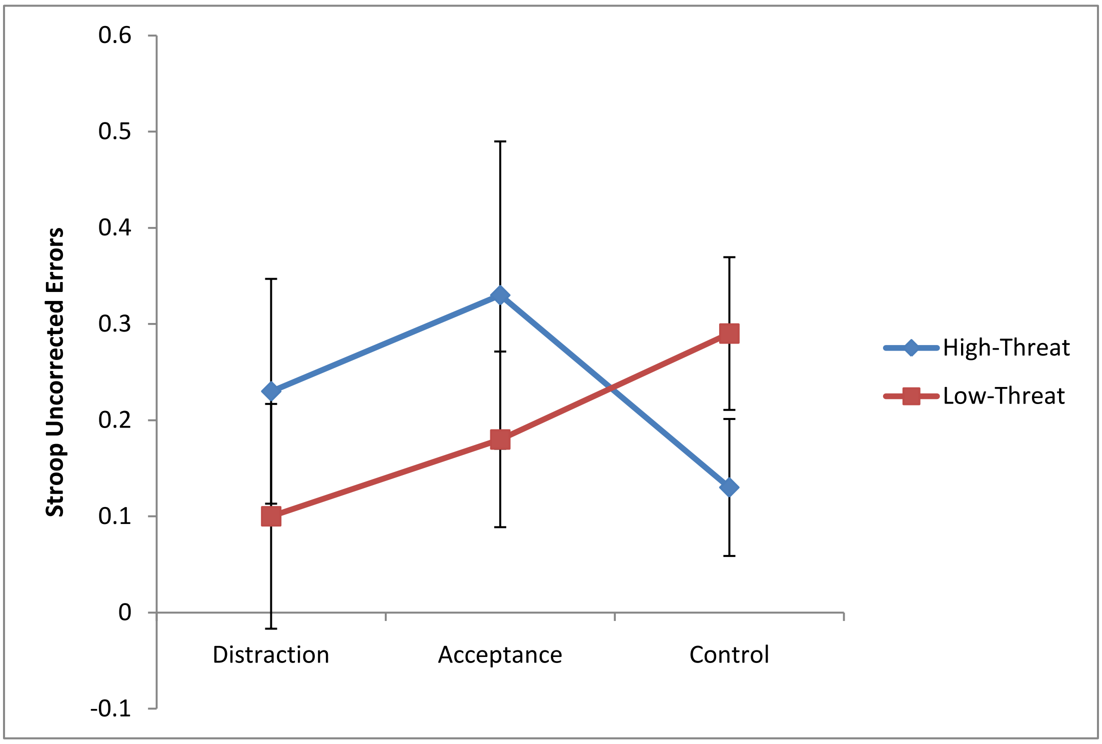

Figure 7. 6. Mean Uncorrected Error Difference Score (error bars indicate SE).

The results showed no significant main effect of threat level, $F(169) < 1$, ns, and no significant main effect of regulation strategy, $F\ (169) < 1$, ns. Importantly, the interaction between threat level and regulation strategy was also not significant, $F(2, 169) = 1.22$, p = .30, $\eta_p^2 = .014$, suggesting that the same pattern noted within the RT results was not due to or complicated by a speed accuracy trade-off.

7.8.3. Discussion

The research question for study 7.2 concerned the impacts particular regulation strategies, undertaken in different threat circumstances, have on prepotent response inhibition. The results indicated that threat level influenced the pattern of response inhibition performance differently depending on the regulatory strategy undertaken. Firstly, increased threat led to impaired prepotent response inhibition in conditions. A self-regulatory interpretation of this impairment shown by the high-threat mind-wandering condition relative to its low-threat counterpart is that increased effort is required to divert attention from threats and the experience of unpleasant affect that participants, when anxious, reflexively engage with (Bar-Haim et al., 2007). Decrements in executive control, attributed to prior regulation, often co-occur with participants reporting increased effort invested during this prior regulation (Baumeister et al., 1998; Schmeichel, 2007; Schmeichel et al., 2003), although not always (Muraven et al., 1998). Hence, although there was no difference in subjective effort expended between the mind-wandering conditions, this result does not mean that a self-regulatory strength explanation of the differences in executive control between the conditions is not relevant. However, it does suggest that the affective theory of ACT and the neurovisceral account, which would have predicted this same pattern of results are highly plausible potential explanations. Differences in heart rate and HRV amongst the two mind-wandering control conditions were found in study 6.1 of chapter 6 and thus shared variance between these variables and Stroop interference needs to be controlled to determine whether the ACT or neurovisceral explanations better account for the differences between the two mind- wandering control conditions (see study 7.5 for this analysis).

Regarding the regulatory hypotheses, the results showed support for the demanding distraction hypothesis across both threat levels. When taking into account the threat circumstances, distraction showed decrements in prepotent response inhibition compared to at least one of the other regulatory conditions in each threat level. Within the high-threat level, distraction did not show decrements in performance relative to the mind-wandering control condition. This suggested that distraction did not add significantly more demands above the imposition of threat and the automatic regulatory attempts. Distraction did show a significant impairment in executive control from the mind-wandering control condition in the low-threat level, supporting the demanding distraction hypothesis.

Threat level also influenced the impacts of the acceptance manipulation, but in the opposite way to the mind-wandering control conditions. The high-threat acceptance condition showed superior performance to the high-threat mind-wandering control condition, suggesting that acceptance preserved executive resources under the presence of an anticipated threat relative to strategies seeking to avoid the affective experience (distraction and, arguably, mind-wandering). However, in the low-threat level, acceptance led to the depletion of executive resources relative to the mind-wandering control condition. Lastly, acceptance undertaken in high-threat circumstances did not differ from engaging in mind-wandering in the low-threat circumstances. These results support the notion that the threat level in which acceptance is undertaken influences the demand that the strategy places on executive resources.

The results are strongly supportive of the self-regulatory theory, particularly when taking into account the predictions of increased threat facilitating reflexive attention towards threats (Mogg & Bradley, 1998) and towards the self (Duval & Wicklund, 1972). These predictions suggest that engaging in acceptance in high-threat circumstances would be less effortful and thus preserve executive control, relative to engaging in a strategy that directs attention away from reflexively attended to threat. Similarly, in low-threat circumstances, which do not facilitate attention to threats or to the self, mind-wandering appears to be a relatively effortless strategy, preserving executive control. In contrast, stimuli of increased threat may require more effort to divert attention from, thus resulting in impaired executive control, as indicated by the distraction and the mind-wandering control conditions. However, as low-threat circumstances do not facilitate attention to threats or self-awareness, the acceptance strategy becomes more effortful than letting the mind wander, resulting in impaired executive control.

Although there was clear support for a self-regulatory strength explanation of the results, there was also support for the threat hypothesis, predicted by both self-regulatory strength theory and ACT). This support was limited to the mind-wandering control conditions and did not exist across all regulatory conditions. Hence, these results show that increased affect, due to increased threat, found across all regulatory conditions noted in study 6.1 in chapter 6 was not completely reflected in the response inhibition of study 7.2.

7.9. Study 7.3: The Effects of Prior Distraction and Acceptance on Working Memory: What Are the Impacts of Persisting Threats?

The results from study 7.2 showed the effects of threats and regulation strategies on prepotent response inhibition directly after engaging in regulation. Threats and regulation strategies also impact working memory, another executive function (Miyake et al., 2000) that requires executive control (Eysenck et al., 2007; Kane et al., 2001; Schmeichel, 2007). Both response inhibition and updating representations in working memory require executive resources (Johns et al., 2008; Schmeichel, 2007) and the impacts of threat and regulation on working memory have demonstrated in similar impacts to response inhibition (Inzlicht et al., 2006; Johns et al., 2008; Schmader & Johns, 2003).

If the differences noted between regulatory conditions are due to executive resources depletion, the same pattern of results should occur in both measures. The executive function of updating representations in working memory (WM) is different from prepotent response inhibition as the difficulty of the task can be increased by increasing the number of representations to be retained within working memory. Previous studies have found that threats and affect regulation impact on overall capacity (Croizet et al., 2004; Johns et al., 2008; Schmader & Johns, 2003; Schmeichel, 2007). Furthermore, depleting self-regulatory effects can negatively impact on task persistence (Baumeister et al., 1998) and impairments in performance can occur when the task increases in difficulty due to reductions in the resources available to support such effortful acts (Hagger et al., 2010).

Study 7.3 uses a WM task that incrementally increases the load level (i.e., the number of representations to be retained and reorganised), and therefore performance in these higher load levels indicates increased task persistence in the face of increased task difficulty. Self-regulatory strength theory predicts that threat level and regulation will combine to impact on performance when participants continue through to the more difficult, higher load trials (Hagger et al., 2010). Likewise, the affective theory, PET, predicts that any WM performance differences due to situational circumstances (e.g., threat levels) and/or regulation should also be found within higher load levels due to anxiety restricting capacity. Hence, if a WM task gradually increases the attentional load, both theories predict the differences in the experimental conditions will occur in the high-load level, although for different reasons: Self-regulatory strength due to diminishing executive resources; and PET due to restricted attentional capacity in the presence of anxiety and worry. Lastly, self-regulatory strength theory predicts that differences in executive control between the threat and regulatory conditions should follow a similar pattern to those in study 7.2.

7.9.1. Method

The design of study 7.3 is identical to the previous two studies. This chapter presents results from the Letter-Number-Sequencing task that measures working memory capacity (Wechsler, 1997). Participants listen to a set of random letters and numbers that they must remember and reorder the stimuli - numbers in order first from lowest to highest, followed by letters in alphabetical order. Participant verbal response accuracy was recorded for each attempted trial, scored as either correct or incorrect. Figure 7.7 indicates the point at which WM was measured in the experimental procedure.

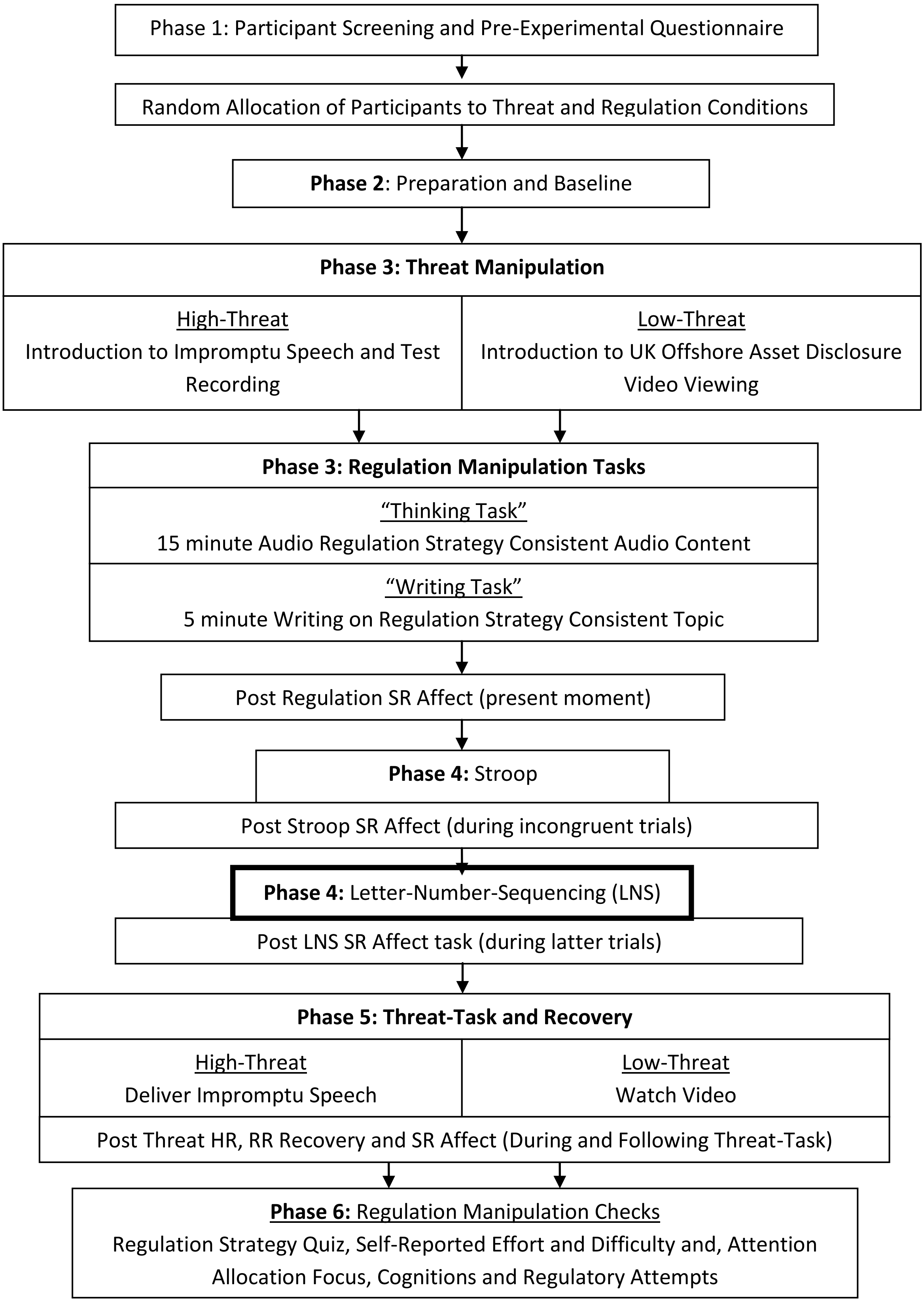

Figure 7. 7. Flow Diagram of Procedural Phases with Relevant Data Collection (Phase 4: LNS) highlighted

7.9.2. Results

Working Memory (WM) Performance: To test both the regulatory and anxious affect hypotheses on the ability to retain and reorganise representations in WM, a 2 (threat level: high and low) X 3 (regulation strategy: distraction, acceptance, and mind-wandering) X 3 (WM Load) mixed design factorial ANOVA was used. The analysis was conducted on the mean score of the trials within a load level: low (trials of 2, 3 and 4 digits in length), medium (trials of 5 and 6 digits in length), and high (trials of 7 and 8 digits in length). Load levels are expressed as the average correct for each item difficulty level for high, medium or low load resulting in the lowest possible score of 0 and highest 3. Means and standard deviations are presented in Table 7.1.

Table 7. 1.

Letter Number Sequencing Mean Score for the Trials in Low, Medium and High-Load Levels.

		Threat Level							
		High-Threat				**Low-Threat**			
	WM Load	Low	Medium	High	**Total**	Low	Medium	High	**Total**
Reg Strategy	**Distract**	2.87	1.90	.15	**1.64**	2.86	1.77	.47	**1.70**
		(.22)	(.86)	(.35)	**(.37)**	(.23)	(.80)	(.64)	**(.45)**
	Accept	2.90	1.58	.48	**1.66**	2.90	1.78	.55	**1.74**
		(.22)	(.85)	(.66)	**(.47)**	(.18)	(.82)	(.78)	**(.49)**
	Control	2.88	1.87	.30	**1.68**	2.91	2.00	.63	**1.85**
		(.20)	(.73)	(.50)	**(.40)**	(.17)	(.84)	(.69)	**(.46)**

Figures in parentheses are *SD.*

There was an expected significant main effect of load, $F(2,173) = 1426.03$, $p < .001$, $\eta_p^2 = .94$, with performance decreasing with increasing load. The main effect of threat level was not significant, $F(1, 174) = 2.45$, $p = .12$, $\eta_p^2 = .014$, although the high-threat conditions showed nominally decreased performance relative to the low-threat level. The main effect of regulation strategy was not significant, $F < 1$, ns. There was a significant interaction between threat level and load, $F(2, 173) = 3.44$, $p = .034$, $\eta_p^2 = .038$, suggesting that at higher levels of load the detrimental impacts of increased threat are exposed. The interaction between regulation strategy and load was approaching significance, $F(4, 344) = 2.27$, $p = .061$, $\eta_p^2 = .026$, showing that at higher load levels the regulation strategy were marginally affecting WM capacity. The interaction between threat level and regulation strategy was not significant, $F < 1$, ns, showing that the different threat levels did not result in a different pattern of results amongst the regulatory conditions. The three-way interaction between threat level, regulation strategy and load was not significant, $F(4, 344) = 1.25$, $p = .29$, $\eta_p^2 = .014$.

A 2 (threat level) x3 (regulation strategy) ANOVA was used on the high-load WM performance data to confirm that the effects of both threat and regulation were present in the higher WM loads. The results showed a significant main effect of threat level, $F(1, 174) = 6.65$, $p = .011$, $\eta_p^2 = .037$, with the high-threat level showing impaired performance relative to the low-threat level. The main effect of regulation strategy was not significant, $F(2, 174) = 1.84$, $p = .16$, $\eta_p^2 = .021$ nor was interaction between threat level and regulation strategy, $F(2, 174) = .87$, $p = .42$, $\eta_p^2 = .010$, showing that threat level did not lead to a different pattern of performance amongst regulation strategies.

To compare the pattern of results with study 7.2, the regulatory strategies were evaluated separately within each threat level within the high-load level. Results from one-way ANOVAs within each of the threat levels showed that there was a significant effect of regulation strategy approaching significance within the high-threat level, $F(2, 87) = 3.08$, $p = .051$, $\eta_p^2 = .066$, but a non-significant effect of regulation strategy in the low-threat level, $F(1, 87) = .42$, $p = .66$, $\eta_p^2 = .009$. Least significant difference post hoc comparisons were conducted within the high-threat level. Distraction led to lower accuracy in the high-load trials relative to acceptance, *p* = .015, mean difference = -.33, *SE* = .13. Distraction did not significantly differ from the control, *p* = .27, mean difference = -.15, *SE* = .13. Additionally, acceptance did not significantly differ from the control condition, *p* = .17, mean difference = .18, *SE* = .13.

Follow-up analyses to test for consistency with the findings of study 7.2 were undertaken. An independent samples *t*-test comparing the high- and low-threat mind-wandering conditions, in the high-load level, was used to test the impact of threat level without the influence of the provided regulation strategies. Participants in the high-threat level showed significantly impaired performance, *t*(52.81[mm]) = -2.13, *p* = .038, *d* = -.55. An independent samples *t*-test was used to assess whether the impact of threat in the acceptance conditions. No difference between high- and low-threat levels was found amongst the acceptance conditions, *t*(58) = -.36, *p* = .72, *d* = -.10. An independent samples *t*-test was used to test whether acceptance in high-threat circumstances preserved WM performance to a similar extent to mind-wandering in low-threat circumstances. The difference between acceptance at high-threat and mind-wandering at low-threat was not significant, *t*(58) = -.86, *p* = .40, *d* = -.22.

7.9.3. Discussion

The results of study 7.3 further confirmed the predictions of self-regulatory strength theory. The results showed that the impacts of threat and the regulation strategies became more prevalent with increased task persistence and difficulty (Hagger et al., 2010) in that threat and regulatory strategies only impacted on WM performance in the high-load level. However, relative to studies 7.1 and 7.2, the results from study 7.3 showed

[mm] Fluctuation in df due to violation of equal variances assumption.

that the impacts of prior regulation were minimal, with differences between the regulatory conditions only found under high-threat circumstances. However, the impacts of the persistent threats were demonstrated when averaging across the regulatory conditions in the high-load level.

As mentioned earlier, the impacts of the regulation strategies were only found within the high-threat level, although distraction did show a nominal overall detrimental impact on performance independent of threat level. The results from within the high-threat level when analysing the high-load level further supported the demanding distraction hypothesis. Distraction resulted in decreased executive control relative to acceptance, and did not differ from the control. Unlike study 7.2, acceptance did not show significantly better performance than the control condition, although the means were in this direction. This non-significant difference suggests that the influence of prior regulation may diminish in the presence of persisting threats or stressors.

There was a notable difference in the pattern of executive control results amongst the threat and regulatory conditions from studies 7.1 and 7.2 to the present study. The most notable difference was that there were no regulatory effects within the low-threat level, as shown in study 7.2, particularly that engaging in acceptance in low-threat circumstances did not result in executive resource depletion. Follow-up analyses suggested that the impact of threat on the control conditions remained. Furthermore, acceptance in high-threat circumstances still preserved executive control to a similar extent to mind-wandering in low-threat circumstances. However, no difference existed between the two acceptance conditions.

The present research is not the only study to find that persistent stressors may diminish the impacts of prior regulation. Hartley (1973) showed that persistent exposure to noise led to increasingly impaired executive control as increased exposure to the stressor occurred. Furthermore, Hartley (1973) also demonstrated that persistent exposure to noise also diminished the negative impacts of prior participant engagement in reading (suggested as a regulatory act) on executive control. The present study suggests that a noise stressor may have similar impacts as an ego/social evaluative threat and that like prior engagement in reading, prior affect regulation can have diminished influence on executive control as time passes. Hence, consistent with previous research, the negative impacts of prolonged exposure to a persisting high level threat became more pronounced relative prior regulation (Hartley, 1973).

Two theoretical accounts[nn] may provide plausible explanations for the different pattern of executive control exhibited amongst the experimental conditions from study 7.2 to 7.3. The first is a self-regulatory strength account, in that the persistent stressors cause ongoing executive resource depletion due to sustained regulation in response to their presence (Muraven & Baumeister, 2000). In addition, the diminished impact of regulation in low-threat circumstances was due to participants opportunity to rest and replenish executive resources (Muraven & Baumeister, 2000), thus remove the impacts of prior regulation. In high-threat circumstances, when threats persist, individuals may be still

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[nn] It is possible that threat and regulation, and their combination, may influence response inhibition and working memory differently because of the influence of threat and regulation may be unique for each of the executive functions. However, in self-regulatory strength research, these executive functions have been shown to be impacted similarly (Hagger et al., 2010; Johns et al., 2008; Muraven & Baumeister, 2000). In addition, Kane and Engle (2001) have suggested that working memory may best be understood by how effectively individuals can both inhibit and shift attention, and thus the results from study 7.2 and study 7.3, should have been identical if other factors (such as the prolonged exposure to threat) were not present. As there are no obvious well supported theories that may explain why the influence threat and regulation should be unique for each executive function, the alternative explanations discussed relate specifically to the theories presented in the literature review (i.e., self-regulatory strength theory, PET, ACT, and the neurovisceral account).

engaging in regulatory attempts to cope with this stressor and therefore the negative impacts of prior regulation persist, although in a somewhat reduced form (Hartley, 1973).

The second explanation for the different pattern of executive control results amongst the threat and regulatory conditions from study 7.2 to the present study (study 7.3) is an affective theory explanation. It may be that the differences in results are due to different patterns of affect experienced amongst these conditions during the performance of each of the executive tasks, with increased affect leading to impaired performance (Eysenck & Calvo, 1992b; Eysenck et al., 2007). An affective explanation would also account for why there was an increased impact of the threat level on WM compared to response inhibition, as participants in the high-threat level would be experiencing increased affect as the threat approaches, producing an increasing impact on executive control (Hartley, 1973).

7.10. Study 7.4: Does Anxious Affect Experienced Whilst Undertaking an Executive Task Explain Differences in Executive Control?

Study 7.4 aims to establish whether the level of anxiety experienced when undertaking the executive tasks explains the patterns of performance in response inhibition and working memory noted amongst the threat and regulatory conditions, in accordance with the affective theories of ACT and PET and to a lesser extent the neurovisceral account. In contrast, self-regulatory strength theory predicts that differences noted between regulation strategies should be accounted for by differences in available executive resources rather than differences in experienced affect. To demonstrate a self-regulatory strength explanation of the results, affective influences need to be controlled. It is possible that the patterns of affect experienced amongst the threat and regulatory conditions were different for each of the executive tasks. If the patterns of affect experienced amongst the threat and regulatory conditions were different for both executive tasks this may have caused the variation in the patterns of performance amongst the threat and regulation on these two executive tasks.

The affective theories of ACT and PET make four key predictions regarding performance. Firstly, there should be differences between threat and regulatory conditions on physiological arousal and/or self-reported anxiety. Secondly, the reported affect variable should be associated with impaired executive control (i.e., greater anxious affect associated with greater Stroop interference and fewer correct responses on LNS). Positive heart rate changes (i.e., increases in HR) measured during executive task performance represents increased effort to sustain performance (Jorna, 1992), especially while anxious (Eysenck & Calvo, 1992b), and therefore increased HR should be associated with superior executive control (i.e., smaller Stroop interference and more correct responses on LNS). For WM, increased effort will be necessary to maintain performance as difficulty increases, hence, increased HR during the later trials should be associated with better performance in those later trials. Fourthly, these variables (i.e., reported affect and HR) should account for a significant level of variance in executive control, and furthermore should eliminate significant differences amongst the experimental groups noted when not accounting for these variables.

In contrast to PET and ACT, the neurovisceral account predicts that increased HR during the performance of the executive tasks should be associated with impaired executive control. Similarly, the neurovisceral account predicts that HR changes should account for a significant portion of the variance in executive control and that, when statistically controlled, the differences amongst the experimental groups will no longer be significant. Conversely, if the differences between the threat and regulatory conditions remain significant after statistically controlling for HR change or reported affect change variables, the results are consistent with the self-regulatory theory and executive resource depletion.

7.10.1. Method

The design was identical to the previous studies, being part of the same experimental procedure. Heart rate was recorded during the performance of both the Stroop and LNS. Following the completion of each of the tasks, participants rated the extent to which five adjectives (anxious, agitated, nervous, uneasy and worried) described their affective state on a scale from one (not at all) to seven (very much). The ratings from each of the adjectives were averaged to form a composite score of anxiety (see chapter 4 for details of method). Executive control measures were Stroop interference effect RT and WM score. Se Figure 7.8 for when the data was collected within the experimental procedure.

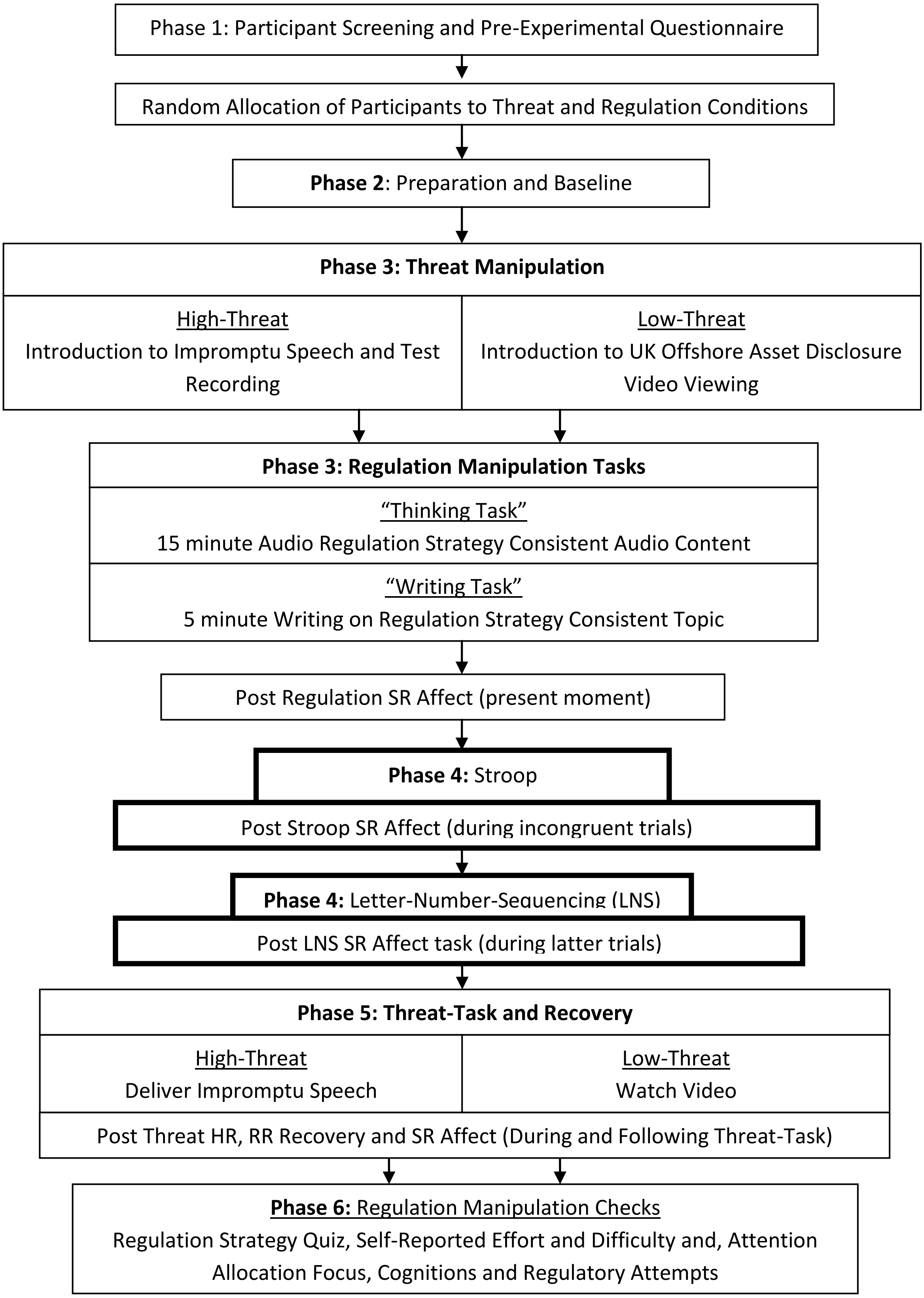

Figure 7. 8. Flow Diagram of Procedural Phases with Relevant Data Collection Period (Phase 4) Highlighted

7.10.2. Results

7.10.2.1. Response Inhibition

Heart Rate: HR shift scores were used to separate the impacts on HR reactivity of naming colours from HR changes representing the mental effort required for naming incongruent colour words. To calculate these shift scores, participants' baseline to colour naming HR change scores (i.e., HR during XXX trials - HR during baseline) were calculated as the indicator of HR reactivity to naming colours alone. The same procedure was used to calculate the level of HR reactivity to the combination of inhibition requirements and naming requirements (HR during baseline – HR during incongruent colour word trials). To demonstrate participants' HR change due to inhibition, free from colour naming reactivity, the HR shift scores were calculated as participants' HR change scores (i.e., the incongruent trial HR change scores - the XXX trial HR change scores). See Figure 7.9 for the mean shift scores for each condition for each trial.

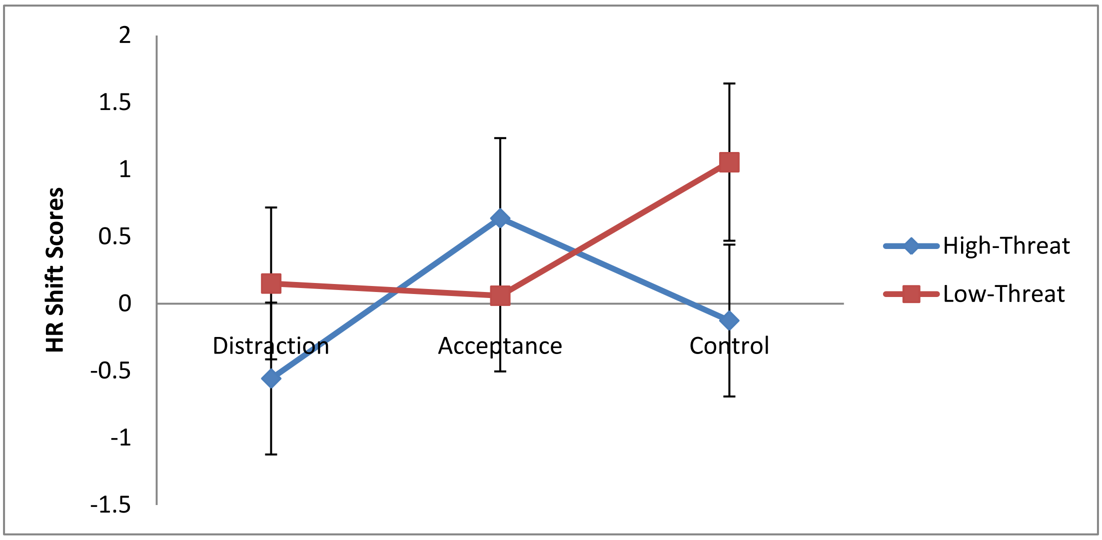

Figure 7. 9. Mean HR Shift scores (incongruent trial change scores – XXX trial change scores) for each condition (error bars indicate SE).

A 2 (threat level: high and low) X 3 (regulation strategy: distraction, acceptance and mind-wandering) ANOVA was used to establish whether there were differences amongst the experimental conditions in arousal experienced during the incongruent colour words trials. There was no effect of threat level, $F(1, 169) = 1.13$, $p = .29$, $\eta_p^2 = .007$, or effect of regulation strategy, $F(2, 169) = 1.03$, $p = .36$, $\eta_p^2 = .012$. Furthermore, there was no interaction between threat level and regulation strategy, $F(2, 169) = 1.34$, $p = .27$, $\eta_p^2 = .016$. These results show that there were no detectable differences in physiological arousal changes resulting from mental effort differences amongst the threat and regulatory conditions.

Testing for Differences in Stroop Performance After Controlling for HR Shift Scores: It is possible that the differences in Stroop interference between experimental threat and regulatory conditions may be due to variations in arousal. The negative correlation between the Stroop interference effect and HR shift scores pooling across conditions showed a trend towards significance, r (175) = -.13, p =.09[oo], suggesting that higher HR was associated with smaller Stroop Interference. A 2 (threat) X 3 (regulation strategy) ANCOVA on Stroop RT interference scores, using HR shift scores as a covariate assessed the possibility that this variable would alter the Stroop performance results. The results showed that physiological arousal as represented by increased HR shift scores did not

[oo] There was significant positive correlation between the Stroop HR shift scores and the Stroop accuracy rate difference scores (incongruent trial accuracy score/RT - XXX trials accuracy score/RT), r (175) = .17, p =.027. This indicates that as HR increased Stroop interference decreased. A 2 (threat level) X 3 (regulation strategy) ANCOVA on the Stroop accuracy rate difference scores, with the Stroop HR shift scores as a covariate was used to determine the impact of threat and regulation when the shared variance between the Stroop HR shift scores and the Stroop accuracy rate difference scores was removed. The results showed that HR shifts scores shared an amount of variance with Stroop accuracy rate difference scores that trended to significance, $F(1, 168) = 3.29$, $p = .071$, $\eta_p^2 = .019$. However, identical to the analysis presented of the RT difference scores, with the interaction between threat level and regulation strategy remained significant, $F(2, 168) = 7.21$, $p = .001$, $\eta_p^2 = .079$.

account for a significant amount of the variance in Stroop interference, $F(1, 168) = 1.40$, $p = .24$, $\eta_p^2 = .008$ and did not alter the Stroop interference effect results, with the interaction between threat level and regulation strategy remaining relatively unchanged, $F(2, 168) = 7.12$, $p = .001$, $\eta_p^2 = .078$.

Self-Reported Anxiety During Stroop: A 2 (threat level) X 3 (regulation strategy) ANOVA was used on participants' self-reported anxious affect change scores (self-reported anxiety during Stroop minus baseline). The Stroop interference outliers were excluded from this analysis. Figure 7.10 displays the means for each group.

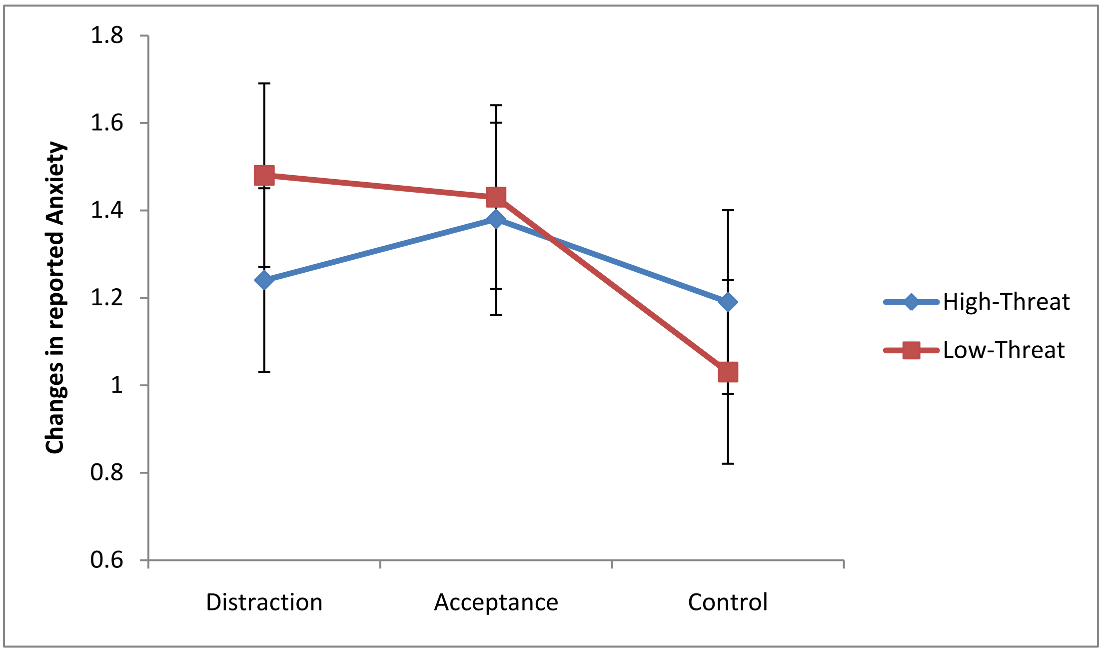

Figure 7.10. Mean Self-reported Anxiety Change Scores During Incongruent Trial Performance for Each Condition (error bars indicate SE).

Results showed no significant main effect of threat level, $F(1, 169) < 1$, ns. The main effect of regulation strategy was non-significant, $F(2, 169) = 1.15$, $p = .18$, $\eta_p^2 = .020$. The interaction between threat level and regulation strategy was not significant, $F(2, 169) < 1$, ns. These results show that neither threat level imposed nor the regulation strategy engaged in (nor their combination) influenced self-reported anxiety experienced during the incongruent Stroop trials.

Testing for Differences in Stroop Performance After Controlling for Self-Reported Anxiety: Stroop interference and self-reported affect did not correlate significantly, r (175) = .10, p= .17[pp]. A 2 (threat level) X 3 (regulation strategy) ANCOVA was used to test whether experienced affect predicted Stroop interference, and to examine group differences in performance controlling for anxiety. Self-reported anxiety change scores were included as a covariate and the Stroop interference as the dependent variable. Reported anxiety change scores did not account for a significant portion of the Stroop interference variance $F(1, 168) = 1.31$, $p = .25$, $\eta_p^2 = .008$, and the interaction between threat level and regulation strategy remained largely unchanged, $F(2, 168) = 7.61$, $p = .001$, $\eta_p^2 = .083$. Hence, the Stroop interference results showed the same pattern of differences between the threat and regulation conditions whether or not anxiety was controlled via covariation[qq].

7.10.2.2. Working Memory

Heart Rate: PET predicted that participants in the high-threat level would show elevated HR during the latter periods of the LNS task as the WM load of the items increased. To test this prediction, the last 2 minutes of HR recording during the performance of LNS were examined in a 2 (threat level: high and low) X 3 (regulation

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[pp] Correlation between the Stroop Accuracy Rate Difference Score and changes in reported affect, was not significant, r (175) = .06, p= .43.

[qq] Adding both HR shift scores and self-reported change scores simultaneously into the ANCOVA also made no significant change to the Stroop Interference results.

strategy: distraction, acceptance and control) ANOVA. Means of each condition are presented in Table 7.2.

Table 7.2.
Mean Self-Reported Anxious Affect Change Scores (HR during LNS - baseline) for Each Condition.

	Threat Level		
	High-Threat	**Low-Threat**	**Regulation Total**
Distraction	4.06 (5.60)	4.17 (5.62)	**4.12 (5.56)**
Acceptance	4.02 (5.09)	2.93 (6.89)	**3.48 (6.03)**
Control	3.68 (6.46)	1.67 (4.95)	**2.68 (5.80)**
Threat Total	**3.92 (5.69)**	**2.92 (5.90)**	

Figures in Parentheses indicate standard deviation.

There was no main effect of threat level, $F(1, 174) < 1$, *ns*, nor of regulation strategy, F (2, 174) < 1, *ns*. Furthermore, the interaction between threat level and regulation strategy was not significant, $F(2, 174) < 1$, ns.

Testing for WM Performance differences After Controlling for Heart Rate: Heart rate change scores from the last 2 minutes of LNS performance were used to test the affective hypothesis. The affect hypothesis predicted a positive relationship between HR and WM performance. Results from the correlations showed that HR change from baseline during the last 2 minutes of WM performance did not significantly correlate with WM performance: Total score, r (180) = -.007, p =.92; Low load; $r(180)$ = .002, p = .98; medium load, $r(180)$ = .002, p =.98, and; high-load, $r(180)$ = -.018, p = .81.

A 2 (threat level) X 3 (regulation strategy) X 3 (load level: low, medium and high) mixed design ANOVA on the WM performance data was conducted with the last 2 minutes of HR change score data as a covariate to remove the affective influences on performance. The results showed that the covariate did not account for a significant amount of the variance, $F(1, 173) < 1$, *ns*. Furthermore, there was no significant interaction between the HR and load, $F(2, 172) = < 1$, *ns*. To test if affect impacted negatively on working memory performance only during a high-load trials, a 2 (threat level) X 3 (regulation strategy) ANCOVA with HR change as the covariate was used. Results showed that HR change did not account for a significant amount of the WM performance variance, $F(1, 173) = < 1$, *ns*. Hence, the performance results remained largely unchanged when adding HR change as a covariate, with the effect of threat, $F(1, 173) = 6.61$, $p = .011.$, $\eta_p^2 = .037$, and the effect of regulation within the high-threat level $F(2, 86) = 3.15$, $p = .048.$, $\eta_p^2 = .068$, remaining significant.

Self-Reported Anxious Affect: A 2 (threat level) x3 (regulation Strategy) ANOVA was conducted on self-reported anxiety change scores (anxiety experienced during LNS-baseline) to determine whether differences in anxious affect occurred amongst the threat and regulatory conditions during LNS. Table 7.3 presents the mean change scores for each condition.

Table 7. 3.

Mean Self-Reported Anxious Affect Change Scores (reported during LNS - baseline) for Each Condition.

	Threat Level		
	High-Threat	**Low-Threat**	**Regulation Total**
Distraction	2.21 (1.41)	2.21 (1.09)	**2.21 (1.25)**
Acceptance	2.25 (1.51)	2.18 (1.52)	**2.22 (1.50)**
Control	2.04 (1.48)	1.55 (1.13)	**1.79 (1.33)**
Threat Total	**2.17 (1.46)**	**1.98 (1.28)**	

Figures in parentheses indicate standard deviation.

The participants in the high-threat condition did not report more anxiety during LNS than the low-threat participants, as the main effect of threat level was not significant, *F*

< 1, *ns*. The main effect of regulation strategy was non-significant, $F(2, 174) = 1.88$, $p = .16$., $\eta_p^2 = .021$. Furthermore, there was no significant interaction between threat level and regulation strategy, $F < 1$, *ns*. These results showed, counter to the affective hypothesis, no differences in affect amongst the threat and regulatory conditions[rr].

Testing for Differences in WM Performance After Removing the Variance Shared with Self-reported Anxiety. The affective hypothesis predicts that increased anxiety and worry causes decreased WM performance. A correlation was used to test whether greater anxiety and worry are associated with lower WM performance, particularly at the higher load levels. The results showed very low negative correlations (i.e., increased anxiety and worry were associated with poorer performance) across the load levels and in each of the three load levels in the predicted pattern, however none reached significance: Total score = $r(180) = -.01$ $p = .92$ low, $r(180) = -.07$, $p = .36$; medium, $r(180) = -.08$, $p = .26$; high, $r(180) = -.09$, $p = .22$.

A 2 (threat level) x3 (regulation strategy) x3 (load level) mixed design ANCOVA on the WM performance data tested whether anxiety accounted for a significant amount of the variance in WM performance and reduced the differences between the threat and regulatory conditions. Anxious affect change score (anxiety experienced during LNS minus baseline) was a covariate. Results showed that reported anxiety during LNS did not account for a significant amount of the variance, $F(1, 173) = 1.22$, $p = .27$, $\eta_p^2 = .007$, and there was no significant interaction between load and self-reported affect, $F < 1$, *ns*. A covariate analysis only within the high-load level showed that that self-reported affect did not account for a significant portion of the variance, $F(1, 173) = .14$, $p = .71$, $\eta_p^2 = .001$. Hence,

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[rr] As PET predicts that it is particularly worry that disrupts working memory performance the worry item was subject to the same analysis but no significant differences were noted.

the WM performance differences between the threat and regulatory conditions remained largely unchanged[ss] with the effect of threat, $F(1, 173) = 6.27$, $p = .013.$, $\eta_p^2 = .035$, and the effect of regulation within the high-threat level $F(2, 86) = 3.29$, $p = .042.$, $\eta_p^2 = .071$, remaining significant.

7.10.3. Discussion

The results from study 7.4 support the self-regulatory strength predictions over the affective predictions. Neither physiological nor self-reported measures of anxious affect displayed differences between the threat levels or regulation strategies when participants were engaging in the executive tasks of prepotent response inhibition or updating and maintaining representations in working memory. Further, there were no significant associations between affect measures and executive control that, when statistically controlled, altered the pattern of results noted amongst the threat and regulatory conditions. Therefore, the results of this study show that the differences noted amongst the threat and regulatory conditions were not due to differences in anxious affect experienced during executive task performance. Hence, these results suggest that the change in the pattern of results from prepotent response inhibition to working memory were not due to differences in the pattern of affect experienced during the execution of these tasks amongst the experimental groups.

There was one finding in study 7.4 that suggested an alternative to a self-regulatory strength explanation. When the HR shift scores were correlated with Stroop interference there was a trend towards significance, with increased arousal associated with less interference. The affective theories predicted a relationship where increased mental effort

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[ss] The worry item also did not account for a significant portion of the variance in WM performance. Adding both HR shift scores and self-reported change scores simultaneously into the ANCOVA also made no significant change to the WM results.

as represented by HR would be associated with better performance (Eysenck & Calvo, 1992b; Jorna, 1992), in contrast to the neurovisceral account, which predicted the opposite (i.e., increased HR associated with impaired performance). However, even when controlling for this increased mental effort, the impacts of the threat circumstances and regulation strategies were still significant, suggesting that the increased mental effort had a minimal effect on results.

Unlike previous studies, study 7.4 measured anxious affect retrospectively during the performance of the executive tasks. Studies testing the affective theory predictions often measure anxious affect in the period of time just before engaging in the executive tasks and show negative impacts of increased prior anxious affect on executive task performance (e.g., Derakshan et al., 2009; Eysenck et al., 2005; MacLeod & Donnellan, 1993; Shackman et al., 2006; Sorg & Whitney, 1992; Tohill & Holyoak, 2000). The aim of study 7.5 is to test whether affect experienced before undertaking the executive control tasks accounts for the executive control differences amongst the threat and regulatory groups.

7.11. Study 7.5: Are the Between Group Differences in Response Inhibition and Working Memory Performance Due to Variations in Anxious Affect Experienced During Regulation?

Study 6.1 established systematic differences between threat levels and the regulation strategies on measures of HRV, HR and self-reported affect towards the end of regulation. The affective theories are usually tested on the assumption that anxious affect experienced prior to engaging in the executive tasks is detrimental to performance (e.g., Derakshan et al., 2009; Eysenck et al., 2005; MacLeod & Donnellan, 1993; Shackman et al., 2006; Sorg & Whitney, 1992; Tohill & Holyoak, 2000). It may be that affect experienced during the regulatory periods (i.e., just before engaging in the executive tasks) has a carry-over effect on the executive control tasks. If carry-over effects are occurring it is likely that they would be more prominent on the response inhibition task (being temporally proximal to the regulatory period) and this reduction in the level of influence of prior experienced affect may explain why the WM results (study 7.3) did not reflect the same pattern of results amongst the threat and regulatory conditions as those noted on prepotent response inhibition in study 7.3. In addition, a number of studies have also tested Thayer's neurovisceral account (Hansen et al., 2003; Hansen et al., 2004; Hansen, Johnsen, Sollers, et al., 2009; Hansen, Johnsen, & Thayer, 2009) measuring vagal tone before undertaking an executive control task, with increased vagal tone associated with superior executive control. Hence, studies both on affect and HRV influencing executive control have demonstrated that prior increased affect or decreased HRV coincide with impaired executive control.

Study 7.5 tests the common occurrence found in previous research that the performance differences found between the threat and regulatory conditions are due to differences in affect experienced prior to executive task engagement, which in this study would be the latter periods of regulation. Furthermore, study 7.5 assesses the possibility that affect during the regulatory period had more influence on the temporally proximal executive task (response inhibition) than the temporally distal executive task (WM). Shared variance between affect and executive control shown on prepotent response inhibition may be greater than the shared variance between affect variables and executive control shown on WM. This difference in the level of shared variance may explain the different in patterns in executive control across threat and regulatory conditions noted in studies 7.2 and 7.3.

Several predictions arise from the affective theories of ACT and PET and Thayer's neurovisceral approach. Firstly, the differences in executive control will eliminated when statistically controlling for the systematic differences noted on affective variables noted between the threat and regulatory conditions during the third regulatory period (cf. study 6.1). Secondly, there will be significant correlations between arousal during the third regulatory epoch and executive task performance. The direction of these correlations will differ depending on the variables examined. According to the predictions made from the above theories, HRV (with increased HRV indicating lower levels of dysregulated affect) should be negatively correlated with Stroop interference (i.e., greater HRV leading to less interference) and positively correlated with WM performance (i.e., greater HRV leading to greater WM). The HR and affect variables are both predicted to correlate positively with Stroop interference (i.e., greater affect leads to greater Stroop interference) and are predicted to correlate negatively with WM performance. Furthermore, affect should account for a significant amount of variance in executive control and controlling for it should reduce the differences in executive control performance noted amongst the threat and regulatory conditions. Lastly, response inhibition should show more shared variance with affect experienced during regulation than WM performance, due to the temporal proximity of the assessment of that function to the thinking regulatory period.

7.11.1. Method

The design was the same as the previous studies. The affective measures chosen were HRV and HR change from baseline scores during the final thinking regulatory epoch, and self-reported affect change from baseline scores to post-regulation (see study 6.1). Executive task performance was measured by Stroop interference and WM accuracy. See Figure 7.11, showing the phases of the experiment during which the data were collected. For a full description of the method see chapter 4.

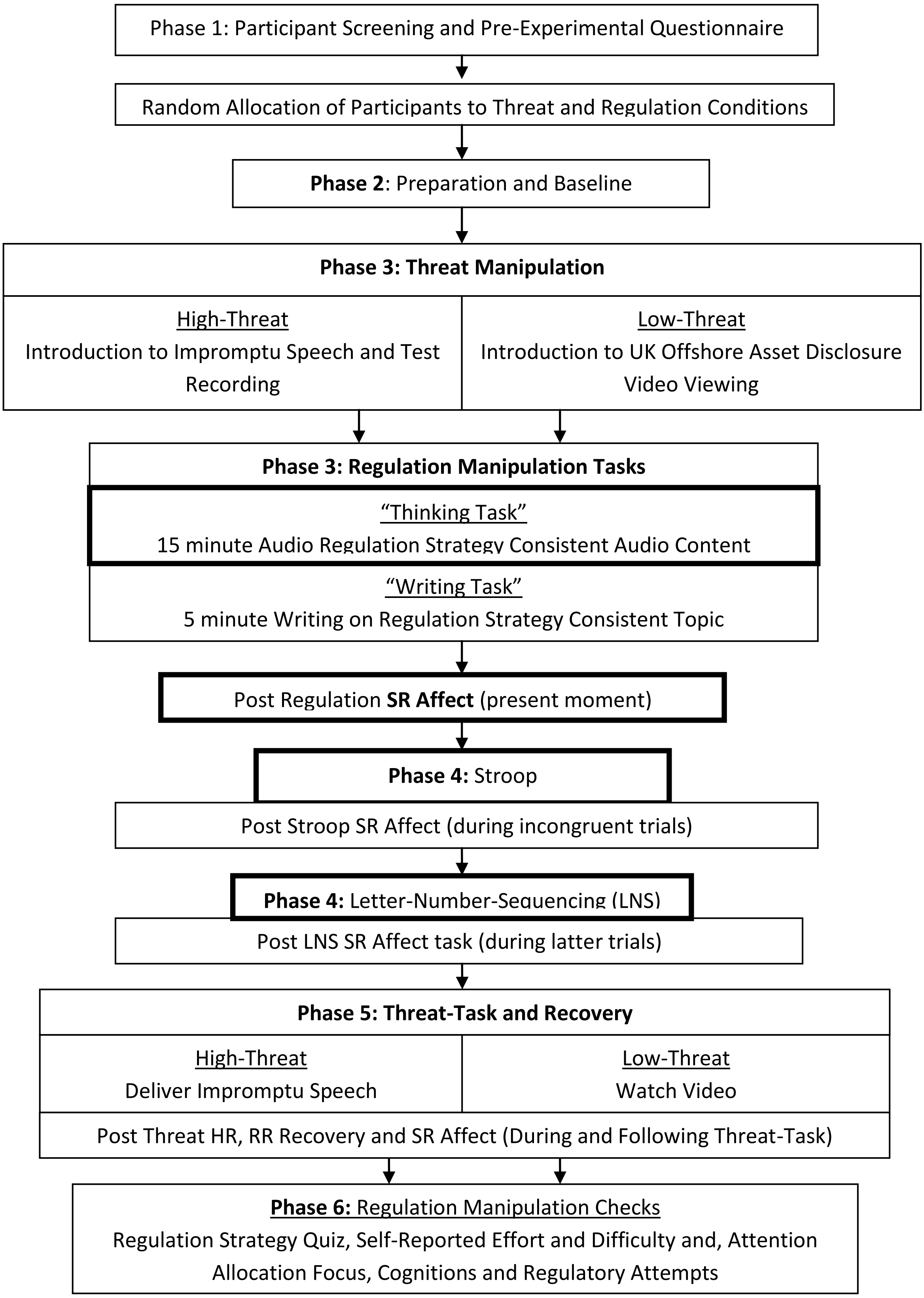

Figure 7.11. Flow Diagram of Procedural Phases with Relevant Data Collection Periods (Phases 3 and 4) Highlighted

7.11.2. Results

The HRV changes and HR changes during third regulatory epoch were chosen to be presented to test the affective and neurovisceral hypotheses[tt].

7.11.2.1. Response Inhibition

The HRV (RMSSD residuals) change scores from the third regulatory epoch showed a weak, non-significant negative correlation, r (175) = -.10, p = .18, with Stroop interference. A 2 (threat level) X 3 (regulation strategy) ANCOVA was used to compare the impacts of threat and regulation on Stroop interference after the influence of HRV changes (covariate) had been removed. The results showed that HRV changes did not account for a significant portion of the variance in Stroop interference, $F(1, 168) = .97$, $p = .33$, $\eta_p^2 = .006$, and the interaction between threat level and regulation strategy remained unchanged, $F(2, 168) = 7.39$, $p = .001$, $\eta_p^2 = .081$, when removing this shared variance.

A correlation between Stroop interference sores and HR change scores (third regulatory epoch- baseline) revealed that greater interference was weakly but significantly associated with increased HR, r (175) = .18, p = .02. A 2 (threat level) X 3 (regulation strategy) ANCOVA showed that the effect of HR change in the third regulatory epoch on Stroop interference was marginally significant, $F(1, 168) = 3.54$, $p = .06$, $\eta_p^2 = .021$. However, when the shared variance between HR and Stroop interference was removed,

[tt] The researcher also tried the first and second epochs and the mean of the three regulatory epochs with the same analytical strategy. A summary of the results of this analysis from the first and second regulatory epochs is that neither HRV changes nor HR changes accounted for a significant amount of the variance in executive control, nor did by removing any shared variance between HRV changes or HR changes and executive control did the pattern of differences between the experimental conditions.

the interaction between threat level and regulation strategy remained significant, $F(2, 168) = 7.16$, $p = .001$, $\eta_p^2 = .079$[uu].

The same analysis steps for HRV and HR were undertaken with self-reported affect change scores. Firstly, the reported affect change scores (post regulation - baseline) were unrelated to Stroop Interference, r (175) = -.02, $p = .87$. A 2 (threat level) X 3 (regulation strategy) ANCOVA, was used to establish whether the significant interaction between threat level remained after controlling for self-reported affect during regulation (covariate). Self-reported anxiety did not explain a significant portion of the variance in Stroop interference, $F(1, 168) = .002$, $p = .97$, $\eta_p^2 < .001$, and therefore did not significantly reduce the differences amongst the threat and regulatory conditions[vv], $F(1, 168) = 7.67$, $p = .001$, $\eta_p^2 = .084$.

7.11.2.2. WM Performance

HRV (RMSSD residuals) change from baseline scores (third regulatory epoch-baseline) were correlated with WM performance including the total WM score and the

[uu]Several issues sought to be ruled out with additional analyses. The first issue was that the limited impact of affect may have only been noted on the Stroop interference scores rather than the Stroop accuracy rate scores. Hence, the same ANCOVA analysis was undertaken with the Stroop accuracy rate scores. The results showed that HR changes from the third regulatory epoch did not account for a significant portion of the variance in Stroop accuracy rate, $F(1, 168) = 1.12$, $p = .29$, $\eta_p^2 = .007$, and the significant interaction between threat level and regulation strategy remained, $F(2, 168) = 7.56$, $p = .001$, $\eta_p^2 = .083$.The second issue was that affect may have had more of a influence in the mind-wandering conditions on Stroop interference. An ANCOVA specifically removing shared variance between HR changes during the third epoch and Stroop interference was undertaken. The results demonstrated, that HR accounted for a significant amount variance in Stroop interference, $F(1, 55) = 8.39$, $p = .005$, $\eta_p^2 = .13$, and the impact of threat was reduced to non-significant difference, $F(1, 55) = 2.34$, $p = .13$, $\eta_p^2 = .041$. However, using the same analysis on Stroop accuracy rate scores, HR changes were only approaching significance, $F(1, 55) = 2.95$, $p = .092$, $\eta_p^2 = .051$, and the impact of threat was marginally significant, $F(1, 55) = 4.00$, $p = .051$, $\eta_p^2 = .68$.

[vv]HRV, HR and self-reported affect change scores were added simultaneously as covariates in an ANCOVA however the pattern of differences between the threat and regulatory conditions remained the same, suggesting that neither of the variables mediated the combined impact of threat and regulation on Stroop interference.

three WM load levels. The results were: Total, r (180) = .10, p =.16; Low, r (180) = .04, p =.59; medium, r (180) = .07, p =.33, and; high, r (180) = .12, p =.14. A 2 (threat level) X 3 (regulation strategy) X 3 (WM load) ANCOVA was used to determine if threat levels and regulation strategies still influenced WM performance, after controlling for HRV changes during regulation (covariate). The results showed that the covariate did not account for a significant portion of the variance, $F(2, 173) = .91$, $p = .34$, $\eta_p^2 = .005$ and there was no interaction between the HRV and WM load, $F(2, 172) = .36$, $p = .70$, $\eta_p^2 = .004$, suggesting that HRV changes had little impact on the influence of threat level and regulation strategy.

Regarding HR, performance on each load level showed a significant negative correlation with HR change from baseline (third regulatory epoch - baseline), with the total WM score and with each of the threat levels, the strongest correlation within the load level being the high-load level: Total, r (180) = -.23, p =.002; low, r (180) = -.19, p =.013; medium, r (180) = -.17, p =.027, and; high, r (180) = -.22, p=.004.

The same 2 (threat level) X 3 (regulation strategy) X 3 (load) ANCOVA as for the HRV analysis was conducted to test this affective hypothesis, this time with HR change from base line (HR from third regulatory epoch- baseline) as the covariate. Unlike HRV, HR change scores did account for a significant portion of the variance in performance, $F(1, 173) = 6.80$, $p = .010$, $\eta_p^2 = .038$, although the interaction between HR and WM load was still not significant, $F(2, 172) = 1.42$, $p = .24$, $\eta_p^2 = .016$, showing that the effect of arousal did not vary across load levels. Within the high-load level only, a 2 (threat level) X 3 (regulation strategy) ANCOVA, using HR changes as the covariate showed HR change significantly influenced performance, $F(1, 173) = 3.91$, $p = .05$, $\eta_p^2 = .020$. Importantly, the main effect of threat level was still significant within the high-load level, $F(1, 173) = 4.04$, $p = .046$, $\eta_p^2 = .023$. Furthermore, when controlling for HR, the difference between distraction and acceptance within the high-threat condition remained significant with the means in the same direction, $F(1, 57) = 5.33$, $p = .025$, $\eta_p^2 = .086$.

Interestingly, reported changes in affect did not show a significant correlation with WM performance or with any of the WM loads, although all coefficients were nominally negative: Total, r (180) = -.09, p = .24; Low, r (180) = -.13, p = .074; medium, r (180) = -.05, p = .47, and; High, r (180) = -.07, p = .34. A 2 (threat level) X 3 (regulation strategy) x3 (load level) ANCOVA on WM performance with self-reported affect change scores used as the covariate showed that self-reported affect did not significantly reduce the differences amongst the threat and regulatory conditions. The results showed that self-reported affect did not account for a significant amount of the variance in performance, $F(1, 173) = .56$, $p = .46$, $\eta_p^2 = .003$. Furthermore, the interaction between self-reported affect and load level was not significant, $F(1, 172) = .04$, $p = .97$, $\eta_p^2 < .001$. Results from the high-load condition only showed that changes in reported affect did not account for a significant portion of the variance in performance, $F(1, 173) = .14$, $p = .71$, $\eta_p^2 = .001$. Therefore, the differences noted between the threat levels and regulatory conditions remained largely unchanged[ww], with the impact of threat, $F(1, 173) = 5.78$, $p = .017$, $\eta_p^2 = .032$, and the impact of regulation within the high-threat level, $F(2,86) = 3.24$, $p = .044$, $\eta_p^2 = .070$, remaining significant.

7.11.2.3. Baseline Individual Differences in HRV and Executive Control

As there was no association found between HRV and executive control during the regulatory epochs it was decided to establish if the imposition of threats and regulation had also eliminated the relationship between individuals differences HRV at baseline and executive control, as demonstrated in previous research (Hansen et al., 2003; Hansen,

[ww]HRV, HR change scores and self-reported affect change scores were added simultaneously as covariates in an ANCOVA however the differences between the threat and regulatory conditions did not change significantly.

Johnsen, & Thayer, 2009; S. C. Segerstrom & Solberg Nes, 2007). However, neither of the correlations between baseline HRV and executive control for Stroop interferences, $r(175) = .01$, $p = .86$, or for the WM total score $r(180) = -.07$, $p = .38$, WM performance in the high-load level, $r(180) = .04$, $p = .61$, were significant.

7.11.3. Discussion

Study 7.5 set out to establish whether affect experienced during the latter period of regulation was associated with impaired executive control and if this relationship accounted for the differences in executive control noted amongst the experiment groups. The correlations between HRV and executive control, although in the direction consistent with the neurovisceral account (i.e., greater increases in HRV correlating positively with executive control), these correlations did not reach significance.

Higher HR during the third regulatory epoch was associated with worse executive control. Both Stroop interference (significant positive correlation) and working memory scores (significant negative correlations) showed this relationship, which was somewhat consistent with the neurovisceral account in that increased arousal would be expected to be associated with increases in amygdala activation and decreased prefrontal cortex activity that is required for the performance of these tasks. Importantly, for similar reasons to the neurovisceral account, the HR results are particularly consistent with affective theories of ACT and PET. Furthermore, HR explained marginally significant portions of both Stroop interference and WM score variance, before accounting for the impacts of threat and regulatory influences. However, the pattern of executive control differences amongst the regulatory conditions remained the same and the differences significant, suggesting that that impacts of threat and regulation were not predominantly mediated by affect experienced during regulation. Furthermore, HR during regulation accounted for similar amounts of variance in both Stroop and WM performance. The similar levels of variance accounted for suggests that the affect experienced during regulation did not influence the temporally proximally measured response inhibition more than the temporally distally measured working memory.

Self-reported affect, unlike HR, did not significantly correlate with executive control, nor did it account for a significant portion of the variance. Hence, self-reported affect did not reduce the differences between the threat and regulatory conditions. This result is inconsistent with the predictions of the affective theories of ACT and PET in that the subjective experience of anxiety, and the level of worrisome cognitions, is considered to be just as important in influencing executive control as physiological indicators.

Lastly, the influence of resting, vagally mediated changes in HR (i.e., HRV as indicated by RMSSD) at baseline did not correlate with executive control. This result is inconsistent with previous research demonstrating this link between resting baseline individual differences in HRV and executive control (Hansen et al., 2003; Hansen et al., 2004; Hansen, Johnsen, Sollers, et al., 2009; Hansen, Johnsen, & Thayer, 2009; S. C. Segerstrom & Solberg Nes, 2007). This result suggests that the experimental manipulations involving threat and regulation occurring between baseline and the executive control tasks reduced the link between stable individual differences in resting HRV (indicating greater vagal tone) and superior executive control.

Taken together with study 7.4, the results of study 7.5 suggest that changes in physiological arousal from baseline during the latter phases of the regulatory period explain more participant variation in subsequent executive control than physiological arousal during executive task performance. In contrast self-reported affect at neither time point was associated with executive control. However, the pattern of results noted on executive control between the threat and regulatory conditions remained largely unchanged when controlling for these variables. Therefore, the results of study 7.5 showed that differences in affect did not account for the pattern of findings amongst the threat and regulatory conditions. Moreover, affect experienced during regulation did not influence prepotent response inhibition more than WM, and therefore does not explain the differences between the pattern of executive control amongst the threat and regulatory conditions for the two executive tasks reported in studies 7.2 and 7.3. Furthermore individual differences in HRV at baseline also have little influence over executive control. These results further suggest that the self-regulatory strength theory of depleted executive resources remains the most plausible explanation the performance decrements noted amongst the experimental conditions, and that this depletion of resources occurs through physiological mechanisms that do not relate to the neurovisceral account.

7.12. General Discussion

The aim of this chapter was to establish the extent to which threat level and affect regulation influenced subsequent executive control. The present research also tested three competing propositions for why differences between threat levels and regulatory conditions may occur. The first was the self-regulatory strength theory, which attributes impairments in executive control to a temporary depletion of a limited pool of executive resources. The second proposition was an affective explanation based on Eysenck and colleagues,' PET and ACT theories that may attribute differences in executive control between the strategies to systematic differences in the experience of anxious affect during and prior to undertaking an executive task. These theories consider physiological arousal during task performance to represent mental effort, with increased arousal predicted to lead to better executive control. The third theory is Thayer and colleagues' neurovisceral account, which, like PET and ACT, predicts increased prior arousal will result in executive task performance decrements. However, it more specifically predicts that decreased vagal inhibition of arousal before or during an executive task will result in impaired performance. Furthermore, unlike PET and ACT the neurovisceral account predicts arousal to have opposite effects on executive task performance depending on whether it occurs prior to or during the task, so increased arousal during the task should lead to impaired performance.

The self-regulatory strength theory was tested with a design that encompassed two threat levels, enabling the testing of executive resource depletion due to ego-threat (i.e., threat hypothesis), and three regulation strategy conditions, enabling the testing of depletion due to the inhibitive nature of a strategy (e.g., demanding distraction), and the interaction between ego-threat and regulation (e.g., susceptible acceptance hypothesis). Cognitive motivational accounts of attention and self-regulatory theory claim that individuals, when anxious, will initially reflexively engage attention to threat information (Bar-Haim et al., 2007; Mogg & Bradley, 1998) and become self-focused (Carver & Scheier, 1988; Duval & Wicklund, 1972). These initial reflexive responses are suggested to be subsequently inhibited by individuals in order to reduce or avoid experiencing unpleasant affect (Derryberry & Reed, 2002; Johns et al., 2008; Koster et al., 2006; Koster et al., 2005). High-threat situations that facilitate attentional engagement with threats and towards the self may make attentional diversion difficult (Knight et al., 2007) and effortful, thereby depleting executive resources and leading to impaired executive control (Heatherton et al., 1993; Johns et al., 2008). Situations that do not involve high-threat would not facilitate attention to threats or self-focused attention and therefore make increased attention towards threats or the self effortful, depleting of executive resources and detrimental to subsequent executive control.

7.12.1. Summary of Findings

The first three studies aimed to establish whether the regulatory strategies impacted directly on executive control in proportion to their predicted depletion of executive resources, given the level of threat under which they were undertaken. Studies 7.4 and 7.5 aimed to rule out the possible indirect effects of the threat circumstances and the strategies on executive control via differences in anxious arousal, and vagal tone elicited by the experimental conditions.

Firstly, it was predicted that the spontaneous tendency to limit self-awareness and attention to threat stimuli in high-threat circumstances would deplete executive resources and impair subsequent attempts to exercise executive control. To test this proposition, the high- and low-threat mind-wandering control conditions were compared, showing no differences in perceived effort expended during regulation (study 7.1), but impaired subsequent executive control by those in the high-threat level relative to the low-threat level (studies 7. 2 and 7. 3). These results suggest that in high-threat circumstances mind-wandering can impair executive control without individuals perceiving that they are investing increased mental resources.

Secondly, it was predicted that engaging in an attention consuming task to reduce self-awareness would deplete executive resources, particularly in high-threat circumstances (i.e., the demanding distraction hypothesis). Study 7.1 showed that distraction was perceived to be more mentally demanding than the other conditions in both threat levels; study 7.2 showed that distraction led to increased Stroop interference. In study 7.3, distraction led to worse performance in the ability to update and maintain high-load levels within WM when assessed after persistent exposure to increased threat.

These results suggest that prior engagement in distraction, particularly in increased threat circumstances, can impair the subsequent executive control.

Based on the definition of the attentional process associated with strategy of acceptance, it was predicted that the acceptance conditions would facilitate increased attention to threat-related thoughts and affective responding in high-threat circumstances and therefore be less effortful in these circumstances than a strategy that tried to inhibit attention to threats and affective responding. However, acceptance in low-threat circumstances was predicted to operate counter to the prevailing tendency to limit attention to threats and affect and, therefore, to demand increased mental resources. Results from study 7.1 showed that in high-threat circumstances acceptance was perceived to be marginally less mentally demanding than distraction and also less demanding than acceptance in low-threat circumstances. In contrast, acceptance in the low-threat level was perceived to be marginally more mentally demanding than the mind-wandering control and no different from distraction. The different influence of acceptance under different threat circumstances was again evident in study 7.2, where acceptance in high-threat circumstances led to significantly superior response inhibition relative to the distraction and mind-wandering conditions. In contrast, in the low-threat level acceptance led to significantly impaired response inhibition relative to acceptance in the high-threat level, and to the mind-wandering condition in the low-threat level. Hence, the threat circumstance in which acceptance is undertaken in can influence whether the strategy preserves and diminishes the capacity to demonstrate executive control.

Study 7.3 tested the impacts of prior regulation on WM. However, this was tested after participants were exposed to the threats over a longer period relative to when prepotent response inhibition was assessed and thus was temporally further from the prior regulation task. The results of study 7.3 further demonstrated the protective effect of engaging in acceptance in high-threat circumstances. However, unlike studies 7.1 and 7.2, study 7.3 did not show negative impacts of engaging in acceptance in the low-threat circumstances or of distraction in low-threat circumstances. Consistent with participants being exposed to the threats for longer, the negative impact of increased threat was demonstrated both pooling across the regulatory conditions, and between the control conditions. Thus, longer exposure to increased threat increases its impact on executive control and can sustain the impacts of prior regulation relative to exposure to lower threat circumstances.

Study 7.4 tested whether anxious affect or arousal experienced during executive task performance accounted for experimental group differences in executive control. The variance shared between executive control measures and anxious affect and arousal were statistically removed to observe whether group differences were attenuated. The results showed that neither concurrent arousal nor self-reported affect during the executive tasks accounted for a significant portion of the variance in executive control, such to alter the pattern of differences between the threat and regulatory conditions. Thus affect experienced during executive task performance did not explain the pattern of executive control differences.

Study 7.5 tested whether affect experienced during the third regulatory period (being temporally proximal to the assessment of response inhibition) explained the pattern of executive control results in terms of; (1) differences amongst experimental conditions, and (2) differences in the pattern of executive control between response inhibition (study 7.2) and WM (study 7.3). The results from study 7.5 showed that HRV did not predict a significant amount of the variance in executive control, although the non-significant relationship between the variables was in the expected direction (i.e., greater HRV increase from baseline associated with superior executive control). In contrast to HRV, HR did significantly predict variance in performance on both measures of executive function, with increased arousal associated with impaired executive control. Hence, the influence of HR did not only impact significantly on response inhibition (being temporally proximal to the regulatory period), rather it was significant for both measures with the effect size of HR being nominally larger on WM than response inhibition. However, group differences in executive control remained significant after the statistical removal of this shared variance. Self-reported affect had no impact on the executive control results. Hence, the results of study 7.5 demonstrated that affect experienced during the latter period of regulation did not explain the differences in executive control between the experimental groups. Furthermore, prior affect did not impact on response inhibition more than WM, and therefore time lag did not explain the difference in executive control patterns amongst the threat and regulatory conditions from studies 7.2 and 7.3. In addition, baseline HRV was shown not be linked with executive control, contrary to demonstrations from previous research (Hansen et al., 2003; Hansen, Johnsen, & Thayer, 2009; S. C. Segerstrom & Solberg Nes, 2007).

7.12.2. Theoretical Implications

The studies presented in this chapter show cumulative support for self-regulatory strength theory and its predictions regarding executive resource depletion. This support began with study 7.1 finding the mental demands of a strategy may differ depending on which strategy is used and the threat circumstances in which that strategy is used. Matching the pattern of perceived mental demands, the combined effects regulation and threat circumstances on executive control was evident in study 7.2 and to a lesser extent study 7.3. Differences in executive control exhibited by the experimental conditions in studies 7.2 and 7.3 could not be attributed to differences in changes to self-reported affect, physiological arousal or vagal inhibition (studies 7.4 and 7.5). Hence, although different threat levels and regulation strategies may lead to different affective responses (cf. chapter 6), these differences do not explain the executive control differences between experimental groups.

Theories of attention and anxiety (Mogg & Bradley, 1998) and self-regulatory theory (Carver & Scheier, 1988; Duval & Wicklund, 1972) claim that individuals, when anxious, reflexively engage with threats, with self-regulatory theory stating that this leads to attention to the self in high-threat circumstances. Furthermore, it was claimed by self-regulatory theory (Carver & Scheier, 1988; Duval & Wicklund, 1972) that spontaneously initiated regulatory attempts to inhibit this reflexive attentional engagement requires significant ongoing cognitive control, a claim that has some support (Cornwell et al., 2011; Knight et al., 2007). Consistent with these propositions, self-regulatory strength theory (Muraven & Baumeister, 2000) predicts and research has shown (Heatherton et al., 1993; Johns et al., 2008) that attempts (spontaneous or imposed) to inhibit reflexive attentional engagement with threats and or negative affect are cognitively effortful and lead to impaired executive control. In contrast, low-threat/stressor situations, where low levels of anxiety are present, and thus do not involve reflexive attentional engagement with threat stimuli or to the self require little inhibition of reflexive attentional responses and thus preserve the capacity to demonstrate executive control.

The results of studies 7.2 and 7.3 were consistent with the above assertions regarding which situations and coinciding regulatory responses are likely to lead to impaired executive control. First, individuals who are under high-threat and used spontaneous attempts to avoid the experience of negative affect (see attentional focus results from chapter 5) showed diminished executive control relative to those who are not under such a high level of threat (Heatherton et al., 1993; Inzlicht et al., 2006; Johns et al., 2008; Schmader & Johns, 2003). Second, in high-threat circumstances, acceptance had the opposite effect on executive control to the distraction and the control conditions, both inhibiting attention to affect. This suggests that under high-threat circumstances, allocating attention towards external neutral stimuli in a mentally active way in an attempt to limit attention towards the self or internal affective experiences achieves similar depletion effects to spontaneous attempts to avoid attending to the self and experiencing negative affect. In contrast, attention towards threats and towards the self and the experience of unpleasant affect, as undertaken during acceptance, preserved the subsequent ability to exercise executive control.

These results are consistent with existing research showing decrements in executive control in dietary restraint (Heatherton et al., 1993) resulting from either the natural tendency to avoid attending to the affective experience of threat or experimenter facilitation of this process through providing distracting content. Furthermore, Heatherton et al.'s (1993) study showed that increased attention to the threatening situation and to the self in high-threat circumstances led to restrained calorie intake (i.e., the measure of executive control) relative to a distraction condition and a control condition involving no particular attentional focus, which would evoke lower self-awareness. Similarly to the present research, Heatherton et al. showed that increased self-awareness did not differ from the low-threat control condition in demonstrated executive control. Hence, the present study extends existing findings by demonstrating that the beneficial impacts self-awareness may have on executive control do not necessarily have to be facilitated using a mirror, or videotaping individuals, but by providing an affect regulation strategy that draws attention to one's threat-related thoughts and emotions. Furthermore, it has now been demonstrated that both increasing self-awareness and distraction in low-threat circumstances can also impair executive control.

Considering the impacts of regulation in low-threat circumstances, purposefully allocating attention to auditorily presented reminders to generate novel responses in a goal driven manner (i.e., distraction) and attention towards the self in noticing negative thoughts and feelings (i.e., acceptance) led to temporary impairments in executive control (study 7.2). However, unlike the high-threat level, the natural tendency to limit self-awareness demonstrated in the low-threat level control condition preserved the capacity to exercise executive control. This finding suggests that any focusing of attention or attentional control that prevents the attention from drifting depletes executive resources, consistent with self-regulatory strength theory and previous research (Muraven & Baumeister, 2000; Schmeichel, 2007; Schmeichel et al., 2003). As both acceptance and distraction require attentional control, it would be expected that they would both differ from the mind-wandering control condition in low-threat circumstances as noted by the results in study 7.2.

Hartley (1973) demonstrated the effects of prior self-regulation to diminish over time. Hartley (1973) also showed that persisting stressors have additive detrimental effects over time. Consistent with Hartley (1973), study 7.3, showed the impact of threat level was the dominant factor influencing WM, rather than the interaction between regulation and threat level as noted in study 7.2. The depleting impacts of regulation within the low-threat level indicated in study 7.1 and study 7.2 were not replicated in study 7.3. However, the impacts of regulation still remained in the high-threat level. One potential reason for regulatory effects to appear in the high-threat level but not the low-threat level may be that the low-threat level allowed for mental rest and replenishment of executive resources during the temporal delay (Muraven & Baumeister, 2000) whilst the high-threat level did not allow for this replenishment.

Lastly, the link between increased vagal inhibition of arousal (HRV) and executive control was tested. The pattern of differences in HRV amongst the regulatory conditions in the third epoch of the regulatory period, noted in study 6.1, largely matched the pattern of differences in executive control in studies 7.2 and 7.3. Hansen et al. separated individuals into high- and low HRV groups, based on resting baseline measurement, and showed that those with higher HRV showed better performance in an executive task. Hansen et al. also showed significant relationships between baseline HRV and executive control. However, in study 7.5, there was no significant relationship between HRV changes from baseline to the affect regulatory period and executive control (both response inhibition and working memory), despite a nominal association in the expected direction, was not significant. Several studies have demonstrated the link between baseline HRV and executive control (Demaree et al., 2004; Hansen et al., 2003; S. C. Segerstrom & Solberg Nes, 2007), however none have demonstrated that HRV changes in a regulation context is directly related to superior regulated responding. The fact that the present study showed that neither baseline HRV or changes in HRV during regulation were linked with subsequent executive control, suggests that the threat and regulatory manipulations removes the link between HRV and executive control.

The shared variance between heart rate changes from baseline and executive functioning demonstrated how several theoretical accounts may possibly simultaneously co-exist to some extent without being mutually exclusive. Heart rate changes from baseline measured during the performance of the Stroop task and during regulation showed a near significant negative correlation with executive control. The correlation between HR and Stroop interference was consistent with the predictions of the affective theories of PET and ACT (Eysenck & Calvo, 1992b; Eysenck et al., 2007), that increased arousal during the undertaking of an executive task would support faster response inhibition. However, this result was counter to the predictions of the neurovisceral account (Thayer et al., 2009; Thayer & Lane, 2000), which predicted that increased HR should coincide with decreased performance. In contrast to study 7.4, study 7.5 showed a correlation between HR change, assessed during the regulatory period, and executive control on both response inhibition and working memory (across all load levels) in the direction (i.e., lower HR associated with better performance) consistent with the both the affective theories of ACT and PET and with the neurovisceral account. Studies supporting the affective theories of ACT and PET can only explain the relationship between HR and executive control in terms of affect experienced prior to the executive task having a carryover effect to influence subsequent executive control (Derakshan et al., 2009; Eysenck et al., 2005; MacLeod & Donnellan, 1993; Shackman et al., 2006; Sorg & Whitney, 1992; Tohill & Holyoak, 2000). Processing efficiency theory and ACT also predict that reported affect would explain variations in executive control. However, neither affect reported during the performance of the executive task, nor during the regulatory period explained significant amounts of the variance in subsequent executive control. Hence, although some evidence was found for the affective theories of PET and ACT and the neurovisceral account, when taking the results together, mediation tests of the predictions of the affective theories of ACT and PET or the neurovisceral account could completely rule out that prior regulation was having a significant direct impact on executive control. Hence, the effect of regulation was still evident when removing of the influence of the variables hypothesised to be mediating the effect of prior regulation on executive control, with the significant combined effects of the threat and regulation remaining.

7.12.3. Limitations

The most obvious limitation of the present research is the difficulty of interpreting the discrepant patterns of executive resource depletion for prepotent response inhibition (study 7.2) and WM (study 7.3). As the order of tasks was held constant, with Stroop preceding LNS, it is unclear whether the different results are due to the nature of the task or to order. The choice to systematically measure response inhibition first was made because this measure was expected to be the more sensitive in detecting the depletion of executive resources (Muraven & Baumeister, 2000). However, the assessment of response inhibition may have influenced the measurement ofWM. Response inhibition has been demonstrated to influence later self regulatory patterns (Schmeichel, 2007; Wallis & Hetherington, 2004). Although engagement in the Stroop task is likely to deplete all threat and regulatory conditions equally, this assumption has not been tested directly. Hence, there may have been carry-over effects of prior response inhibition assessment on WM. Another issue related to order of measurement issue is that some combinations of threat and regulatory strategy may have combination-specific effects. It is possible that engaging in acceptance and distraction under low-threat levels may have been more detrimental to response inhibition than working memory. Hence, the role of temporal delay on response inhibition and working memory tasks is uncertain until these alternative possibilities (i.e., order/carry-over effects and task-specific effects) are addressed.

It is increasingly common for self-regulatory strength studies to rule out systematic differences in the perceptions of executive task difficulty amongst experimental groups that may also explain executive control differences amongst different experimental groups (Hagger et al., 2010; Schmeichel, 2007). Accounting for systematic differences in perceptions of executive task difficulty, by asking participants to rate the difficulty of the executive task and removing shared variance between the rating and executive task performance, may eliminate the possibility that there were systematic individual differences in executive functioning at baseline due to ineffective randomisation. In the present research, the level of anxiety experienced during each task was measured, and may provide some indication of the difficulty of the task for individuals, however this measure of anxiety is not a direct measure of how difficult the participants perceived the executive tasks to be, or their level of cognitive ability, and therefore cannot rule out the possibility that there may have been systematic differences in the experimental groups in how difficult they found the executive control task.

Lastly, although the present research measured HR during the executive tasks, HRV was not computed and the study did not seek to rule out the level of HRV during the performance of the executive tasks as a potential explanation of the variance in executive control. The neurovisceral account does indeed predict that tonal vagal inhibition or arousal during executive task performance could explain differences in executive control, a finding supported by previous research (Croizet et al., 2004). HRV was not measured during executive task performance in the present research as the executive tasks required verbal responses, altering respiratory patterns and therefore HRV, and were also not long enough to measure HRV for the five minute period of measurement recommended (Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996). The extent to which this may have changed the interpretation of the current set of results is unclear. If indeed HRV during executive task performance mediated the effect of regulation on executive control, this may lead to an interpretation that required a more comprehensive integration of self-regulatory strength theory with the neurovisceral account.

7.12.4. Future Research

Given the novelty of the finding, future research should aim to expand the understanding of how regulation strategies vary in their demand for executive resources under different threat/affective circumstances. Additionally, it is important, in the interests of providing a more confident theoretical account of the findings, to rule out the possibility of carryover/order effects on working memory, as well as task specific effects (i.e., some regulatory attempts in low-threat circumstances only influencing response inhibition and not WM) of the threat and regulatory conditions. Specifically, future research could either assess WM alone, counterbalance the task order, to determine more precisely the circumstances under which persistent threats begin to have more influence over executive control when temporal delay exists between executive control assessment and affect regulation. Furthermore, future studies should investigate the diminishing impacts of affect regulation on executive control in circumstances where there is an absence of persistent threats and where these diminishing effects of regulation cannot be attributed to carry over/ order effects or task specific effects. Additionally, future research could also address the assumption behind the temporal delay explanation regarding the different pattern of executive control from study 7.2 to study 7.3 by varying the time delay between the regulation tasks and engaging in the executive task.

Future studies seeking to extend the understanding of the depleting nature of particular affect regulation strategies should carefully consider the experimental circumstances. Varying the threat level under which acceptance was undertaken led to a nuanced understanding of what impacts acceptance may have. Previous research has shown that the influence that both reappraisal and distraction have on executive resources can also be altered by the circumstances in which they are used in (Alberts et al., 2008; Johns et al., 2008; Sheppes & Meiran, 2008). Such previous research has highlighted the time sequence, early versus late initiation of the strategy in relation to the affective stimulus. Hence, the present study, along with previous research (Alberts et al., 2008; Johns et al., 2008; Sheppes & Meiran, 2008), highlights how important the context in which regulation occurs in influences subsequent executive control. Therefore, future studies should continue to test strategies under a variety of circumstances (e.g., high-threat vs low-threat, anticipatory regulation vs assisting stressor recovery) to discover when they may best preserve executive control.

Future self-regulatory strength studies investigating the influence of affect regulation strategies on executive control should pre-test or gain a baseline of participants' executive functioning in an earlier experimental session or measure the perceived difficulty of the executive tasks in the attempt to eliminate potential systematic difference in executive functioning amongst experimental groups due to participant randomisation ineffectively equating the groups on capacity to exercise executive control.

Lastly, the neurovisceral account provides a physiological mechanism to explain why executive control may be impaired by regulation. This physiological mechanism may have been represented in HRV during the executive control task, as indicated in Croizet et al. (2004), rather than HRV changes prior to executive task performance. To fully test the neurovisceral explanation of the present studies' results, HRV should have ideally been measured during the performance of the executive control task and any shared variance between HRV and executive control should be removed, before concluding the regulatory strength model is the most likely explanation for any significant differences found between threat levels or regulatory conditions.

7.12.5. Summary and Conclusions

This chapter presented the results of five studies that demonstrated the effects of the affect regulation strategies of distraction and acceptance, used in the anticipation of threats, on executive control. Each strategy was tested under both high- and low-threat circumstances to investigate their impact on the perceived mental demands of strategy engagement on response inhibition and WM. The strategy of distraction, regardless of threat level, was found to impair subsequent executive control. In contrast, acceptance preserved participants' capacity to demonstrate executive control in the high-threat circumstances, but impaired capacity in the low-threat circumstances, at least when executive control (prepotent response inhibition) was assessed temporally proximally to regulation. The pattern of executive control for the acceptance conditions relative to the other threat and regulatory conditions was not consistent across executive tasks: acceptance in the low-threat level led to impaired performance on response inhibition but not on the later assessed WM, and this inconsistency was not due to differences in anxious affect experienced either during executive task performance or during the latter periods of regulation prior to executive task performance. Arousal (HR) experienced during the latter periods of regulation did account for a significant amount of the variance in executive control, however it did not account for the differences in executive control noted amongst the experimental groups, suggesting that arousal is relevant to executive control but does not account for the impacts prior regulation on subsequent executive control. Hence, the results are most strongly supportive of the self-regulatory strength model of executive resource depletion due to imposed threats and engagement in affect regulation rather than the affective theories of PET or ACT, or the neurovisceral account. Furthermore, theory (Carver & Scheier, 1988; Duval & Wicklund, 1972; Mogg & Bradley, 1998) and findings regarding reflexive attentional focusing when anxious (Bar-Haim et al., 2007) and cognitively effortful spontaneous attempts to divert attentional focus from unpleasant stimuli (Cornwell et al., 2011; Knight et al., 2007) provide understanding of how regulatory attempts and circumstances are likely to combine either to preserve or deplete executive resources. Future research should test affect regulation strategies under different circumstances to gain a better understanding their limitations in facilitating or impairing executive control.

Chapter 8: Discussion and Conclusions

The introduction to this thesis (chapter 1) identified three research questions, which were addressed in chapters 5, 6 and 7. These three research questions corresponded to three domains in which the utility of two regulation strategies, distraction and acceptance, could be evaluated, including: (1) effectiveness in altering attentional focus and reducing maladaptive regulatory attempts; (2) effectiveness in reducing anxious affect, and (3) effectiveness in preserving executive control. The threat level in which participants engaged in distraction and acceptance was manipulated to evaluate the extent to which the strategies had utility in reducing affect and preserving executive control in different circumstances.

The first research question related to the first domain, the emphasis being on the cognitive mechanisms via which the strategies of distraction and acceptance alter affective experiences. Two possibilities were considered: (a) via altering attention focus with respect to threats and feelings and/or (b) via restricting the use of maladaptive regulatory attempts. The second research question focused on the effectiveness of distraction and acceptance in reducing anxious affect, firstly during active engagement in the strategy while anticipating threat, and secondly, the strategies' subsequent impacts on affective reactivity and recovery to during and following engagement in threat-tasks. The third research question comprised two separate but related questions: (a) what direct impacts do distraction and acceptance have on the subsequent executive control? And (b) are the impacts of regulation on executive control accounted for by fluctuations in anxious affect and vagal inhibition caused by regulation?

A single sample of 180 university student participants was subjected to a within and between subjects experimental procedure (see chapter 4 for method) to answer these three research questions. Between subjects manipulations included threat level (high and low), and regulation strategy (distraction, acceptance and a mind-wandering control condition). The data gathered were divided into three groupings of measures based on the questions that they would answer: (1) reported attentional focus and level of engagement in maladaptive regulatory attempts (presented in chapter 5); (2) affect (subjective and physiological) and vagal tone measured during threat anticipation, engagement and recovery (presented in chapter 6, studies 6.1 and 6.2), and (3) indicators of executive resource depletion including reported effort during regulation, executive control (prepotent response inhibition and working memory), and affect and arousal experienced during the performance of executive control tasks (presented in chapter 7, studies 7.1 to 7. 5).

8.1. Content, Focus and Structure of this Chapter

This final chapter aims to integrate the findings presented in chapters 5, 6 and 7 with each other and with previous research and theory. Discussion will focus on evaluating the possible interpretations of the findings of the present research in light of previous research and theory. Possible interpretations aim to explain *why* the imposed strategies of distraction and acceptance had the observed impact on attentional focus and engagement in maladaptive regulatory attempts, affect, and subsequent executive control. Hence, the sections 8.1.1, to 8.1.4, provide summaries of the findings from chapters 5, 6 and 7, discussed in relation to predictions from theory, consistency with previous research and alternative possible explanations for the phenomena observed.

The sequence of presentation to build an understanding of the effects of distraction and acceptance begins, in section 8.1.1, with findings regarding imposed regulation reducing or eliminating the well-documented impact of increased threat on attentional focus (Bar-Haim et al., 2007; Derryberry & Reed, 2002; Ellenbogen et al., 2002; Koster et al., 2006; Koster et al., 2005), maladaptive regulatory attempts (Lazarus & Folkman, 1984; Pyszczynski & Greenberg, 1987), affect experienced (Bloom et al., 1977; Carver & Scheier, 1988, 1990; Feldman, Cohen, Hamrick, & Lepore, 2004; Gramer & Saria, 2007; Houston & Holmes, 1974; Lazarus & Folkman, 1984; Monat et al., 1972), vagal tone (Croizet et al., 2004; S. C. Segerstrom & Solberg-Nes, 2007) and executive control (Inzlicht et al., 2006; Johns et al., 2008; Lavric et al., 2003; Schmader & Johns, 2003; Shackman et al., 2006; Tohill & Holyoak, 2000). To establish the situations or contexts in which regulation strategies decrease or eliminate the usual impact of threat, the findings relating to the effect of threat averaged across the regulatory conditions is compared with previous findings of studies investigating the effect of threat with and without imposed regulation. Hence, the sequence begins with understanding the impact of threat and the extent to which imposed regulation diminished threat impacts.

The second and third steps (presented in sections 8.1.2 and 8.1.3, respectively) in the sequence of developing an understanding of distraction and acceptance focus on the possible interpretations of the effect of regulation (both imposed and spontaneously initiated) on attentional focus, levels engagement in maladaptive regulatory attempts, anxious affect, and executive control. The second step in the sequence illustrates *how* the imposed regulation strategies (distraction and acceptance) prevented, reduced or disrupted the typical attentional focus of spontaneously initiated regulatory processes found in the mind-wandering control conditions and in previous research (Derryberry & Reed, 2002; Ellenbogen et al., 2002; Koster et al., 2006; Koster et al., 2005; MacLeod et al., 1986). Within this second step of the sequence, the comparisons made between the imposed regulation strategies and the mind-wandering control conditions on attentional focus, engagement in maladaptive regulatory attempts, affect and executive control, are presented with the emphasis on the different strategies providing the opportunity to test competing theoretical predictions.

The third step in sequence outlines the utility of the imposed regulation strategies relative to each other in each threat circumstance and how each strategy can be understood in terms of how they differ in altering the spontaneously initiated regulation occurring in each circumstance. Following this is a brief discussion of the possible physiological mechanisms that may explain impairments in executive control. Section 8.1.5 presents a two-step model of regulation that an explanation for the present set of findings in the context of previous research and theory. Sections 8.2, 8.3, and 8.4 which address the clinical and organisational implications of the research, methodological limitations, and avenues for future research, follow this.

8.1.1. Effects of Threat

Previous research shows that exposure to threat increases engagement in maladaptive regulatory attempts (Lazarus & Folkman, 1984; Pyszczynski & Greenberg, 1987) and anxious affect experienced (Bloom et al., 1977; Carver & Scheier, 1988, 1990; Feldman et al., 2004; Gramer & Saria, 2007; Houston & Holmes, 1974; Lazarus & Folkman, 1984; Monat et al., 1972), reduces vagal tone (Croizet et al., 2004; S. C. Segerstrom & Solberg-Nes, 2007), and has a detrimental impact on executive control (Inzlicht et al., 2006; Johns et al., 2008; Lavric et al., 2003; Schmader & Johns, 2003; Shackman et al., 2006; Tohill & Holyoak, 2000). When individuals are anxious, attention has been shown to engage with threatening stimuli presented for short durations (Bar-Haim et al., 2007), but diverted away from threats when presented for longer durations (Derryberry & Reed, 2002; Ellenbogen et al., 2002; Koster et al., 2006; Koster et al., 2005; MacLeod et al., 1986).

8.1.1.1. Threat and Attentional Focus

Chapter 5 tested the extent to which threat influenced attentional focus and the engagement maladaptive regulatory attempts. Mogg and Bradley (1998) propose that stimuli of lower threat value may be allocated less attention than those of higher threat value. Wilson and MacLeod (2003) supported this proposal showed that threat-stimuli of lower threat value were more easily ignored than those of high-threat value. Interestingly, the effect of the level threat influencing attentional engagement has been shown to reduce where threat-stimuli are presented over longer durations (Mogg, Bradley, De Bono, & Painter, 1997). Based on the evidence, that when anxious, individuals are likely to engage with high-threat-stimuli (Bar-Haim et al., 2007) chapter 5 hypothesised that high-threat-stimuli would engage more attention than low-threat-stimuli, during the anticipatory regulatory period, translating into high-threat conditions reporting less attention diversion from threats than low-threat conditions.

The results from chapter 5 demonstrated that threat level, when averaged across the regulatory conditions, did not have a major influence on attentional focus towards threatening stimuli or towards affective responses. Furthermore, within the mind-wandering condition, there were no significant effects of threat on the extent of attentional diversion from threats or from feelings. Hence, even when removing the imposed regulation strategies from the analysis, an effect of threat on focus of attention could not be established. Studies suggest that increased threat primarily enhances initial reflexive attentional engagement with threat-stimuli (Bar-Haim et al., 2007), however, in studies evaluating controlled attentional focus when threat-stimuli are presented over longer durations(≥500ms) these biases are reversed (Derryberry & Reed, 2002; Ellenbogen et al., 2002; Koster et al., 2006 ; Koster et al., 2005; MacLeod et al., 1986) or eliminated (Mogg et al., 1997). The present research used a 15-minute anticipatory period during which participants were assessed on their overall attentional focus. Hence, it is likely participants have reported their control attempts (i.e., top-down efforts) to divert attention from threats, rather than their occasional reflexive engagement with them, thus not demonstrating the impacts of increased threat. However, the present research used self-report as a measure of attentional focus rather than a more objective cognitive task, as used in the studies finding the influence of threat, and this may also explain why the no effect of threat were found in the present research.

8.1.1.2. Threat and Maladaptive Regulatory Attempts

A stimulus to which attention is allocated, and which is appraised as a threat, is predicted by Lazarus and Folkman's (1984) and Gross and Thompson's (2007) models to lead to maladaptive (i.e., counterproductive in reducing affect) response-focused regulatory strategies such as worry, rumination and suppression. In addition, the control process theories (Carver, 1979; Carver & Scheier, 1988, 1990; Pyszczynski & Greenberg, 1987) predict that a situation perceived to impede progress towards a goal, or to produce a larger discrepancy between an actual state and desired state, will facilitate cognitive processes that are representative of maladaptive regulatory attempts, particularly when the person is unable to avoid that impediment. Importantly, such maladaptive, response-focused strategies have been shown to demand concurrent attention capacity (Exner, Martin, & Rief, 2009; S. Hayes et al., 2008; Richards & Gross, 2000; E. Watkins & Baracacaia, 2002).

The results of chapter 5 showed that increased threat across the regulatory conditions led to participants reporting significantly more spontaneously initiated maladaptive regulatory attempts (i.e., worry, rumination and suppression). This finding supports the predictions of Lazarus and Folkman (1984) and Gross and Thompson (2007) and the control processes models (Carver & Scheier, 1982, 1988, 1990; Pyszczynski & Greenberg, 1987) that threat will spontaneously initiate maladaptive coping strategies, and this effect of threat is not eliminated by facilitating engagement in adaptive regulatory strategies.

8.1.1.3. Threat, Reported Affect and Physiology

Lazarus and Folkman (1984), and Gross and Thompson's (2007) appraisal based models also predict that once a stimulus is attended to and appraised as a threat, it will lead to increased affect relative to a stimulus of lower threat value. Additionally, the control process theories (Carver, 1979; Carver & Scheier, 1988, 1990; Pyszczynski & Greenberg, 1987) predict that regulation towards a stimulus is widening the gap between an actual state and an ideal state will increase anxious affect. The results from chapter 6 showed that the threat manipulation did lead to increased anxiety during threat anticipation, during threat-task engagement, and during threat-task recovery, as indicated by both subjective reports and physiological arousal across regulatory conditions. In addition, increased threat reduced vagal tone (indicating reduced regulated responding) across the regulatory conditions (including within the mind-wandering control conditions); suggesting that imposed regulation did not eliminate the influence of threat on affect and the inhibition of arousal.

The findings from chapter 6 show, consistent with previous research, that increased threat in the absence of imposed regulation (Croizet et al., 2004; Monat et al., 1972; S. C. Segerstrom & Solberg Nes, 2007), or in the presence of imposed regulation (Bennett & Holmes, 1975; Bloom et al., 1977; Holmes & Houston, 1974; Houston & Holmes, 1974), can have significant impacts on subjective reports and physiological arousal indicators of anxious affect. Previous research investigating attentional focus during threat

(Bloom et al., 1977; Houston & Holmes, 1974) and the results from chapter 5 and 6 of the present research have demonstrated that imposed regulation, subsequent to attending to a threatening stimulus, does not remove the influence of increased threat on affect. In addition, like previous research (Davis et al., 2002), the present findings suggest that when a threat is attended to and appraised as a threat to either one's physical wellbeing (Bloom et al., 1977; Holmes & Houston, 1974; Houston & Holmes, 1974; Monat et al., 1972), or positive self-perceptions (Bennett & Holmes, 1975), it gives rise to an affective response which gradually intensifies from when that stimulus is presented (Croizet et al., 2004; Fuller, 1992; S. C. Segerstrom & Solberg Nes, 2007). Indeed, it may take some time for the individual to restore positive self perceptions or be assured of physical safety and, hence, affect may linger once the threat stimulus has passed. Importantly, however, previous research testing the mediation effects of stimulus appraisal on affect suggests that it only accounts for a portion (13-25%) of variance found in physiological variables (Feldman et al., 2004). Hence, in the present research, appraisal of the threat stimuli alone may not have maintained high levels of affect during the anticipation of threat and following threat-task engagement; the engagement in maladaptive regulatory attempts, shown to spontaneously occur in chapter 5, may also have contributed.

8.1.1.4. Threat and Regulated Responding: Controlled Thought, Inhibition of Arousal and Executive Control

There are several indicators of regulated responding, including reported level of maladaptive regulatory attempts, vagal inhibition of arousal and lastly executive control. Before presenting the executive control results it is important to consider the results from chapter 5 and 6 regarding the reporting of maladaptive regulatory attempts and vagal inhibition of arousal. The impacts that threat had on increasing maladaptive regulatory attempts and reducing vagal tone, when taken together with previous research (Geisler et al., 2010; B. Verkuil et al., 2009) suggest that threat led to dysregulated responding (Carver & Scheier, 1988; Pyszczynski & Greenberg, 1987; Thayer et al., 2009; Thayer & Lane, 2000) that resulted in increase affect. Thayer and colleagues (Thayer et al., 2009; Thayer & Lane, 2000) argue that the increased perception of threat disrupts regulated responding by decreased activation in the prefrontal cortex (the anatomical region, when activated, supports regulated responding) and can be represented by decreased vagal inhibition, a claim that has received some support (Shapiro et al., 2000). If increased threat has a uniform negative impact across the regulatory conditions on prefrontal activation, as indicated primarily by decreased vagal tone, and secondly by increased arousal, thirdly with the engagement in maladaptive regulatory attempts, this uniform negative impact of increased threat, across the regulatory conditions, should have also be noted on the ability to demonstrate executive control, an activity heavily associated with prefrontal activation (Braver et al., 1997). This hypothesis was tested in chapter 7.

In chapter 7 increased threat was hypothesised to impair regulated responding in the form of executive control. Importantly, three possible pathways through which the effect might occur were tested. The first of these pathways came from the self-regulatory strength theory (Muraven & Baumeister, 2000), claiming that increased threat would trigger spontaneously initiated effortful regulatory attempts to inhibit prepotent affective and attentional responses, which would in turn temporarily deplete executive resources. The second possible pathway was drawn from the affective theories of the processing efficiency theory (PET; Eysenck & Calvo, 1992b) and attentional control theory (ACT; Eysenck et al., 2007), which propose that threat elicits anxiety, and anxiety itself disrupts executive control. The third possible pathway tested was drawn from the neurovisceral account (Thayer et al., 2009; Thayer & Lane, 2000), which proposes that threat reduces vagal tone, increasing amygdala activity and reducing activation of the prefrontal cortex, a region supporting executive control (Braver et al., 1997), resulting in executive control impairment.

Study 7.1 tested the self-regulatory prediction that threat would influence the perceived mental demands of engaging in regulation. Threat did influence the perceived mental demands of engaging in regulation. However, increased threat did not lead to participants perceiving regulation to be more mentally demanding when averaged across the regulatory conditions or within the mind-wandering control conditions. Study 7.2 tested the influence of threat on prepotent response inhibition (an objective indicator of executive control). Results showed that increased threat did not lead to impaired executive control across the regulatory condition. However, within the mind-wandering control conditions, increased threat impaired executive control, a finding consistent with previous research investigating the influence of threat without imposed regulation (Croizet et al., 2004; Inzlicht et al., 2006; Lavric et al., 2003; Schmader & Johns, 2003; Shackman et al., 2006; Tohill & Holyoak, 2000).

The results of study 7.2, taken together with previous findings, support the suggestion that the impact of threat on executive control can be reduced by regulation (Heatherton et al., 1993; Johns et al., 2008; Schmader et al., 2009). Neither ACT, nor PET nor the neurovisceral account convincingly explain why regulation moderates the effects of threat as the effects of threat level on affect or vagal tone were not eliminated by regulation (c.f. study 6. 1). Hence, the results of study 7.2 supported the predictions of self-regulatory strength theory in that prior regulation can alter the impacts of threat on executive control.

In contrast to 7.2, study 7.3, tested the impacts of prolonged exposure to threat on working memory (another indicator of executive control) and found a detrimental impact of increased threat across the regulatory conditions. This result, when taken together with study 7.2, suggests that the *prolonged exposure* to different threat circumstances led to more pronounced influences of threat level. The suggestion that prolonged exposure to stressors results in more impairment in executive control is similar to pattern of results found in a study (Hartley, 1973) showing that persistent exposure to a stressor can have a cumulative effect and reduce the prior impacts of prior regulation. Hartley (1973) speculated that the increased level of arousal due to the prolonged presence of a stressor caused performance decrements. Consistent with Hartley's (1973) speculation, study 6.1 showed that threat led to increased affect prior to performing the executive tasks. Hence, a plausible explanation for the executive control differences between the mind-wandering control conditions in studies 7.2 and 7.3 was due to prior experienced affect (Eysenck & Calvo, 1992b; Eysenck et al., 2007) or perhaps reductions in vagal tone (Thayer et al., 2009; Thayer & Lane, 2000). However, studies 7.4 and 7.5 testing the impacts of reported affect and physiological arousal experienced during executive tasks (study 7.4), and the influence of reported affect, arousal and vagal tone during regulation prior to the executive tasks (study 7. 5), indicated that none of these factors, at any of the time-points assessed, could explain the effect that threat had on executive control. Taking together the findings of studies 7.1 – 7.5, the only remaining mediating mechanism that could provide a plausible explanation for why threat leads to impairments in executive control is that threat depletes a finite reserve of resources that support executive control (i.e., self-regulatory strength theory).

How good an explanation self-regulatory strength theory offers for threat impairing executive control is influenced by whether this theory can be integrated with theories relating to spontaneous regulate of attention and affect. Regarding the regulation of attention, the proposal of self-regulatory strength theory that threat impairs executive control because people spontaneously seek to inhibit their initial automatic attentional engagement with the threat and their affective responses (Johns et al., 2008; Koster et al., 2006; Koster et al., 2005; Schrooten & Smulders, 2010), and this depletes a finite pool of resources making them unavailable to support further acts of executive control (Croizet et al., 2004; Heatherton et al., 1991; Lavric et al., 2003; Schmader & Johns, 2003). The findings from chapter 5 regarding attentional focus of the mind-wandering control conditions suggested that the initial attentional bias for engagement with threat, when anxious, that is usually noted (Bar-Haim et al., 2007) had been reduced, possibly by spontaneously initiated controlled regulation.

Previous research has suggested that individuals' attention, when anxious, initially automatically engages with threat-related stimuli (Bar-Haim et al., 2007), however, after prolonged exposure (≥500ms), individuals will actively ignore threat-related stimuli (Derryberry & Reed, 2002; Ellenbogen et al., 2002; Koster et al., 2006; Koster et al., 2005; MacLeod et al., 1986). This active ignoring of threat-stimuli is suggested to be a mentally difficult (Carver & Scheier, 1988; Duval & Wicklund, 1972) top-down process (Bar-Haim et al., 2007; Mogg & Bradley, 1998) that requires substantial attentional resources to be maintained (Cornwell et al., 2011; Knight et al., 2007; Mather & Knight, 2005). It has also been demonstrated that ignoring low-threat-stimuli may be easier than ignoring high-threat-stimuli (Wilson & MacLeod, 2003) and thus may be less demanding of executive resources. In addition, the prolonged exposure to threat would also be likely to lead to continued spontaneous attempts to inhibit reflexive attention towards threats and further depleted executive resources thus explaining the impairments to executive control noted in study 7.3.

The findings that the detrimental impact of threat on executive control being confined to the mind-wandering control conditions in study 7.2, but then demonstrated across the regulatory conditions after prolonged exposure to threats in study 7.3 can be explained by two processes proposed in self-regulatory strength theory (Muraven & Baumeister, 2000): resource depletion and resource replenishment. The first process, depletion, refers to the reduction in available executive resources that occurs when sustained effort is required to divert attention away from a persistent and prolonged exposure to threat. This continued depletion of executive resources impacted on all conditions in high-threat circumstances, with all leading to at least nominally lower scores than their low-threat counterparts. In contrast, the process of replenishment refers to executive resources being recharged by periods of rest, for example, when threatening stimuli are transient or their threat value is less and they are thus more easily ignored (Wilson & MacLeod, 2003). Prolonged exposure to low-threat circumstances may not have initiated effortful ongoing controlled regulation, thus allowing the replenishment of executive resources resulting in superior executive control compared to high-threat. Hence, a combination of what is known about regulation of attention towards threat and resource depletion and replenishment provide an explanation of why the impact of threat was more influential in study 7.3, than study 7.2.

8.1.1.5. Summary of the Impacts of Threat

In summary, threat was predicted to influence attentional focus, increase engagement in maladaptive regulatory attempts, to increase affect, reduce vagal tone and to impair executive control. The results from chapter 5 showed that increased threat did not influence self-reported attentional focus. This absence of an impact of increased threat on attentional focus suggests that participants are equally able to ignore high- and low-threat-stimuli over longer response durations. The results from chapters 5, 6, and 7 showed that increased threat level, across the regulatory conditions, did increase maladaptive regulatory attempts and affect, but only led to impaired executive control after further exposure to threat on working memory, rather than when executive control was assessed immediately following imposed regulation via prepotent response inhibition. Increased threat did have detrimental impact on executive control (via prepotent response inhibition) in the mind-wandering control conditions immediately following regulation. Impairments to executive control were not attributable to increased affect or diminished vagal tone (studies 7.4 and 7.5). These results suggest that increased threat does not necessarily impair executive control via increased anxiety, arousal, reductions in vagal tone, or engagement in the maladaptive regulatory attempts of worry, rumination or suppression.

8.1.2. Effects of Imposed vs Spontaneous Regulatory Strategies

The discussion below summarises findings from the comparisons made between the mind-wandering control conditions and the imposed regulation strategies of distraction and acceptance on attentional focus, maladaptive regulatory engagement, affect, and executive control. The mind-wandering control conditions serve as an indicator of individuals' spontaneous regulatory attempts. Hence, the comparisons with mind-wandering show how the imposed strategies of distraction and acceptance facilitated, prevented, disrupted or altered spontaneously initiated regulatory attempts. These findings are compared with previous research and interpreted in the context of affect regulation theory to provide an understanding of the utility of imposing distraction and acceptance, how these strategies alter spontaneous regulatory processes to influence affect and subsequent capacity to exercise executive control.

8.1.2.1. Imposed Regulation Altering Spontaneous Attention Diversion

Chapter 5 provided the first evidence for the utility of the imposed strategies of distraction and acceptance in altering attentional focus and in building the understanding of *how* they may alter the affective experience. Based on Mogg and Bradley's (1998) cognitive-motivational model of attentional allocation to threat and Duval's and Wicklund's objective self-awareness theory (1972), chapter 5 tested the predictions that the mind-wandering control conditions would show moderate levels of spontaneous diversion of attention from threats and feelings, showing less diversion than distraction (which should facilitate it) but more than acceptance (which should impede it). As predicted, the mind-wandering conditions showed decreased attention to threats and feelings relative to acceptance. However, in contrast to predictions, the mind-wandering also led to significantly more diversion from threats than distraction, suggesting that the distraction task was less effective than the naturally occurring process of attentional diversion (see section 8.1.3.1 for more detailed interpretation on the impacts of distraction on attentional focus). Hence, the theoretical implications from the mind-wandering control conditions in chapter 5 are that healthy individuals in high- and low-threat circumstances automatically attempt to avoid attending to threat-stimuli (Mogg & Bradley, 1998) perhaps to the self (Duval & Wicklund, 1972; Wicklund, 1975), possibly in an effort to down-regulate anxious affect. The results also suggested that attentional focus towards threats can occur through two manipulations: first, by instruction to focus on threats and feelings (acceptance), and second, paradoxically, by providing an unrelated task that disrupts spontaneous attempts to divert attention from threats (Cornwell et al., 2011; Knight et al., 2007; Mather & Knight, 2005).

The comparison between the mind-wandering condition and the acceptance condition is consistent with previous studies investigating the time course of attentional focus to threats, which have demonstrated that when psychologically healthy individuals are given no attentional directive, they eventually spontaneously direct attention away from threat and affective stimuli (B. P. Bradley, Mogg, White, & Millar, 1995; Derryberry &

Reed, 2002; Ellenbogen et al., 2002; Johns et al., 2008; Koster et al., 2006; MacLeod et al., 1986). Studies using spatial cuing tasks and dot probe tasks show that individuals, initially focus attention on high-threat-stimuli when presented for short durations of 100-250ms (Bar-Haim et al., 2007; Derryberry & Reed, 2002; Koster et al., 2006). However, when threat-stimuli are presented for longer durations, ≥500ms (Koster et al., 2006; Koster et al., 2005) and/or when participants are given longer to respond (Derryberry & Reed, 2002; Mackintosh & Mathews, 2003; Schrooten & Smulders, 2010), individuals across the trait anxiety spectrum will show at least a reduction in their attentional bias towards threat and often enhanced attentional avoidance of threatening stimuli (B. P. Bradley et al., 1995; MacLeod et al., 1986). The present research findings are consistent with studies showing attentional diversion amongst undergraduate individuals (B. P. Bradley et al., 1995; MacLeod et al., 1986) whose trait and state anxiety and stress are within the normal range (P. F. Lovibond & Lovibond, 1995; C. Spielberger et al., 1983), see study 6.1 for scores for trait anxiety and state anxiety and stress scores. Hence, the present study is consistent with the assertions of Mogg and Bradley (1998) and Duval and Wicklund (1972) that, given sufficient exposure duration or response time, healthy individuals will spontaneously engage in top-down cognitive control processes (Cornwell et al., 2011; Knight et al., 2007; Mather & Knight, 2005) to direct attention away from threats and affective stimuli in an attempt to regulate their affective experiences.

8.1.2.2. Imposed Regulation and Maladaptive Regulatory Attempts

In chapter 5, the utility of distraction and acceptance in reducing maladaptive regulatory attempts was investigated as an alternative mechanism to alter affect. Nolen-Hoeksema and Morrow (1990; 1991) suggested that distraction minimised unpleasant affect by restricting concurrent attentional capacity for the spontaneous engagement in perseverative processes of worry and rumination. Similarly, Hoffman and Asmundson

(2008) proposed that acceptance reduces unpleasant affect by restricting the capacity to engage in suppression and attempts to avoid the experience of affect. Nevertheless, previous studies have assumed that engagement in experimentally manipulated adaptive strategies led to reductions in negative affect by minimising engagement in maladaptive strategies (Blagden & Craske, 1996; Hofmann et al., 2009; Low et al., 2008; Lyubomirsky & Nolen-Hoeksema, 1993; Morrow & Nolen-Hoeksema, 1990; Wong & Moulds, 2009), and none of these studies has explicitly tested this assumption. In chapter 5, it was hypothesised that imposed regulation would reduce reported maladaptive regulatory attempts. In contrast to these predictions, the results presented in chapter 5 indicated no differences amongst the regulatory conditions in the spontaneous engagement in maladaptive self-regulatory attempts, including worry, rumination and suppression.

A potential explanation for not finding differences in the level of engagement in spontaneously initiated maladaptive regulatory amongst the regulatory conditions comes from the attentional focus results. These suggested that participants in the mind-wandering conditions were spontaneously directing attentional focus away from threats and affect. Previous research has suggested that spontaneous attentional diversion from affective or threatening stimuli requires significant online attentional resources (Cornwell et al., 2011; Knight et al., 2007; Mather & Knight, 2005). Hence, these spontaneous attempts may have restricted attentional capacity available to engage in maladaptive regulatory attempts competing for the same online resources to a similar extent as the imposed regulation strategies of distraction and acceptance.

8.1.2.3. Implications of the Attentional Focus and Maladaptive Regulation Findings for the Interpretation of Affective and Executive Control Results

The finding that the regulation strategies altered attentional focus but not the engagement in maladaptive regulatory attempts has important implications for the interpretations of the affective and executive control findings. Primarily, this combination of findings suggests that the attentional focus, rather than restriction of maladaptive regulatory attempts, is more likely to explain why the regulatory strategies result in different impacts to affect and executive control. In addition, the attentional focus results from chapter 5 affected the relevance of particular theoretical models' explanations of interpreting the affective and executive control findings. Both affect regulation (Greenberg & Paivio, 1997; Gross & Thompson, 2007) and self-regulatory theories (Carver & Scheier, 1988, 1990; Duval & Wicklund, 1972) predicted that differences in attentional focus would mediate differences in affective response. The results from chapter 5 indicated that the mind-wandering control conditions showed a pattern of attentional allocation away from threats and away from affect, demonstrating attentional diversion, that made testing the predictions of Gross and Thompson's (2007) modal model, and Greenberg and Paivio's (1997) process of a feeling model possible. Hence, the above theories predict that differences in attentional focus found between the regulatory conditions in chapter 5 should lead to differences in affect experienced in chapter 6 (studies 6.1 and 6.2).

Due to attentional diversion from threats and affect found to be occurring spontaneously in chapter 5, Duval and Wicklund's (1972) objective self-awareness theory and Mogg and Bradley's (1998) cognitive motivational model of anxiety, predicting that individuals spontaneously minimise attention to threats and towards the self to reduce unpleasant experiences, were given specific consideration in how difficult it would be to minimise attentional focus to stimuli of high-threat. Attempts to control automatic or reflexive attentional responses are predicted by self-regulatory strength theory (Muraven & Baumeister, 2000) to be effortful and depleting of self-regulatory (or executive) resources available for subsequent acts requiring executive control.

8.1.2.4. Imposed vs Spontaneous Regulation and Effective Affect Regulation

Chapter 6 addressed the second research question, regarding the utility of distraction and acceptance in reducing affect, both during strategy engagement while anticipating threat (study 6.1), and subsequently, during threat-tasks engagement and recovery (study 6.2). According to the predictions of the Gross and Thompson's (2007) modal model, Duval and Wicklund's (1972) objective self-awareness theory, and Mogg and Bradley's (1998) cognitive motivational account of anxiety, the mind wandering conditions (showing greater spontaneously initiated attentional diversion from threats than either of the imposed strategies, in chapter 5) should have shown reduced affect relative to both acceptance and distraction during the anticipatory regulation period. In contrast, based on the predictions of Greenberg and Paivio's (1997) process of a feeling model, in the high-threat level, mind-wandering should have led to significantly more anxious affect than acceptance by the end of the regulatory period following acceptance's initial peak in arousal. When considering the attentional focus results of chapter 5 (attention to threat but not to affect), all of the above mentioned theories would predict that distraction would result in increased affect.

The results from the comparisons between acceptance and mind-wandering in study 6.1 were not consistent with the predictions of the process of a feeling model in that engaging in acceptance never eventuated in lower levels of anxious affect than mind-wandering, and actually led to increased reported affect following regulation relative to mind-wandering. These results were more consistent with the predictions of the modal model, objective self-awareness theory, and cognitive motivational accounts in that mind-wandering led to significantly lower reported affect than acceptance. In addition, mind-wandering led to lower levels of arousal during the middle of the regulatory period, relative to acceptance, while those in the acceptance condition were instructed to attend to threats and affect.

Mind-wandering led to increased vagal tone (indicating less dysregulated affect) in comparison to the distraction conditions, across both threat levels. In addition, in the low-threat level, distraction and acceptance led to lower levels of vagal tone in comparison to the mind-wandering condition. These results further support the prediction that attentional focus towards threat and affect, exhibited by distraction and acceptance, led to increased reported affect, increased arousal and lower vagal tone (indicating dysregulated responding) relative to spontaneously initiated attentional diversion. Hence, the comparisons of mind-wandering with distraction and acceptance from study 6.1 demonstrated partial support for the modal model, objective self-awareness theory and the cognitive motivational account, but limited support for the process of a feeling model.

Study 6.2 investigated the subsequent impacts of distraction and acceptance on affect experienced during threat-task engagement and during recovery. The process of a feeling model predicted that prior engaged, self-initiated, attentional diversion from affect (shown in the mind-wandering control conditions) should lead to increased affect relative to acceptance due to limited opportunity to integrate affect with reason. In contrast, objective self-awareness theory predicts that the conditions that reduced self-awareness (as exhibited in the mind-wandering control conditions) would show reduced affect relative to acceptance, which increased self-awareness. In addition, based on the cognitive motivational account of anxiety, more attention to threat-stimuli, such as occurred in distraction and acceptance, should have resulted in increased affect. The results of study 6.2 contradicted the predictions of the process of a feeling model: ignoring of threats during the anticipation phase by the mind-wandering conditions led to reduced affective reactivity and more rapid affective repair during threat-task engagement and threat-task recovery, respectively, than the regulation strategies of distraction and acceptance. These results were consistent with the predictions of objective self-awareness theory and the cognitive motivational account of anxiety in that the conditions that resulted in more attention towards threatening stimuli (acceptance and distraction) showed increased affect and arousal relative to mind-wandering, which facilitated spontaneous attentional diversion from threats.

The results from study 6.2 are consistent with Ellenbogen et al. (2002), demonstrating that naturally occurring attentional diversion from threat-stimuli can subsequently reduce indicators of stress immediately following stressor cessation. Other studies have also demonstrated that attentional focus towards threats leads to increased cortisol release (Dandeneua, Baldwin, Pruessner, Baccus, & Sakellaropoulo, 2007) and lowered vagal tone (Baert, Casier, & De Raedt, 2012), and that participants trained to focus attention away from threats reported lower stress (Dandeneua et al., 2007) and faster recovery of vagal tone (Baert et al., 2012) following stressor exposure. Hence, the present research adds to previous research (Baert et al., 2012; Dandeneua et al., 2007; Ellenbogen et al., 2002) supporting the predictions of objective self-awareness theory and the cognitive motivational account regarding the effectiveness of self-initiated attentional diversion in reducing unpleasant affect (reported and physiological) and in sustaining regulated responding (indicated by increased vagal tone).

8.1.2.5. Imposed vs Spontaneous Regulation and Executive Control

The third research question focused on the utility of distraction and acceptance in preserving the ability to demonstrate executive control. Three theories were pivotal in deriving predictions for the pattern of executive control differences expected amongst the regulatory conditions. Firstly, according to self-regulatory strength theory (Muraven & Baumeister, 2000), prior attempts to inhibit automatic responding deplete finite executive resources and thus diminish subsequent attempts at executive control. Secondly, according to the affective theories of impaired executive control, PET and ACT (Eysenck & Calvo, 1992b; Eysenck et al., 2007), increased affect would result in impaired executive control. Thirdly, the neurovisceral account (Thayer, Friedman, Borkovec, Johnsen, & Molina, 2000; Thayer et al., 2009) predicted that reduced vagal tone resulting from regulation would give rise to impairments in executive control.

The reasons for self-regulatory strength theory predicting differences between the regulation strategies were based on the way that the strategies were conceptualised. Distraction was conceptualised as a strategy that would require actively directing attention away from stimuli that reflexively engage attention and, therefore, be mentally effortful. In contrast, acceptance, directing attention towards threats and towards affect, would be relatively effortless in circumstances of high-threat where attention automatically captured engages with such stimuli (Duval & Wicklund, 1972; Mogg & Bradley, 1998), but effortful in circumstances of low threat, being inconsistent with reflexive responding, where it would require controlling attention (Schmeichel, 2007; Schmeichel et al., 2003). In direct contrast to acceptance, spontaneously initiated attentional diversion from threats and affect (represented by the mind-wandering control condition) was predicted to be mentally demanding in circumstances of high-threat when attention was automatically engaging with threats and affect, but effortless in circumstances of low-threat when participants did not have to override the automatic tendency to engage with threat (Bar-Haim et al., 2007; Mogg & Bradley, 1998) making diverting attention easier (Wilson & MacLeod, 2003).

Chapter 7 presented five studies that investigated the influence of regulation strategies undertaken in high and low-threat levels on subsequent executive control. Study 7.1 investigated the extent to which participants perceived regulation to be effortful and difficult. The results from study 7.1 demonstrated that distraction was perceived to be effortful and difficult in both threat levels relative to mind-wandering, and thus supported the prediction that a strategy requiring controlling attention and maintaining an attentional load would be mentally effortful regardless of threat level. In contrast, acceptance was perceived to be as effortful and difficult as mind-wandering in high-threat circumstances, but more effortful than mind-wandering in low-threat circumstances. These results are consistent with self-regulatory strength theory in that different forms of regulation require different levels of mental resources. In addition that the results supported the proposition that the mental resource demands of regulation strategies are not constant but depend on threat level of the circumstance they are undertaken in (Alberts et al., 2008; Duval & Wicklund, 1972; Mogg & Bradley, 1998; Sheppes & Meiran, 2008).

Study 7.2 investigated the impacts of threat and regulation on executive control via subsequent prepotent response inhibition. Distraction impaired response inhibition to the same extent as the mind-wandering control condition relative to acceptance in high-threat. In the low threat level distraction impaired response inhibition to the same extent as acceptance relative to mind-wandering. Hence, the results for acceptance varied by threat level, where, relative to mind-wandering, acceptance preserved the capacity to inhibit responses in high-threat circumstances, but impaired response inhibition in low-threat circumstances. In addition, acceptance in high-threat circumstances did not differ from low-threat mind-wandering, suggesting that focusing on threats in high-threat circumstances is just as effortless as ignoring low-threat-stimuli in low-threat circumstances. The results of study 7.2 largely reflected the pattern of differences in perceived expended mental resources reported in study 7.1, except that in high-threat circumstances, mind-wandering led to impaired executive control relative to acceptance (study 7.2), despite both strategies being rated as having similar effort and difficulty levels (study 7.1).

Taken together, the findings from studies 7.1 and 7.2 are generally consistent with the interpretation that high-threat circumstances promote attention to threats and negative affect and that it requires more executive resources to direct attention away from these than towards them. Conversely, in low-threat circumstances, it was effortful to allocate attention to threats and affect where circumstances did not facilitate attention to threats and affect. These results support the integration of objective self-awareness and cognitive motivational accounts of attention and anxiety with self-regulatory strength theory, in that regulation counter to reflexive attentional responding in some circumstances that results in impairments to executive control, but that this same regulation, when consistent with reflexive attentional responding in other circumstances, preserves executive control .

The finding in study 7.2 that increased attention to threat in high-threat circumstances preserves the ability to demonstrate executive control relative to attempts to ignore threats presented are consistent with previous research. A study by Heatherton et al. (1993) showed that in high-threat circumstances, both spontaneously occurring and experimentally manipulated attentional diversion from threat led to impaired subsequent controlled responding (i.e., restricting intake of ice cream whilst on a limited calorie diet) relative to a condition that encouraged attention to threatening stimuli and participants' own responding, and to a low-threat control condition with no regulation task. In addition, Johns et al. (2008) established that objectively measured spontaneous attempts to divert attention from threat-stimuli led to subsequent impairments in executive control.

The present research extends Heatherton et al.'s study by demonstrating that increasing attention to threat and to the self can occur via the manipulation of an affect regulation strategy rather than via a mirror or a video camera to lead to similar level of self-control in high-threat circumstances relative to a control condition in low-threat circumstances. In addition, unlike the Heatherton et al. study, the present study confirmed, via participant reports that the acceptance condition had a higher focus on threats than the control condition. A further extension of Heatherton et al. is the finding from the low-threat level that regulation that increases self-awareness (acceptance) may actually be as detrimental as a strategy that involves controlling attention (distraction), indicates that increased self-awareness does not preserve executive control in all circumstances. These findings from study 7.2 in the low-threat level, are consistent with studies demonstrating that controlling attention, even in the absence of affect regulation, leads to subsequent impairments in other tasks requiring different forms of cognitive control (Schmeichel, 2007; Schmeichel et al., 2003). Hence, the findings from study 7.1 and 7.2 provide, within a single experiment, an extension of previous research (Alberts et al., 2008; Heatherton et al., 1993; Johns et al., 2008; Sheppes & Meiran, 2008) in demonstrating that strategies that may preserve capacity to demonstrate self-control in one circumstance may impair capacity in another.

Study 7.3 assessed executive control (through assessment of working memory) after prolonged exposure to threat. The findings from study 7.3 were not consistent with study 7.1 and 7.2 in that the effect of regulation was only present within the high-threat level. Increased threat significantly impaired working memory in high-load trials, however increased threat impaired working memory when averaged across the regulatory conditions rather than only within the mind-wandering control conditions. Importantly, study 7.3 still indicated that acceptance at the high-threat level did not significantly differ from low-threat mind-wandering condition. A potential interpretation of this null result may be that, when taken together with the same null finding from study 7.2, the attentional focus facilitated by acceptance in high-threat circumstances preserves executive control to a similar extent to being under little threat and engaging in minimally effortful regulation. This may be because the attentional focus demonstrated by the two regulatory conditions in their respective threat circumstances (high-threat acceptance, and low-threat mind-wandering) is consistent with automatic/reflexive responding in those circumstances and therefore translates into similar levels of preserved executive control.

The results from study 7.3 also showed that in high-threat level, the pattern of effects of regulation on executive control remained consistent with study 7. 2. However, in the low-threat level, the effects of regulation had disappeared, suggesting that some circumstances can sustain the influence of prior regulation and others diminish it. The findings that the influence of the regulation strategies had on executive control found in study 7.2 remained in study 7.3, although in a somewhat reduce form, in high- but not low-threat conditions. In study 7.3 participants had been exposed to threats for a prolonged period and this prolonged exposure to threat may have influenced the processes of resource depletion and resource replenishment that may account for the discrepancy in executive control findings from study 7.2 and 7.3. It may be that resource depletion, occurring as part of the effortful process of divert attention away from a persistent and prolonged exposure to threats (Cornwell et al., 2011; Knight et al., 2007) sustained differences in executive resources between regulatory conditions in high-threat circumstances. In contrast, resource replenishment, occurring in the low-threat circumstances, where threat-stimuli are more easily ignored (Wilson & MacLeod, 2003) may not have required effortful ongoing controlled regulation to divert attention, thus allowing the replenishment of executive resources and thus resulting in reduced the differences in executive resources available support executive control amongst the regulatory conditions previously existing at this threat level. Hence, a combination of what is known about regulation of attention towards threat and resource depletion and replenishment provide an explanation of why patterns of executive control amongst the regulatory conditions differed from study 7.2 to study 7.3.

Studies 7.4 and 7.5 tested the predictions of affective theories (PET and ACT) and the neurovisceral account that differences in executive control may be accounted for by differences in affect experienced during executive task performance and differences in affect and vagal tone demonstrated during prior regulation. The results from these studies suggested that differences in affect experienced did not explain the differences in executive control amongst the regulatory conditions. This analysis also suggested that the differences in the pattern of results between response inhibition and working memory could also not be explained by different levels of affect experienced during executive task performance or to varying carry over effects from affect experienced during regulation. Hence, studies 7.4 and 7.5 ruled out the explanations proposed by PET, ACT and the neurovisceral account that affect and vagal inhibition could be the causes of impairments in executive control shown by particular regulatory conditions, leaving self-regulatory strength as the only theoretical explanation investigated and not ruled out.

8.1.2.6. Summary of Comparisons Between Imposed and Spontaneous Regulation

The most plausible interpretation that summarises the comparisons between mind-wandering and the imposed strategies of distraction and acceptance is that the imposed regulation strategies alter spontaneous regulatory attempts. Consistent with the predictions of objective self-awareness theory and the cognitive motivational account of anxiety, participants in the mind-wandering control conditions spontaneously sought to divert attention from threat and this diversion led to lower levels of affect relative to imposed strategies, which either disrupted the spontaneous controlled responses to divert attention from threats (i.e., distraction) or facilitated attention to threats (i.e., acceptance).

In addition, regulation that alters attentional focus towards or away from threat was suggested to deplete executive resources if these controlled regulatory responses were inconsistent with reflexive attentional responses. Hence, although attention to threat and one's own negative affect may be subjectively unpleasant and lead to increased arousal, it appears that such attention in high-threat circumstances (a situation likely to facilitate this attentional focus) requires little effort and thus preserves executive control. However, in situations of low-threat, which may not facilitate attention to threats and one's affective response, is relatively effortful, increases affect and impairs executive control.

8.1.3. Effects of Distraction and Acceptance

This section presents and interprets the findings of the comparisons between experimentally manipulated distraction and acceptance on attentional focus, affect and executive control. These findings are discussed with the aim of further developing an understanding of how spontaneous regulatory attempts to control attention can be altered through imposed regulation strategies including how the focus of attention, when altered by imposed regulation, leads to different affective and executive control outcomes. In addition, this section discusses findings in context of previous research, to build an understanding of how particular circumstances influence the effectiveness of distraction and acceptance in reducing affect and preserving the capacity to demonstrate executive control. Hence, this section proposes explanations of *why* the imposed strategies led to differences in attentional focus, affective responding and the ability to demonstrate executive control.

8.1.3.1. Distraction, Acceptance and Attentional Focus

Chapter 5 addressed the first research question, regarding the effects of the imposed regulation strategies on attentional focus. It was hypothesised that providing an alternative attentional focus that had an associated attentional load (i.e., distraction) would minimise threat-related thoughts and the awareness of affective response relative to acceptance, which facilitated attention towards threat and affect. In contrast to this prediction, the results of chapter 5 showed that participants engaging in distraction did not differ in their level of threat-related thoughts from those in the acceptance condition. Effective distraction was defined as diverting attention from affect eliciting and maintaining stimuli, through engagement in a task that involves attentional focus to neutral and benign stimuli (Gross & Thompson, 2007; Morrow & Nolen-Hoeksema, 1990; Van Dillen & Koole, 2007). However, as noted in chapter 5, experimentally manipulated distraction resulted in an attentional focus that did not exemplify effective distraction, as participants reported *more* thoughts related to threats than the mind-wandering condition and a similar level to acceptance.

There are two possible explanations for the relatively high level of threat-related thought noted in the distraction conditions: the disruption account and the suppression account. The disruption account is based on the assertion made from several studies (Cornwell et al., 2011; Knight et al., 2007; Mather & Knight, 2005; Wegner et al., 1993) that an attentional load (e.g., a distraction task) *disrupts* the spontaneously initiated goal directed regulatory processes that divert attention from threats (Duval & Wicklund, 1972; Knight et al., 2007; Mather & Knight, 2005; Mogg & Bradley, 1998). These spontaneously initiated attentional regulatory processes are suggested to require substantial concurrent attentional resources (Knight et al., 2007; Mather & Knight, 2005) for the maintenance of such cognitive control. Imposing an attentional load may disrupt these spontaneously initiated cognitively effortful goal-directed processes, resulting in the reinstitution of the innate prepotent response to engage attention with threats (Bar-Haim et al., 2007; Mogg & Bradley, 1998).

Support for the disruption account comes from several studies. A study by Cornwell et al. (2011) demonstrated that when participants were under high attentional load, they showed a greater attentional bias to a distracting threat stimulus relative to a distracting neutral stimulus than when not undertaking a task to create a high attentional load. Similarly, Knight et al., (2007) also showed that distraction (via an arithmetic task) reversed an emotional attentional bias from positive visual stimuli to negative visual stimuli in older adults. Likewise, Wegner et al. (1993) demonstrated that imposing an attentional load (through an arithmetic task) when individuals were already asked to control their affective experiences led to paradoxical effects to attention and affect, in that attentional focus and valence of affect was the opposite to what the individual's mental control motivation was. Mather and Knight (2005) demonstrated that the bias for retrieving positive emotional episodes from memory typically shown by older adults can be reversed to retrieving negative episodes when they were asked to simultaneously engage in a distraction task. Hence, each of these studies show that goal-directed or controlled regulation (affective and attentional) can be disrupted by an attentional load, leading to increased attention to stimuli sought to be avoided and difficulties in reducing affect that was sought to be down-regulated. These studies support the notion that controlled regulatory attempts (spontaneous and imposed) are *disrupted* by imposing a concurrent attentional load and suggest that regulation (spontaneous and imposed involving directed at altering attention or emotion) require considerable cognitive resources to be implemented without adverse consequences.

The second account that provides an explanation for why distraction resulted in increased threat-related thoughts is based on the proposition that imposed distraction initiates a similar cognitive process to thought suppression. This suppression account is based on the premise that attempts at mental control (such as distraction and suppression) have paradoxical effects on the internal phenomenon sought to be inhibited (Wegner, 1994; Wegner, Schneider, Carter, & White, 1987). The paradoxical effects are explained by a proposed underlying search and operate process. Seeking to inhibit a particular internal phenomenon initiates a search process for the presence of the internal phenomenon to be inhibited, and this search process inevitably keeps that internal phenomenon at the forefront of consciousness, thus undermining the goal of suppressing that internal phenomenon from consciousness (Wegner, 1994; Wegner et al., 1987). Support for the suppression account being relevant to investigations of distraction is based upon the constructs of distraction and suppression being conceptually and empirically related (Kamholz et al., 2006; Wegner & Zankos, 1994). Conceptually, both strategies involve seeking to avoid or inhibit the experience of unpleasant affect. Empirically, items from self-report measures of these constructs load on the same factor when subjected to a factor analysis, forming scales that have high internal consistency (Kamholz et al., 2006; Wegner & Zankos, 1994). Studies investigating suppression have demonstrated similar patterns of results to the studies investigating distraction tasks in the presence of situations requiring controlled regulation (Abramwitz et al., 2001; Cornwell et al., 2011; Knight et al., 2007; Mather & Knight, 2005; Wegner et al., 1993).

It was also predicted in chapter 5 that distraction would result in reduced attention to affect compared with acceptance. The results of chapter 5 showed that, despite similar levels of attention to threat-related *thoughts* being reported in the two conditions, those engaged in distraction reported allocating less attention to *feelings* than those engaged in acceptance. Hence, consistent with the definition of distraction, the imposed distraction task did reduce attention towards affect relative to acceptance but, as noted in section 8.1.2.1, it did not reduce attention to affect more than mind-wandering. This combination of results is important because it suggests that imposed distraction did not reduce attention to affect any more than what naturally occurs due to spontaneous attempts at diverting attention occurring in mind-wandering in healthy participants. However, the reason why imposed distraction resulted in low levels of attention to affect but selectively disrupted the spontaneously initiated attempts to direct attention away from threats is unclear, although several highly speculative explanations may be plausible.

One plausible explanation for the selective disruption of attention diversion from threat but not affect by the imposition of attentional load relates to the underlying processes behind the disruption and suppression accounts of why imposed attentional load increases attention to threats. Both disruption and suppression accounts predict increased affect as a result of imposing the attentional load, but do not explicitly predict the selective increase in attention to threats but not affect. However, both accounts do implicitly suggest that the processes behind the eventual inhibition of threat-related thoughts are top-down, intentional attempts of individuals to avoid the experience of unpleasant affect. The selective effect of an attentional load increasing on attention to threat but not to affect may be due to innate initial engagement of attention to threats but not to affect (Bar-Haim et al., 2007; Mogg & Bradley, 1998). Attentional focus may not be innately pre-programmed to be drawn or engage with affect or arousal to the same extent as to threats as the affective response may be less relevant to maintaining immediate physical safety. Hence, if individuals are not innately attentive to feelings, one would require some initial level of controlled responding to initiate attention to such internal phenomena. If cognitive control is already being utilised to avoid or inhibit threatening stimuli or to direct attention elsewhere, there would be restricted attentional capacity to attend to feelings. Hence, it may be that the attentional load of imposed distraction assisted in maintaining limited attention towards affect to a similar extent as spontaneous attempts to divert attention from threats. Thus, the attentional load imposed by the distraction condition is suggested to have disrupted the spontaneously initiated and cognitively effortful process of ignoring threats to reveal the innate pre-programmed response of attending to threats, whilst simultaneously sustaining the limited the ability to focus attention to affect.

8.1.3.2. Distraction, Acceptance and Affect Regulation

There are some similarities and differences between the theories of affect regulation regarding the role of focus of attention, and effective affect regulation that relate directly to the attentional focus exhibited by distraction and acceptance. The affect regulation models including the modal model (Gross & Thompson, 2007) and the process of a feeling model (Greenberg, 2004; Greenberg & Paivio, 1997) allow for the possibility that attentional focus will not be allocated to affective responses even if stimuli that initiated and maintain those affective responses continue to be an attentional focus. However, the process of a feeling model stands alone in predicting that the combination of attentional focus towards threat and feelings (as reported by those undertaking acceptance) would lead to increased affect initially but would eventually reduce the affective response by providing the opportunity for these stimuli to be integrated with reason. In contrast, objective self-awareness theory and cognitive motivational accounts of attention and anxiety predict that focus towards threats and towards one's own responding would result in increased affect. Chapter 6 tested the above predictions regarding the affective impacts of distraction and acceptance.

Study 6.1 tested the relative effectiveness of distraction and acceptance in reducing affect during the anticipation of threat. The results confirmed that imposing a distraction task, in anticipated threat circumstances, led to reduced vagal tone (suggesting affect dysregulation) and increased arousal relative to acceptance at the conclusion of regulation. Coinciding with the results of chapter 5, that distraction restricted attention to affect, the distraction conditions did not *report* increased affect relative to acceptance, despite showing greater arousal. This combination of low reported affect and attention to affect but high physiological arousal from 6.1 and chapter 5 is remarkably consistent with previous studies that have investigated individuals using distraction or suppression in response to threat showing that these individuals reported low levels of anxious affect, but showed high levels physiological arousal (Asendorpf & Scherer, 1983; Fuller, 1992; Hofmann et al., 2009; Houston & Holmes, 1974; Wegner et al., 1993). Such findings are also consistent with the predictions of the process of a feeling model (Greenberg, 2004; Greenberg & Paivio, 1997). These differences in affect between distraction and acceptance in study 6.1 in combination with the attentional focus results of chapter 5 are also consistent with the modal model in that both distraction and acceptance reported higher levels of attention to threat and this co-occurred with increased affect. From these results, it can be concluded that active engagement in distraction was counterproductive in reducing affect resulting in increased affect and dysregulated responding whereas active engagement in acceptance resulted in an eventual lowered level of arousal and regulated responding, suggesting that acceptance may result in affective response completion, and perhaps longer lasting benefits.

Study 6.2 tested the predictions of the process of a feeling model that acceptance would facilitate the completion of an affective episode and thereby lead to decreased affective reactivity and quicker recovery from threat-tasks than distraction. In contradiction to this prediction, the results from study 6.2 showed that acceptance, in both threat levels, did not differ from distraction during the threatening task or during recovery. Thus, there was no support for the conceptualisation of acceptance within the process of a feeling model as a strategy that facilitates the integration of affect with reason, thereby reducing affective reactivity and facilitating rapid affective repair.

The findings of studies 6.1 and 6.2, when taken together, are consistent with those of several previous studies. Previous research investigating distraction have found that it can increase physiological arousal during regulation in anticipated threat circumstances (Houston & Holmes, 1974). Others have found that imposing an attentional load in situations where participants are already regulating can lead to increases in unwanted affect (Cornwell et al., 2011; Wegner et al., 1993). The relevance of the paradoxical effects of prior mental control is related to distraction having conceptual and empirical similarities to suppression. The finding that distraction led to increased affect following regulation can also be explained via this suppression account. Early research on mental control found that paradoxical effects can be found most prominently after suppression has ceased (Wegner et al., 1993). A more recent study by Koster, Rassin, Crombez and Naring (2003) supported this previous research, demonstrating that inhibition of a particular unpleasant thought can increase the presence of unpleasant affect after the attempt at inhibition had ceased. Thus, these studies suggest that distraction during the anticipation of a threat can be akin to suppression, leading to both concurrent (Fuller, 1992; Hofmann et al., 2009) and subsequent increased affect (Koster et al., 2003; Wegner et al., 1993). Due to the combination of results on attentional focus and affect in chapter 5 and study 6.1 and 6.2, the disruption account could also explain how an attentional load could interrupt effective spontaneous regulatory attempts that prepare the individual for stressors and thus protect the individual from later experiencing stress (Ellenbogen et al., 2002; Kamphuis & Telch, 2000).

Although the present research findings from study 6.1 and 6.2 suggest that distraction is an ineffective strategy in reducing affect relative to both mind-wandering and acceptance, these results are inconsistent with several other studies finding that distraction was effective in reducing affect (Bloom et al., 1977; Glynn, Christenfeld, & Gerin, 2002;

Lyubomirsky & Nolen-Hoeksema, 1993; Morrow & Nolen-Hoeksema, 1990; Neumann et al., 2004; Nolen-Hoeksema, 1991; Rusting & Nolen-Hoeksema, 1998; Sheppes et al., 2009; Van Dillen & Koole, 2007; Wong & Moulds, 2009). The reason for the inconsistency between the present research and these studies may be due to some key factors, including the circumstances in which the strategy was evaluated and how distraction was manipulated. The previous research that has found distraction to be ineffective has only examined anticipated threat circumstances (Houston & Holmes, 1974; Kamphuis & Telch, 2000), where participants are perhaps already attempting to regulate by diverting their attention (Knight et al., 2007; Mather & Knight, 2005). The effectiveness of distraction has been demonstrated in other circumstances, such as during or subsequent to an affect-eliciting task, in reducing affective reactivity (Sheppes & Meiran, 2007; Van Dillen & Koole, 2007) and improving affective repair (Blagden & Craske, 1996; Neumann et al., 2004; Wong & Moulds, 2009). However, this support for the use of distraction comes from studies that compare distraction to a strategy that is counter-productive in the circumstances (Glynn et al., 2002; Lyubomirsky & Nolen-Hoeksema, 1993; Morrow & Nolen-Hoeksema, 1990; Neumann et al., 2004; Nolen-Hoeksema, 1991; Rusting & Nolen-Hoeksema, 1998; Sheppes et al., 2009; Wong & Moulds, 2009). Sheppes and colleagues (Sheppes et al., 2009; Sheppes & Meiran, 2007) have demonstrated that self-facilitated distraction (i.e., instruction to focus on some other topic with no specific topic or externally relevant attention-consuming task), after an affective stimulus has been presented, results in lower levels of experienced affect than late initiations of reappraisal (i.e., initiation of developing an alternative meaning after prolonged exposure to the affective eliciting stimulus to be reappraised). Although partly consistent with the findings of Sheppes and colleagues (Sheppes et al., 2009; Sheppes & Meiran, 2007), the present findings did suggest that self-initiated attentional diversion or distraction (as represented by the mind-wandering control condition) was effective. The present research did not evaluate the use of distraction during the actual affect eliciting task/event, or following it, so the results are not directly comparable with those of studies supporting the use of distraction task to effectively reduce unpleasant affect. However, the present findings clearly show that distraction in anticipatory threat circumstances is an ineffective strategy in reducing affect.

The effectiveness of acceptance in reducing anxious affect depended on some of the same issues as distraction. The present findings, when placed in the context of previous research, show that acceptance's effectiveness can be impacted by experimental and contextual factors. These factors include: (1) the circumstances in which it is evaluated (threat level and whether effects are evaluated during or subsequent to engagement); (2) for how long the strategy is used and the method used to elicit the strategy, and (3) the conditions against which it is evaluated.

Firstly, the present research showed that the level of threat under which acceptance is undertaken, and the time point at which its effectiveness is evaluated can impact on the findings. Acceptance used in low-threat circumstances led to dysregulated responding relative to mind-wandering. No identified published studies have evaluated acceptance in low-threat circumstances, however Ellenbogen et al. (2002) showed that attention towards threatening stimuli, as demonstrated by those in the acceptance conditions, will lead to increased anxious affect. However, the present study is not the only one to show acceptance, used in high-threat/affective circumstances sometimes resulting in increased affective responding subsequent to the strategies engagement. A study by Dunn et al. (2009) evaluated the effectiveness of acceptance and suppression both during engagement, in response to negatively valenced film content, and then subsequent to engagement in response to pictures of positive, negative and neutral content unrelated to the film content. Dunn et al. found, similarly to the findings from studies 6.1 and 6.2, that acceptance initially led to lower arousal during engagement, but subsequent to engagement resulted in increased reactivity in response to all picture content (negative, neutral and positive). In addition, participants who had engaged in acceptance showed prolonged affective recovery according to self-reports taken at one week follow-up. Findings against the effectiveness of acceptance come from studies, including from chapter 6, where the strategy is provided when there is minimal anticipatory anxiety placed on the individual (low-threat level study 6.1) or affect is measured after strategy use has ceased such as study 6.2 and (Dunn et al., 2009). However, studies, including study 6.1, finding beneficial effects for acceptance have evaluated affect while the strategy is being actively used (Dunn et al., 2009; Hofmann et al., 2009; Low et al., 2008).

The second set of related factors that influence the effectiveness of acceptance is the time period of evaluation and how the strategy is elicited (i.e., how the strategy is manipulated influences how long the strategy may be used for). The present findings (from study 6.1) and Low et al. (2008), both using regulation tasks that required longer participant engagement time, showed that acceptance led to lower arousal in a stressful circumstance after more than 10 minutes of engagement, relative to a maladaptive strategy (i.e., ruminative evaluative recall), but no difference from control comparison condition (objective recall). Neither Low et al. (2008) nor Hoffmann et al. (2009), who both showed beneficial effects of acceptance on HR, found that acceptance resulted in initial higher levels of arousal relative to a control condition, followed by a decline in arousal as found in study 6.1. The reason for no peak in affect in either Hofmann et al.'s (2009) or Low et al.'s (2008) studies may be that these two studies provided initial regulatory instructions to follow, rather than a mindfulness script to continually follow to support regulatory strategy use. The simple instruction manipulation, relative to the mindfulness script, may have been less successful at directing attentional focus towards threat and affect, thus not creating an initial peak in arousal. Hence, the way that the present research manipulated acceptance facilitated an attentional focus that resulted in the peak in arousal noted in study 6.1 that was not found in previous studies manipulating acceptance via alternative methods. Although this may not necessarily be desirable in the short-term, if it facilitates a process similar to habituation or an eventual sustained reduction of affect towards that stimulus it may be desirable, although this outcome is yet to be seen.

The third factor that influences how effective acceptance is judged to be is the comparison condition used to evaluate this effectiveness. Low et al. (2008) and Hofmann et al. (2009) compared acceptance in high-threat/stress circumstances to maladaptive strategies (viz, ruminative evaluation and suppression) and found favourable reductions in anxious affect, but did not find differences relative to another adaptive or neutral control condition. The present research set out to evaluate acceptance against another proposed adaptive strategy (distraction), however the findings clearly suggest that experimenter imposed distraction was maladaptive in anticipated threat circumstances. Nevertheless, like the previous research finding benefit for acceptance, the present research did not find that acceptance was more beneficial than other possibly adaptive strategies (such as self-initiated attentional diversion occurring in the present research's mind-wandering conditions), factual recall in Low et al., (2008) and reappraisal in Hofmann et al., (2009). Hence, the present findings, like previous research (Hofmann et al., 2009; Low et al., 2008) suggest that acceptance is no more effective than other known adaptive strategies, or than neutral control conditions and sometimes can be counter-productive (Dunn et al., 2009).

The present research findings from distraction and acceptance, when combining attentional focus and affective responding results, can be summarised as two strategies that share a similar level of attentional focus towards threat-related thoughts and often show similar levels of increased affect, relative to mind-wandering control. In addition, when considering the findings from distraction and acceptance together with previous research, the impact of these strategies on affect varies depending on the circumstances in which they are used (e.g., high or low level of threat and engagement before, during or after the encounter of an affect eliciting stimulus). Furthermore, the effects of strategies can vary depending on the duration of time over which they are evaluated, their subsequent affective impacts and what alternative regulatory conditions they are evaluated against. Hence, the suggestion that there are several factors that influence the extent to which a strategy will be effective in reducing affect, leads to the conclusion that the rigid and repetitive use of any affect regulation strategy across contexts may be somewhat counterproductive, and thus effective regulation may be about adjusting attention and appraisals to the particular circumstance.

8.1.3.3. Distraction, Acceptance and Executive Control

The third research question asked what temporary impacts distraction and acceptance have on subsequent executive control. Distraction and acceptance were proposed to differ in the extent to which they depleted executive resources that would subsequently lead to impairments in executive control. Study 7.1 tested the self-regulatory strength prediction that demands of regulation would be perceived by participants to be greatest for distraction, and the results supported this across threat levels. A more detailed analysis showed that acceptance was evaluated as less effortful than distraction in high-threat circumstances, but equally effortful in low-threat circumstances. In addition, acceptance was perceived to be more difficult in low-threat circumstances than acceptance undertaken in high-threat circumstances. Hence, the results of study 7.1 were largely consistent with the predictions of self-regulatory strength theory in that strategies were found to differ in their perceived mental demands. In addition, the pattern of differences in perceived mental demands between the regulatory conditions was supportive of objective self-awareness theory predictions in that threat level influenced how effortful it was to focus on threats and feelings for the acceptance condition.

Study 7.2 tested the impacts of regulation on inhibition of prepotent responses immediately following regulation. The results were largely consistent with participants' perceived demands of the strategy found in study 7.1. Although distraction was not found to be detrimental to subsequent attempts to inhibit prepotent responses when assessed across both threat levels, it was found to be detrimental in high-threat circumstance relative acceptance, but the two were equally detrimental in low-threat circumstances. In addition, acceptance preserved executive control in high-threat circumstances relative to low-threat circumstances. These findings, taken together with the results of study 7.1, suggest that individuals find it less mentally effortful to focus on threats and feelings in high-threat circumstances than engaging in strategies that seek to direct attention away from threats and feelings or to focus on threats and feelings in low-threat circumstances. It was always mentally fatiguing to maintain an attentional load that was unrelated to threats.

The findings of study 7.2, like the findings of study 7.1, supported the predictions of self-regulatory strength theory in that strategies reported to be more mentally demanding were also found subsequently to impair executive control. The pattern of findings across the regulatory conditions was consistent with objective self-awareness theory and cognitive motivational account of anxiety propositions that increased threat facilitates reflexive attentional engagement with threatening stimuli and towards affective responding, where as in low-threat circumstances attention is not reflexively drawn to such stimuli[xx].

Previous research supporting the finding made distraction's impact on subsequent self-control attempts has invoked two different accounts to explain the results. The first explanation is based on the interpretation of findings by Heatherton et al., (1993), of which the finding that were discussed previously in section 8.1.2.5, which related to distraction reducing self-awareness. Heatherton et al., interpretation of the findings was self-awareness is necessary to identify deviations from desired states (Duval and Wicklund, 1972) and because distraction shifts attention from this self-monitoring error detection process evaluating actions in relation to goals it disables a mind-set that facilitates subsequent impairments in controlled responding (i.e., error detection mind set account). The second account for distraction impairing subsequent self-control comes from conceptualising distraction as an act of mental control (similar to that of suppression) that also disrupts self-control in the domains of attention and affect (Cornwell et al., 2011; Knight et al., 2007; Mather & Knight, 2005; Wegner, 1994; Wegner et al., 1993), and depletes executive resources available for subsequent acts of self-control (i.e., effortful mental control account).

There is significantly more evidence for the effortful mental control account. Previous research has shown that both, thought suppression and affective suppression have led to subsequent impairments regulated thought or action (Baumeister et al., 1998; Johns et al., 2008; Schmeichel et al., 2003) that resembles the impacts on executive control

[xx] More detailed argument is presented in section 8.1.2.5, regarding the integration of cognitive motivational accounts of anxiety and objective self-awareness theory with self-regulatory strength as an explanation for the findings relating to the impacts of prior regulation on executive control.

that distraction had in studies 7.1 and 7.2. In addition, distraction led to similar impacts to executive control as attempts to inhibit reflexive attention to task irrelevant stimuli seen in previous research (Schmeichel, 2007; Schmeichel et al., 2003).These studies have also typically shown that suppression, and in this study distraction, is perceived as mentally more demanding than alternative mental acts, which suggests the depletion of an internal reservoir of executive resources. Additionally there is evidence counter to the error detection mind-set account from the present research from the finding that acceptance increases self-awareness but was rated as more difficult and impaired executive control in low-threat circumstances (study 7.2). Thus, the proposal that increased self-awareness, leads to superior self-control because it primes a mindset for error detection was contradicted in the presence of evidence supporting the alternative account, that any regulation if depleting of mental resources will impair subsequent attempts at executive control. Hence, the impact of distraction, represented as a strategy requiring mental control of reflexive responses that is mentally demanding rather than as a strategy that disables an error detection mind-set better accounts for the findings of the present research.

Interestingly, previous studies have actually showed, contrary to the present findings, that distraction, in some circumstances, can preserve the capacity to demonstrate executive control (Alberts et al., 2008; Sheppes & Meiran, 2008). The pivotal difference of the present research and previous research supporting the use of distraction in preserving executive control was that distraction did not occur in anticipated threat circumstances. Rather, the circumstances in which distraction has been shown to preserve executive control is when it is engaged in concurrently with the affective response such as when asked to watch a sad movie (Sheppes & Meiran, 2008) or when engaging in a pain eliciting task (Alberts et al., 2008). Distraction in these circumstances would still reduce self-awareness and thus provide further evidence contradicting the assertions of Heatherton et al. (1993) and Duval and Wicklund (1972) suggestion that self-awareness primes error detection necessary to promote subsequent self-control.

Importantly, Alberts et al.'s (2008) also showed that when participants engaged in the distraction task while anticipating the same pain eliciting task, it led to impaired self-control, similar to findings of the study 7.2. The reason for anticipatory circumstances making distraction an executive resource depleting strategy, relative to non-anticipatory circumstances suggests that executive resource depletion (Muraven & Baumeister, 2000) is occurring in these anticipatory circumstances due to control attempts to inhibit innate attentional engagement with *threat* (Bar-Haim et al., 2007; Mogg & Bradley, 1998), as inhibiting reflexive attention engagement with peripheral stimuli of any valence is effortful (Schmeichel, 2007; Schmeichel et al., 2003). However, in the study of Sheppes and Meiran (2008) the initiation of distraction in non-anticipatory circumstances involving sad affect, when watching a movie, may not have reflexively enaged attention to feelings or sad movie content and therefore distraction did not require inhibition of reflexive responding in these circumstances and thus preserved executive control. Hence, when taking the findings from previous research supporting distraction and the present findings, the circumstances that distraction is undertaken influences the extent to which it impairs executive control, and further supports the suggestion that it is only when distraction involves substantial inhibiting of reflexive responding occurring within a circumstance that it impairs subsequent self-control.

Alternative explanations for why acceptance may preserve executive resources in high-threat circumstances but deplete them in low-threat circumstances (in studies 7.1 and 7.2) comes from previous research on the effects of meta-cognitive awareness (Ben-Zeev et al., 2005; Johns et al., 2008; Schmader et al., 2009) and engagement in late reappraisal

(Sheppes & Meiran, 2008) on subsequent executive control. One alternative explanation is that acceptance may represent meta-cognitive awareness, relating specifically to being aware of thinking, feeling and to actively changing interpretations of particular thoughts and feelings (as distinct from objective self-awareness of simply observing one's response). A study by Schamder et al. (2009) placed participants in threatening circumstances and then prompted them to interpret affect and bodily sensations in alternative or more benign ways. Those who interpreted their feelings in more benign ways subsequently showed better executive control. It may be that, in the present study, acceptance (supporting meta-cognitive awareness), led participants to interpret their affective states differently in high and low-threat circumstances, with this alternative interpretation being less mentally demanding in high-threat circumstances leading to superior executive control relative to developing an alternative interpretation in low-threat circumstances and thus resulting in the discrepancy in executive control. Studies by Sheepes and Meiran (2009; 2007, 2008) have suggested that reinterpreting stimuli once an individual has become entrenched in an emotional response to that stimulus and has already begun to make meaning of affective stimuli, is effortful and executive resource depleting. These results suggest that the more familiar the individual is with the affective stimuli, the more effortful they will find it to change their interpretation of them. Altering the meaning of an affective state, that is entrenched possibly because it is consistent with an individual's usual pleasant affective state (e.g., affect experienced in low-threat circumstances), may therefore be effortful and executive resource depleting. However, altering the meaning of such stimuli in high-threat circumstance may have been less effortful due to it facilitating an alteration of an already unpleasant state that an individual does not usually experience. Hence, meta-cognitive awareness and changes to interpretations of affective stimuli an alternative explanation to objective self-awareness theory and cognitive motivation theory of altering attention focus as to why acceptance led to impaired executive control in low-threat circumstances and preserved executive control in high-threat circumstances.

8.1.3.4. Summary of Influences on the Utility of Distraction and Acceptance

In summary, the findings from the comparisons made between distraction and acceptance aided the understanding of how imposed regulation strategies can impact on attentional focus, affect, vagal tone and executive control. When comparing the findings of the present research with previous studies, it was emphasised that contextual factors (e.g., time period for evaluation, threat/affective level of circumstances, timing of regulation strategy in relation to affective stimulus) in which both distraction and acceptance are evaluated will influence each strategy's effects on attentional focus, affect, vagal tone, and executive control. The overall patterns for distraction appears that if the strategy is engaged in during the anticipation of a threat or affective stimulus it is likely to result in increased affect, reduced vagal tone and impaired executive control. This is in contrast to if distraction is engaged in during or subsequent to exposure to that stimulus, where it is likely to reduce affect, increase vagal tone and preserve executive control. In contrast, acceptance, during engagement, is effective in reducing affect during the anticipation, exposure, and recovery from an affective stimulus, as long as engagement can be sustained for a period longer than 10 minutes. However, subsequent to engagement, acceptance may result in increased affect. In addition, acceptance may only be beneficial in reducing affect and preserving executive control in high-threat/affective circumstances, and may actually be counterproductive in reducing affect and preserving executive control in low-threat circumstances. It was argued that imposed regulation involves mental control to the extent that it runs counter to the reflexive responses dominant within the situation, and this mental control often results in increased affect and impaired executive control.

8.1.4. Are Executive Control Differences Between Conditions Explained by a Physiological Mechanism?

Chapter 2 (the literature review) presented two possible physiological pathways that may account for different levels of executive control. The first, drawn from the neurovisceral account (Thayer et al., 2009; Thayer & Lane, 2000), was that increased vagal inhibition of arousal influences the central autonomic network, decreasing amygdala activation and increasing activation in the prefrontal cortex, supporting executive control. Consistent with this link between arousal and executive control, increased vagal tone (representing regulated responding that inhibits arousal) has often co-occurred with superior executive control (Croizet et al., 2004; Hansen et al., 2003; Hansen, Johnsen, & Thayer, 2009; S. C. Segerstrom & Sloberg-Nes, 2007; Thayer et al., 2009). In addition, previous research has shown that increased arousal resulting from a stressor co-occurred with impaired executive control (Croizet et al., 2004; Lavric et al., 2003; Shackman et al., 2006; Sorg & Whitney, 1992). The second potential pathway presented was drawn from a physiological resource account, linked to self-regulatory strength theory, that proposes that blood glucose is vital to supporting effortful mental processes required when engaging in tasks requiring executive control, and that regulation can deplete blood glucose levels resulting in diminished levels to support further acts requiring these same reserves to support requiring self-control (Gailliot et al., 2007).

Study 7.5 tested the presence of a relationship between vagal inhibition and arousal variables as potential explanations for the impacts that the imposed threat and regulation strategies had on executive control. In study 7.5, the threat and regulatory conditions that displayed a pattern of increased vagal inhibition towards the end of the regulatory period also displayed better executive control in absolute terms, but increased vagal inhibition did not correlate significantly with superior executive control. Increased arousal (indicated via increased HR) was associated with poorer executive control on both response inhibition and working memory. However, the differences between the experimental conditions in executive control still remained when heart rate was statistically controlled. Thus, the present research did not support the suggestion that vagal tone and arousal during the regulatory period mediated the impact of threat or regulation strategy on executive control. In addition, the co-occurrence of low resting baseline vagal tone and poor executive control found in previous studies (eg., Hansen et al., 2003; Hansen, Johnsen, & Thayer, 2009; S. C. Segerstrom & Solberg Nes, 2007; Thayer et al., 2009) was not found in the present research. These previous studies did not involve exposure to threat in combination with regulation prior to engagement in executive control tasks, rather they involved either regulation (S. C. Segerstrom & Solberg Nes, 2007) or threat (Croizet et al., 2004; Hansen, Johnsen, & Thayer, 2009) but not both together. Hence, the underlying physiological explanation of decreased vagal tone, increasing amygdala activation and decreasing activation in the prefrontal cortex, did not account for executive control differences amongst the threat and regulatory conditions. Rather, the results of the present research suggest that the combination of threat and regulation removes the usual relationship noted between baseline resting vagal tone and heart rate and executive control.

The differences in executive control found between the threat and regulatory conditions in studies 7.2 and 7.3 were best explained by the self-regulatory strength account of executive control impairments. This account emphasises a depletion of limited reserves of energy. Hence, it is very consistent with the physiological mechanism of decreased blood glucose as being the cause of executive control impairments. Several studies (Benton et al., 1994; Gailliot et al., 2007; P. Y. Martin & Benton, 1999; Scholey et al., 2001) have suggested that blood glucose is required to fuel intensive brain activity that supports sustained, attentive and flexible responding and the performance required for tasks required for executive control[yy]. It may be that threat and regulatory strategies deplete glucose levels in the blood, and this reduction in blood glucose overrides the positive relationship between baseline vagal tone and executive control. Thus, the possible explanation for disconnect between resting baseline vagal tone with executive control is that imposed threat and affect regulation strategies utilise the more sensitive physiological pathway, unrelated to vagal tone, of reducing blood glucose and impairing executive control.

8. 1.5. A Synthesis of the Effects of Distraction and Acceptance: The Two Step Model

From the foregoing discussion, it is apparent that explaining how distraction and acceptance influenced attention, affect and executive control is best achieved through the integration of several theories of affect regulation (Gross & Thompson, 2007), self-regulation (Carver and Scheier, 1982; Duval & Wicklund, 1972), and the automatic and controlled attention to threat-stimuli (Bar-Haim, et al., 2007; Mogg & Bradley, 1998). The unique account proposed in this thesis is referred to as the two-step regulatory model (presented in Figure 8.1) presents a proposed integration of these theories and provides a figural synthesis of the interpretations of the findings of the present research.

This two-step model begins with cognitive motivational accounts of attention involving the reflexive bottom-up influences over attentional allocation to peripheral

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[yy] *Other studies (e.g., Kurzban, 2010; Molden, Hui, Scholer, Meier, Noreen, D'Agostino & Martin, 2012) have not found a link between blood glucose and executive control or diminishing blood glucose as a result of an initial self-regulatory task, so the glucose depletion mechanism is suggested tentatively.*

stimuli followed by a pre-conscious evaluation of those stimuli and either sustained or disengaged subsequent attention. This first step in the model represents primitive reflexive regulatory processes where threats engage attention and this rigidly promotes the survival responses of fight, flight or freeze. These primitive reflexive responses, although vital when encountering physical threats, are often not appropriate to the more ambiguous threats experienced in work and social environments of adults in modern, industrialised societies. When initiated, these reflexive responses may complicate attempts to engage in more flexible, controlled responding that is better suited to such diffuse ambiguous threats.

The second step in the model introduces components included in affect and self-regulatory models, specifically, controlled attention and controlled evaluation/appraisal. These components require top-down processes and are aimed at promoting higher-order goal achievement (e.g., positive self-view) rather than primitive urges (e.g., safety). The habitual or spontaneous initiation of these top-down processes in a circumstance may occur as a consequence of over-learning. However, these spontaneously initiated top-down processes still involve adjusting attentional and thought processes that differ from the automatic reflexive processes, regarding the time duration over which they are initiated and the level of cognitive resource required for their initiation and maintenance (if required). Hence, a situation may elicit a reflexive regulatory reaction and this, depending upon the time an individual has available to respond and whether or not control processes are being used for an alternative task, may also result in a controlled regulatory response in the form of altering the reflexive attentional focus or altering the meaning of the stimulus from its reflexive automatic evaluation. Hence, this model predicts that it is the combination of these two steps (automatic, reflexive, bottom-up regulatory processes and the top-down, controlled, regulatory processes) that influences the frequency, intensity and duration of affect that will be experienced and the amount of executive resources that will be utilised.

The level of affect that the two-step model predicts individuals will experience depends on the level of attentional allocation (both reflexive and controlled) provided to the stimulus and how threatening it is evaluated (by reflexive and controlled processes) to be. The more attention (reflexive and controlled) is allocated to a stimulus, the more affect will be experienced, unless the attention results in an interpretation that the stimulus is of low-threat value. If attention to the threat is inhibited or if the deployment of attention allows or facilitates an appraisal of the stimulus that is more benign than the reflexive evaluation, then anxious affect will be reduced.

The depletion of executive resources predicted by the two-step model depends upon the extent to which top-down regulatory processes operate to inhibit the automatic reflexive processes occurring in response to threat, with greater inhibition of reflexive responses by the controlled processes being more depleting of executive resources. In addition, if an attentional load (engaging top-down processes) is imposed, the controlled regulatory processes usually used to maintain comfortable levels of affect are impaired, thus unveiling the automatic reflexive responses to dominate the system and leading to dysregulated affect and depleted executive resources.

The two step model presented in Figure 8.1 starts by presenting two possible situations: in the first, the stimulus is of high-threat value and in the second, it is of low-threat value. Peripheral, novel stimuli that reflexively attract attention will be automatically evaluated and, if evaluated to be of high-threat value, will be momentarily allocated increased attention (Bar-Haim et al., 2007; Mogg & Bradley, 1998). If the individual evaluates the stimulus as a threat but subsequently determines, via controlled processes, that a fight, flight or freeze response is not appropriate, then the individual is likely to spontaneously initiate a controlled regulatory process. The first of these spontaneously initiated controlled regulatory processes is to inhibit the reflexive response of attending to the threat stimulus and thus avoid experiencing anxious affect (Carver & Scheier, 1988; Duval & Wicklund, 1972; Mogg & Bradley, 1998). Because this spontaneously initiated controlled process actively seeks to inhibit an automatic, reflexive process, it is effortful and depletes executive resources (Muraven & Baumeister, 2000). In contrast, low-threat circumstances that do not greatly facilitate attention towards mildly threatening stimuli (Bar-Haim et al., 2007; Mogg & Bradley, 1998; Wilson & MacLeod, 2003), do not trigger spontaneous control process attempts to inhibit attentional reflexes, and thus pleasant levels of affect are maintained and executive resources are not depleted.

In Figure 8.1, the arrows down to the executive resource expenditure box indicate when components of the controlled regulatory processes in particular circumstances are inconsistent with the automatic reflexive regulatory processes and likely to deplete executive resources. Lastly, the impacts of a distraction or suppression task is represented in the model as consuming controlled processes that support more effective forms of controlled regulation, exposing the reflexive regulatory responses, dysregulating affect and depleting executive resources.

In summary, the two-step model sets out a sequence involving two regulatory processes to represent underlying affect regulation mechanisms. These two underlying mechanisms are best represented as (1) automatically initiated, bottom-up, reflexive regulatory processes, and (2) top-down, conscious and goal directed controlled regulatory processes. Although other models have suggested that some affect regulation may be automatic and some under conscious control (Gross & Thompson, 2007; Lazarus & Folkman, 1984), the few that have incorporated this distinction explicitly within their models have been more centred on the disruption of behavioural goals (Bar-Haim et al., 2007; Carver & Scheier, 1988; Mogg & Bradley, 1998) rather than affect regulation. In addition, the two step model is the first model to attempt explicitly to provide the components of top-down processes and bottom-up processes that enable more reliable predictions of when executive resource depletion is likely. Hence, this two step model provides a unique integrated perspective on how reflexive and controlled processes combine to result in a particular focus of attention, levels of arousal, and the ability to demonstrate executive control.

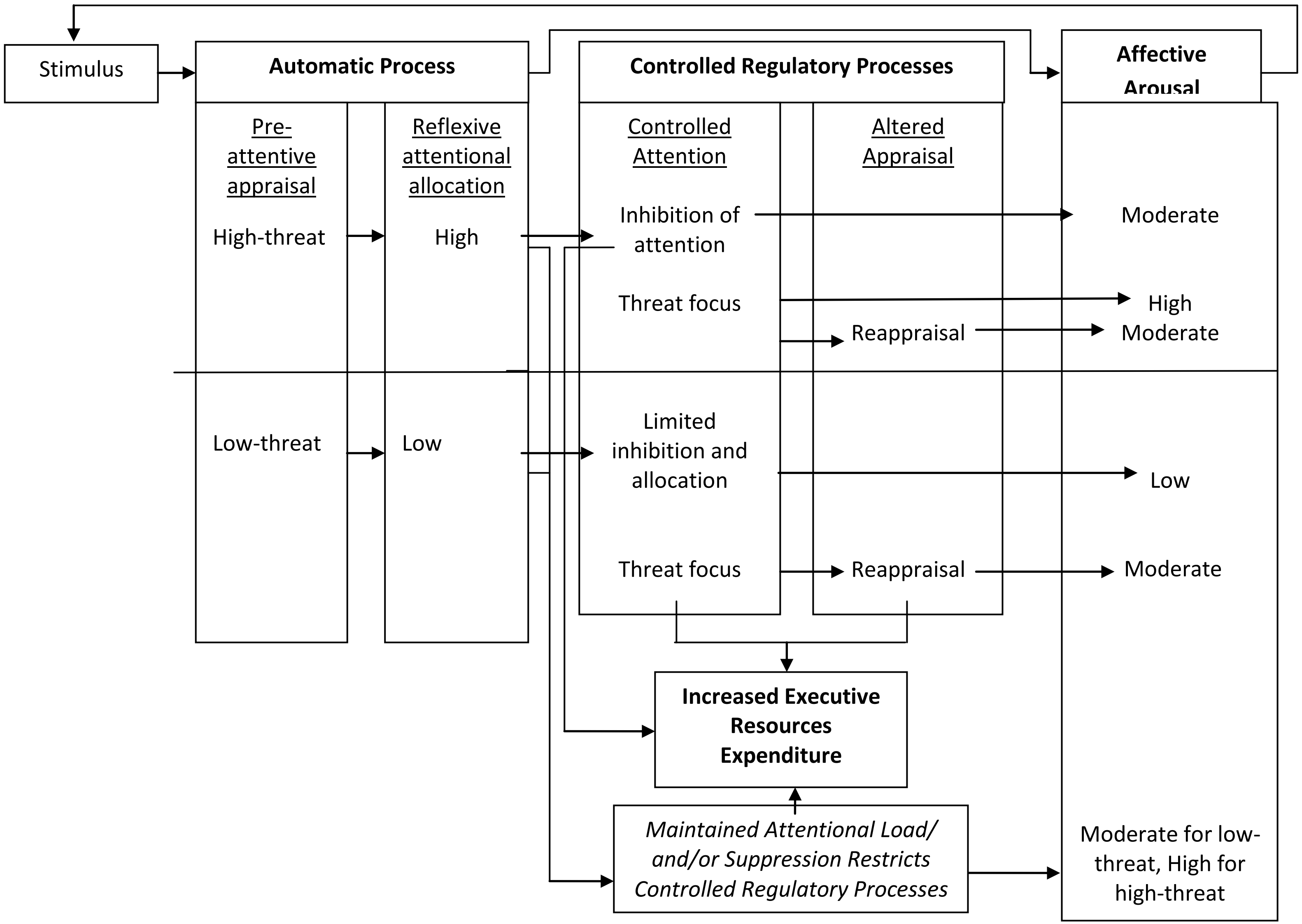


Figure 8.1. Two Step Model of Automatic and Controlled Regulatory Processes Influencing Affect and Executive Resource Depletion

8.2. Practical and Clinical Implications

There are several clinical implications of the present research regarding informing individuals of the autonomic and the costs to executive control they are likely to incur when entering particular situations, and what forms of controlled regulation strategy they may choose to undertake in that situation. There are also implications for the long-term outcomes of the experience of increased affect and reduced executive control. These are important because sustained periods of increased exposure to stress and anxiety can increase risk of health (Bleil et al., 2008; Esch et al., 2002) and mental health problems (Hammen, 2005). In addition, impaired executive control may result in impaired educational performance (Schmeichel et al., 2003), poor calorie intake restriction (Heatherton et al., 1991; Heatherton et al., 1993; Herman et al., 1987), and increased aggression (DeWall et al., 2007). The first major implication relates to increased threat and the influence of regulation in limiting the affective and executive control deficits associated with increased threat, the second to the use of distraction and acceptance and when these strategies are likely to be effective in reducing affect. The third implication relates to when distraction and acceptance are likely to impair or preserve the capacity to demonstrate executive control.

Firstly, the present findings indicate that the unpleasant effects of increased threat on anxious affect are unlikely to be eliminated by regulation, with high-threat circumstances resulting in increased affect no matter what regulation strategy adopted. Hence, if reflexive attention and evaluations cannot be altered, behavioural strategies for threat avoidance, such as predicting threats and finding less threatening situations in which to achieve behavioural goals are likely to be most effective in reducing exposure to the harmful effects of sustained affect. However, when behavioural avoidance of threat circumstances may impair social and occupational functioning, controlled cognitive regulation may partially moderate the level of affect experienced in higher threat circumstances, making it more manageable if not fully eliminating the increased risk of negative outcomes from remaining in a threatening environment.

To preserve the capacity to demonstrate executive control, a practical strategy may be to identify what the reflexive responses may be in particular situations and to identify a regulation strategy that does not merely seek to inhibit these reflexive responses but rather to transform them into relevant and functional responses to the situation. If controlled regulation can limit the extent to which reflexive responding is inhibited, this may eliminate the negative impacts of increased threat on executive control. However, increased threat is likely to lead to subsequent impairments in acts requiring executive control, especially as exposure to threat becomes increasingly prolonged.

Secondly, the practical use of distraction through focused attention towards a response generation task under *anticipated* threat circumstances lacks support for use in reducing affect during engagement, subsequently, in reducing affective reactivity or in promoting affective repair. However, distraction used in the recovery from threat (i.e., affective repair) may still provide a benefit in accelerating affective recovery (Augustine & Hemenover, 2009). The present research suggested that distraction in anticipated threat circumstances, like suppression, has paradoxical effects on attentional focus which lead to increased affect and impaired executive control. Rather than providing a task that provides an attentional load (e.g., the present study's manipulation of distraction), training of attentional refocusing (e.g., rehearsal of altering attentional focus from threat-stimuli to naturally occurring environmental stimuli) may be a more useful intervention strategy for those experiencing increased anxiety as a result of anticipated threats (Baert et al., 2012; Dandeneua et al., 2007). Thus, imposing an attentional load during the anticipation of threat is likely to lead to subsequent increased affect, and is not recommended if seeking to reduce anxiety.

In contrast to distraction, the use of acceptance during anticipation of threat does receive support, albeit with limitations. When considering the results of studies 6.1 and 6.2 together with Hofmann et al. (2009) and Dunn et al., (2009), the evidence suggests that, for acceptance to be an effective strategy, it must be initiated in moderately high affect-arousing circumstances and must be used continually as the situation changes (throughout anticipation, to threat engagement, and threat recovery) for sustained benefits to be noted throughout such changing circumstances. If the strategy of acceptance cannot be continued as the situation changes, the strategy is likely to be counterproductive (study 6.2 and Dunn et al.). Therefore, individuals intending to use the strategy may need to practice using the strategy under different circumstances, and constantly remind themselves to adopt the approach as the situation changes (Hofmann, et al., 2009). However, acceptance may not lead to experiencing subjectively less anxious affect despite physiological arousal being reduced, hence clients with physiological symptoms may benefit more from acceptance than those seeking to reduce subjective anxiety.

The implication from the present research for distraction's impact on executive control was that, in anticipated threat circumstances, maintaining an attentional load impaired subsequent ability to demonstrate executive control. Importantly, previous research suggests that distraction in the presence of unpleasant affect, not in anticipatory circumstances, can preserve the capacity to demonstrate self-control (Alberts et al., 2008; Sheppes & Meiran, 2008). Hence, any possible benefits to executive control arising from maintaining an attentional load may be specific to the circumstances in which it is undertaken. However, undertaking distraction in anticipated threat is likely to lead to impaired decision making in social, health and educational contexts and is not recommended for clinical use in these anticipated threat situations.

The effect that acceptance had on executive resources is also of importance to clinical practice. The present study is consistent with the previous research by Heatherton et al. (1993) showing that increased awareness of affect and threats in high-threat circumstances preserves the ability to exercise self-control. The present research extends these findings by showing that increased self-awareness (facilitated by acceptance) can preserve executive control, even after prolonged exposure to threats (study 7.3). However, the present study also further extended Heatherton et al.'s (1993) study by showing that increased self-awareness in low-threat circumstances can actually lead to impairments in self-control. The clinical implication of this is that increased awareness of mild threats and affect *increase* a person's vulnerability to submit to temptation or to automatic, rigid responding. Thus, acceptance is not recommended in low-threat circumstances. Thus, the context in which this strategy is used needs to be carefully considered to determine whether it will provide benefit in reducing affect and preserving executive control.

In summary, in recommending strategies to individuals, the outcome sought, whether it is to reduce affect or to preserve self-control needs to be taken into account. This is due to some strategies reducing affect but not preserving executive control, and vice versa. Thus, in some situations where one outcome will be preferred over others, achieving this outcome may occur to the detriment of another.

8. 3. Methodological and Interpretive Limitations

There are several potential methodological factors that have not been discussed during the previous chapters that constrain some interpretations of the results presented in chapters 5, 6 and 7. These include the method of manipulating the regulatory strategies, absence of measurement of participant interpretation of affective responses, skill of participants in using the strategies, the extent that experimental conditions altered motivation or beliefs about executive resources, the psychometric properties of physiological measurement, and the limited application to clinical population.

First, the tasks that were used to facilitate the engagement in regulation strategies require deeper consideration. These tasks were not presented to participants as being designed specifically to regulate emotions. Instead, they were presented as preparation for providing written responses to be assessed for their creativity. Although the use of this instruction was designed to reduce participants' demand awareness, it did not necessarily give participants the conscious motivation to use the task to alter their affective state in the way that engaging in a regulation strategy might outside of an experimental laboratory situation. Other studies (Dunn et al., 2009; Hofmann et al., 2009; Richards & Gross, 2000; Sheppes & Meiran, 2007) do present instructions as affect regulation and do not give such consideration to minimising demand awareness, with the contributions of this demand awareness towards the differences in outcomes noted between the present study and previous studies being unknown. Hence, future research could investigate whether the way that the strategies are manipulated by different activities or by giving participants different information about the purpose of particular tasks influence the utility of the strategies in reducing anxious affect and preserving executive control.

Another issue with regulation strategy manipulation was that there was limited opportunity for the participants to tailor the strategy to make it suitable for the situation that they were in. Regarding distraction, generating different uses for donkeys, ponies and horses by imagining them in different settings may not have been particularly suitable for providing a distraction in anticipated threat situations, as opposed to an active card sorting strategy (Blagden & Craske, 1996) or completing arithmetic tasks (Van Dillen & Koole, 2007), as these are more typical working memory tasks that have been suggested to more fully consume participant attention and limit attention to threats, rather than a response generation task. The manipulation of acceptance was not tailored to the different threat levels, but was based on scripts provided by reputable sources on mindfulness and acceptance-based regulation of affect (Roemer & Orsillo, 2009). Both threat levels using acceptance were asked to focus their attention on any negative thoughts and feelings, however, the low-threat condition may not have been experiencing many negative thoughts or feelings at the time and the script may not have given participants the flexibility to focus on other thoughts and feelings. This limitation may have influenced the physiological results (HRV and HR) during engagement in acceptance when anticipating the threats in study 6.1, which showed acceptance leading to increased arousal particularly when participants were asked to turn to unpleasant thoughts and feelings. Furthermore, asking participants to focus on negative thoughts and feelings if they are not the dominant feature being experienced may also explain why acceptance was reported as more difficult and more effortful in the low-threat level relative to the high-threat level (study 7.1), and led to worse performance in inhibiting prepotent responses (study 7.2). Furthermore, not tailoring the acceptance instructions to each threat level manipulation may also not have allowed the participant to accept their thoughts and feelings specifically about the anticipated activity and therefore may explain why the acceptance conditions responded with increased affectivity to the threat manipulation tasks and slower affective recovery in study 6.2. Hence, future research may benefit from giving more flexible instructions to account for different tasks/situations, and thoughts and feelings experienced when manipulating these regulation strategies.

The present research did not measure an individual's integration of affect with logical thought as per the sequence of steps to affect reduction proposed by the process of a feeling model. Rather, integration was assumed to occur as participants became increasingly aware of the threat-stimuli and their affect. Therefore, participants were possibly not integrating the affective experiences and detaching from the affective experience once it became too unpleasant. Previous research into the mindfulness construct has shown that awareness is not always associated with reduced affect or reduced use of maladaptive regulatory strategies. Bayer, Smith, Hopkins, Krietermyer and Toney (2006) showed that awareness of emotions and bodily sensations can be associated with increased reported dissociation (tendency to detach from present situation including internal and external stimuli). Furthermore, Bayer et al., (2008) have also shown that awareness accounts for no variance in psychological wellbeing after controlling for other factors associated with acceptance (such as non-judgement or non-reactance). Hence, the present research and previous studies such as Dunn et al. (2009) may simply contribute to our understanding of how increased awareness can lead to increased detachment from affective responding, leading to subsequent increased reactivity and increased affect noted in study 6.2. Some more appropriate measures demonstrating integration of affect and logical thought or at least a lack of detachment in experimental circumstances may rule out this possibility.

It is a key assumption of the present research and previous research (Hofmann et al., 2009; Dunn et al., 2009) that experimenter manipulation of acceptance would lead to less evaluative thinking. However, this assumption contradicts the predictions of Duval and Wicklund's objective self-awareness theory that increased observation of the self and responding would automatically initiate such evaluative and self-critical thoughts. In the present research, the acceptance conditions did not demonstrate less judgemental or less evaluative thoughts than other strategies when participants were directing attention towards themselves (no differences between regulation strategies on rumination shown in chapter 5). Furthermore, individuals' appraisals of their affective responses were not assessed, so the acceptance conditions could not be shown to be different from distraction or the mind-wandering control condition in the way they interpreted their affect , which would be a stronger test of the cyclical version of the modal model or meta-awareness theory. The assumption that acceptance does indeed lead to some kind of integration of the affective experience with reason and restricts spontaneously initiated self-evaluation, should be explicitly tested in future research. Furthermore, appraisals of affective responses should be measured to determine whether individuals engaging in experimental investigations of acceptance appraise negative thoughts and feelings differently (Wells, 2009; Wells & Cartwright-Hatton, 2004).

A final criticism of the acceptance manipulation is that it may have more accurately reflected relaxation. However, the results from study 6.1 demonstrate that participants in the acceptance condition did not report being more relaxed, or demonstrate lower arousal through the regulatory period. Importantly, the acceptance condition reported and physiologically showed increased anxious affect during the regulatory period in comparison to the mind-wandering control condition, suggesting that participants were not simply undertaking relaxation. Hence, the data from study 6.1 are not readily explained by interpreting the strategy of acceptance as a relaxation condition.

The participants in the present research were provided with regulation strategies but their level of experience using these strategies is unknown. It may be that with increased practice, individuals can use a strategy more effectively to reduce affect. Furthermore, practice may render the strategy less depleting of executive resources. Hence, the present research findings cannot explain how effective or costly the strategy is to executive resources when it is highly rehearsed. Future research should test whether training and rehearsal of distraction and acceptance influences the utility of the strategies.

Muraven & Slessareva, (2003) demonstrated that differences in participant motivation and beliefs about executive resources can influence performance on the executive control task that indicating executive resource depletion. From these findings it may be suggested that the regulation strategies may have influenced participant motivation. However, this explanation appears unlikely as the influence of the regulation strategies did not uniformly impact on executive control across both threat levels. Despite motivation being a possible explanation, the present results cannot indicate whether resource depletion occurred due to exhaustion and fatigue, or because participants were motivated to preserve limited resources. Because, it remains unclear how a regulation strategies, such as acceptance and mind-wandering, may be motivating in one circumstances and not in another, an explanation concerning motivations remains implausible until further research is conducted.

A larger issue, relevant to research evaluating the effectiveness of affect regulation strategies using physiological measures, is the limitation of the psychometric properties of HR as an indicator of anxiety and HRV as an indicator of regulated responding. Physiological variables, particularly HR and HRV have all been suggested to provide indicators of the energetical requirements of an organism (Jorna, 1992; Wientjes, 1992). These energetical requirements result from a flight or fight or response that is associated with the subjective experience of tension and anxiety that occurs particularly under threat (physical and social). However, the same physiological response can be found when undertaking mentally demanding tasks due to the energetical requirements associated with them and, hence, HR and HRV have been considered indicators of mental workload (Jorna, 1992) with central parasympathetic influences of HRV reduced during mentally demanding tasks (Althaus et al., 1998). It could be argued that threats impose a situation that requires an individual to focus their attention, and engage in planning or regulatory attempts to avoid or cope with the threat, which indeed imposes a mental workload and therefore increases HR and decreases in HRV result. However, an important consideration regarding these physiological variables is that they may reflect differences in mental workload rather than anxiety, particularly when considering the regulation strategies. When observing the HR and HRV results from study 6.1, in the third regulatory epoch, and the reported effort results in 7.1, there is a consistent pattern amongst the regulatory conditions, of similarity between effort and HR and HRV. Hence, it is possible that engagement in distraction imposes a high mental workload on participants reflected as increased HR and decreased HRV, rather than increased affect.

Lastly, although the present research advanced understanding of how effective acceptance may be for healthy undergraduate populations, its application to cases with severe anxiety or clinical cases with disorders relating to self-control may be limited. Previous research has investigated the impacts of experimentally manipulated acceptance on individuals with anxiety and mood disorders when watching affective content and demonstrated reduced HR relative to suppression (Campbell-Sills et al., 2006). Hence, the present research is consistent with the findings from this sample, in that acceptance led to reduced arousal relative to an anti-experiencing strategy in affectively arousing circumstances. Considering the scope and size of the present research, it was not possible to recruit a clinical sample of 180 participants to randomly allocate to conditions. However, the results of the present research provide a point of reference smaller studies involving clinical samples to further test the proposed explanations for how affect may be best regulated and to preserve executive resources in high- and low-threat circumstances.

8. 4. The New Questions and Directions for Future Research

The present research assessed the focus of attention, but did not assess the extent to which online attentional resources were available. Objective assessments of incidental attention to information presented in the environment while participants were regulating have been used in previous studies (Richards & Gross, 2000; Sheppes & Meiran, 2008). Sheppes and Meiran (2008) have demonstrated that the usage of online attentional resources by a strategy does not necessarily lead to impaired executive control. The present research suggested that attentional focus to some stimuli may be more effortful than to others, and this may differ according to circumstance, which may explain how directing online attentional resources to a particular set of stimuli may sometimes be relatively effortless and not result in impairments in executive control. Nevertheless, future research could further investigate the circumstances under which online use of attentional resources does and does not deplete executive resources.

Lastly, the impacts of affect regulation on individuals of different trait tendencies to experience affect could be investigated in light of the two step-model proposed. For example, high trait-anxious individuals have more reflexive initial attentional bias to engage with threat (Bar-Haim et al., 2007) but also subsequently display greater attentional diversion from threat than low trait anxious individuals (Derryberry & Reed, 2002; Koster et al., 2006; Koster et al., 2005; Mackintosh & Mathews, 2003). From this, the two-step model predicts that altering attentional focus of high trait-anxious individuals through acceptance may provide alternative affective outcomes and perhaps reduce the impacts of increased threat on executive resource depletion. It has been demonstrated that high trait-anxious individuals show impaired executive control (Derakshan & Eysenck, 1998; Eysenck et al., 2005; MacLeod & Donnellan, 1993) in the presence of a threat or stressors (Eysenck, 1985; Sorg & Whitney, 1992). Hence, based on the two-step model proposed, it may be that, where high-threat would usually lead to excessive inhibition and impairment in executive control, the supporting of the reflexive focus of attention may reduce the level of executive resources depletion and result in less impaired performance. In contrast, the opposite should be true of low trait anxious individuals. Such potential exists for other individuals such as those who are high in levels of narcissism (being particularly sensitive to threats to their positive self-views) to be investigated (Besser & Priel, 2010; Bushman & Baumeister, 1998; A. L. Pincus et al., 2009) to determine the extent to which regulation influences their attentional focus or reduces the negative impacts of threat on the ability to demonstrate self/executive-control.

8. 5. Concluding Remarks

This thesis evaluated the impacts of the two cognitive affect regulatory strategies of distraction and acceptance, under different threat levels, on altering attentional focus, restricting use of maladaptive regulatory strategies, reducing anxious affect, and preserving executive control. The findings suggested that the imposed strategies alter spontaneously initiated regulation that compete for the same control processes required for top-down, goal-directed regulation producing different outcomes on attentional focus, affective responding and the capacity to demonstrate executive control. Distraction was shown to disrupt spontaneous regulatory attempts to divert attention from threats, leading to increased arousal and impaired executive control. Acceptance encouraged attentional focus to threats and affect, which led to increased affect and arousal. However, acceptance did preserve executive control in high-threat circumstances, although it impaired capacity in low-threat circumstances.

A two-step model of affect regulation was proposed to explain the current findings. This two-step regulatory model includes both immediate, bottom-up, reflexive, primitive regulatory responses and slower-acting, top-down, controlled regulatory processes. The interaction of these two regulatory processes accounts for the impact of both spontaneous and imposed regulation on attentional focus, affect, and executive control in high- and low-threat circumstances. This model accounts for the time course of an individuals' reflexive attentional and physiological responses to threats, and controlled responses to these reflexive responses including attentional inhibition or reappraisal of stimuli, and their resulting consequences for resources available to demonstrate executive control. The findings from the present research, when placed within this two-step model suggest that seeking to inhibit one's own primitive responses to threat may reduce affect but can harm one's subsequent attempts to demonstrate executive control. In addition, rigid regulation requiring the maintenance of attentional load (irrelevant to the situation), as exhibited by those undertaking distraction, disrupted one's ability to effectively inhibit reflexive responses and increased attention to threats, reducing regulated responding and increasing physiological arousal.

A concluding message that best summarises the interpretation of the findings of this thesis is that the primitive attentional and affective responses need to be incorporated (e.g., organised in combination) within a controlled response, rather than inhibited, to preserve the ability to show further regulated responding. However, this incorporation of reflexive responses with controlled responses may lead to initial increases in arousal and a heightened subjective experience of affect which individuals would understandably want to avoid. Neither avoidance nor awareness of threat and affect results in reduced affect and superior executive control. Hence, some level of recognition of one's dominant reflexive response may be vital in determining what controlled regulation, if any, is required to result in a beneficial affective or cognitive outcome.

References

Abramwitz, J. S., Tolin, D. F., & Street, G. P. (2001). Paradoxical effect of thought suppression: A meta-analysis of controlled studies. *Clinical Psychology Review, 21*, 683-703. doi: 10.1016/S0272-7358(00)00057-X

Akselrod, S., Gordon, D., Ubel, F. A., Shanno, D. C., Barger, A. C., & Cohen, R. J. (1981). Power spectrum analysis of heart rate fluctuation: A quantitative prober of beat-to-beat cardiovascular control. *Science, 213*, 220-222.

Alberts, H. J. E. M., Martijn, C., Nievelstein, F., Jansen, A., & De Vries, N. K . (2008). Distracting the self: Shifting attention prevents ego depletion. *Self and Identity, 7*, 322-334. doi: 10.1080/15298860801987583

Albinet, C. T., Boucard, G., Bouquet, C. A., & Audiffren, M. (2010). Increased heart rate varibility and executive performance after aerobic training in the elderly. *European Journal of Applied Physiology, 109*, 617-624. doi: 10.1007/s00421-010-1393-y

Althaus, M., Mulder, L.J.M., Mulder, G., van Roon, A. M., & Minderaa, R. B. (1998). Influence of respiratory activity on the cardiac response pattern to mental effort. *Psychophysiology, 420-430*, 420-430. doi: 10.1111/1469-8986.3540420

Amat, J., Baratta, M. V., Bland, S. T., Watkins, L. R., & Maier, S. F. (2005). Medial prefrontal cortex determines how stressor controllability affects behaviour and dorsal raphe nucleus. *Nautre Neuroscience, 8*, 365-371. doi: 10.1038/nn1399

Antony, M. M., Bieling, P. J., Cox, B. J., Enns, M. W., & Swinson, R. P. (1998). Psychometric properties of the 42-item and 21-item versions of the depression anxiety and stress scales in clinical groups and a community sample *Psychological Assessment, 10*, 176-181. doi: 10.1016/j.jad.2008.01.023

Appelhans, B. M., & Luecken, L. J. (2006). Heart rate variability as an index of regulated emtoinal responding. *Review of General Psychology, 10*, 229-240. doi: 10.1037/1089-2680.10.3.229

Arch, J. J., & Craske, M. G. (2006). Mechanisms of mindfulness: Emotion regulation following a focused breathing induction. *Behaviour Research and Therapy, 44*, 1849-1858. doi: 10.1016/j.brat.2005.12.007

Asendorpf, J. B., & Scherer, K. R. (1983). The discrepant repressor: Differentiation between low anxiety, high anxiety, and repression of anxiety autonomic-facial-verbal patterns of behavior. *Journal of Personality and Social Psychology, 45*, 1334-1346.

Asplund, C. L., Todd, J. J., Snyder, A. P., & Marois, R. (2010). A central role for the lateral prefrontal cortex in goal-directed and stimulus-driven attention. *Nautre Neuroscience, 13*, 507-512. doi: 10.1038/nn.2509

Augustine, A. A., & Hemenover, S. H. (2009). On the relative effectiveness of affect regulation strategies: A meta-analysis. *Cognition and Emotion, 23*, 1181-1220. doi: 10.1080/02699930802396556

Austin, M. A., Riniolo, T. C., & Porges, S. W. (2007). Borderline personality disorder and emotion regulation: Insights from the polyvagal theory. *Brain and Cognition, 65*, 69-76. doi: 10.1016/j.bandc.2006.05.007

Baddeley, A. (1996). Exploring the central executive. *The Quarterly Journal of Experimental Psychology 49A*, 5-28. doi: 10.1080/713755608

Baddeley, A. D. (1986). *Working memory*. Oxford, England: Clarendon Press.

Baer, R. A., Smith, G. T., & Allen, K. B. (2004). Assessment of mindfulness by self-report: The Kentucky Inventroy of Mindfulness Skills. *Assessment, 11*, 191-206. doi: 10.1177/1073191104268029

Baer, R. A., Smith, G. T., Hopkins, J., Krietemyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment, 13*, 27-45. doi: 10.1177/1073191105283504

Baer, R., Smith, G. T., Lykins, E., Button, D., Krietemeyer, J., Sauer, S., . . . Williams, J. M. G. (2008). Construct validity of the Five Facet Mindfulness Questionnaire in meditating and nonmeditating samples. *Assessment, 15*, 329-342. doi: 10.1177/1073191107313003

Baert, S., Casier, A. , & De Raedt, R. (2012). The effects of attentional training on physiological stress recovery after induced social threat. *Anxiety, Stress, & Coping, 25*, 365-379. doi: 10.1080/10615806.2011.605122

Bar-Haim, Y., Lamy, D., Pergamin, L., Bakermans-Kranenburg, M. J., & Ijzendoorn, M. H. (2007). Threat-related attentional bias in anxious and nonanxious individuals: A meta-analytic study. *Psychological Bulletin, 133*, 1-24. doi: 10.1037/0033-2909.133.1.1

Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology, 74*, 1252-1265. doi: 10.1037/0022-3514.74.5.1252

Baumeister, R. F., Muraven, M., & Tice, D. M. (2000). Ego depletion: A resource model of volition, self-regulation, and controlled processing. *Social Cognition, 18*, 130-150. doi: 10.1521/soco.2000.18.2.130

Beck, A. T., & Steer, R. A. (1987). *Manual for the revised Beck Depression Inventory.* San Antonio: Psychological Corporation.

Beck, A. T., & Steer, R. A. (1990). *Manual for the Beck Anxiety Inventory*. San Antonio: Psychological Corporation.

Ben-Zeev, T., Fein, S., & Inzlicht, M. (2005). Arousal and stereotype threat. *Journal of Experimental Social Psychology, 41*, 174-181. doi: 10.1016/j.jesp.2003.11.007

Bennett, D. H., & Holmes, D. S. (1975). Influence of denial (situation redefinition) and projection on anxiety associated with threat to self-esteem. *Journal of Personality and Social Psychology, 32*, 915-921. doi: 10.1037/0022-3514.32.5.915

Benton, D., Owens, D. S., & Parker, P. Y. (1994). Blood glucose influences memory and attention in young adults. *Neuropsychologia, 32*, 595-607. doi: 10.1016/0028-3932(94)90147-3

Berntson, G. G., Bigger, J. T., Eckberg, D. L., Grossman, P., Kaufmann, P. G., Malik, M., . . . van der Molen, M. W. (1997). Heart rate variability: Origins, methods and interpretive caveats. *Psychophysiology, 34*, 623-648. doi: 10.1111/j.1469-8986.1997.tb02140.x

Berntson, G. G., Cacioppo, J. T., Binkley, P. F., Uchino, B. N., Quigley, K. S., & Fieldstone, A. (1994). Autonomic cardiac control. III. Psychological stress and cardiac response in autonomic space as revealed by pharmacological blockades. *Psychophysiology, 31*, 599-608. doi: 10.1111/j.1469-8986.1994.tb02352.x

Berntson, G. G., Cacioppo, J. T., & Quigley, K. S. (1993). Respiratory sinus arrhythmia: Autonomic origins, psychological mechnisms, and pscyhophysiological implications. *Psychophysiology, 30*, 183-196. doi: 10.1111/j.1469-8986.1993.tb01731.x

Berntson, G. G., Cacioppo, J. T., & Quigley, K. S. . (1991). Autonomic determinism: The modes of autonomic control, the doctrine of autonomic space, and the laws of autonomic constraint. *Psychological Review, 98*, 459-487. doi: 10.1037/0033-295X.98.4.459

Berntson, G. G., Quigley, K. S., & Lozano, D. (2007). Cardiovascular psychophysiology. In J. T. Cacioppo, L. G. Tassinary & G. G. Berntson (Eds.), *Handbook of psychophysiology* (3rd ed., pp. 182-210). Melboune: Cambridge University Press.

Besser, A., & Priel, B. (2010). Grandiose narcissism versus vulnerbale narcissism in threatening situations: Emotional reactions to achievement failure and interpersonal rejection. . *Journal of Social and Clinical Psychology, 29*, 874-902. doi: 10.1521/jscp.2010.29.8.874

Bieling, P. J., Antony, M. M., & Swinson, R. P. (1998). The state-trait anxiety inventory, triat version: Structure and content re-examined. *Behaviour Research and Therapy, 36*, 777-788. doi: 10.1016/S0005-7967(98)00023-0

Bijl, R. V., Ravelli, A., & van Zessen, G. (1998). Prevalence of psychiatric disorder in the general population: Results of the Netherlands Mental Health Survey and Incidence Study. *Social Psychiatry and Psychiatric Epidemiology, 33*, 587-595. doi: 10.1007/s001270050098

Blagden, J. C. , & Craske, M. G. . (1996). Effects of active and passive rumination and distraction: A pilot replication with anxious mood. *Journal of Anxiety Disorder, 10*, 243-252. doi: 10.1016/0887-6185(96)00009-6

Bleil, M. E., Gianaros, P. J., Jennings, J. R., & Flory, J. D. (2008). Trait negative affect: Toward an integrated model of understanding psychological risk for impairment in cardiac autonomic function. *Psychosomatic Medicine, 70*, 328-337. doi: 10.1097/PSY.0b013e31816baefa

Bloch, S., Lemeignan, M., & Aguilera, T. N. (1991). Specific respiratory patterns distinguish amoung human basic emotions. *International Journa of Psychophysiology, 11*, 141-154. doi: 10.1016/0167-8760(91)90006-J

Block-Lerner, J., Salters-Pedneault, K., & Tull, M. T. (2005). Assesing mindfulnes and experiential acceptance: Attempts to capture inherently elusive phenomena. In S. M. Orsillo & L. Roemer (Eds.), *Acceptance and mindfulness-based approaches to anxiety: Conceptualisation and treatment* (pp. 71-99). New York: Springer.

Bloom, L. J., Houston, B. K., Holmes, D. S., & Burish, T. G. (1977). The effectiveness of attentional diversion and situation redefinition for reducing stress due to a nonambiguous threat. *Journal of Research in Personality, 11*, 83-94. doi: 10.1016/0092-6566(77)90031-9

Bonanno, G. A. , Davis, P. D., Singer, J. L., & Schwartz, G. E. (1991). The repressor personality and avoidant information processing: A dichotic listening study. *Journal of Research in Personality, 25*, 386-401. doi: 10.1016/0092-6566(91)90029-P

Borkovec, T. D. (1985). Worry: a potentially valuable concept. *Behaviour Research and Therapy, 23*, 481-482. doi: 10.1016/0005-7967(85)90178-0

Borkovec, T. D., Alcaine, O. M., & Behar, E. (2004). Avoidance theory of worry and generalized anxiety disorder. In R. Heimberg, C. L. Turk & D. S. Mennin (Eds.), *Generalized anxiety disorder: Advances in research and practice* (pp. 77-108). New York: Guilford Press.

Borkovec, T. D., Robinson, E., Pruzinsky, T., & DePree, J. A. (1983). Preliminary exploration of worry: Some characteristics and processes. *Behaviour Research and Therapy, 21*, 9-16. doi: 10.1016/0005-7967(83)90121-3

Braams, B., Blechert, J., Boden, M. T., & Gross, J. J. (2012). The effects of acceptance and suppression on anticipation and reciept f painful stimulation. *Journal of Behavior Therapy and Experimental Psychiatry, 43*, 1014-1018. doi: 10.1016/j.jbtep.2012.04.001

Bradley, B. P., Mogg, K., White, J., & Millar, N. (1995). Selective processing of negative informatin: Effects of clinical anxiety, concurrent depression, and awareness. *Journal of Abnormal Psychology, 104*, 532-536. doi: 10.1037/0021-843X.104.3.532

Bradley, M. M., Codespoti, M., Cuthbert, B. N., & Lang, P. J. (2001). Emotion and motivation I: defensive and appetitive reactions in picture processing. *Emotion, 1*, 276-298. doi: 10.1037/1528-3542.1.3.276

Braver, T. S., Cohen, J. D., Nystrom, L. E., Jonides, J., & Smith, E. E. (1997). A parametric stuy of prefrontal involvement in human working memory. *Neuroimage, 5*, 49-62. doi: 10.1006/nimg.1996.0247

Brodal, P. (2010). *The central nevous system: Structure and function* (4th ed.). Hong Kong: Oxford University Press.

Bushman, B. J., & Baumeister, R. F. (1998). Threatended egotism, narcissism, self-esteem, and direct and displaced aggression: Does self-love or self-hate lead to violence? *Journal of Personality and Social Psychology, 75*, 219-229. doi: 10.1037/0022-3514.75.1.219

Campbell-Sills, L., Barlow, D. H., Brown, T. A., & Hofmann, S. G. (2006). Effects of suppression and acceptance on emotional responses of individuals with anxiety and mood disorders. *Behaviour Research and Therapy, 44*, 1251-1263. doi: 10.1016/j.brat.2005.10.001

Cardaciotto, L., Herbert, J. D., Forman, E. M., Moitra, E., & Farrow, V. (2008). The assessment of present-moment awareness and acceptance: The Philadelphia Mindfulness Scale. *Assessment, 15*, 204-223. doi: 10.1177/1073191107311467

Carver, C. S. (1979). A cybernetic model of self-attention processes. *Journal of Personality and Social Psychology, 37*, 1251-1281. doi: 10.1037/0022-3514.37.8.1251

Carver, C. S., & Scheier, M. F. (1982). Control theory: A useful conceptual framework for personality-social, clinical, health psychology. *Psychological Bulletin, 92*, 111-135. doi: 10.1037/0033-2909.92.1.111

Carver, C. S., & Scheier, M. F. (1988). A control-process perspective on anxiety. *Anxiety Research, 1*, 17-22.

Carver, C. S., & Scheier, M. F. (1990). Origins and functions of positive and negative affect: A control-process view. *Psychological Review, 97*, 19-35. doi: 10.1037/0033-295X.97.1.19

Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology, 56*, 267-283. doi: 10.1037/0022-3514.56.2.26

Clark, D.L., Boutros, N. N., & Mendez, M. F. (2005). *The brain and behaviour: an introduction to behavioural neuroanatomy* (2nd ed.). Cambridge: Cambridge University Press.

Cohen, H., Kotler, M., Matar, M. A., Kaplan, Z., Loewenthal, U., Miodownik, H., & Cassuto, Y. (1998). Analysis of heart rate variability in posttraumatic stress disorder patients in response to a trauma-related reminder. *Biological Psychiatry, 44*, 1054-1059. doi: 10.1016/S0006-3223(97)00475-7

Cornwell, B., Alvarez, R. P., Lissek, S., Kaplan, R., Ernst, M., & Grillon, C. (2011). Anxiety overides the blocking effects of high perceptual load on amygdala reactivity to threat-related distractors. *Neuropsychologia*, 1363-1368. doi: 10.1016/j.neuropsychologia.2011.02.049

Croizet, J. C., Despres, G., Gauzins, M. E., Huguet, P., Leyens, J. P., & Meot, A. (2004). Stereotype threat undermines intellectual performance by triggering a disruptive mental load. *Personality and Social Psychology Bulletin, 30*, 721-731. doi: 10.1177/0146167204263961

Crowe, S. F., Mathews, C., & Walkenhorst, E. (2007). Relationships between worry, anxiety and thought suppresion and the components of working memory in a non-clinical sample. *Australian Psychologist, 42*, 170-177. doi: 10.1080/00050060601089462

Crowne, D. P., & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology. *Journal of Consulting Psychology, 24*, 349-354. doi: 10.1037/h0047358

Dandeneua, S. D., Baldwin, M. W. , Pruessner, J. C., Baccus, J. R., & Sakellaropoulo, M. (2007). Cutting stress off at the pass: reducing vigileance and responsiveness to social threat by manipulating attention. *Journal of Personality and Social Psychology, 93*, 651-666. doi: 10.1037/0022-35114.93.4.651

Davey, G. C. L., Hampton, J., Farrell, J., & Davidson, S. (1992). Some characteristics of worrying: Evidence for worrying and anxiety as separate constructs. *Personality and Individual Differences, 13*, 133-147. doi: 10.1016/0191-8869(92)90036-O

Davidson, R. J. (2002). Anxiety and affective style: Role of prefrontal cortex and amygdala. *Biological Psychiatry, 51*, 68-80. doi: 10.1016/S0006-3223(01)01328-2

Davis, M., Montgomery, I., & Wilson, G. (2002). Worry and heart rate variables: Autonomic rigidity under challenge. *Anxiety Disorders, 16*, 639-659. doi: 10.1016/S0887-6185(02)00132-9

Demaree, H. A., & Everhart, D. E. (2004). Healthy high-hostiles: Reduced parasympathetic activity and decresed sympathovagal flexibility during negative emotional processing. *Personality and Individual Differences 36*, 457-469. doi: 10.1016/S0191-8869(03)00109-0

Demaree, H. A., Pu, J., Robinson, J. L., Schmeichel, B. J., & Everhart, D. E. (2006). Predicting facial valence to negative stimuli from resting RSA: Not a function of active emotion regulation. *Cognition and Emotion, 20*, 161-176. doi: 10.1080/02699930500260427

Demaree, H. A., Robinson, J. L., Everhart, D. E., & Schmeichel, B. J. (2004). Resting RSA is associated with natural and self-regulated responses to negative emotional stimuli. *Brain and Cognition, 56*, 14-23. doi: 10.1016/j.bandc.2004.05.001

Derakshan, N., & Eysenck, M. W. (1998). Working memory capacity in high trait-anxious and repressor groups. *Cognition and Emotion, 12*, 697-713. doi: 10.1080/026999398379501

Derakshan, N., & Eysenck, M. W. (2001a). Effects of focus of attention on physiological, behavioural, and reported state anxiety in repressors, low-anxious, high-anxious, and defensive high-anxious individuals. *Anxiety, Stress and Coping, 14*, 285-299. doi: 10.1080/10615800108248358

Derakshan, N., & Eysenck, M. W. (2001b). Manipulation of focus of attention and its effects on anxiety in high-anxious individuals and repressors. *Anxiety, Stress and Coping, 14*, 173-191. doi: 10.1080/10615800108248353

Derakshan, N., Smyth, S., & Eysenck, M. W. (2009). Effects of state anxiety on performance using a task-switching paradigm: An investigation of attentional control theory. *Psychonomic Bulletin & Review, 16*, 1112-1117. doi: 10.3758/PBR.16.6.1112

Derryberry, D., & Reed, M. A. (2002). Anxiety related attentional biases and their regulation by attentional control. *Journal of Abnormal Psychology, 111*, 225-236. doi: 10.1037/0021-843X.111.2.225

DeWall, C. N., Baumeister, R. F., Stillman, T. F., & Gailliot, M. T. (2007). Violence restrained: Effects of self-regulation and its depletion on aggression. *Journal of Experimental Social Psychology, 43*, 62-76. doi: 10.1016/j.jesp.2005.12.005

Dishman, R. K., Nakamura, Y., Garcia, M. E., Thompson, R. W., Dunn, A. L., & Blair, S. N. (2000). Heart rate variability, trait anxiety, and perceived stress among physically fit men and women. *International Journal of Psychophysiology, 37*, 121-133. doi: 10.1016/S0167-8760(00)00085-4

Dove, A., Pollmann, S., Schubert, T., Wiggins, C. J., & von Cramon, D. Y. (2000). Prefrontal activation in task switching: an event-related fMRI study. *Cognitive Brain Research, 9*, 103-109. doi: 10.1016/S0926-6410(99)00029-4

Drevets, W. C., Price, J. L., Simpson, J. R., Todd, R. D., Reich, T., Vannier, M., & Raichle, M. E. (1997). Subgenual prefrontal cortex abnormalities in mood disorders. *Nature, 386*, 824-827. doi: 10.1038/386824a0

Dua, J. K., & King, D. A. (1987). Heart rate and skin conductance as measures of worry. *Behaviour Change, 4*, 26-32.

Dunn, B. D., Billotti, D., Murphy, V., & Dalgleish, T. (2009). The consequences of effortful emotion regulation when processing distressing material: A comparison of suppression and acceptance. *Behaviour Research and Therapy, in press*, 761-773. doi: 10.1016/j.brat.2009.05.007

Duval, S. , & Wicklund, R. (1972). *A theory of objective self-awareness.* NY: Academic Press.

Easterbrook, J. A. (1959). The effect of emotion on cue utilisation and the organisation of behaviour. *Psychological review, 66*, 183-201. doi: 10.1037/h0047707

Egloff, B., Schmukle, S. C., Burns, L. R., & Schwerdtfeger, A. (2006). Spontaneous emotion regulation during evaluated speaking tasks: Associations with negative affect, anxiety expression, memory and physiological responding. *Emotion, 6*, 356-366. doi: 10.1037/1528-3542.6.3.356

Egloff, B., Willhelm, F. H., Neubauer, D. H., Mauss, I. B., & Gross, J. J. (2002). Implicit anxiety measure predicts cardiovascular reactivity to an evaluated speaking task. *Emotion, 2*, 3-11. doi: 10.1037/1528-3542.2.1.3

Ellenbogen, M. A., Schwartzman, A. E. , Stewart, J., & Walker, C. . (2002). Stress and selective attention: the interplay of mood, cortisol levels, and emotional infomration processing. *Psychophysiology, 39*, 723-732. doi: 10.1.17/S0048577202010739

Engle, R. W. (2002). Working memory capacity as executive attention. *Current Directions in Psychological Science, 11*, 19-23. doi: 10.1111/1467-8721.00160

Epstein, S. (1972). The nature of anxiety with emphasis upon its relationship to expectancy. In C. D. Spielberger (Ed.), *Anxiety: Current trends in theory and research* (Vol. 2). London: Academic Press.

Erdfelder, E., Faul, F., & Buchner, A. (1996). GPOWER: A general power analysis program. *Behaviour Research Methods, Instruments, and Computers, 28*, 1-11.

Erisman, S. M., & Roemer, L. (2010). A preliminary investigation of the effects of experimentally induced mindfulness on emotional responding to film clips. *Emotion, 10*, 72-82. doi: 10.1037/a0017162

Erskine, J. A. K., Kvavilashvili, L., & Kornbrot, D. E. (2007). The predictors of thought suppression in young and old adults: effects of rumination, anxiety, and other variables. *Personality and Individual Differences, 42*, 1047-1057. doi: 10.1016/j.paid.2006.09.016

Esch, T., Stefano, G. B., Fricchione, G. L., & Benson, H. . (2002). Stress in cardiovascular diseases. *Medical Science Monitor, 8*, RA93-101.

Etkin, A., Egner, T., Peraza, D. M., Kandel, E. R., & Hirsch, J. (2006). Resolving emotional conflict: A role for the rostral anterior cingulate cortex in modulating activity in the amygdala. *Neuron, 51*, 1-12. doi: 10.1016/j.neuron.2006.07.029

Exner, C., Martin, L. L., & Rief, W. (2009). Self-focused ruminations and memory deficits in obsessive-compulsive disoder. *Cognitive Therapy and Research, 33*, 163-174. doi: 10.1007/s10608-007-9162-x

Eysenck, M. W. (1982). Theories of Arousal and Performance *Attention and Arousal* (pp. 47-66). NY: Springer-Verlag.
Eysenck, M. W. (1985). Anxiety and cognitive-task performance. *Personality and Individual Differences, 6*, 579-586. doi: 10.1016/0191-8869(85)90007-8
Eysenck, M. W., & Calvo, M. G. (1992a). Anxiety and performance: Processing efficiency theory. *Cognition and Emotion, 6*, 409-434. doi: 10.1080/02699939208409696
Eysenck, M. W., & Calvo, M. G. (1992b). Anxiety and performance: The processing efficiency theory. *Cognition and Emotion, 6*, 409-434. doi: 10.1080/02699939208409696
Eysenck, M. W., Darakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and congitive performance: attentional control theory. *Emotion, 7*, 336-353. doi: 10.1037/1528-3542.7.2.336
Eysenck, M. W., Payne, S., & Derakshan, N. (2005). Trait anxiety, visuospatial processing, and working memory. *Cognition and Emotion, 19*, 1214-1228. doi: 10.1080/02699930500260245
Feldman, P. J., Cohen, S., Hamrick, N., & Lepore, S. J. (2004). Psychological stress, appraisal, emotion and cardiovascular response in a public speaking task. *Psychology and Health, 19*, 353-368. doi: 10 1080/0887044042000193497
Field, A. (2009). *Discovering statistics using SPSS* (3rd ed.). Singapore: Sage.
Fresco, D. M., Frankel, A. N., Mennin, D. S., Turk, C. L., & Heimberg, R. G. (2002). Distinct and overlapping features of rumination and worry: The relationship of cognitive production to negative affective states. *Cognitive Therapy and Research, 26*, 179-188. doi: 10.1023/A:1014517718949
Friedman, B. H., & Thayer, J. F. (1998). Anxiety and autonomic flexibility: A cardiovascular approach *Biological Psychology, 47*, 243-263. doi: 10.1016/S0301-0511(97)00027-6
Friedman, N. P., & Miyake, A. (2004). The relations among inhibition and interference control functions: A latent-variable analysis. *Journal of Experimental Psychology: General, 133*, 101-135. doi: 10.1037/0096-3445.133.1.101
Fuller, B. F. (1992). The effects of stress-anxiety and coping styles on heart rate variability. *International Journal of Psychopysiology, 12*, 81-86. doi: 10.1016/0167-8760(92)90045-D
Gailliot, M. T., & Baumeister, R. F. (2007). Self-regulation and sexual restraint: Dispositionally and temporarily poor self-regulatory abilities contribute to failures at restraining sexual behaviour. *Personality and Social Psychology Bulletin, 33*, 173-186. doi: 10.1177/0146167206293472
Gailliot, M. T., Baumeister, R. F., De Wall, C. N., Maner, J. K., Plant, E. A., Tice, D. M., & Brewer, L. E. (2007). Self-control relies on glucose as a limited energy source: Will power is more than a metaphor. *Journal of Personality and Social Psychology, 92*, 325-336. doi: 10.1037/0022-3514.92.2.325
Garnefski, N., & Kraaij, V. (2006). Cognitive Emotion Regulation Questionnaire -- development of a short 18-item version (CERQ-Short). *Personality and Individual Differences, 41*, 1045-1053. doi: 10.1016/j.paid.2006.04.010
Garnefski, N., Kraaij, V., & Spinhoven, P. (2001). Negative life events, cognitive emotion regulation and emotional problems. *Personality and Individual Differences, 30*, 1311-1327. doi: 10.1016/S0191-8869(00)00113-6
Geisler, F. C. M., Vennewald, N., Kubiak, T., & Weber, H. (2010). The impact of heart rate variability on subjective well-being is mediated by emotion regulation. *Personality and Individual Differences, 49*, 723-728. doi: 10.1016/j.paid.2010.06.015
Gianaros, P. J., van der Veen, F. M., & Jennings, J. R. (2004). Regional cerebral blood flow correlates with heart period and high-frequency heart period variability during

working-memory tasks: Implications for the cortical and subcortical regulation of cardiac autonomic activity. *Psychophysiology, 41*, 521-530. doi: 10.1111/1469-8986.2004.00179.x

Glynn, L. M., Christenfeld, N., & Gerin, W. (2002). The role of rumination in recovery from reactivity: cardiovascular consequences of emotional states. *Psychosomatic Medicine, 64*, 714-726. doi: 10.1097/01.PSY.0000031574.42041.23

Goldman-Rakic, P. S. (1996). Regional and cellular fractionation of working memory. *Proceedings of the National Academy of Sciences of the United States of America, 93*, 13473-13480.

Gramer, M. (2006). Social anxiety and cardiovascular responses to active coping conditions. *Psychology Science, 48*, 39-52.

Gramer, M., & Saria, K. (2007). Effects of social anxiety and evaluative threat on cardiovascular responses to active performance situations. *Biological Psychology, 74*, 67-74. doi: 10.1.16/j.biopsycho.2006.07.004

Gramer, M., & Sprintschnik, E. (2008). Social anxiety and cardiovascular responses to an evaluative speaking task: The role of stressor anticipation. *Personality and Individual Differences, 44*, 371-381. doi: 10.1016/j.paid.2007.08.016

Grassi, G., Vailati, S., Bertinieri, G., Seravalle, G., Stella, M. L., Dell'Oro, R., & Mancia, G. (1998). Heart rate as a marker of sympathetic activity. *Journal of Hypertension, 16*(11), 1635-1639.

Greenberg, L. S. (2004). Emotion-focused therapy. *Clinical Psychology and Psychotherapy, 11*, 3-16. doi: 10.1002/cpp.388

Greenberg, L. S., & Paivio, S. C. (1997). *Working with emotions in psychotherapy.* New York: Guilford press.

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology, 85*, 348-362. doi: 10.1037/0022-3514.85.2.348

Gross, J. J., & Levenson, R. W. (1993). Emotional suppresion: Physiology, self-report, and expressive behavior. *Journal of Personality and Social Psychology, 64*, 970-986. doi: 10.1037/0022-3514.64.6.970

Gross, J. J., & Levenson, R. W. (1995). Emotion elicitation using films. *Cognition and Emotion, 9*, 87-108. doi: 10.1080/02699939508408966

Gross, J. J., & Levenson, R. W. (1997). Hiding feelings: The acute effects of inhibiting negative and positive emotion. *Journal of Abnormal Psychology, 106*, 95-103. doi: 10.1037/0021-843X.106.1.95

Gross, J. J., & Thompson, R. A. (2007). Emotional regulation: Conceptual foundations. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3-24). New York: Guilford press.

Hagger, M. S., Wood, C., Stiff, C., & Chatzisarantis, N. (2010). Ego depletion and the strength model of self-control: A meta-analysis. *Psychological Bulletin, 136*, 495-525. doi: 10.1037/a0019486

Hammen, C. (2005). Stress and Depression. *Annaual Review of Clinical Psychology, 1*, 293-319. doi: 10.1146/annurev.clinpsy.1.102803.143938

Hansen, A. L., Helge, B., & Thayer, J. F. (2003). Vagal influence on working memory and attention. *International Journal of Psychopysiology*, 263-274. doi: 10.1016/S0167-8760(03)00073-4

Hansen, A. L., Johnsen, B. H., Sollers, J. J., Stenvik, K., & Thayer, J. F. (2004). Heart rate variability and its relation to prefrontal cognitive function: the effects of training and detraining. *European Journal of Applied Physiology 93*, 263-272. doi: 10.1007/s00421-004-1208-0

Hansen, A. L., Johnsen, B. H., Sollers, J. J., Stenvik, K., & Thayer, J. F. (2009). Heart rate variability and its relation to prefrontal cognitive function: the effects of training and detraining. *European Journal of Applied Physiology, 93*, 263-272. doi: 10.1007/s00421-004-1208-0

Hansen, A. L., Johnsen, B. H., & Thayer, J. F. (2009). Relationship between heart rate variability and cognitive function during the threat of shock. *Anxiety, Stress & Coping, 22*, 77-89. doi: 10.1080/10615800802272251

Hargus, E., Crane, C., Barnhofer, T., & Williams, J. M. G. (2010). Effects of midfulness on meta-awareness and specificity of describing prodromal symptoms in suicidal depression. *Emotion, 10*, 34-42.

Hartley, L. R. (1973). Effect of prior noise or prior performance on serial reaction. *Journal of Experimental Psychology, 101*, 255-261. doi: 10.1037/h0035204

Hasher, L., & Zacks, R. T. (1979). Automatic and effortful processes in memory. *Journal of Experimental Psychology: General, 108*, 356-389. doi: 10.1037/0096-3445.108.3.356

Hayes, S. C. (2004a). Acceptance and commitment therapy and the new behavior therapies: Mindfulness, acceptance, and relationship. In F. S.C. Hayes, V. M. & M. M. Linehan (Eds.), *Mindfulness and Acceptance: Expanding the cogntive-behavioura tradition.* (pp. 1-29). London: Guilford Press.

Hayes, S. C. (2004b). Acceptance and commitment therapy and the new behaviour therapies: mindfulness, acceptance and relationship *Mindfulness and Acceptance: Expanding the cognitive-behavioural tradition.* (pp. 1-29). London: Guilford Press.

Hayes, S. C., Luoma, J. B., Bond, F. W., Masuda, A, & Lillis, J. (2006). Acceptance and commitment therapy: Model process and outcomes. *Behaviour Research and Therapy, 44*, 1-25. doi: 10.1016/j.brat.2005.06.006

Hayes, S. C., Strosahl, K., Wilson, K. G., Bissett, R. T., Pistorello, J., Toarmino, D., ... (2004). Measuring experiential avoidance: a preliminary test of a working model. *The Psychological Record, 54*, 553-578.

Hayes, S., Hirsch, C., & Mathews, A. (2008). Restriction of working memory capacity during worry. *Journal of Abnormal Psychology, 117*, 712-717. doi: 10.1037/a0012908

Heatherton, T. F., Herman, C. P., & Polivy, J. (1991). Effects of physical threat and ego threat on eating behavior. *Journal of Personality and Social Psychology, 60*, 138-143. doi: 10.1037/0022-3514.60.1.138

Heatherton, T. F., Polivy, J., Herman, C. P., & Baumeister, R. F. (1993). Self-awareness, task failure, and disinhibition: How attentional focus affects eating. *Journal of Personality, 61*, 49-61. doi: 10.1111/j.1467-6494.1993.tb00278.x

Heimberg, R. G., & Becker, R. E. (2002). *Cognitive-behavioral group therapy for social phobia: Basic mechanisms and clinical strategies*. New York: The Guilford Press.

Herman, C. P., Polivy, J., Lank, C. N., & Heatherton, T. F. (1987). Anxiety, hunger, and eating behaviour. *Journal of Abnormal Psychology, 96*, 264-269. doi: 10.1037/0021-843X.96.3.264

Hofmann, S. G., & Asmundson, G. J. G. (2008). Acceptance and mindfulness-based therapy: new wave or old hat? *Clinical Psychology Review, 1*, 1-16. doi: 10.1016/j.cpr.2007.09.003

Hofmann, S. G., Heering, S. , Sawyer, A. T., & Asnaani, A. (2009). How to handle anxiety: The effects of reappraisal, acceptance, and suppression strategies on anxious arousal. *Behaviour Research and Therapy, 47*, 389-394. doi: 10.1016/j.brat.2009.02.010

Hofmann, S. G., Moscovitch, D. A., Pizzagalli, D. A., Litz, B. T., Kim, H., & Davis, L. L. (2005). The worried mind: Autonomic and prefrontal activation during worrying. *Emotion, 5*, 464-465. doi: 10.1037/1528-3542.5.4.464

Holmes, D. S., & Houston, B. K. (1974). Effectiveness of situation redefinition and affective isolation in coping with stress. *Journal of Personality and Social Psychology, 29*, 212-218. doi: 10.1037/h0035912

Hong, R. Y. (2007). Worry and rumination: Differential associations with anxious and depressive symptoms and coping behaviour. *Behaviour Research and Therapy, 45*, 277-290. doi: 10.1016/j.brat.2006.03.006

Houston, B. K., & Holmes, D. S. (1974). Effect of avoidant thinking and reappraisal for coping with threat involving temporal uncertainty. *Journal of Personality and Social Psychology, 30*, 382-388. doi: 10.1037/h0036899

Inzlicht, M., McKay, L., & Aronson, J. (2006). Stigma as ego depletion: How being the target of prejudice affects self-control. *Psychological Science, 17*, 262-269. doi: 10.1111/j.1467-9280.2006.01695.x

Inzlicht, M., & Schmeichel, B. J.(2012). What is ego depletion? Toward a mechanistic revision of the resource model of self-control. Perspectives on Psychological Science, 7, 450-463. doi: 10.1177/1745691612454134

Izzard, C. E. (1993). Four systems of emotion activation: cognitive and noncognitive processes. *Psychological Review, 100*(1), 68-90. doi: 10.1037/0033-295X.100.1.68

Johns, M., Inzlicht, M., & Schmader, T. (2008). Stereotype threat and executive resource depletion: examining the influence of emotion regulation. *Journal of Experimental Psychology, 137*, 691-705. doi: 10.1037/a0013834

Jorna, P. G. A. M. (1992). Spectral analysis of heart rate and psychological state: A review of its validity as a workload index. *Biological Psychology, 34*, 237-257. doi: 10.1016/0301-0511(92)90017-O

Just, N., & Alloy, L. B. (1997). The response styles theory of depression: tests and an extension of theory. *Journal of Abnormal Psychology, 106*, 221-229. doi: 10.1037/0021-843X.106.2.221

Kamholz, B. W., Hayes, A. M., Carver, C. S., Gullivver, S. B., & Perlman, C. A. (2006). Identification and evaluation of cognitive affect-regulation strategies: Development of a self-report measure. *Cognitive Therapy and Research 30*, 227-262. doi: 10.1007/s10608-006-9013-1

Kamphuis, J. H., & Telch, M. J. (2000). Effects of distraction and guided threat reappraisal on fear reduction during exposure-based treatments for specific fears. *Behaviour Research and Therapy, 38*, 1163-1181. doi: 10.1016/S0005-7967(99)00147-3

Kane, M. J., Bleckley, M. K., Conway, A. R. A., & Engle, R. W. (2001). A controlled-attention view of working-memory capacity. *Journal of Experimental Psychology: General, 130*, 169-183. doi: 10.1037/0096-3445.130.2.169

Kane, M. J., & Engle, R. W. (2002). The role of prefrontal cortex in working-memory capacity, executive attention, and general fluid intelligence: An individual-differences perspective. *Psychonomic Bulletin & Review, 9*, 637-671. doi: 10.3758/BF03196323

Kelly, W. E. (2004). Examining the relationship between worry and trait anxiety. *College Student Journal, 38*, 370-373.

Kessler, R. C., McGonagle, K. A., Zhao, S., Nelson, C. B., Hughes, M., Elshlem, S., . . . Kendler, K. S. (1994). Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States: Results from the national comorbidity survey *Achives of General Psychiatry, 51*, 8-19. doi: 10.1001/archpsyc.1994.03950010008002

Knight, M., Seymour, T. L., Gaunt, J. T., Baker, C., Nesmith, K., & Mather, M. (2007). Aging and goal-directed emotional attention. *Emotion, 7*, 705-714. doi: 10.1037/1528-3542.7.4.705

Koole, S. L., & Jostmann, N. B. (2004). Getting a grip on your feelings: Effects of action orientation and external demands on intuitive affect regulation. *Journal of Personality and Social Psychology, 87*, 974-990. doi: 10.1037/0022-3514.87.6.974

Koster, E. H. W., Crombez, G., Verscheuer, B., Van Damme, S., & Wierseman, J. R. . (2006). Components of attentional bias to threat in high trait anxiety: facilitated engagement, impaired disengagement, and attentional avoidance. *Behaviour Research and Therapy, 44*, 1757-1771. doi: 10.1016/j.brat.2005.12.011

Koster, E. H. W., Rassin, E., Crombez, G., & Naring, G. W. B. (2003). The paradoxical effects of suppressing anxious thoughts during imminent threat. *Behaviour Research and Therapy, 41*, 1113-1120. doi: 10.1016/S0005-7967(03)00144-X

Koster, E. H. W., Verscheuer, B., Crombez, G., & Van Damme, S. (2005). Time-course of attention for threatening pictures in high and low trait anxiety. *Behaviour research and Therapy, 43*, 1087-1098. doi: 10.1.16/j.brat.2004.08.004

Kudielka, B. M., Buske-Kirshbaum, A., Hellhammer, D. H., & Kirschbaum, C. (2004). Differential heart rate reactivity and recovery after a psychosocial stress (TSST) in healthy children, young adults and elderly adults: The impact of age and gender. *International Journal of Behavioural Medicine, 11*, 116-121. doi: 10.1207/s15327558ijbm1102_8

Kurzban, R. (2010). Does the brain consume additional glucose during self-control tasks? *Evolutionary Psychology, 8*, 244-259.

Lacey, J. (1956). The evaluation of autonomic responses: Towards a general solution. *Annals of the New York Academy of Science, 67*, 123-167. doi: 10.1111/j.1749-6632.1956.tb46040.x

Lane, R. D., McRae, K., Reiman, E. M., chen, K., Ahern, G. L., & Thayer, J. F. (2009). Neural correlates of heart rate variability during emotion. *Neuroimage, 44*, 213-222. doi: 10.1016/j.neuroimage.2008.07.056

Lavric, A., Rippon, G., & Gray, J. R. (2003). Threat-evoked anxiety disrupts spatial working memory performance: An attentional account. *Cognitive Therapy and Research, 27*, 489-504. doi: 10.1023/A:1026300619569

Lazarus, R. S., & Averill, J. R. (1972). Emotion and cognition: With special reference to anxiety. In C. D. Spielberger (Ed.), *Anxiety: Current trends in theory and research* (Vol. 2). London: Academic Press.

Lazarus, R. S., & Folkman, F. (1984). *Stress, appraisal, and coping*. NY: Springer Publishing Company.

LeDoux, J. L. (1995). Emotion: clues from the brain. *Annual Review of Psycology, 46*, 209-235. doi: 10.1146/annurev.ps.46.020195.001233

LeDoux, J. L. (2000). Emotion circuits in the brain. *Annual Review of Neuroscience, 23*, 155-184. doi: 10.1146/annurev.neuro.23.1.155

LeDoux, J. L. (2002). The emotional brain, fear, and the amygdala. *Cellular and Molecular Neurobiology, 23*, 727-738. doi: 10.1023/A:1025048802629

Levitt, J. T., Brown, T. A., Orsillo, S. M., & Barlow, D. H. (2004). The effects of acceptance versus suppression of emotion on subjective and psychophysiological responses to carbon dioxide challenge. *Behavior Therapy, 35*, 747-766. doi: 10.1016/S0005-7894(04)80018-2

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the depression anxiety stress scales (DASS) the Beck depression and anxiety inventories. *Behaviour Research and Therapy, 33*, 335-343. doi: 10.1016/0005-7967(94)00075-U

Lovibond, S. H. & Lovibond, P. F. (1995). *Manual for the Depression Anxiety Stress Scales* (2nd ed.). Sydney: Psychology Foundation.

Low, C. A., Stanton, A. L., & Bower, J. E. (2008). Effects of acceptance-oriented versus evaluative emotional processing on heart rate recovery and habituation. *Emotion, 8*, 419-424. doi: 10.1037/1528-3542.8.3.419

Lyonfields, J. D., Borkovec, T. D., & Thayer, J. F. (1995). Vagal tone in generalised anxiety disorder and the effects of aversive imagery and worrisome thinking. *Behvior Therapy, 26*, 457-466. doi: 10.1016/S0005-7894(05)80094-2

Lyubomirsky, S., & Nolen-Hoeksema, S. (1993). Self-perpetuating properties of dysphoric rumination. *Journal of Personality and Social Psychology, 65*, 339-349. doi: 10.1037/0022-3514.65.2.339

Lyubomirsky, S., & Nolen-Hoeksema, S. (1995). Effects of self-focused rumination on negative thinking and interpersonal problem solving. *Journal of Personality and Social Psychology, 69*, 176-190. doi: 10.1037/0022-3514.69.1.176

Mackintosh, B., & Mathews, A. (2003). Don't look now: attentional avoidance of emotionally valenced cues. *Cognition and Emotion, 17*, 623-646. doi: 10.1080/02699930244000101

MacLeod, C., & Donnellan, A. M. (1993). Individual differences in anxiety and the restriction of working memory capacity. *Personality and Individual Differences, 15*, 163-173. doi: 10.1016/0191-8869(93)90023-V

MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional Bias in emotional disorders. *Journal of Abnormal Psychology, 95*, 15-20. doi: 10.1037/0021-843X.95.1.15

Malliani, A. (1999). The pattern of sympathovagal balance explored in the frequency domain. *News in Physiological Science, 14*, 111-117.

Marteau, T. M., & Bekker, H. (1992). The development of a six-item short-form of the state scale of the spielberger State-Trait Anxiety Inventory. *British Journal of Clinical Psychology, 31*, 301-306.

Martin, L. L., & Tesser, A. (1996). Some ruminative thoughts. In R. S. Wyer (Ed.), *Ruminative thoughts* (Vol. 9, pp. 1-48). New Jersey: Lawrence Erlbaum Associates.

Martin, P. Y., & Benton, D. (1999). The influence of a glucose drink on a demanding working memory task. *Physiology and Behaviour, 67*, 69-74. doi: 10.1016/S0031-9384(99)00040-2

Mather, M., & Knight, M. (2005). Goal-directed memory: the role of cognitive control in older adults' emotional memory. *Psychology and Aging, 20*, 554-570. doi: 10.1037/0882-7974.20.4.554

Mauss, I. B., Bunge, S. A., & Gross, J. J. (2007). Automatic Emotion Regulation *Social and Personality Psychology Compass, 1*, 146-167. doi: 10.1111/j.1751-9004.2007.00005.x

Mauss, I. B., Wilhelm, F. H., & Gross, J. J. (2003). Autonomic recovery and habituation in social anxiety. *Psychophysiology, 40*, 648-653. doi: 10.1111/1469-8986.00066

Mauss, I. B., Wilhelm, F. H., & Gross, J. J. (2004). Is there less to social anxiety than meets the eye? Emotion experience, expression and bodily responding. *Cognition and Emotion, 18*, 631-662. doi: 10.1080/02699930341000112

McDonald, P. J. (1980). Reactions to objective self-awareness. *Journal of research in personality, 14*, 250-260. doi: 10.1016/0092-6566(80)90032-X

McLaughlin, K. A., Borkovec, T. D., & Sibrava, N. J. (2007). The effects of worry and rumination on affect states and cognitive activity. *Behavior Therapy, 38*, 23-38. doi: 10.1016/j.beth.2006.03.003

Meyer, T. J., Miller, M. L., Metzger, R., & Borkovec, T. D. (1990). Development and validation of the Penn State Worry Questionnaire. *Behaviour Research and Therapy, 28*, 487-495. doi: 10.1016/0005-7967(90)90135-6

Miller, G. A., Galanter, E., & Pribram, K. H. (1960). *Plans and the structure of behaivour*. NY: Holt, Rinehart and Winston

Miu, A. C., Heilman, R. M., & Miclea, M. (2009). Reduced heart rate variability and vagal tone in anxiety: Trait versus state, and the effects of autogenic training. *Autonomic Neuroscience: Basic and Clinical, 145*, 99-103. doi: 10.1016/j.autneu.2008.11.010

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology, 41*, 49-100. doi: 10.1006/cogp.1999.0734

Mogg, K., & Bradley, B. P. (1998). A cognitive-motivational analysis of anxiety. *Behaviour Research and Therapy, 36*, 809-848. doi: 10.1016/S0005-7967(98)00063-1

Mogg, K., Bradley, B. P., De Bono, J., & Painter, M. (1997). Time course of attentional bias for threat information in non-clinical anxiety. *Behaviour Research and Therapy, 35*, 297-303. doi: 10.1016/S0005-7967(96)00109-X

Molden, D. C., Hui, C. M., Scoler, A. A., Meier, B. P., Noreen, E. E., D'Agostino, P. R., & Martin, V. (2012). Motivational versus metabolic effects of carbohydrates on self-control. *Psychological Science, 23*, 1137-1144. doi: 10.1177/0956797612439069

Monat, A., Averill, J. R., & Lazarus, R. S. (1972). Anticipatory stress and coping reactions under various conditions of uncertainty. *Journal of Personality and Social Psychology, 24*, 237-253. doi: 10.1037/h0033297

Moors, A. (2009). Theories of emotion causation: a review. *Cognitive and Emotion, 23*, 625-662. doi: 10.1080/02699930802645739

Morrow, J., & Nolen-Hoeksema, S. (1990). Effects of response to depression on the remediation of depressive affect. *Journal of Personality and Social Psychology, 58*, 519-527. doi: 10.1037/0022-3514.58.3.519

Muraven, M., & Baumeister, R. F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin, 126*, 247-259. doi: 10.1037/0033-2909.126.2.247

Muraven, M., Baumeister, R. F., & Tice, D. M. (1999). Longitudinal improvement of self-regulation through practice: buildng self-control strenght through repeated exercise. *Journal of Social Psychology, 139*, 446-457. doi: 10.1080/00224549909598404

Muraven, M., Collins, R. L., & Nienhaus, K. (2002). Self-control and alcohol restraint: An initial application of the self control strength model. *Psychology of Addictive Behaviours, 16*, 113-120. doi: 10.1037/0893-164X.16.2.113

Muraven, M., Collins, R. L., Shiffman, S., & Paty, J. A. (2005). Daily fluctuations in self-control demands and alcohol intake. *Psychology of Addictive Behaviours, 19*, 140-147. doi: 10.1037/0893-164X.19.2.140

Muraven, M., & Slessareva, E. (2003). Mechanisms of self-control failure: Motivation and limited resources. *Personality and Social Psychology Bulletin, 29*, 894-906. doi: 10.1177/0146167203029007008

Muraven, M., Tice, D., & Baumeister, R. F. (1998). Self-control as a limted resource: Regulatory depletion patterns. *Journal of Personality and Social Psychology, 74*, 774-789. doi: 10.1037/0022-3514.74.3.774

Neumann, S. A., Waldstein, S. R., Soller, J. J., Thayer, J. F., & Sorkin, J. D. (2004). Hostility and distraction have differential influences on cardiovascular recovery from anger recall in women. *Health Psychology, 23*, 631-640. doi: 10.1037/0278-6133.23.6.631

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology, 102*, 569-582. doi: 10.1037/0021-843X.100.4.569
Nolen-Hoeksema, S. (1998). The other end of the continuum: The costs of rumination. *Psychological Inquiry, 9*, 216-219. doi: 10.1207/s15327965pli0903_5
Nolen-Hoeksema, S. (2000). The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. *Journal of Abnormal Psychology, 109*, 504-511. doi: 10.1037/0021-843X.109.3.504
Nolen-Hoeksema, S., & Morrow, J. (1991). A prospective study of depression and posttrumatic stress symptoms after a natural disaster: The Loma Prieta earthquake. *Journal of Personality and Social Psychology, 61*, 115-121. doi: 10.1037/0022-3514.61.1.115
Nolen-Hoeksema, S., Parker, L. E., & Larson, J. (1994). Ruminative coping with depressed mood following loss. *Journal of Personality and Social Psychology, 67*, 92-104. doi: 10.1037/0022-3514.67.1.92
Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science, 3*, 400-424. doi: 10.1111/j.1745-6924.2008.00088.x
Norman, D., & Shallice, T. (1986). Attention to action: Willed and automatic control of behaviour. . In R. Davidson, G.Shwartz & D. Shapiro (Eds.), *Consciousness and self-regulation: Advances in research and theory* (Vol. 4, pp. 1-18). NY: Plenum Press.
Ochsner, K. N., Bunge, S. A., Gross, J. J., & Gabrieli, J. D. (2002). Rethinking feelings: An fMRI study of the cognitive regulation of emotion. *Journal of Cognitive Neuroscience, 14*, 1215-1229. doi: 10.1162/089892902760807212
Orsillo, S. M., & Roemer, L. (2005). An acceptance based behaviour therapy for generalized anxiety disorder. . In L. Roemer & S. M. Orsillo (Eds.), *Acceptance and mindfulness-based approaches to anxiety: Conceptualisation and treatment* (pp. 213-240). NY: Springer.
Orsillo, S. M., Roemer, L., Block Lerner, J., & Tull, M. T. (2004). Acceptance, mindfulness, and cognitive-behavioral therapy: comparisons, contrasts, and application to anxiety. In S. C. Hayes, V. M. Follette & M. M. Linehan (Eds.), *Mindfulness and acceptance: expanding the cognitive-behavioural tradition* (pp. 66-96). NY: Guilford press.
Perez-Jaranay, J. M., & Vives, F. (1991). Electrophysiological study of the response of medial prefrontal cortex neurons to stimulation of the basolateral nuceus of the amygdala in the rat. *Brain Research, 564*, 97-101. doi: 10.1016/0006-8993(91)91357-7
Pieper, S., Brosschot, J. F., van der Leeden, R., & Thayer, J. F. (2007). Cardiac effects of momentary assessed worry episodes and stressful events. *Psychosomatic Medicine, 69*, 901-909. doi: 10.1097/PSY.0b013e31815a9230
Pincus, A. L., Ansell, E. B., Pimentel, C. A., Cain, N. M., Wright, A. G. C., & Levy, K. N. (2009). Initial construction and validation of the Pathological Narcissism Inventory *Psychological Assessment, 21*, 365-379. doi: 10.1037/a0016530
Pincus, T., Burton, A. K., Vogel, S., & Field, A. P. (2002). A systematic review of psychological factors as predictors of chronicity/disability in prospective cohorts of low back pain. *Spine, 27*, E109-E120.
Porges, S. W. (2001). The polyvagal theory: Phylogenetic substrates of a social nervous system. *International Journal of Psychophysiology, 42*, 123-146. doi: 10.1016/S0167-8760(01)00162-3
Porges, S. W. (2007). The polyvagal perespective. *Biological Psychology, 74*, 116-143. doi: 10.1016/j.biopsycho.2006.06.009

Power, M., & Dalgleish, T. (1997). The cognitive philosophy of emotion *Cognition and emotion: from order to disorder* (pp. 17-64). Hove, UK: Psychology Press.
Pulus, P. B., Annis, A. B., & Risner, H. T. (1978). An analysis of the mirror-induced objective self-awareness effect. *Bulletin of the Psychonomic Society, 12*, 8-10.
Pyszczynski, T., & Greenberg, J. (1987). Self-regulatory perseveration and the depressive self-focusing style: a self-awareness theory of reactive depression *Psychological Bulletin, 102*, 122-138. doi: 10.1037/0033-2909.102.1.122
Quirk, G. J., Likhtik, E., Pelletier, J. G., & Pare, D. (2003). Stimulation of medial prefrontal cortex decreases the responsiveness of central amygdala output neurons. *The Journal of Neuroscience, 23*, 8800-8807.
Rapee, R. M. (1993). The utlisation of working memory by worry. *Behaviour Research and Therapy, 31*, 617-620. doi: 10.1016/0005-7967(93)90114-A
Richards, J. M., & Gross, J. J. (2000). Emotion regulation and memory: The cogitive costs of keeping one's cool. *Journal of Personality and Social Psychology, 79*, 410-424. doi: 10.1037/0022-3514.79.3.410
Roemer, L., & Orsillo, S. M. (2009). *Mindfulnes-& acceptance-based behavioral therapies in practice* NY: Guilford Press.
Roemer, L., Salter, K., Raffa, S. D., & Orsillo, S. M. (2005). Fear and avoidance of internal experiences in GAD: Preliminary tests of a conceptual model. *Cognitive Therapy and Research, 29*, 71-88. doi: 10.1007/s10608-005-1650-2
Russel, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology, 39*, 1161-1178. doi: 10.1037/h0077714
Rusting, C. L., & Nolen-Hoeksema, S. . (1998). Regulating responses to anger: Effects of rumination and distraction on angry mood. *Journal of Personality and Social Psychology, 74*, 790-803. doi: 10.1037/0022-3514.74.3.790
Salters-Peneault, K., Suvak, M., & Roemer, L. (2008). An experimental investigation of the effect of worry on response to a discrimination learning task. *Behavior Therapy, 39*, 251-261. doi: 10.1016/j.beth.2008.01.001
Satyapriya, M., Nagendra, H. R., Nagarathna, R., & Padmalatha, V. (2009). Effects of integrated yoga on stress and heart rate variability in pregnant women. *International Journal of Gynecology and Obstetrics, 104*, 218-222. doi: 10.1016/j.ijgo.2008.11.013
Schachter, S., & Singer, J. E. (1962). Cognitive, social, and physiological determinants of emotional state. *Psychological Review, 69*, 379-399. doi: 10.1037/h0046234
Schmader, T., Forbes, C. E., Zhang, S., & Mendes, W. B. (2009). A metacognitive perspecitive on the cognitive deficits experienced in intellectually threatening environments. *Personality and Social Psychology Bulletin, 35*, 584-596. doi: 10.1177/0146167208330450
Schmader, T., & Johns, M. (2003). Converging evidence that stereotype threat reduces working memory capacity. *Journal of Personality and Social Psychology, 85*, 440-452. doi: 10.1037/0022-3514.85.3.440
Schmeichel, B. J. (2007). Attention control, memory updating, and emotion regulation temporarily reduce the capacity for executive control. *Journal of Experimental Psychology: General, 136*, 241-255. doi: 10.1037/0096-3445.136.2.241
Schmeichel, B. J., Demaree, H. A., Robinson, J. L., & Pu, J. (2006). Ego depletion by response exaggeration. *Journal of Experimental Social Psychology, 42*, 95-102. doi: 10.1016/j.jesp.2005.02.005
Schmeichel, B. J., Vohs, K. D., & Baumeister, R. F. (2003). Intellectual performance and ego depletion: Role of the self in logical reasoning and other information processing.

Journal of Personality and Social Psychology, 85, 33-46. doi: 10.1037/0022-3514.85.1.33

Schmeichel, B. J., Volokhov, R. N., & Demaree, H. A. (2008). Working memory capacity and the self-regulation of emotional expression and experience. *Journal of Personality and Social Psychology, 95*, 1526-1540. doi: 10.1037/a0013345

Schneider, W., & Shiffrin, R. M. (1977). Controlled and automatic human information processing: I detection, search, and attention *Psychological Review, 84*, 1-66. doi: 10.1037/0033-295X.84.1.1

Scholey, A. B., Harper, S., & Kennedy, D. O. (2001). Cognitive demand and bood glucose. *Physiology and Behaviour, 73*, 585-592. doi: 10.1016/S0031-9384(01)00476-0

Schrooten, M. G. S., & Smulders, F. T. Y. (2010). Temporal dynamics of selective attention in non-clinical anxiety. *Personality and Individual Differences, 48*, 213-217. doi: 10.1016/j.paid.2009.10.013

Segerstrom, S. , Tsao, J. C. I., Alden, L. E., & Craske, M. G. (2000). Worry and Rumination: Repetitive thought as a concomitant and predictor of negative mood. *Cognitive Therapy and Research, 24*, 671-688. doi: 10.1023/A:1005587311498

Segerstrom, S. C., & Solberg Nes, L. (2007). Heart rate variability reflects self-regulatory strength, effort and fatigue. *Psychological Science, 18*, 275-281. doi: 10.1111/j.1467-9280.2007.01888.x

Shackman, A. J., Sarinopoulos, I., Maxwell, J. S., Pizzagalli, D. A., Lavric, A., & Davidson, R. J. (2006). Anxiety selectively disrupts visuospatial working memory. *Emotion, 6*, 40-61. doi: 10.1037/1528-3542.6.1.40

Shallice, T., & Burgess, P. (1993). Supervisory control of action and thought selection. In A. Baddeley & L. Weiskrantz (Eds.), *Attention, selection, awareness & control: A tribute to Donald Broadbent* (pp. 171-1987). NY: Oxford University Press.

Shallice, T., Burgess, P. W., Schon, F., & Baxter, D. M. (1989). The origins of utilisation behaviour. *Brain 112*, 1587-1598. doi: 10.1093/brain/112.6.1587

Shapiro, P. A., Sloan, R. P., Bagiella, E., Kuhl, J. P., Anjilvel, S., & Mann, J. J. (2000). Cerebral activation, hostility, and cardiovascular control during mental stress. *Journal of Psychosomatic Research, 48*, 485-491. doi: 10.1016/S0022-3999(00)00100-8

Sheppes, G., Catran, E., & Meiran, N. (2009). Reapraisal (but not distraction) is going to make you sweat: physiological evidence for self-control effort. *International Journal of Psychophysiology, 71*, 91-96. doi: 10.1016/j.iipsycho.2008.06.006

Sheppes, G., & Meiran, N. (2007). Better late than never? On the dynamics of online regulation of sadness using distraction and cognitive reappraisal. *Personality and Social Psychology Bulletin, 33*, 1518-1532. doi: 10.1177/0146167207305537

Sheppes, G., & Meiran, N. (2008). Divergent cognitive costs for online forms of reappraisal and distraction. *Emotion, 8*, 870-874. doi: 10.1037/a0013711

Siegrist, M. (1997). Test-retest reliability of different versions of the stroop test. *The Journal of Psychology, 131*, 299-306. doi: 10.1080/00223989709603516

Simpson, J. R., Drevets, W. C., Snyder, A. Z., Gusnard, D. A., & Raichle, M. E. (2001). Emotion-induced changes in human medial prefrontal cortex: II. During anticipatory anxiety *Proceedings of the National Academy of Sciences of the United States of America, 98*, 688-693. doi: 10.1073/pnas.98.2.688

Sorg, B. A., & Whitney, P. (1992). The effect of trait anxiety and situational stress on working memory capacity. *Journal of Research in Personality, 26*, 235-241. doi: 10.1016/0092-6566(92)90041-2

Spielberger, C. D. (1972). Anxiety as an emotional state. In C. D. Spielberger (Ed.), *Anxiety: Current trends in theory and research* (Vol. 1, pp. 23-49). London: Academic Press.

Spielberger, C., Gorsuch, R., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *State-Trait Anxiety Inventory: sampler set, manual, test, scoring key*. Redwood City, CA: Mind Garden, Inc.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18*, 643-662. doi: 10.1037/h0054651

Stucke, T. S., & Baumeister, R. F. (2006). Ego depletion and aggressive behaviour: Is the inhibition of aggression a limited resource? *European Journal of Social Psychology, 36*, 1-13. doi: 10.1002/ejsp.285

Tabachnick, B. G., & Fidell, L. S. (1996). *Using multivariate statistics* (3rd ed.). NY: HarperCollins College Publishers

Taelman, J., Vandeput, S., Spaepen, A., & Van Huffel, S. . (2008). Influence of mental stress on heart rate and heart rate variability *IFMBE Proceedings, 22*, 1366-1369. doi: 10.1007/978-3-540-89208-3_324

Tarvainen, M. P., & Niskanen, J. (2008). Kubios HRV version 2.0 user's guide Kupio.

Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology. (1996). Heart rate variability: Standards of measurement, physiological interpretation, and clinical use. *Circulation, 93*, 1043-1065. doi: 10.1161/01.CIR.93.5.1043

Thayer, J. F., Friedman, B. H., & Borkovec, T. D. (1996). Autonomic characteristics of generalized anxiety disorder and worry. *Biological Psychiatry, 39*, 255-266. doi: 10.1016/0006-3223(95)00136-0

Thayer, J. F., Friedman, B. H., Borkovec, T. D., Johnsen, B. H., & Molina, S. (2000). Phasic heart period reactions to cued threat and nonthreat stimuli in generalised anxiety disorder. *Psychophysiology, 37*, 361-368. doi: 10.1111/1469-8986.3730361

Thayer, J. F., Hansen, A. L., Saus-Rose, E., & Johnsen, B. H. (2009). Heart rate variability, prefrontal neural function, and cognitive performance: The neurovisceral integration perspective on self-regulation, adaption, and health. *Annals of Behavioral Medicine, 37*, 141-153. doi: 10.1007/s12160-009-9101-z

Thayer, J. F., & Lane, R. D. (2000). A model of neurovisceral integration in emotion regulation and dysregulation. *Journal of Affective Disorders, 61*, 201-216. doi: 10.1016/S0165-0327(00)00338-4

Tohill, J. M., & Holyoak, K. J. (2000). The impact of anxiety on analogical reasoning. *Thinking and Reasoning, 6*, 27-40. doi: 10.1080/13546780039391

Trask, P . C. , & Sigmon, S., T. (1999). Ruminating and distracting: Th effects of sequential tasks on depressed mood. *Cognitive Therapy and Research, 23*, 231-246. doi: 10.1023/A:1018787430249

Treynor, W., Gonzalez, R., & Nolen-Hoeksema, S. (2003). Rumination reconsidered: A Psychometric Analysis. *Cognitive Therapy and Research, 27*, 247-259. doi: 10.1023/A:1023910315561

Van Dillen, L. F., & Koole, S. L. (2007). Clearning the mind: A working memory model of distraction from negative mood. *Emotion, 7*, 715-723. doi: 10.1037/1528-3542.7.4.715

Verkuil, B. , Brosschot, J. F., de Beurs, D. P, & Thayer, J. F. (2009). Effects of explicit and implicit perseverative cognition on cardiac recovery after cognitive stress. *International Journal of Psychophysiology, 74*, 220-228. doi: 10.1016/j.ijpsycho.2009.09.003

Verkuil, B., Brosschot, J. F., Borkovec, T. D., & Thayer, J. F. (2009). Acute autonomic effects of experimental worry and cognitive problem solving: Why worry about worry? *International Journal of Clinical and Helath Psychology, 9*, 439-453.

Vohs, K. D., Baumeister, R. F., & Schmeichel, B. J. . (2012). Motivation, personal beliefs, and limited resources all contribute to self-control. *Journal of Experimental Social Psychology, 48*, 943-947. doi: 10.1016/j.jesp.2012.03.002

Vohs, K. D., & Heatherton, T. F. (2000). Self-regulatory failure: A resource-depletion approach. *Psychological Science, 11*, 249-254. doi: 10.1111/1467-9280.00250

Vohs, K., & Schmeichel, B. J. (2003). Self-regulation and the extended now: Controlling the self alters the subjective experience of time. *Journal of Personality and Social Psychology, 85*, 217-230. doi: 10.1037/0022-3514.85.2.217

Wallis, D. J., & Hetherington, M. M. (2004). Stress and eating: the effects of ego-threat and cognitive demand on food intake in restrained and emotional eaters. *Appetite, 43*, 39-46. doi: 10.1016/j.appet.2004.02.001

Watkins, E. (2004). Appraisals and strategies associated with rumination and worry. *Personality and Individual Differences, 37*, 679-694. doi: 10.1016/j.paid.2003.10.002

Watkins, E., & Baracacaia, S. (2002). Rumination and social problem-solving in depression. *Behaviour Research and Therapy, 40*, 1179-1189. doi: 10.1016/S0005-7967(01)00098-5

Watkins, E., Moulds, M., & Mackintosh, B. (2005). Comparison between rumination and worry in a non-clinical population. *Behaviour Research and Therapy, 43*, 1577-1585. doi: 10.1016/j.brat.2004.11.008

Watkins, E. R. (2009). Thought control strategies, thought suppression, and rumination in depression. *International Journal of Cognitive Therapy, 2*, 235-251. doi: 10.1521/ijct.2009.2.3.235

Watkins, L. L., Grossman, P., Krishnan, R., & Sherwood, A. (1998). Anxiety and vagal control of heart rate. *Psychosomatic Medicine, 60*, 498-502.

Watson, D., & Clark, L. A. (1984). Negative affectivity: The disposition to experience aversive emotional states. *Psychological Bulletin, 96*, 465-490. doi: 10.1037/0033-2909.96.3.465

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*, 1063-1070. doi: 10.1037/0022-3514.54.6.1063

Wechsler, D. (1997). *WAIS-III manual*. New York: Psychological Corporation.

Wegner, D. M. (1994). Ironic processes of mental control. *Psychological Review, 101*, 34-52. doi: 10.1037/0033-295X.101.1.34

Wegner, D. M., Erber, R., & Zanakos, S. (1993). Ironic processes in the mental control of mood and mood-related thought. *Journal of Personality and Social Psychology, 65*, 1093-1104. doi: 10.1037/0022-3514.65.6.1093

Wegner, D. M., Schneider, D. J., Carter, S. R., & White, T. L. (1987). Paradoxical effects of thought suppression. *Journal of Personality and Social Psychology, 53*, 5-13. doi: 10.1037/0022-3514.53.1.5

Wegner, D. M., & Zankos, S. (1994). Chronic thought suppression. *Journal of Personality, 62*, 615-639. doi: 10.1111/j.1467-6494.1994.tb00311.x

Weinberg, A., Klonsky, E. D., & Hajcak, G. (2009). Autonomic impairment in borderline personality disorder: A laboratory investigation. *Brain and Cognition, 71*, 279-286. doi: 10.1016/j.bandc.2009.07.014

Wells, A. (2009). *Metacognitive therapy for anxiety and depression.* New York: Guilford Press.

Wells, A., & Cartwright-Hatton, S. (2004). A short form of the metacognitions questionnaire: Properties of the MCQ-30. *Behaviour Research and Therapy, 42*, 385-396. doi: 10.1016/S0005-7967(03)00147-5

Wenzlaff, R. M., & Luxton, D. D. (2003). The role of thought suppression in depressive rumination. *Cognitive Therapy and Research, 27*, 293-308. doi: 10.1023/A:1023966400540

Westphal, M., & Bonanno, G. A. (2004). Emotion self-regulation. In M. Beauregard (Ed.), *Consciousness, emotional self-regulation and the brain* (Vol. 54, pp. 1-34). Philadelphia: John Benjamins North America.

Wicklund, R. A. (1975). Objective self-awareness. *Advances in Experimental Social Psychology, 8*, 233-275. doi: 10.1016/S0065-2601(08)60252-X

Wientjes, C. J. E. (1992). Respiration in psychophysiology: methods and applications. *Biological Psychology, 34*, 179-203. doi: 10.1016/0301-0511(92)90015-M

Wilder, J. (1962). Basimetric approch (law of initial value) to biological rhythms. *Annals of the New York Academy of Science, 98*, 1211-1220. doi: 10.1111/j.1749-6632.1962.tb30629.x

Wilson, E., & MacLeod, C. (2003). Contrasting two accounts of anxiety-linked attentional bias: selective attention to varying level of stimulus threat. *Journal of Abnormal Psychology, 112*, 212-218. doi: 10.1037/0021-843X.112.2.212

Wong, Q. J. J., & Moulds, M. L. (2009). Impact of rumination versus distraction on anxiety and maladaptive self-beliefs in socially anxious individuals. *Behaviour Research and Therapy, 47*, 861-867. doi: 10.1016/j.brat.2009.06.014

Zajonc, R. B. (1980). Feeling and thinking: preferences need no inferences. *American Psychologist, 35*, 151-175. doi: 10.1037/0003-066X.35.2.151

Zajonc, R. B. (2000). Feeling and thinking: closing the debate over the independence of affect. In J. P. Forgas (Ed.), *Feeling and thinking: the role of affect in social cognition* (pp. 31-58). Cambridge Cambridege University Press.

Zebb, B. J., & Beck, J. G. (1998). Worry versus anxiety: Is there really a difference? *Behaviour Modification, 22*, 45-61. doi: 10.1177/01454455980221003

Appendix A: Writing Paper

Regulation Instructions on Writing Pages

Acceptance

Please do not just list your thoughts. Rather, describe your observation, allowance, non reactive, non judgmental acceptance of your bodily sensations, thoughts and feelings that you experience.

Distraction

Generate and describe as many uses as possible for donkeys ponies and horses within a context taking into account the animals characteristics.

Mind-wandering Control Condition

Let your mind wander and write down any of your thoughts that come to mind.

Appendix B: Reported Affect (Experiment)

To what extent do the following words describe how you feel <u>at the present moment</u> from

"*not at all"* (1) to "*very much"*(7).

Item No	Adjective	Not at all					Very much
1	agitated	1	2	3	4	5	6	7
2	anxious	1	2	3	4	5	6	7
3	nervous	1	2	3	4	5	6	7
4	uneasy	1	2	3	4	5	6	7
5	worried	1	2	3	4	5	6	7

Don't turn over page until instructed to.

Several different instructions were used at different points during the experiment including with reference to what time period people were asked to report their affective state, rather than simply "at the present moment" or how you feel right now, at the present moment".

Such wording included:

1. During the Stroop;

"<u>how you felt whilst engaged in the colour naming task **involving the colour words (ie. not during naming the XXX strings)**</u>"and," <u>how you felt whilst engaged in the colour naming task **involving the colour words (ie. not during naming the XXX strings)**</u>"

2. During Letter Number Sequencing;

"<u>how you felt towards the end of the letter number task</u>" and, <u>"how you felt towards the end of the letter number task</u>"

3. During the Affect Manipulation Task

"<u>how you felt during the speech</u>" or "<u>how you felt during the movie</u>"

Appendix C: Regulation Audiotape Quiz Questions with Answers

<u>Acceptance</u>

Quiz A

Participant no:

1. What sort of posture were you asked to get into? **(Relaxed dignified back erect but not stiff)**

2. Were you asked to close your eyes? **(yes)**

3. How were you asked to view your thoughts? (as passing mental events/ as clouds)

4. Were you asked to notice feelings**?(yes)**

5. Was there a poem in the tape?**(no)**

6. What were you asked to do with clouds? **(put thoughts and feelings on them)**

7. Were you asked to let go of efforts to change your thoughts and feelings? **(yes)**

8. Where were you asked to picture yourself? **(on the deck of a house, on a raft in a pond, on a blanket in a field, anywhere you have a clear full view of the sky)**

9. What were the clouds meant to represent in your mind? **(thoughts and feelings)**

10. What was the sky meant to represent in the tape? **(your mind)**

<u>Distraction</u>

Quiz D

Participant no:

1. Were you instructed to think about each animal individually? **(yes)**

2. Was it mentioned that donkey ponies and horses are part of the equidae family in the audio? **(no)**

3. Were you instructed to think about the animals in movies? (**yes)**

4. Were differences in coats, manes and tails considered for use generation? (yes)

5. Were you asked to think about the landscape each animal is in? **(yes)**

6. Were you asked to think about the noises the animals made? **(yes)**

7. Were the uses for animals body parts presented as an opportunity for use generation? **(no)**

8. Were you asked to visualise the different animals. **(yes)**

9. Was past or present contexts mentioned? **(yes)**

10. Was differences in food consumption mentioned**?(no)**

<u>Mind-wandering Control condition</u>

Quiz NR

Participant no:

1. Was there any songs or beats played in the audio? **(no)**

2. Was there both male and female voices in the audio? **(yes)**

3. Was there girls voices saying ok in the audio? **(yes)**

4. Was there girl laughing in the audio? **(yes)**

5. Was there male laughter in the audio? **(yes)**

6. Was there the sound of a printer or photocopier in the audio? **(no)**

7. Was their a squeaky high pitched sound (like a door opening)? **(yes)**

8. Was their a high pitched chime sound (lie a computer providing a notification)?

(**yes)**

9. Did someone mention something about going to work? **(yes)**

10. Was the expression “no worries” used by someone in the audio? **(yes)**

Appendix D: Effort and Difficulty Items

Please answer the following regarding the period in which you were asked to engage in the thinking (i.e., following the audio tape).

Item No		1 not any effort at all	2	3	4	5	6	7 all of my available effort
1	How much effort did the thinking task require?	1	2	3	4	5	6	7
2	How difficult did you find the thinking task?	1	2	3	4	5	6	7

Appendix E: Attentional Focus, Cognitive Evaluations and Attempts at Controlling Thoughts or Feelings

High-Threat level

Item No		not at all						Very much so
1	I distracted myself by thinking about other things unrelated to the future speech.	1	2	3	4	5	6	7
2	I concentrated on some other topic and tasks rather than how I felt.	1	2	3	4	5	6	7
3	I thought about things other than the speech	1	2	3	4	5	6	7
4	I tried to see the impromptu speech task as positively as possible.	1	2	3	4	5	6	7
5	I viewed the impromptu speech as a challenge.	1	2	3	4	5	6	7
6	I thought of the impromptu speech in a way that made me stay calm.	1	2	3	4	5	6	7
7	I accepted my thoughts and feelings about doing the impromptu speech.	1	2	3	4	5	6	7
8	I had thoughts that it was natural to feel this way.	1	2	3	4	5	6	7
9	I wished that I could control my thoughts and feelings more easily.	1	2	3	4	5	6	7
10	I had thoughts about the consequences of performing poorly in the impromptu speech.	1	2	3	4	5	6	7
11	I had thoughts wondering how well others would perform in the impromptu speech.	1	2	3	4	5	6	7
12	I had worrisome thoughts about my performance during the speech.	1	2	3	4	5	6	7
13	I thought “what am I doing to deserve this?”	1	2	3	4	5	6	7
14	I thought “why do I always react this way?”	1	2	3	4	5	6	7
15	I thought “why can’t I handle things better?”	1	2	3	4	5	6	7
16	During the situation I thought I should control my thoughts.	1	2	3	4	5	6	7
17	I tried to control my feelings.	1	2	3	4	5	6	7
18	I tried to stop thinking about the upcoming impromptu speech.	1	2	3	4	5	6	7
19	I tranced out during that moment in time.	1	2	3	4	5	6	7
20	I zoned out and lost a sense of where I was and what I was to do.	1	2	3	4	5	6	7
21	I numbed out to what was going to happen.	1	2	3	4	5	6	7

Low-threat Level

Item No		not at all						Very much so
1	I distracted myself by thinking about other things unrelated to the short film clip.	1	2	3	4	5	6	7
2	I concentrated on some other topic and tasks rather than how I felt.	1	2	3	4	5	6	7
3	I thought about things other than the short film clip.	1	2	3	4	5	6	7
4	I tried to see the short film clip task as positively as possible.	1	2	3	4	5	6	7
5	I viewed watching the short film clip as a challenge.	1	2	3	4	5	6	7
6	I thought of the short film clip in a way that made me stay calm.	1	2	3	4	5	6	7
7	I accepted my thoughts and feelings about watching the short film clip.	1	2	3	4	5	6	7
8	I had thoughts that it was natural to feel this way.	1	2	3	4	5	6	7
9	I wished that I could control my thoughts and feelings more easily.	1	2	3	4	5	6	7
10	I had thoughts about the consequences of performing poorly at watching the short film clip.	1	2	3	4	5	6	7
11	I had thoughts wondering how well others would perform at watching the short film clip.	1	2	3	4	5	6	7
12	I had worrisome thoughts about my performance at watching the short film clip.	1	2	3	4	5	6	7
13	I thought “what am I doing to deserve this?”	1	2	3	4	5	6	7
14	I thought “why do I always react this way?”	1	2	3	4	5	6	7
15	I thought “why can’t I handle things better?”	1	2	3	4	5	6	7
16	During the situation I thought I should control my thoughts.	1	2	3	4	5	6	7
17	I tried to control my feelings.	1	2	3	4	5	6	7
18	I tried to stop thinking about the upcoming short film clip.	1	2	3	4	5	6	7
19	I tranced out during that moment in time.	1	2	3	4	5	6	7
20	I zoned out and lost a sense of where I was and what I was to do.	1	2	3	4	5	6	7
21	I numbed out to what was going to happen.	1	2	3	4	5	6	7

Regulation Item Instructions

Several different instructions were used before participants completed the items in the regulation strategy manipulation check, depending on the regulation condition and affect condition they were in. These instructions included:

1. *High-threat Acceptance*

What sorts of thoughts or mental activities did you undertake during the thinking task (ie. when asked to follow the audio taped instructions) when asked to observe and accept your thoughts and feelings. Please rate the following items as being indicative of what you did during the thinking period which was after hearing the news that you would be delivering an impromptu speech.

2. *High-threat Distraction*

What sorts of thoughts or mental activities did you undertake during the thinking task (ie. when asked to follow the audio taped instructions) when asked to think about donkeys, ponies and horses and their uses. Please rate the following items as being indicative of what you did during the thinking period which was after hearing the news that you would be delivering an impromptu speech.

3. *High-threat Control Condition*

What sorts of thoughts or mental activities did you undertake during the thinking task (ie. during the audio tape) when asked to let your mind wander. Please rate the following items as being indicative of what you did during the thinking period which was after hearing the news that you would be delivering an impromptu speech.

4. *Low-threat Acceptance*

What sorts of thoughts or mental activities did you undertake during the thinking task (ie. when asked to follow the audio taped instructions) when asked to observe and accept your thoughts and feelings. Please rate the following items as being indicative of what you did during the thinking period (when following the audio taped instructions) which was after hearing the news that you would be watching a short film clip about UK tax Law.

5. Low-threat Distraction

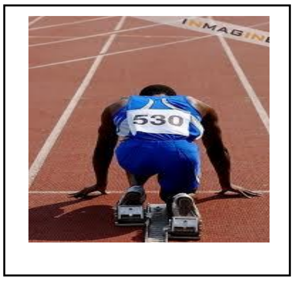
What sorts of thoughts or mental activities did you undertake during the thinking task (ie. when asked to follow the audio taped instructions) when asked to think about donkeys, ponies and horses and their uses. Please rate the following items as being indicative of what you did during the thinking period (when following the audio taped instructions) which was after hearing the news that you would be watching a short film clip about UK tax Law.

6. Low-threat Control Condition

What sorts of thoughts or mental activities did you undertake during the thinking task (ie. during the audio taped instructions) when asked to let your mind wander. Please rate the following items as being indicative of what you did during the thinking period which was after hearing the news that you would be watching a short film clip about UK tax Law.

Appendix F: Advertisement

<u>Performance and Stress in Creative and Assessment Based Tasks</u>



Ethics Permit No: 2010/092

Some tasks are thought to be more stressful than others. Stress can be not only unwanted by unhelpful on particular tasks, impairing performance. This study investigates the role how stress can result from varying task and how it may impact on performance. You will be given feedback regarding your stress levels for each task and how you performed on that task at the end of the experiment, plus some information about how to handle stress during particular tasks.

What the Study will Involve?

If you decide to participate in this study, you will be asked to complete the following tasks:

1. Complete a questionnaire about personal dispositions towards experiences and how you deal with particular situations before attending the experimental session. It is estimated that the questionnaire will take approximately 20 minutes.
2. Complete an experimental session, involving a range of tasks. These will include memory and attention tasks, and writing a short piece on a set topic.
3. Responses will be verbal and written. Some self report questions regarding your emotional state and a heart rate measurement will be taken. It is estimated that the experimental session will take approximately 1.5 hours.

You are likely to experience mild degree's of stress during the tasks and if you have any conditions that may result in particularly adverse reactions please do not take part. You are free to withdraw at anytime.

Participation Requirements

Participants should be fluent English speakers and 18 years of age or older.

Reimbursement for Your Participation

Participants have a choice of a hot drink voucher at a guild coffee shop or 2 hours logged on subject pool if a psychology student.

If you wish to participate in the study simply log on to subject pool on the Murdoch's school of psychology web page http://www.psychology.murdoch.edu.au/subjpool.html or contact Paul on telephone 9360 6911 (leave a message if office is unattended) or email paulknorman@gmail.com

If you have any questions about this project please feel free to contact either Paul Norman on 9360 6911, or email paulknorman@gmail.com or my supervisor, Dr Helen Davis, on ph. 9360 2859 or on email h.davis@murdoch.edu.au.

Appendix G: Threat Manipulation Instructions

High-threat Manipulation

"As the assessment based task, after a unrelated 5 minute writing task in the middle of the experiment, you will be asked to deliver a 5 minute speech which will indicate your capacity for grasping an understanding of a core academic topic. The topic must remain unknown to you until the very moment before you must deliver the speech. During your impromptu speech you will be videotaped. This video of you will be watch by some staff, who will rate your speech on three areas, including (1) clarity of presentation, (2) correctness of points, and (3) level of detail provided as indicators of understanding. You will have the choice of 2 questions on the topic, both taking slightly different perspectives. Which one do you choose. Ok so here is the envelope with the question in it. You must not open the envelope until I say which will be at the very moment before the speech. So I'm just going to test the camera now by doing an initial recording of you and to get you used to how you need to sit and where to look and what volume level you should speak at. Initially we were using a microphone however that appears faulty so we are having to use the microphone on the video camera instead, which requires you to speak up. Ok so this is on now and I am going to hit record for a test. This is participant number X. What year you are in and is psychology is your only major? Speak up a bit. How did you get to uni today? Ok so make sure you look into the camera when you speak. So now that we have done the test run we will prepare you to perform the written task.

Low-Threat Manipulation

"In the middle of the experiment you will be watching a short film clip about UK tax Law as we were interested in your physiological responses. There will not be any questions on any of the information presented in the film clip or on your knowledge of UK tax law. You must maintain your focus on the video for the whole time. The film clips runs for a bit over 6 minutes but you will only watch about 5 minutes". It involves an interview of a particular tax expert regarding offshore bank accounts and the disclosure of income from those offshore bank accounts. The film clip has been made for people from the UK who have an account or an asset and have not paid enough uk tax on it. Typically these people are in their 60's and 70's and have not touched the money for many years. It informs these people as to how they can make a disclosure to the relevant authority and the benefits of doing this if they think that they have something to disclose regarding unpaid taxes. Both men in the interview have very heavy accents, they are both dressed in suits. The interviewer is older than the interviewee. Both men are balding. Adrian Houston, the interviewee was a former tax inspector working for the British government and now is a tax consultant. The film was made for the 2009 calendar year. Do you have any questions about the film clip? Do you have any interest in UK tax law? When the time comes all you will have to do is swivel your chair around and face the screen when the time comes and sit nice and still and quiet whilst watching the screen paying attention to what they are saying."

Appendix H: Affect Regulation Instructions

<u>Initial General Instructions</u>

Participants in the acceptance and distraction conditions heard

"I'm going to get you to do a writing task in a moment, but first I will give you 15 minutes to think about the topic, with an recording to help guide your thoughts that you will then write about".

Participants in the mind-wandering control conditions heard

"I'm going to get you to do a writing task in a moment, but first I will give you 15 to think about the topic, with a recording of some background noises in the library to help you prepare for what you will then write about".

Initial Specific Instructions

1. Acceptance

" We want to you to notice and later describe your process of watching your thoughts and feelings come and go. We want you to observe and accept your thoughts and feelings as they arise."

2. Distraction

"For this period of time please sit and think about donkeys, ponies, and horses and how they might be used. Please generate as many uses for donkeys, ponies and horses as you can."

1. Mind-wandering

" We want to describe your thoughts as on whatever crosses your mind. You could describe anything from the upcoming tasks in the experiment to a memory of a previous lecture."

Appendix I: Regulation Writing Examples

<u>Regulation Strategy Writing Examples</u>

All participants heard:

I will read you an example of how you could do this and then an example of how not to do this followed by an improved example and then your time will begin

1. <u>High-threat Acceptance</u>

A Good Example

"I have noticed the silence now in the room, as I am now supposed to sit write. I have made a judgment about how silly this writing task is, and I now am accepting the fact that I will sit here for the next five minutes, noticing and describing my thoughts, feelings and sensations. I can feel the chair on my back and the wires around me. I can feel the pen pressing into my fingers and my hand on the cold paper. I am having thoughts about what the impromptu speech topic will be about and there is a touch of excitement, and then fear and then possible boredom and I watch these feelings just drift away. I think I just spelt boredom wrong. I notice the slight interruption in writing and simply continue. I take the perception of misspelling boredom as just a thought and then accept that this causes some nervousness, and allow feelings to subside as I wait for the next thought or feeling to arise. I see the thought and feelings like a leaf on a stream, slowly approaching, until the leaf floats on past me and out of sight, and I wait for the next sensation, thought or feeling to come to awareness."

A bad example of the task is simply listing thoughts without separating and yourself from them

I think that this writing task is silly and I don't really want to do it. These wires and tape feel funny and weird around me and will hurt to take off. I am going to start fidgeting to stay comfortable. Now I don't know what to write about, how am I going to write about my thoughts feelings and sensations for five minutes.

This bad example could have been written like

I have noticed that I am having the thought that the writing task is silly. I am noting the sensations of the wires and how they feel around me and the way they make contact with my body and I am allowing the experience of these sensations. I have noticed that I am having the thought that I don't know what to write about and I watch this thought pass. I *then observe the next follow on thought of a question if I can write about my thoughts, feelings and sensations for the next five minutes and I see this thought drift away. I sit waiting for the next sensation, thought or feeling to come to awareness.*

2. Low-threat Acceptance

Instructions are the same as anxious acceptance except to reference to the speech is replaced with reference to the short film clip on UK tax law.

3. High-threat Distraction

Good example

"In the past donkeys ponies and horses were used much more extensively than they are now. Horses were the main form of transportation for centauries before the invention of the car. Horses could be ridden on or used to draw a carriage. Horses were used in both civilian urban and rural settings as well as in military activities in remote area's. Now days horses no longer have these primary roles in transportation, in westernized nations. However, horses have retained their uses in entertainment and sports activities, such as doing circus tricks, dressage events, jumping, and racing. On the less humane side horses have for some time been used for meat, and for the production of certain goods, including for human and pet consumption, for making soap products, and for the production of gellatine. Donkeys have different uses from a hoarse because they don't have the same elegance and beauty. Kings, important and wealthy people own horses, and would never be seen riding a donkey. Ponies look pretty and are very popular amongst little girls for riding and made into toys. Many young girls have a liking towards ponies and hence can be used for entertainment for shows or at parties for this group."

A bad example of this is simply just listing the differences between the animals

"Donkeys ponies and horses are different from each other. Ponies are simply just a small horse with thicker coats, mains and tails than horses, and larger bodies proportionally to horses. Horses are taller and faster animals, whilst donkeys have longer ears and hear better and make very loud sounds to communicate to other donkeys. In the wild horses live in packs whilst donkeys are solitary animals."

A better example of this is

"In coming up with many different uses for donkeys ponies and horses it is important to note the similarities and differences between the animals. Although ponies are considered simply small horses, their thicker coats make them more suitable for colder environments than horses. Horses being faster than ponies could be used for traveling further distances or where speed is a high priority (eg. in delivering urgent messages in areas where there are no cars). Although donkeys make different noises and have longer ears this does not present any clearly favourable uses for them different to that of a horse or pony. Horses are more suited to be used together due to their natural tendency to live in packs in the wild."

4. <u>Low- threat Distraction</u>

Instructions are the same as anxious distraction.

5. <u>High-threat Mind-wandering</u>

Good Example

"Ok so I have to sit here and describe my thoughts about whatever comes to mind. This thinking task seems pretty silly. I wonder what this topic and question for the speech will be about. I wonder what the other tasks will be. This is a strange room, I have never been in here before. I wonder if I can move my leg a bit to be a bit more comfortable. I don't really know what to think about. I have an assignment coming up. Is there a chance it is going to have anything to do with the topic I will have to speak about. That unit's workshops are so boring I can't remember what the assignment topics options were, none of the topics presented seemed interesting. Just got to jump the hoops and do what the marking guide says. I wonder if I can reference the text book or some of the set reading. I liked one of the set readings. It reminded me of a good documentary I had seen on channel 2. I love channel 2 documentaries. The best part is that they make you think and you don't have to watch any ads. Plus the ABC jingle is so catchy and makes me feel relaxed and at home."

A bad example is focusing on one topic

"An important topic in psychology is the nature versus nurture debate in which academics debate whether particular tendencies are influenced primarily by genes or by learning. To investigate this topic researchers often use monozygotic twin based studies where the twins were separated at birth and raised in different environments. The twins are then followed up and measured on a range of constructs usually personality based."

A better example of this bad example would be

"I wonder what the speech topic will be on. Will it have anything to do with the nature versus nurture debate. I wonder if it will be a practical or ethical issue or a methodological issue topic. I really like the nature versus nurture debate because there is so much you can say. I often just think about myself and try and think about which characteristic I must have learned and what I must have inherited. Sometimes I wonder about my voice, if that is a heritable or a learned thing. I wonder what would have happened if I took more singing lessons and sung different songs in the shower if my voice would change. Inhaling helium will definitely help."

6. Low-threat Mind-wandering

Good example

"Ok so I have to sit here and describe my thoughts about whatever comes to mind. This thinking task seems pretty silly. I wonder what this film clip on UK tax law will be like. I wonder what the other tasks will be. This is a strange room, I have never been in here before. I wonder if I can move my leg a bit to be a bit more comfortable. I don't really know what to think about. I have an assignment coming up. There is no chance that it is going to have anything to do with UK tax law. That unit's workshops are so boring I can't remember what the assignment topics options were, none of the topics presented seemed interesting. Just got to jump the hoops and do what the marking guide says. I wonder if I can reference the text book or some of the set readings. I liked one of the set readings. It reminded me of a good documentary I had seen on channel 2. I love channel 2 documentaries. The best part is that they make you think and you don't have to watch any ads. Plus the ABC jingle is so catchy and makes me feel relaxed and at home."

A bad example is focusing on one topic

"Uk tax law is similar to that of Australian tax law, it is legislated for and the money goes to pay for government programs. They also have a GST in the UK like here in Australia but the rate is over 10%. UK tax law is very relevant to people in the UK or people deriving an income within the UK."

A better example of this bad example would be

"I wonder what is going to be in the short film clip on UK tax law. Will it have anything to do with Australian tax law. Stupid GST makes everything more expensive, maybe I could take a unit in taxation so that I can evade paying tax legally. I wonder what units I actually have

left to do and if I can do some more general electives. Tax law doesn't really fit in with my other general electives or my degree in general. Maybe I could just start another degree that is related to tax. No actually, not that keen on starting something else just yet. I want to earn some money rather than start another degree. I can't spend my life at uni."

Appendix J: Affect Regulation Audiotape Instructions

Acceptance

"Please take a very definite posture…. Relaxed, dignified, back erect, but not stiff, letting your body express a sense of being present and awake. Now closing your eyes, if that feels comfortable for you, move your observation to how you are sitting in the chair………, to the sensations of your body pressing against the chair……. and to the pressure on the soles of your feet on the floor……….. Now bring your attention to your breath…notice how the air enters your body……., where it travels,……….. and how it leaves your body…..Notice the parts of your body that move as you are breathing…. Now placing your hand on your abdomen and noticing whether it moves as you are breathing…gently deepen your breath so that you are breathing from you abdomen….Noticing your abdomen, chest, and shoulders expand as you inhale….Continue to deepen and slow your breath…..Pay attention to the sensation you experience…..just continue to focus on your breath for the next several moments….

Now move your attention to what is going through your mind…… what thoughts are around? …………….just notice the thoughts as mental events………………… and then notice the feelings that are around at the moment … …..in particular, turning toward any sense of discomfort or unpleasant feelings……………. Rather than trying to push thoughts or feelings away……….observe them……………acknowledge them……………. Perhaps saying "ah there you are"…… And similarly with sensations in the body……… are there sensations of tension, or holding?…..and again, awareness of them……. simply noting them. Just notice each sensation…. Each thought….. each feeling as it arises……not trying to alter or change your experience……and noticing any desire to change what you are feeling ……….and gently letting go of that effort……….expanding your attention to allow your full experience here and now….notice what the feelings are like……..noticing if the feelings change in anyway……………… If you notice yourself becoming immersed and caught within a particular thought or feeling….. simply allow yourself a moment to label whatever it was that you were experiencing……. and move your attention back to observing your bodily sensations.

Now, picture yourself, lying someplace outside where you can see the sky. You can picture any place that feels comfortable and vivid to you—lying on your back on raft in a pond…………..on a blanket in a field……..on the deck of a house…………any place where you have a clear full view of the sky. Now imagine yourself comfortably lying……..your body sinking into whatever you're lying on………. as you gaze at the sky…… Notice the sky and the *clouds that hang in the sky, moving across it ………….Imagine that your thoughts and feelings are the clouds in the sky……………….while your mind is the sky itself……….. See your thoughts and feelings gently drifting across the sky………………..as you notice your thoughts and feelings place them in the clouds and notice them passing across the sky………………Notice yourself as you become distracted or immersed in the clouds, loosing sight of the sky………………… noticing how even when the clouds cover the sky, the sky still exists behind the clouds…….. Practice putting your thoughts and feelings onto the clouds………………..notice the different shapes they take……………………the different consistency of the clouds they are on………………….when you find yourself drifting on a cloud, slowly shift your attention back to the sky behind the clouds and practicing putting your thoughts and feelings onto the clouds.*

Begin to bring your attention back to the room……..Start making small movements with your finger as your toes…..and open your eyes…… and turn to the experimenter now that the audio has finished."

Distraction

"Please sit and concentrate your thought on donkeys, ponies and horses. You can generate uses for these animals by thinking about each suggestion provided. Think about each animals characteristics…….. Think about one animal at a time and then compare across…………. Think about each potential use for each animal at a time. Think about context………….think about what the animal does in the wild………what is usually associated with the animal?

Picture a donkey in you mind………….what does donkey look like?…………..is anything attached to donkey? Is the donkey dirty or clean? ………………………. Are there other donkeys around? Are there any other animals around?................where is the donkey? What sort of landscape or setting is the donkey in? Is the donkey making noises………….? What does the donkey's mane, tail and coat look like? How big is the donkey?................does the donkey do as it is commanded…………………. Is the donkey easily scared? Are there different types of donkeys?

Now picture a pony in your mind…………..what does the pony's look like……………..is there anything attached to the pony? Is the pony dirty or clean? Are there other ponies around? Are there any other animals around?................where is the pony? What sort of landscape or setting is the pony in? Is the pony making noises………….? What does the pony's mane, tail *and coat look like? How big is the pony?................does the pony do as it is commanded…………………. Is the pony easily scared? Are there different types of ponies.*

Now picture a horse in your mind…………..what does the horse look like……………..is there anything attached to the horse? Is the horse dirty or clean? Are there other horses around? Are there any other animals around?................where is the horse? What sort of landscape or setting is the horse in? Is the horse making noises…………? What does the horses mane, tail and coat look like? How big is the horse?................does the horse do as it is commanded…………………. Is the horse easily scared? Are there different types of horses?

Imagine the past. Where may have donkeys been used in the past? Now think to the present, what are donkeys used for now? What movies have you seen with lots of donkeys in it? Were these movies set in the past or the present? What were the things that the donkeys were doing in that movie? What were the donkeys being used for? Have there been media stories or news bulletins about donkeys that you can recall?

Imagine the past. Where may have ponies been used in the past? Now think to the present, what are ponies used for now? What movies have you seen with lots of ponies in it? Were these movies set in the past or the present? What were the things that the ponies were doing in that movie? What were the ponies being used for? Have there been media stories or news bulletins about ponies that you can recall?

Imagine the past. Where may have horses been used in the past? Now think to the present, what are horses used for now? What movies have you seen with lots of horses in it? Were these movies set in the past or the present? What were the things that the horses were doing in that movie? What were the horses being used for? Have there been media stories or news bulletins about horses that you can recall?

Begin to bring your attention back to the room……..and remember to keep your thoughts in mind about donkeys, ponies and horses. Turn to the experimenter now that the audio has finished."

Appendix K: Affect Regulation Writing Instructions

<u>Acceptance</u>

"In this next part of the task we are going to ask you to simply write about your approach of observing, allowing and accepting your thoughts, feelings and sensations that you experience. Spelling and grammar is not important. You have 5 minutes to write about observing, allowing and accepting your thoughts and feelings as they arise. Simply place your written response into the box next to you when you have been notified that the 5 minute writing period ends. Please don't write outside the border provided. At the top of the writing sheets are the key instructions for the task. I will give you the sheets face down, and when I say turn over your time starts. There is only one rule. You have to write for the entire time. If you run out of things to say, just repeat what you have already written. Please do not just list your thoughts. Rather, describe your observation, allowance, non reactive, non judgmental acceptance of your bodily sensations, thoughts and feelings that you experience."

<u>Distraction</u>

"*In this next part of the task we are going to ask you to simply write how many uses you can come up with for donkeys, ponies and horses,. You have 5 minutes to write about all the many different uses for donkeys, ponies and horses. Spelling and grammar is not important. Simply place your written response into the box next to you when you have been notified that the 5 minute writing period ends. Please don't write outside the border provided. At the top of the writing sheets are instructions reminding you of the task. I will give you the sheets face down, and when I say turn over your time starts. There is only one rule. You have to write for the entire time. If you run out of things to say, just repeat what you have already written. Generate and describe as many uses as possible for donkeys ponies and horses within a context taking into account the animals characteristics."*

<u>Mind-wandering</u>

"In this next part of the task please sit for 5 minutes and please let your mind wonder and write any thoughts you are having. You can write about anything that you like. You have 5 minutes to write down any thoughts that cross your mind. Spelling and grammar is not important. Simply place your written responses into the box next to you when you have been notified that the 5 minute writing period ends. Please don't write outside the border provided. At the top of the writing sheets are instructions reminding you of the task. I will give you the sheets face down, and when I say turn over your time starts. There is only one

rule. You have to write for the entire time. If you run out of things to say, just repeat what you have already written. Let your mind wander and write down any of your thoughts that come to mind."

Appendix L: Stroop Instructions

"For this next task, I am going to ask you to name some colours. Can you name, out loud the colour of the ink that the XXX strings are printed in this practice list, in order without missing any."

Answers for practice examples are:

1. Brown
2. Red
3. Purple
4. Blue
5. Red
6. Green
7. Brown

Participants are corrected on their use of colour terms, with visual examples (set of XXX strings in a particular colour with the name of the colour printed under the particular XXX) of name of the ink used in the practice list and then asked to complete the practice list again using the following instructions:

"Let's call this ink colour...
Can you please name the colours one more time for me?"

Participants then do a full trial of 40 XXX string stimuli introduced by the following instructions. Point to the top of the list and run your finger down it to demonstrate:

"Here is a longer list of XXX strings <u>(show them)</u>*. Please name the colour of the ink of each XXX string out loud and as fast as possible, without making mistakes. Start at the top and work down to the bottom, without missing any. If you make a mistake and you realise you can correct yourself.I will give you this sheet facing the other way. The number should be at the top of the page, so you start the list from the start. Use both hands to hold the page throughout the task. When I say start you turn it over and begin. "*

Once participants have completed the initial trial list participant then are presented with the incongruent colour practice list using the following instructions:

"Now, this one is a bit harder. Don't read the words. Same as before: just name the ink colour as fast as possible without making mistakes. If you make a mistake and you realise you can correct yourself. Use both hands to hold the page throughout the task. When I say turnover you can begin."

Appendix M: Threat-Task Instructions

High-Threat

"It is time to deliver a speech on the academic topic. Remember to look into the camera and keep your voice volume at the level before. You may open your envelope now. The topic is "what are the possible ways investigators might establish that an event or construct causes another event or changes in another construct? Give examples and give a description of such methods." Please talk for 5 minutes about this topic. Ok I am hitting record now. This is participant number XX doing the speech."

If participants finishes before 5 minutes indicate how long they talked for but still wait out the five minute period and use the prompt:

"Keep thinking about the topic for the remaining 5 minutes and if you can think of something you wish to add simply do so."

Low-Threat

"Now simply sit and relax and watch this film clip. It goes for about 5 minutes. We are simply interested in your physiological responses to it. Please remember to focus on the film clip.

Appendix N: Blind Coder Classification

Answer Sheet

Place participant number under the subheading that you think best fitted the participants written response.

Group		
Distraction	**Acceptance**	**Mind-wandering**

Distraction participants were asked to:

Generate and describe as many uses as possible for donkeys ponies and horses within a context taking into account the animals characteristics.

Acceptance Participants were asked to:

Please do not just list your thoughts. Rather, describe your observation, allowance, non reactive, non judgmental acceptance of your bodily sensations, thoughts and feelings that you experience

Mind-wandering participants were asked to:

Let your mind wander and write down any of your thoughts that come to mind.

Appendix O: Stroop Accuracy Rate from Study 7. 2

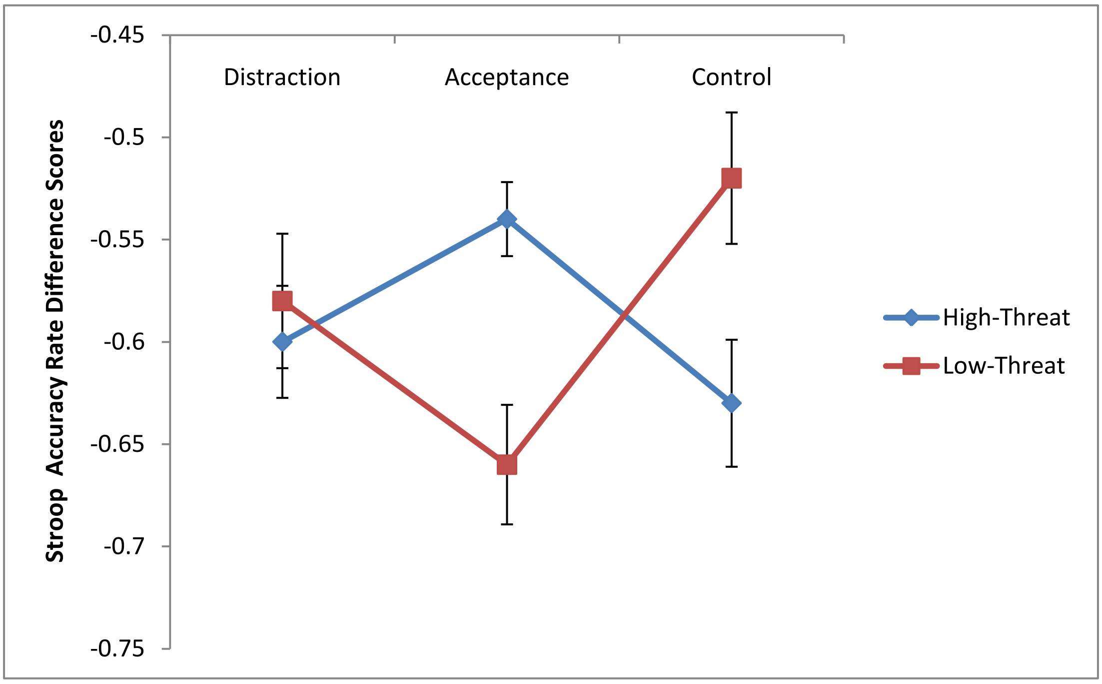


Figure 7. 12. Mean Stroop Accuracy Rate Difference Scores (incongruent trial accuracy score/RT - XXX trials accuracy score/RT). Error Bars indicate SE.