THE UNIVERSITY OF HULL

# Investigations of Stress Appraisals and Emotions, and their impact upon Coping Resources, Performance, and Neuroendocrine Response among Athletes

being a thesis submitted for the degree of Doctor of Philosophy

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by

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Thompson, M.A., Perry, J.L., Toner, J., & Nicholls, A.R. (in preparation). Pleasant emotions widen thought-action repertoires, develop long-term resources, and improve reaction-time performance: A multi-study examination of Broaden-and-Build theory within sporting populations. *Journal of Sport Psychology.*

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# List of Abbreviations and Symbols

| | |
|---|---|
| ANOVA | Analysis of Variance |
| A-SAGS | Attainment of Sport Achievement Goals Scale |
| BaB | Broaden-and-Build (Theory) |
| BPSM | Biopsychosocial Model |
| CFI | Comparative Fit Index |
| CI | Confidence Interval |
| CICS | Coping Inventory for Competitive Sports |
| cm | Centimetre |
| CMR | Cognitive-Motivational-Relational (Theory) |
| CV | Coefficient of Variation |
| DCICS | Dispositional Coping Inventory for Competitive Sports |
| FDR | False Discovery Rate |
| *g* | Hedges *g* Effect Size |
| HPA | Hypothalamic–Pituitary–Adrenocortical (Axis) |
| LED | Light-Emitting Diode |
| kg | Kilograms |
| km | Kilometres |
| ms | Milliseconds |
| ng/ml | Nanogram/Millilitre |
| *p* | *p* Value |
| PAM | Precompetitive Appraisal Measure |
| *q* | *q* Value |
| RCDRS | Revised Connor-Davidson Resilience Scale |
| RMSEA | Root Mean Squared Error of Approximation |
| SA | Sympathetic-Adrenomedullary (Axis) |
| SAM | Stress Appraisal Measure |
| SEQ | Sport Emotion Questionnaire |
| SRM | Schoberer Rad Mebtechnik (Cycle Ergometer) |
| SRMR | Standardised Root Mean Squared Residual |

| | |
|---|---|
| TLI | Tucker-Lewis Index |
| TP | Time Point |
| TT | Time Trial |
| ω | McDonald's Omega |

# Abstract

Both the Cognitive-Motivational-Relational (CMR) Theory of Emotions and the Broaden-and-Build (BaB) Theory of Emotions are seminal in the domain of psychology. Despite the widespread relevance of their combined core ingredients (that is, stress appraisals, emotions, and coping) to the field of sport psychology, there remain comprehensive gaps in their application to sporting populations, particularly in regards to psychological, neuroendocrine, and athlete performance response. Therefore, the contribution of this thesis was to investigate stress appraisals and emotions in relation to their impact upon psychophysiology and athletic performance through use of five interrelated studies. The CMR theory was examined through cross-sectional and laboratory research, whilst the BaB theory was tested via cross-sectional, longitudinal, and laboratory explorations. Regarding CMR theory, stress appraisals were found to be aligned with both subjective and objective measures of performance, as well as possessing a causal psychophysiological impact within athletes. The temporal orientation of stress appraisals may elicit distinct psychological, neuroendocrine, and performance profiles. Further, in relation to BaB theory, pleasant emotions may have short- and long-term performance and psychological benefits, including 'broadening' one's attention to facilitative coping strategies, 'building' enduring coping resources, and 'undoing' psychological costs incurred from previous unpleasant emotional experiences. Cross-study evidence for the existence of physiological 'success stress' was also discovered. Loss stress appraisals and unpleasant emotions may elicit a performance benefit in some athletes but are also linked with psychophysiological stress. Implications for athletes and their stakeholders, as well as future research recommendations are offered. This thesis represents the first causal examinations of both past-oriented stress appraisals and BaB theory within athletes and can be viewed as a novel contribution to the extant sport psychological literature.

# Chapter 1:
# Introduction

## 1.1. Introduction

For many athletes, particularly those in the upper echelons of their craft, the term "playing sport" is an oxymoron. To "play" is to "engage in activity for enjoyment" (Oxford Dictionary of English, 2015). And yet, modern sport can often be characterised by the ubiquitous psychological stress (Turner & Jones, 2014) that surrounds and permeates it, rather than for the enjoyment it brings its participants. Whilst the experience of stress is dependent on one's appraisal of a stimuli (Lazarus, 1999), the numerous performance pressures (Mellalieu, Neil, Hanton, & Fletcher, 2009; Noblet & Gifford, 2002) placed upon an athlete's shoulders means that stressful experiences are almost inevitable. Indeed, it has been posited that to successfully cope with such pressures is the fundamental challenge of sport (Patmore, 1986). A failure to cope with the level of competitive stress experienced, regardless of sporting level, will inhibit an athletes ability to function fully and perform optimally (Lazarus, 2000). With the deleterious effects that competition can have on performance a major concern of sport psychology (Lazarus, 2000b), this thesis has undertaken a holistic yet post-positivist approach to examining the relationships between the appraisal of stressors, emotional experiences, coping behaviours, and subsequent sporting performance.

The detrimental effects of sporting stress are of even greater concern when one considers that the unpleasant emotion of anger has been cited to be the most commonly experienced athlete emotion during sporting competition (Nicholls, Hemmings, & Clough, 2010; Nicholls, Jones, Polman, & Borkoles, 2009). With unpleasant emotions likely to inhibit and narrow an individual's coping processes (Fredrickson, 2013), it is plausible that athletes may enter a "downward spiral" (Fredrickson & Joiner, 2002) of cyclical stressful experiences and poor sporting performance. Thankfully, the engenderment of pleasant emotions within individuals has been shown to be a consistent predictor of broadened coping repertoires

(Fredrickson & Joiner, 2002). Further, pleasant emotions have also been associated with the development of enduring personal resources such as resilience (Cohn, Fredrickson, Brown, Mikels, & Conway, 2009), a construct which itself has been linked to achieving high levels of sporting performance and resistance to sporting pressure (Sarkar & Fletcher, 2014). However, currently little is known regarding the existence of such effects within athletic populations, nor whether such benefits are sustained over time. The scope of this thesis therefore, extends beyond athletic performance, and attempts to examine the psychological influence of emotions experienced during competitive sport via a longitudinal approach.

Scholars based within the domain of sport psychology, such as Weiss (2008), have long championed the use of interdisciplinary approaches in order to elevate the impact of scientific research and professional practice. The mission of this research is no different. Controlled environments offer the opportunity to measure the causal performance influence of stress appraisals and emotions; a suitable compliment to the theoretical and validity benefits provided by field research. As such, this research synergises field and experimental research to reciprocally guide one another. Further, incorporating physiological aspects from domains such as sport science into psychological experimental examinations may allow for the development of athlete neuroendocrine profiles through real-time measurement of stress markers such as cortisol. Such profiles could identify stress appraisals and emotional states within athletes, uninhibited by social desirability. In the quest for optimum performance, the real-world potential benefits of such knowledge remain excitingly yet frustratingly untapped.

## 1.2. Purpose of Thesis

It has been suggested that stress appraisals and emotions are just as important in the shaping of athlete coping (Nicholls, Perry, & Calmeiro, 2014). Therefore, the overarching purpose of this thesis was to examine the psychophysiological and performance impacts of

stress appraisals and emotions. For this purpose, five distinct yet complimentary research studies were undertaken. To aid the generalisability of this work, a myriad of athletes of all ages, abilities, sport, and gender have participated within the stated research. The design of each of these studies was guided by psychological literature in order to avoid potential methodological constraints and to progress knowledge from the previous study. The following section of this introduction details the rationale and purpose of each Chapter included in this thesis.

### 1.2.1. Chapter 2: Literature Review

This Chapter serves to provide an extensive yet concise analysis of the extant psychological literature in relation to constructs key to this research. This includes stress appraisals, emotions, coping, athletic performance, and physiological stress markers. Resulting from this analysis is a brief thesis plan at the end of the Chapter.

### 1.2.2. Chapter 3: Stress Appraisals, Emotions, Coping, and Perceived Goal Attainment – a Path Analysis

The cognitive-motivational-relational theory of emotions (Lazarus, 1991, 1999, 2000) is a cognitive process model which has dominated recent stress research within sport. Made up of stress appraisals, emotions, and coping behaviours, the cognitive-motivational-relational theory was designed to be researched as a single conceptual unit. However, academics within sport psychology have often narrowed their research scope by investigating these constructs separately. Subsequently, such studies fail to capture the totality of an athletes competitive experience (Nicholls, Polman, & Levy, 2012), at least in a quantitative fashion. This prompted Nicholls and associates (2014) to test (and validate) a structural equational model which consisted of achievement goals, stress appraisals, emotions and coping. The purpose of Chapter 3 was to build upon the work of Nicholls et al. by further establishing a sequential pattern from precompetitive stress appraisals through to goal

attainment. I assessed stress appraisals, emotions, coping, and subjective performance via goal attainment across three time-points during a number of sporting competitions. It was intended that the results of Chapter 3 would create a theoretical underpinning for any subsequent experimental studies, with the relationship between stress appraisals and performance requiring more thorough investigation (Nicholls, Perry, & Calmeiro, 2014).

### 1.2.3. Chapter 4: A Psychophysiological Examination of Lazarus' CMR Theory of Emotions via a Lab-Based 16.1 km Cycling Time Trial Task

With a path from stress appraisals through to athlete perceived performance established in Chapter 3, Chapter 4 was constructed to build upon this work by experimentally assessing the applicability of Lazarus' cognitive-motivational-relational theory within sport. An experimental application is not before time, with leading researchers having made repeated calls for an examination of cognitive-motivational-relational theory within a controlled laboratory environment to establish causality (Moore, Wilson, Vine, Coussens, & Freeman, 2013; Nicholls et al., 2012, 2014). Additionally, empirical knowledge of past-oriented stress appraisals (e.g. benefit and harm/loss) remains equivocal (Nicholls, Levy, Jones, Rengamani, & Polman, 2011), with no study having investigated these stress appraisals from a psychophysiological and performance paradigm. For this purpose, I recruited high-level, gender-matched athletes to perform in an ecologically valid and applicable to real-life sports cycling task (Currell & Jeukendrup, 2008; Sparks et al., 2016). This task was supplemented by similar psychometric measurements from Chapter 3, as well as neuroendocrine measurements. Implications for both athletes and their stakeholders in regards to the engendering of pre-performance stress appraisals and subsequent cognitive, somatic, and performance responses are discussed.

### 1.2.4. Chapter 5: Establishing the Validity of the Broaden-and-Build Theory within Sport – a Path Analysis

Pleasant emotional experiences are linked with numerous favourable sport psychological constructs, such as trait resilience (Fredrickson, Tugade, Waugh, & Larkin, 2003), and broad-minded coping (Fredrickson & Joiner, 2002). In spite of this, unpleasant emotions such as anger, dejection, and in particular anxiety have dominated the sports emotional research landscape (Campo, Mellalieu, Ferrand, Martinent, & Rosnet, 2012). With the performance influence of pleasant emotions potentially a subtle and indirect one, their benefits may have hitherto not been wholly realised (McCarthy, 2011). It has been widely suggested that the broaden-and-build theory of positive emotions (Fredrickson, 2001; Fredrickson & Joiner, 2002) could potentially bridge this theoretical gap (McCarthy, 2011; Nicholls, Perry, & Calmeiro, 2014; Tamminen, Crocker, & McEwen, 2014), yet little research has attempted to realise this potential within sporting populations. This study was designed with the purpose of prospectively investigating evidence of both "broadening" and "build" effects resulting from the experience of positive emotions within sport. Psychometrics measuring athlete emotions, dispositional coping strategies, and trait resilience were employed. This Chapter, to my knowledge, equates to the first theoretical examination of the broaden-and-build theory (Fredrickson, 2001; Fredrickson & Joiner, 2002) within sport.

### 1.2.5. Chapter 6: A Six-Month Investigation of Emotions, Coping, and Resilience within Athletic Populations – the Broaden-and-Build Theory in Sport

Repeated experiences of pleasant emotions may lead to more facilitative broad-minded coping strategies becoming habitual, which are themselves a facet of trait resilience (McCarthy, 2011). This "upward spiral" effect (Fredrickson, 2001; Fredrickson & Joiner, 2002) may "build" personal resources, which may help athletes cope sufficiently with future person-environment interactions. In spite of this, longitudinal emotional research in sport is

sparse (McCarthy, 2011), and difficult to undertake. The purpose of this study was therefore to investigate whether there is longitudinal evidence for the "broaden" and "build" hypotheses within sporting populations. Thus, Chapter 6 mirrored the design of Chapter 5 (that is, investigating emotions, dispositional coping, and trait resilience), and measured the same athletes 6 months later.

### 1.2.6. Chapter 7: A Psychophysiological Examination of the Broaden-and-Build Theory in Sport via a Lab-Based Reaction Task

Current evidence linking pleasant emotions and performance has been criticised as being too thin to make any substantial claims (McCarthy, 2011). This is partly due to experimental studies often invoking emotions which were experienced after goal acquisition or invoking emotions not relevant to a goal, resulting in low approach motivation (Gable & Harmon-Jones, 2008). Laboratory-based research afford scholars the ability to control extraneous variables, and to engender the exact emotions they wish – incorporating both low and high approach motivation. Following on from Chapters 5 and 6, Chapter 7 was devised to assess, through use of a controlled and causal environment, the applicability of the broaden-and-build theory of emotions to sporting contexts. Across multiple time-points, emotionally manipulated athletes undertook a sport-specific task designed to measure any evidence of broadening or build effects in relation to psychological, neuroendocrine, or performance response. As such, Chapter 7 represents the first experimental application of the broaden-and-build theory (Fredrickson, 2001; Fredrickson & Joiner, 2002) within sport.

### 1.2.7. Chapter 8: General Discussion

Chapter 8 provides an epilogue and discussion of the research outcomes stemming from this thesis, and their subsequent implications. This includes a discussion on the potential benefits of suitable stress appraisals and pleasant emotions. Thesis limitations and future research recommendations are also offered. Finally, concluding remarks are presented.

# Chapter 2:
# Literature Review

## 2.1. Theory

*"Emotion, which is suffering, ceases to be suffering as soon as we form a clear and precise picture of it."*

(Spinoza. *Ethics, Part V, Prop III*)

Whilst interest and development in cognitive appraisal theories have grown since Arnold's work in the 1960's (Arnold, 1960), the idea that emotions are resultant from transactions between a subject and their environment is not new. Indeed, as noted by De Sousa (2013), philosophers such as Aristotle, Spinoza, and Hume all devised theories of emotion which entailed appraisal of stimuli, physiological changes, and subsequent behaviour. However, what is key about the work of Arnold, and later Lazarus (1966), is that these schools of thought began to be transformed from philosophies into comprehensive and empirically testable mechanisms surrounding the elicitation of emotions.

Lazarus and Folkman (1987) proposed a cognitive-relational theory known as the transactional model of stress and coping, which would later provide the theoretical underpinnings of the now seminal CMR theory (Lazarus, 1991, 1999, 2000). Fundamental to this theory is the idea that no stimulus is inherently stressful; instead, subjects appraise the environment around them and their coping resources to deal with the issue at hand. Lazarus and Folkman suggested that transactions with the environment and subject were continuous, with a recursive and dynamic relationship existing between stress and coping (Lazarus, 2000). By recursive and dynamic, what Lazarus was attempting to convey was that both the environment and the individual impact one another in a manner characterised by constantly change.

Over time, Lazarus (1991) began to focus on a more detailed account of emotion elicitation, and make demands of "ingredients" a basic emotional theory must contain.

Firstly, any workable model must include propositions about the emotion process which state the way in its key variables operate. That is, all variables are interdependent and can act as an antecedent, mediator, or outcome in a process known as reciprocal determinism (Bandura, 1978). Secondly, this theory should also state how individual emotions (such as anger, anxiety, and pride) are elicited as well as how they impact future actions and reactions. This created the cognitive-motivational-relational (CMR) theory of emotions. *Cognitive* refers to one's beliefs on "how things work", as well as evaluating what an encounter with the environment personally signifies. *Motivational* denotes that emotions are activated by the progress of relevant goals. Lazarus posits that the term "motivational" is both transactional and dispositional, in the sense that one's predisposition to reach a goal must be triggered by the environment. *Relational* is used to suggest that emotions relate to the person-environment relationship, which may result in one of two categories: benefits (relating to positive emotions), or harms (relating to negative emotions). The CMR theory of emotions is made up of the following components: primary appraisal, secondary appraisal, emotion, and coping behaviours.

### 2.1.1. Primary Appraisal

When an individual undertakes a primary appraisal, he or she evaluates how the current situation impacts upon his or her personal goals. There are three concepts taken into consideration: goal relevance, goal congruence, and ego involvement. Goal relevance is an evaluation of how significantly related a situation is to one's personal goals. If a situation is deemed irrelevant to one's goals, then no emotion will be generated (Lazarus, 1991). Further, the intensity of the elicited emotion is dependent on the goal relevance of a situation. Goal congruence regards whether the situation is facilitative or inhibitive with one's desires. If facilitative, the situation may engender a positive emotion, whilst an incongruent situation may lead to more negative emotions being experienced. Ego-involvement (or goal content)

concerns the degree in which a situation impacts upon one's ego-identity (made up of self- and social-esteem, values, meaning, and ego-ideas; Lazarus, 1991). The type of ego-involvement within a situation distinguishes between the emotions experienced (e.g. pride/anger are experienced if one's ego-identity is maintained/threatened). From this process, one of four primary appraisals are made if a person-environment relationship is deemed relevant and stressful. Firstly, a *threat* stress appraisal is reached if an upcoming scenario is deemed inhibitive to goal attainment. Conversely, a c*hallenge* stress appraisal represents the prospect of making personal gains. An individual will form a *harm/loss* stress appraisal if a loss has already been incurred. Finally, *benefit* was later added to the CMR theory by Lazarus (1999) and refers to gains already achieved. As challenge and threat stress appraisals relate to events about to occur, they can be labelled as temporally "future-oriented stress appraisals". Conversely, with benefit and harm/loss relating to gains or losses that have already been experienced, these are regarded as temporally "past-oriented stress appraisals".

*Secondary Appraisal:* Secondary appraisal represents an evaluation of one's potential coping choices, and their expected outcomes. In blame/credit, the individual determines the primary agent/s responsible for the threat, harm, challenge, or benefit appraised. Coping potential concerns what behaviours an individual can undertake to impact upon their relationship with the environment. Future expectations are a prediction of how a situation in the environment will pan out – either favourably, or unfavourably. Despite the names 'primary' and 'secondary appraisal' hinting at a temporal order, Lazarus (1999) proposed that these processes occurred simultaneously.

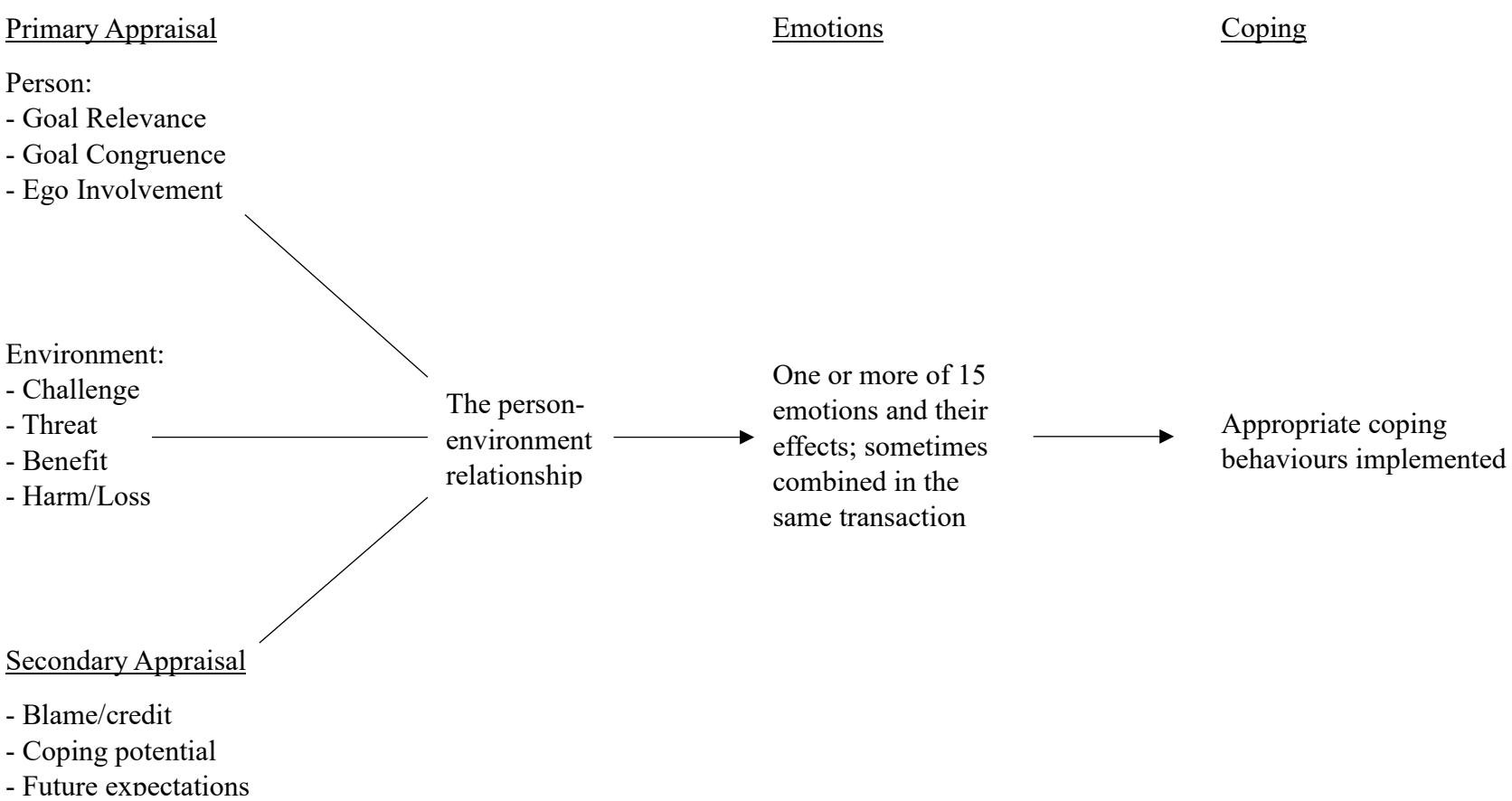


**Figure 2.1.** An adaptation of Lazarus' (1999) "revised model of stress and coping"

### 2.1.2. Emotions

Research on emotion is widely considered to be a difficult process (see Lazarus, 1991). As noted by Cabanac (2002), this difficulty stems from the fact that the term emotion is often “ill defined”, with Kleinginna and Kleinginna (1981) finding 92 separate definitions of emotion. Further, distinguishing emotion from similar concepts such as mood and affect has proved challenging (Vallerand & Blanchard, 2000). However, cognitive theorists such as Ortony, Clore, and Collins (1990) and Lazarus (2000) have begun to form a consensus in recent years with the idea that emotion is "an organized psychophysiological reaction to ongoing relationships with the environment" (Lazarus, 2000a, p. 230). Lazarus (1999) also devised a list of the 15 emotions he theorised to be most important. These were categorised as follows:

- nasty emotions (e. g., anger, envy, and jealousy)
- existential emotions (e. g., anxiety, fright, guilt, and shame)
- emotions provoked by unfavourable life conditions (e. g., relief, hope, and sadness-depression)
- empathic emotions (e. g., gratitude and compassion)
- emotions provoked by favourable life conditions (e. g., happiness, pride, and love)

According to Lazarus, each of the aforementioned emotions tells a different story about one’s struggle with their environment. The essences of these stories are communicated through “core relational themes” (Lazarus, 1991), which summarises the relational gain or loss for each emotion. For example, anger is characterised by “a demeaning offense against me and mine”, whilst happiness is characterised by “making reasonable progress towards realisation of a goal”. Lazarus (1991) believed these core relational themes to be universal in human experience. What is more, each emotion was also hypothesised to have its own

"action tendency" (see Frijda, 1986; Frijda, Kuipers, & Ter Schure, 1989; Lazarus, 1991). For example, an experience of anger is associated with the impulse to attack the offending agent, whilst fear is associated with fleeing a dangerous situation.

However, determining the evolutionary significance of positive emotions has been harder to theorise, as these typically have 'vague and underspecified' action tendencies (Fredrickson & Levenson, 1998). For example, the experience of a positive emotion such as contentment is related with inactivity, as an individual has no pressing need to change their person-environment relationship (Frijda, 1986). This prompted Fredrickson (1998) to put forward the broaden-and-build (BaB) theory of positive emotions, in an attempt to better capture the unique effects of positive emotions. The BaB theory posits that positive emotions *broaden* an individual's thought-action repertoires, that is, to increase the range of thoughts and solutions open to an individual in order to improve their person-environment relationship. This reframes positive emotions in a completely different light – for example, from being linked with inactivity, contentment is now associated with the broadening effect by creating an urge to savour the current life circumstances and to integrate them into new views of the self and of the world (Izard, 1977). Although not as detailed as Fredrickson's theory, Lazarus hinted at the broadening nature of positive emotions when formulating his CMR theory, describing the action tendency of happiness as "expansiveness… to share with others one's good fortune" (Lazarus, 1991b). Recent psychological literature has shown support for a potential broaden effect, with positive emotions linked with holistic processing and attentional flexibility (Fredrickson & Branigan, 2005), as well as high-level (Pyone & Isen, 2011) and creative (Rowe, Hirsh, & Anderson, 2007) thought. This may well be due to positive emotions increasing the levels of the neurotransmitter dopamine (Ashby & Isen, 1999).

Fredrickson (1998) also believed that the benefits of positive emotions were not limited to the short-term. The *build* hypothesis states that the experience of positive emotions may assist in the development of long-term coping resources. These resources can be physical (Boulton & Smith, 1992), social (such as bonds arising from play; Aron, Norman, Aron, McKenna, & Heyman, 2000; Gervais & Wilson, 2005; Lee, 1982), and intellectual (such as enhancements in creativity; Cohn, Fredrickson, Brown, Mikels, & Conway, 2009; Gloria & Steinhardt, 2016; Phillips, Bull, Adams, & Fraser, 2002; Rowe et al., 2007). Empirical research findings in the mainstream psychological literature concur with the build hypothesis, with positive emotions facilitating a range of real-world benefits, including global life satisfaction (Cohn et al., 2009), emotional well-being (Fredrickson & Joiner, 2002), physical health (Cohen, Alper, Doyle, Treanor, & Turner, 2006) increased resilience (Tugade & Fredrickson, 2007), and life span (Danner, Snowdon, & Friesen, 2001). Additionally, these benefits are reciprocally deterministic – positive emotions predict personal resources, which in turn predict further emotional resources. This creates what Fredrickson (2001) labelled an "upward spiral". In spite of the above-mentioned findings and the potential benefits that may be accrued from positive emotions, the BaB theory of positive emotions (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) has not been tested in a sporting context.

### 2.1.3. Coping

Lazarus and Folkman (1984) defined coping as "constantly changing cognitive and behavioural efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" (p. 141). Lazarus (1991) originally theorised that individuals managed these demands in two ways: problem-focused coping, and emotion-focused coping. Problem-focused coping refers to direct actions on the environment or oneself to change the person-environment relationship. Such actions can include increasing effort levels, information seeking, planning, and problem solving. Conversely, emotion-

focused coping involves regulating the amount of emotional stress one incurs. This can be done through behaviours such as relaxation, social support, and acceptance. Higher levels of coping behaviours can signify that an individual has been placed in an environment appraised to be highly challenging.

In more recent times, researchers have gravitated from Lazarus' (1991) two higher-order dimension towards three-order dimensions such as those conceptualized by Compas, Connor-Smith, Saltzman, Thomsen, and Wadsworth (2001) and Connor-Smith, Compas, Wadsworth, Thomsen, & Saltzman (2000). This is because three-order models have been found to be superior to bidimensional models through use of hierarchical confirmatory factor analyses conducted by scholars (Connor-Smith et al.). As such, researchers within sport psychology have been prompted to utilise a similar approach, with Gaudreau, El Ali, and Marivain (2005) proposing a three-factor model consisting of task-, distraction-, and disengagement-oriented coping. Like problem-focused coping, task-oriented coping describes attempts to master a stressor (e.g. planning and effort expenditure). Whilst distraction-oriented behaviours focus an individual's attention on stimuli unrelated to the task (e.g. distancing and mental distraction), disengagement-oriented behaviours are attempted with the aim of removing oneself from the stressful situation (e.g. withdrawal and venting of emotions). The three-order dimension of coping has been supported by the sport psychological literature (Levy, Nicholls, & Polman, 2011; Louvet, Gaudreau, Menaut, Genty, & Deneuve, 2007) and was therefore employed in research which comprises this thesis.

Lazarus (1999) was keen to emphasise that coping had been underestimated in its importance in the stress process. Indeed, rather than following on from emotions, Lazarus theorised that emotions and coping reciprocally shaped one another. It is important to note, however, that Lazarus did not claim that one coping behaviour is inherently more appropriate

or effective than another. Whilst one strategy may be on average more facilitative than another strategy, either may be sufficient in a particular situation.

### 2.1.4. Psychophysiology

Developments in research technology have meant that the cognitive revolution (Lazarus, 2000) has not been limited to abstract cognitive theory. Indeed, physiological responses can be used, with increasing effect, to infer psychological states and processes (Seery, 2013). One of the most common psychophysiological stress markers utilised in the literature is cortisol, a steroid hormone controlled by the hypothalamic–pituitary–adrenocortical (HPA) axis (Hellhammer, Wüst, & Kudielka, 2009). Increased cortisol levels have been linked with negative affective states such as anxiety (Lader, 1983), whilst lower levels have been associated with positive psychological constructs such as happiness (Steptoe, Wardle, & Marmot, 2005). What is more, excessively high cortisol levels may negatively impact bodily systems (Miller, Chen, & Zhou, 2007), which may result in long-term health implications (Burns, 2006). Whilst methods of assessing cortisol levels include sampling saliva, urine, hair, and serum, salivary cortisol is viewed as the gold standard measurement (Vining, McGinley, Maksvytis, & Ho, 1983). This is because salivary cortisol can be measured non-invasively and more accurately reflects unbound cortisol when compared to serum total cortisol. Menstrual cycle stage and oral contraceptive use have also been found to have no significant impact upon cortisol response (Liening, Stanton, Saini, & Schultheiss, 2010). Further, with cortisol secretion induced by high intensity exercise taking up to 59 minutes to significantly increase (Jacks, Sowash, Anning, McGloughlin, & Andres, 2002) compared to just 15 minutes via psychological stress, cortisol has become a popular measure of psychological stress during exercise in the extant literature. Outside of cortisol, other psychophysiological measures include vagal tone (Porges, 1995), heart rate, ventricular contractility, cardiac output, and peripheral resistance (Seery, 2011).

The biopsychosocial model of challenge and threat states (BPSM; Blascovich, 2008) is an ambitious attempt to incorporate some of the aforementioned psychophysiological markers in harmony with the key tenets of Lazarus' (1991) CMR theory. As in CMR theory, individuals engage in an appraisal of a situation, labelled in this case as demand and resource evaluations. With challenge and threat states initiated only by goal relevant environments, this leads to the activation of the sympathetic-adrenomedullary (SA) axis, indexed by increases in heart rate and ventricular contractility (Seery, 2011). If a challenge state is reached, the HPA axis is not activated (inhibiting cortisol secretion), resulting in greater epinephrine in the blood, lower peripheral resistance, and higher cardiac output. Conversely, threat states are theorised to activate the HPA axis, leading to cortisol spikes, inhibited epinephrine, heighted peripheral resistance, and lower cardiac output (Seery, 2011).

Whilst the sensitive nature of psychophysiological markers such as vagal tone and cardiac output make them unsuitable for stress measurement during sports performance, the BPSM of challenge and threat states is a useful conceptual grounding in conjunction with CMR theory. As such, the BPSM guided the psychophysiological design and hypotheses within this thesis.

### 2.1.5. Alternative Theoretical Perspectives

Despite the fact that the CMR theory has become the most prominent theoretical explanation of the relationship between stress and coping within the sport psychology literature, it is not without its criticisms. Firstly, Lazarus' (1999) conceptualisation of a dynamic and recursive process between stress appraisals, emotions, and coping behaviours was criticised for many years by Zajonc (1980) for failing to account for emotions being seemingly instantaneous and automatic. Zajonc argued that emotion was independent of, and even preceded cognition, with his “affective primacy hypothesis” stating that a stimulus can

be processed first for its affective qualities, before being assessed ontologically. Proponents of this school of thought include Smith and Kirby (2001), who proposed a two-process model of appraisal consisting of associative processing and reasoning. However, such models have themselves been criticised as being unnecessarily complex (Marsella & Gratch, 2009).

Scholars such as Skinner (1995) have contended that current conceptualisations of coping, which posit that coping is limited to behaviours that involve conscious effort are insufficient, and should be amended to incorporate all reactions to stress – including voluntary and involuntary responses. Whilst it is true that involuntary and voluntary responses are elicited by psychological disequilibrium (Nicholls, 2010), measuring all responses to stress would make coping incredibly difficult to measure (Lazarus, 1999). Additionally, involuntary responses to stressful stimuli can only be indirectly influenced by psychological interventions (Compas et al., 2001). With this research primarily undertaken with the aim to guide athletic interventions, only voluntary actions towards dealing with stress were considered coping behaviours. This concurs with the conclusions of other leading researchers in the sport psychological literature including Crocker, Tamminen, and Gaudreau, (2015), and Nicholls (2010). After due consideration of the abovementioned theoretical perspectives, the CMR theory was chosen as the primary theory to underpin this thesis. Simply put, whilst emotion may be processed before cognition (Murphy & Zajonc, 1993) and involuntary coping behaviours plausibly existing (Skinner, 1995), their measurement within experiments is undoubtedly difficult for very limited theoretical benefit. Indeed, involuntary actions by their very nature are difficult to voluntarily change. Conversely, applications of CMR theory within sport focus on guiding athletes to positively appraise and change their person-environment relationship, with real-world performance and psychophysiological benefits within reach. With benefitting athletes the true goal of any sport psychological scholar, the employment of CMR theory was an easy choice to make.

## 2.2. The CMR theory within sport

Despite the fact that CMR theory was designed as a conceptual unit, researchers within sport psychology have routinely investigated the constructs of stress appraisals (Thatcher & Day, 2008), emotion (Vast, Young, & Thomas, 2010), and coping (Nieuwenhuys, Hanin, & Bakker, 2008; Raedeke & Smith, 2004) separately. Whilst this limits scholarly knowledge of an athlete's stressful experience from stress appraisals through to coping, these studies have nonetheless been crucial in increasing understanding (Nicholls, Polman, & Levy, 2012) and as such, shall be reviewed in turn below.

### 2.2.1. Stress Appraisal Research Findings among Athletes

Competitive stress in sport can be defined as "an athlete's perception of the imbalance between the environmental demands placed on him or her and the athlete's response capacity and resources for meeting those demands" (Gould & Rolo 2004). Such stressors include: injury fears (Chase, Magyar, & Drake, 2005), poor form (Noblet & Gifford, 2002), and wishing to be perceived as a competent sportsperson by teammates and/or spectators (Mellalieu et al., 2009). How an athlete appraises these stressors shapes the emotions they may feel (Uphill & Jones, 2007) and the coping behaviours they undertake (Anshel, Jamieson, & Raviv, 2001). As conceptualised by Lazarus (1999), four potential stress appraisals may occur when an athlete examines these stressors: challenge, threat, benefit, and harm/loss. However, at the time of writing, temporally past-oriented stress appraisals (e.g. benefit and harm/loss) have been subjected to very little scientific scrutiny. Researchers such as Didymus (2017) and Didymus and Fletcher (2014) have conducted qualitative research in regards to past-oriented stress appraisals of organisational stressors, although Didymus and Fletcher did not include benefit in their research scope. In regards to competitive stressors, only Nicholls, Levy, Jones, Rengamani, and Polman (2011) have investigated Lazarus' full

stress appraisal catalogue, which was undertaken via a qualitative approach. Nicholls and colleagues undertook semi-structured interviews with 10 professional rugby union players, who discussed the competitive stressors they faced and what emotions were subsequently elicited from their appraisals of the situation. Nicholls et al. discovered that gain stress appraisals (e.g. challenge and benefit) resulted in the experience of both pleasant emotions (e.g. happiness, excitement, hope) and some occasional unpleasant emotions (e.g. anxiety, embarrassment, anger). It is worth noting, however, that Nicholls et al. did not explore coping strategies and their relation to stress appraisals. To provide a more parsimonious understanding of the stress process, both benefit and harm/loss stress appraisals need to be further explored by scholars.

In contrast, challenge and threat stress appraisals have been the subject of a number of studies in the sport psychology literature; be it through qualitative or quantitative methodologies. Dependent on one's appraisal, the numerous competitive stressors that athletes face can act as a catalyst for a wide range of fluctuating emotions including anxiety, anger, and happiness (Campo et al., 2012). For example, Neil, Bayston, Hanton, and Wilson (2013) and Uphill and Jones (2007) found in their qualitative research that sporting situations appraised as threatening resulted in the experience of unpleasant emotions, whilst challenge stress appraisals resulted in more pleasant emotions. This also aligns with the imagery-based work of Williams, Cumming, and Balanos (2010), with threat stress appraisals relating to more pessimistic interpretations of anxiety symptoms, and challenge stress appraisals relating to facilitative interpretations. This finding in particular is noteworthy, as Williams et al. reported that there were no differences in physiological response intensities for both stress appraisals imagery scripts. The importance of facilitating challenge stress appraisals within athletes during sporting competitions is further enhanced by their potential association with positive psychological constructs such as intrinsic motivation (Deci & Ryan, 2008) and the

experience of “flow” (Jackson & Csikszentmihalyi, 1999). With females found to report more threat stress appraisals and fewer harm/loss or challenge stress appraisals than their male counterparts (Anshel & Delaney, 2001), investigations into gender differences in appraisal are particularly warranted.

It has long been believed that an athletes stress appraisal is key in determining what coping behaviours are utilised to deal with different sources of stress (Kim & Duda, 2003). From their systematic review, Nicholls and colleagues concluded that coping behaviours fluctuate depending on an athletes stress appraisal and the success of previous coping behaviours, supporting the assumptions of Lazarus' (1999) CMR theory. Both primary and secondary appraisals have shown to be reliable predictors of coping (Aldwin, 2007), with this relationship found to be recursive in an longitudinal idiographic analyses involving high level female footballers (Holt & Dunn, 2004). Through use of a structural equational model utilising data from a previous study (Skinner & Brewer, 2002), Skinner and Brewer (2004) found that threat stress appraisal styles were associated with lower coping expectancies, which lead to higher levels of anxiety, whilst challenge stress appraisals were linked to more confident coping expectancies. Threat and challenge stress appraisals have also been negatively and positively related to mental toughness respectively (Levy, Nicholls, & Polman, 2012), a construct shown to be a predictor of both coping behaviour and coping effectiveness (Kaiseler, Polman, & Nicholls, 2009). What is more, threat stress appraisals have been negatively associated with approach-oriented coping strategies (Anshel & Wells, 2000), and positively associated with emotion-focussed and avoidance-oriented coping strategies (Anshel, Jamieson, & Raviv, 2001; Dias, Cruz, & Fonseca, 2012).

Recent investigations through field- and laboratory-based methods have supported the notion that athlete stress appraisals are directly linked to sports performance. Concurring with the mainstream psychological literature (Blascovich, Mendes, Hunter, & Salomon, 1999;

Mendes, Blascovich, Hunter, Lickel, & Jost, 2007; Seery, Weisbuch, Hetenyi, & Blascovich, 2010), the following studies have almost unanimously suggested that challenge stress appraisals facilitate higher levels of performance, whilst threat stress appraisals are liable to inhibit performance. Utilising a path analysis on the data of 118 high-performance male golfers, Freeman and Rees (2009) reported that challenge stress appraisals were linked with better performance, whilst threat stress appraisals were linked with poorer performance. However, Freeman and Rees admitted that their sample was homogenous, limiting the generalisability of their findings. In a gender diverse sample, Blascovich, Seery, Mugridge, Norris, and Weisbuch (2004) found that cardiovascular indexes, based upon the BPSM of challenge and threat, subsequently predicted athlete baseball/softball performance. Twenty-seven athletes were required to imagine and then perform a speech regarding a specific sports performance situation whilst measures such as total peripheral resistance and cardiac output were recorded. Blascovich and colleagues found that athletes who appraised the task as a challenge performed better in the following season than those who appraised the task as a threat. However, Blascovich et al. did not investigate the immediate performance impact of challenge and threat stress appraisals.

One such study that investigated the immediate effects of different stress appraisals is that of Moore, Vine, Wilson, and Freeman (2012), who investigated subsequent motor task performance. With a large, gender-balanced sample of 127 novice golfers, Moore et al. engendered challenge and threat states within participants via a standardised instructional set based upon the manipulation research of Feinberg and Aiello (2010). Participants were then required to undertake a laboratory-based golf putting task whilst a number of psychophysiological measures were recorded. These included quiet eye measurements, demand and resource evaluations, and electromyographic activity. In accordance with the study's hypothesis, the performance of the challenge group was superior to that of the threat

group, whilst simultaneously experiencing more pleasant emotions. What is more, the challenge group also displayed longer quiet eye durations (i.e. longer quiet eye durations are indicative of more efficient attentional control), and more efficient electromyographic activity, the latter of which mediated the group-performance relationship. The results of Moore et al. (2012) were followed up by Moore, Wilson, Vine, Coussens, and Freeman (2013) in their multi-study investigation into stress appraisal states during pressurised competition. In their first study, Moore et al. (2013) recruited 199 golfers, who reported their appraisals of competition demands and their coping resources before a golf competition. Golfers who perceived the competition as a challenge performed better than those who perceived it as a threat, suggesting that stress appraisals made immediately before a competition can have an instant performance impact. In their second study, Moore et al. (2013) manipulated 60 experienced golfers into challenge or threat states before they undertook a laboratory-based golf task. Again, challenge participants outperformed threat participants, whilst also reporting less anxiety, and displaying longer quiet eye durations. Additionally, the challenge group exhibited a cardiovascular response consisting of higher cardiac output and lower total peripheral resistance in comparison to the threat group; a finding in line with the predictions of the BPSM (Blascovich, 2008). Whilst the studies of Moore et al. (2012; 2013) have made an important contribution to the literature, neither study investigated benefit or harm/loss stress appraisals, whilst their measurement into athlete emotional states was limited to four-item psychometrics measuring only cognitive and somatic anxiety. Further, no control group was included to provide a baseline performance comparison.

Challenge and threat stress appraisals have not always been found to be universally facilitative or inhibitive of performance, however. Turner et al. (2013) investigated whether challenge cardiovascular indexes would predict performance in 42 high-level cricketers

during a pressurised batting test. Whilst challenge indexed participants performed stronger than their threat counterparts, there were inconsistent relationships between the psychometrics employed and cardiovascular reactivity. Moreover, some participants who exhibited threat cardiovascular reactivity performed more strongly than participants who portrayed cardiovascular reactivity associated with a challenge stress appraisal state. Turner et al. attributed these unexpected findings to high levels of self-efficacy within some threat participants, whilst some challenge participants reported significantly higher performance avoidance goals. With associations between cardiovascular indexes and psychological responses also found to be either weak or absent in other research within the sport psychological literature (Turner, Jones, Sheffield, & Cross, 2012), scholars should look to incorporate other psychophysiological indexes into their research to see if more concrete relationships between the two exist. This could include, but is not limited to, the measurement of cortisol, vagal tone, and testosterone. In relation to cortisol, Harvey, Nathens, Bandiera, and LeBlanc (2010) have reported that salivary cortisol response levels increase when an individual conducts a threat stress appraisal, whilst Quested et al. (2011) reported that challenge stress appraisals may suppress cortisol secretion.

### 2.2.2. Emotions among Athletes

Participation in sport can be considered a "natural laboratory" for the study of emotion (Patmore, 1986). Lazarus (2000) believed that if his CMR theory was correct about how emotion and coping may influence sports performance, then athletes should be aware of exactly what emotions are aroused during competition, and how to cope with them. For example, the knowledge that an athlete is experiencing anger, sadness, or pride is more informative than knowing he or she is feeling threatened or challenged (Lazarus & Folkman, 1984). However, the classification of emotions has often been an issue of contention, with no agreed set list of emotions amongst researchers (Jones, Lane, Bray, Uphill, & Catlin, 2005).

In their study of top karate athletes, Ruiz and Hanin (2004) suggested that only eight emotions (e.g. anger, anxiety, fright, sadness, shame, happiness, pride, and relief) are experienced in competition. Nicholls, Jones, Polman, and Borkoles (2009) reported that professional rugby union players experienced nine emotions (anger, anxiety, guilt, sadness, shame, happiness, hope, pride, and relief). It is likely that the nature and requirements of specific sports will moderate the range and type of emotions experienced by athletes (Cerin, Szabo, Hunt, & Williams, 2000; Dunn & Nielsen, 1996).

With mainstream psychological research suggesting that emotions are "brief, multisystem responses" (Fredrickson, 2013, p. 3) to environmental changes, it stands to reason that events during the course of a sporting competition can influence athlete emotions on numerous occasions (Sève, Ria, Poizat, Saury, & Durand, 2007). Evidence suggests that athletes may even experience numerous emotions simultaneously (Cerin, 2004), an occurrence known as "emotional blend" (Martinent, Campo, & Ferrand, 2012). Martinent et al. interviewed national table-tennis players as soon as possible following an important competition to recall their in-competition emotional experiences, aided by a video recording of their performance. It was found that athletes simultaneously experienced two or more emotions during their performance, with self-oriented anger/anxiety, self-oriented anger/discouragement, joy/relief, and joy/pride the most common emotional blends. Conversely, Brehm and Miron (2006) have suggested that simultaneous emotional experience is impossible, with the emotional system constructed to experience only one emotion at a time. However, emotional blend is consistent with CMR theory (Lazarus, 1991, 1999, 2000), with Lazarus stating that emotions such as hope are often paired with anxiety because "the outcome of hoping is always in doubt". For this reason, researchers are advised to keep an open mind as to the possibility of "emotional blend".

In their systematic review of athlete emotions in team contact sports, Campo, Mellalieu, Ferrand, Martinent, and Rosnet (2012) found that anger and anxiety are the most commonly researched athlete emotions (Cerin, 2003; Mellalieu, Hanton, & Fletcher, 2006). Negative emotions have also been shown to be experienced more commonly than positive emotions during a competition, with anxiety cited most frequently by athletes (Nicholls, Hemmings, & Clough, 2010; Nicholls, Jones, Polman, & Borkoles, 2009). This is important, as the negative emotions that sporting competition can engender can result in a number of deleterious consequences, including a wide range of mental illnesses (Hughes & Leavey, 2012), mental burnout (Gustafsson, Hassmén, Kenttä, & Johansson, 2008), or increased risk of taking performance enhancing drugs (Nicholls et al., 2014). Whilst this finding is noteworthy, researchers have been advised to look beyond athlete anxiety (Woodman et al., 2009) and to provide more empirical research on positive emotions (Lundqvist & Kenttä, 2010). This is because an athlete's emotional experience cannot be accurately described purely by a presence or absence of anxiety (Cerin, 2003; Lundqvist & Kenttä, 2010). Further, the investigation of positive emotions may have far reaching benefits for athletes in the short- and long-term, as theorised by the BaB theory of positive emotions (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002). Positive emotions have been linked with increased resilience (Fredrickson, Tugade, Waugh, & Larkin, 2003; Tugade & Fredrickson, 2007) and concentration (Vast, Young, & Thomas, 2010), both of which are desirable constructs in the stressful world of sport. The benefits of experiencing positive emotions may not be limited to an individual athlete, either. Team-sport research by Totterdell (2000) has showed significant associations between the average of teammates' happy moods and the players' own moods and subjective performances. Such potential benefits highlight the importance of future investigations into positive emotions experienced within sport.

As anticipated by Folkman and Lazarus (1988), interactions between athlete emotions and coping behaviours have been observed as bidirectional in the sport psychological literature. In their study into Olympic-level athletes, Pensgaard and Duda (2003) observed that coping effectiveness was significantly related to the experience of positive emotions. What is more, Nicholls, Hemmings, and Clough (2010) discovered that both positive and negative emotions were reported after coping behaviours, but not always as a consequence of an athlete's stress appraisal. In regards to emotions influencing coping behaviours, Crocker and Graham (1995), Gaudreau and Blondin (2002), and Ntoumanis, Biddle, and Haddock (1999) have all discovered that positive emotions have positively related to task-oriented coping strategies, such as effort expenditure and logical analysis. Further, negative emotions have also been positively related to distraction- and disengagement-oriented coping strategies. Regardless of direction, effective regulation of one's emotions is vital to sporting success (Laborde, Brüll, Weber, & Anders, 2011; Uphill & Jones, 2011).

It has been suggested that emotions can influence an athletes performance in both a general way (Hanin, 2007), as well as in more specific ways, such as impacting one's processing efficiency or attention. For example, in their study with novice rock climbers, Nieuwenhuys, Pijpers, Oudejans, and Bakker (2008) found that anxiety subsequently reduced processing efficiency, leading to increased performance times. This finding may have been caused by an increase in task-irrelevant thoughts prompted by high anxiety levels (Mullen, Hardy, & Tattersall, 2005). Further, Vast, Young, and Thomas' (2010) investigation into national level softball athletes discovered that positive emotions such as excitement and happiness were linked to better concentration and self-reported performance than negative emotions. Vast, Young, and Thomas (2011) also discovered that positive and neutral manipulations resulted in improved sensorimotor skills when compared to a negative performance group during a laboratory-based basketball task. The notion that positive

emotions are more beneficial for performance than negative emotions is nothing new, and has received considerable empirical support (Erez & Isen, 2002; Lane et al., 2010; Nicholls et al., 2012; Totterdell, 2000; Uphill, Groom, & Jones, 2014).

Conversely, negative emotions have not always proved maladaptive to athletic performance, nor have positive emotions proved uniformly facilitative (Tamminen et al., 2014). In their multi-study research in which positive, neutral, and negative emotions were elicited within handball players, Laborde and Raab (2013) reported that the best decision-making performance was found in the neutral experimental condition. Further, both Terry and Slade (1995) and Robazza and Bortoli (2007) reported that anger was associated with facilitating performance in karate and rugby athletes respectively. One explanation for these findings is the concept of "approach motivation" (Gable & Harmon-Jones, 2008), which concerns whether the specific action tendency for an emotion is to face or withdraw from the stimulus. For example, whilst the experience of anger may narrow a karate competitor's attention, their subsequent approach motivation may aid their ability to land a point scoring technique upon their opponent. This is more performance facilitative than the experience of happiness, which may widen attention onto irrelevant stimuli, and inhibit the competitor's willingness to engage their opponent. This concurs with the research of Skinner and Brewer (2004) and Woodman et al. (2009), who reported that the facilitative or inhibitive impact of a positive or negative emotion is dependent upon the demands of the sport or task. It is for this reason that Jones, Lane, Bray, Uphill, and Catlin (2005) recommended that classifying emotions as unpleasant (e.g., anger, anxiety, and dejection) or pleasant (happiness and excitement) is more applicable for sporting populations, than positively or negatively toned emotions. As such, the terms "unpleasant emotions" and "pleasant emotions" shall be employed throughout the rest of this thesis.

In order to provide a more comprehensive knowledge on athlete emotion experiences, researchers have begun to look beyond using only psychometrics (Martinek, Oberascher-Holzinger, Weishuhn, Klimesch, & Kerschbaum, 2003). With the expression of emotions in sporting competitions influenced by an athletes neurological and endocrine mechanisms (Parmigiani et al., 2009), cortisol has become a popular physiological stress index amongst researchers. Typically in the psychoneuroendocrinological literature, pleasant emotions have been indexed through a negative relationship to cortisol response, with unpleasant emotions indexed by a positive relationship (Smyth et al., 1998). Within sporting populations, significant relationships between anxiety and increased cortisol levels have been found (Filaire, Rouveix, Alix, & Le Scanff, 2007). This has then been linked to decreased performance levels in cases of extreme cortisol secretion (Elloumi et al., 2008; Kivlighan, Granger, & Booth, 2005). However, moderate increases in cortisol levels before a competition has been suggested to be beneficial to an athlete (Eubank, Collins, Lovell, Dorling, & Talbot, 1997), as this may prepare an athlete for the physical and mental demands ahead (Salvador, Suay, Gonzalez-Bono, & Serrano, 2003). What is more, the catalogue of emotional experiences that an athlete undergoes when succeeding in competition suggests that winning itself may be a physiologically stressful event (Suay et al., 1999). Clearly more research is required into the relationship between athlete emotional experiences and subsequent cortisol response.

One further area within the sport psychological literature which requires more exploration is that of the long-term effects of pleasant and unpleasant emotions. Whilst BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) has long been championed by researchers for its potential significance (McCarthy, 2011; Nicholls, Perry, & Calmeiro, 2014; Tamminen et al., 2014), it has yet to have been tested by empirical research within a sports setting. With plentiful evidence for the long-term facilitative effects of pleasant

emotions in the mainstream psychological literature (Cohn et al., 2009; Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008; Lyubomirsky, King, & Diener, 2005; Mauss et al., 2011), it appears that sport psychological researchers may have overlooked an important area for athlete growth. If evidence for the BaB theory can be found, then such research could be used to form theory-guided interventions that may benefit athletic populations cognitively and physiologically in the short- and long-term.

### 2.2.3. Coping among Athletes

Athlete coping behaviours are essential in the quest for sporting success (Crocker & Graham, 1995) for the benefits they afford in regards to reducing stress (Crocker, 1992) and enhancing well-being (Nicholls, Levy, Carson, Thompson, & Perry, 2016). When coping behaviours are successfully employed by an athlete, they are more likely to produce a high level of performance, and subsequently enjoy participating (Nicholls & Polman, 2007). Conversely, ineffective coping may lead to lower goal attainment (Gaudreau & Antl, 2008), lower life satisfaction (Gaudreau & Antl, 2008), and inhibited performance (Lazarus, 2000). It is therefore important that researchers look beyond simply describing coping behaviours, and also attempt to determine effective and ineffective coping (Folkman, 1992).

Attempts to define coping behaviours within sport have resulted in two traditional schools of thought: the trait perspective and the state perspective. The former (also known as coping styles) posits that athletes are predisposed to certain coping behaviours, which remain relatively consistent across different situations (Hoedaya & Anshel, 2003). Such tendencies are often measured via psychometrics in which individuals are asked what they would typically do during a situation (Aldwin, 2007). The latter perspective suggests that individuals interact with their environment in a dynamic process, with behaviours deemed appropriate to a situation undertaken following an appraisal. Empirical support has been

found for both the trait (Anshel, Sutarso, & Jubenville, 2009; Crocker, 1992; Wang, Morris, & Marchant, 2004; Yoo, 2001) and state perspectives (Kim & Duda, 2003; Poczwardowski & Conroy, 2002; Tamminen & Holt, 2010), with the process perspective the most dominant theoretical approach (Nicholls & Polman, 2007). One potential explanation for the prominence of the process perspective is that the trait approach is often retrospective and relies on athlete recall, which may be unreliable (Folkman & Moskowitz, 2004). More recently, scholars (Anshel & Si, 2008; Gaudreau & Miranda, 2010) have suggested that both an athlete's disposition and the environment that surrounds them may influence their coping behaviours. It appears that coping researchers should look to incorporate situational and long-term coping behaviours into their research to investigate their potential theoretical avenue.

Psychological researchers within sport have demonstrated that, overall, athletes tend to utilise a range of task-, distraction-, and disengagement-oriented coping strategies (Dias, Cruz, & Fonseca, 2012). When taking the effectiveness of these strategies into account, it is important to note that no coping strategy is universally suitable (Folkman, 1992), that the frequency of using a coping strategy is not necessarily an indicator of coping effectiveness (Hoedaya & Anshel, 2003), and that athlete experiences and behaviours will vary across individuals and sports (Neil, Hanton, Mellalieu, & Fletcher, 2011). Nonetheless, research into coping effectiveness is still highly important, as it has the potential to have a beneficial effect upon performance and satisfaction for a large number of athletes (Nicholls & Polman, 2007). To this end, a number of researchers have investigated and subsequently discovered positive associations between task-oriented coping and both subjective and objective measures of performance (Doron & Gaudreau, 2014; Gaudreau, Nicholls, & Levy, 2010; Laborde, Dosseville, & Kinrade, 2014; Nicholls, Taylor, Carroll, & Perry, 2016; Schellenberg, Gaudreau, & Crocker, 2013). Further, negative relationships between disengagement-oriented coping and measure of performance have also been established (Amiot, Gaudreau, &

Blanchard, 2004; Gaudreau et al., 2010; Laborde, Dosseville, Guillén, & Chávez, 2014; Schellenberg et al., 2013), although it has been suggested that avoidance coping (similar to disengagement-oriented coping) can aid an athlete in situations beyond their control (Anshel, Kim, Kim, Chang, & Eom, 2001). Finally, scholars have yet to reach a consensus regarding distraction-oriented coping and athletic performance, with non-significant (Gaudreau et al., 2010; Laborde, Dosseville, & Kinrade, 2014), negative (Nicholls, Polman, & Levy, 2012), and positive (when combined with task-oriented coping; Gaudreau & Blondin, 2004) relationships found. As such, further research into the impact of combined coping strategies within a sequential model could be beneficial.

Interestingly, despite a large amount of empirical attention, understanding of gender differences in regards to coping is equivocal. Several studies have suggested that there are potentially large variances in the coping behaviours of males and females (Anshel, Sutarso, & Jubenville, 2009; Hoar, Kowalski, Gaudreau, & Crocker, 2006), with males and females believed to utilise more task-oriented and emotion-focused behaviours respectively (Hammermeister & Burton, 2004; Yoo, 2001). However, other researchers have reported no significant differences in the use of task-oriented coping between genders (Anshel & Sutarso, 2007; Crocker & Graham, 1995; Philippe, Seiler, & Mengisen, 2004), with Bebetsos and Antoniou (2003) and Pensgaard, Roberts, and Ursin (1999) reporting no gender coping differences whatsoever. These contradictory findings may be due to gender differences being limited to only one or two coping behaviours within the broader coping dimensions (Tamres, Janicki, & Helgeson, 2002). If gender differences do exist, it is important that scholars investigate the underlying reasons for these trends, as teaching coping strategies based on gender may prove effective (Nicholls, Polman, Levy, Taylor, & Cobley, 2007).

### 2.2.4. Synthesising Psychological, Physiological, and Performance Response

Lazarus (1999) regarded the separation of the fields within the CMR theory as "an absurdity" (p. 35) and suggested that the phenomenon of the stress process needed to be "resynthesized to what it is in nature" (p.195) – or in layman terms, measured as a sequential unit. Until recently, the complexity of sequential stress process models has frustrated scholars (Somerfield, 1997). However, scholars such as Miles, Neil, and Barker (2016), Neil, Hanton, Mellalieu, and Fletcher (2011), Nicholls, Perry, and Calmeiro (2014), and Nicholls, Polman, and Levy (2012) have undertaken a more holistic approach through interviews, path analyses, and structural equational models. Of particular interest is the research of Nicholls and colleagues (2012), as theirs was the first study to investigate athlete stress appraisals, emotions, coping, and performance satisfaction within a path analysis model. Using a diverse sample of 557 athletes, Nicholls et al. demonstrated that stress appraisals, emotions, and coping are highly related constructs that may influence performance. In a follow-up study, Nicholls et al. (2014) found additional support for the application of Lazarus' CMR theory within sport. Further, Nicholls et al. also found that contrary to Lazarus' (1991a) assertion that stress appraisals are the most important construct within the CMRT, stress appraisals and emotions are equally influential within the stress process. This finding highlights the importance of sequential models, as such analyses can identify potential indirect paths between constructs, which may otherwise be missed. It has been recommended that researchers continue utilising such methods to investigate other constructs, including athlete goals in relation to stress appraisals, emotions, and coping strategies (Miles et al., 2016).

Such recommendations are not limited to theoretical field research. Through experimental research, scholars possess greater control in shaping an athlete's environment to influence their stress appraisals and measure the subsequent effects on emotions, coping, performance, and physiological response (Moore, Wilson, Vine, Coussens, & Freeman, 2013;

Nicholls et al., 2012, 2014). This is particularly important in regards to the CMR theory of emotions. Indeed, with emotion considered an organised psychophysiological response (Lazarus, 2000) resulting from a superordinate system involving motivation, appraisal, stress, emotion, and coping (Lazarus, 1999), there is a need to consider psychophysiological measurement in conjunction with appraisals, emotions, and coping. With this in mind, contemporary, publications from researchers such as Moore, Vine, Wilson, and Freeman (2012), Moore et al. (2013), Woodman et al. (2009) and Turner et al. (2013) have all provided excellent psychophysiological contributions to the CMR literature. However, gaps still remain in relation to research applications of CMR theory. For example, all four primary stress appraisals have yet to be examined from a psychophysiological and performance perspective (including through neuroendocrine response), whilst subsequent emotion and coping strategies have only been covered minimally (via somatic anxiety and perceptions of control). Additional work in this line of research would be beneficial to both practitioners and their athletes. If psychophysiological profiles of Lazarus' (1991, 1999, 2000) entire stress appraisal catalogue could be developed, it could help practitioners identify what stress appraisal an athlete is experiencing, and also help monitor the effectiveness of efforts to alter/reaffirm that stress appraisal. However, until this research is conducted within a controlled environment, understanding of these relationships and their neuroendocrine underpinnings shall remain equivocal.

## 2.3. Summary

Overall, it appears that scholars have established empirical support for the CMR theory and its place within sport. This understanding can be furthered, however, by examining all of the constructs within the CMR theory in a sequential manner, as was intended by Lazarus (1999). Additionally, there remains a niche within the literature to examine all four primary stress appraisals, and how these may relate to an individual's

neuroendocrine response. This is important, as the temporal orientation of a stress appraisal may influence an athlete's psychophysiological and performance response, regardless of the stress appraisal's valence. Another area which would benefit from investigation is that of athlete emotions. Pleasant emotions may have a range of long-term benefits to athletes, including the development of resources such as resilience, broadening of attention, and undoing of previously incurred losses from unpleasant emotions. However, the BaB theory of emotions (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) is yet to have been investigated within sport. Such an investigation could potentially begin to address the need for longitudinal sports emotion research, as well as providing evidence for the theory's sport psychophysiological applicability.

# Chapter 3:
# Stress Appraisals, Emotions, Coping, and Perceived Goal Attainment – a Path Analysis

## 3.1. Abstract

The purpose of this research was to investigate a theoretical path from stress appraisals through to subjective measures of goal attainment, via emotions and coping behaviours. I predicted that athlete stress appraisals would be associated with emotions, emotions with coping, and coping with goal attainment. One hundred and ninety-two athletes of all abilities completed psychometric assessments of the abovementioned constructs before and after an individually relevant sporting competition, with results explored through use of a path analysis. This analysis demonstrated support for the hypothesised model, with a sequential path from stress appraisals through to goal attainment established. Further, pleasant emotions were linked to task-oriented coping, which was positively linked to all three types of subjective goal attainment, whilst unpleasant emotions were linked with distraction- and disengagement-oriented coping, which were negatively related to goal attainment. This contrast serves to highlight the potential importance of engendering athletes with challenge stress appraisals and facilitating the experience of pleasant emotions.

## 3.2. Introduction

Stress can be inhibitive to athletic performance (Woodman & Hardy, 2003). Throughout the previous two decades, a myriad of research has been rooted within the Cognitive-Motivational-Relational Theory of Emotions (CMR; Lazarus, 1991, 1999, 2000) to examine relationships between stress appraisals, emotions, coping behaviours, and performance within sport (Nicholls, Perry, & Calmeiro, 2014; Nicholls et al., 2012). Despite this, comparatively few studies have utilised methodologies that adequately reflect the reciprocally deterministic nature of the aforementioned constructs. Until these theoretical niches are explored, scholars may not fully understand the nature of constructs within the stress process, and theory-guided interventions designed to improve performance could be limited. The mission of this research was to measure the stress process in a way more conceptually aligned to CMR theory in order to reflect an evolving stress process. For this purpose, this study was designed as a prospective field study which theoretically explored CMR theory within sport through the assessment of stress appraisals, emotions, coping, and perceived goal attainment across three time-points. This Chapter is the first of two studies examining CMR theory in sport both theoretically and experimentally.

### 3.2.1. Lazarus' Cognitive-Motivational-Relational Theory of Emotions

This section details the CMR theory and the gaps in the literature which guided this research in a concise fashion. For a more comprehensive discussion of CMR theory, please refer to the Literature Review offered in this thesis in Chapter 2. In the now seminal CMR theory, Lazarus (Lazarus, 1991, 1999, 2000) proposed that the constructs of stress appraisals, emotions, and coping behaviours are intertwined both recursively and dynamically. In practice, this dictates that each construct can influence one another in a relationship characterised by its state of flux. One should not assume that these constructs are weighted

equally, however: Lazarus (1999) posited that stress appraisals are the most important construct within his model. Stress appraisals are formulated via evaluations of an individual's person-environment relationship, and how this relationship has or may impact one's pursuit of his or her goals. When an individual *primary appraises* a stressful relationship, he or she evaluates how the current situation impacts upon his or her personal goals. This includes goal relevance (i.e., the importance of the goal), goal congruence (i.e., whether the upcoming event is facilitative or inhibitive to goal attainment), and ego involvement (i.e., how one's self-efficacy will be impacted). From this process, one of four primary appraisals are made if a person-environment relationship is deemed stressful. Firstly, a h*arm/loss* stress appraisal is formed if a loss has occurred, such as suffering an injury. However, if a gain such as scoring a goal has occurred, then a b*enefit* stress appraisal occurs. A *threat* stress appraisal is made if an upcoming scenario is deemed inhibitive to goal attainment, such as a forthcoming match against a superior player, whilst a c*hallenge* stress appraisal represents the prospect of making personal gains. Lazarus categorised challenge and benefit stress appraisals as gains, and threat and harm/loss stress appraisals as losses. In regards to CMR theory (Lazarus, 1991, 1999, 2000), challenge and threat stress appraisals have been extensively researched within both field (Nicholls, Perry, & Calmeiro, 2014; Nicholls et al., 2012) and laboratory (Moore et al., 2012, 2013) conditions, with the consensus formed that challenge stress appraisals facilitate improve athletic performance, whilst threat stress appraisals may inhibit athletic performance. However, despite CMR theory being designed as a sequential unit, sport psychological researchers have often investigated its constructs in a manner that does not reflect an evolving process over time. Until these limitations are addressed, the extent to which the stress process changes over time shall remain unknown. Lazarus (Lazarus, 1991, 1999, 2000) also reported *secondary appraisal* in his model, which concerns one's evaluation of potential coping choices and the outcomes of particular strategies. Despite the misleading

nature of the terms, primary and secondary appraisals do not occur sequentially, nor are they independent of one another (Lazarus, 1991, 1999, 2000). Considering the importance of secondary appraisals within the stress process, it is surprising that they have not been included in theoretical research such as Nicholls et al. (2014). As such, if a more parsimonious understanding of the stress process is to be achieved, secondary appraisals formed by athletes require investigation. From this understanding, it is hoped that effective theory-guided interventions that facilitate positive appraisals of person-environment relationships by athletes and improve athletic performance can be formed.

It is from both primary and secondary appraisals of person-environment relationships that athlete emotional experiences are often generated (Lazarus, 1991, 1999, 2000). Within CMR theory, emotions are regarded as conscious, organised psychophysiological reactions to a stimulus that is either tangible or abstract (Lazarus, 2000b). The classification of what constitutes an athletic emotional experience is often a contentious issue, with no agreed set list of emotions amongst researchers (Jones et al., 2005). Whilst Lazarus (1999) posited the existence of 15 varying emotions (e.g. anger, anxiety, happiness, hope), sports scholars (Nicholls et al., 2011) revealed that athletes report far fewer emotions during competition. Indeed, Lazarus (2000) himself suggested that if CMR theory accurately replicated how emotions and coping impact athlete performance, then athletes should have an active understanding of what emotions they may experience when competing, and how best to cope with them.

The purposes of coping behaviours are to address and manipulate the person-environment relationship, as well as regulating and dictating past, present, and future emotional experiences. It is for this reason that Lazarus (Lazarus, 2000b) championed coping as the second most important construct of CMR theory. For the purposes of this research, coping can be understood as any cognitive or behavioural actions undertaken to control one's

relationship with their environment. Although coping can be conceptualised in different ways, the three-dimensional approach developed by Gaudreau and Blondin (Gaudreau & Blondin, 2004) was used in this programme of research. As such, coping was categorised into task-oriented coping (i.e., attempts to master a stressor), distraction-oriented (i.e., focusing on stimuli unrelated to the task), and disengagement-oriented coping (i.e., ceasing efforts to achieve one's goals). Although the relationship between coping and performance is established (Nicholls, Taylor, et al., 2016), the relationship between stress appraisals and performance could be more thoroughly investigated (Nicholls, Perry, & Calmeiro, 2014).

### 3.2.2. Hypotheses

Centred within Lazarus' (1991, 1999, 2000) CMR theory, I measured stress appraisals, emotions, and coping behaviours, and subjective performance via goal attainment (Nicholls, Taylor, et al., 2016) across the course of real-life sporting competitions. I assessed these constructs in a way that reflects the constantly evolving nature of the stress process. Further, I built upon the work of Nicholls and colleagues (Nicholls, Perry, & Calmeiro, 2014) through the addition of both secondary appraisals and goal attainment, in order to understand how the controllability of a situation may influence challenge and threat stress appraisals, and indirectly affect goal attainment. I predicted that goal relevance, goal congruence, coping potential, and future expectations would have positive and negative relationships with challenge and threat stress appraisals, respectively. As the construct of blame/credit relates to perceptions of control, I predicted that this would yield positive relationships between both challenge and threat. Following on from previous research (Nicholls, Perry, & Calmeiro, 2014) I predicted that positive paths would exist between challenge and pleasant emotions, as well as between threat and unpleasant emotions. Negative paths were also anticipated between challenge and unpleasant emotions, as well as between threat and pleasant emotions. Based upon research by scholars (Nicholls et al., 2012) I envisaged pleasant emotions

producing a positive relationship with task-oriented coping, but negative relationships with distraction- and disengagement-oriented coping. In contrast, unpleasant emotions were expected to relate positively to distraction- and disengagement-oriented coping, but negatively to task-oriented coping. Finally, task-oriented coping was anticipated to reveal positive associations with all three goal constructs (e.g., mastery, self-referenced, and normative goals), with distraction- and disengagement-oriented coping expected to reveal negative associations due to recent findings in a meta-analysis that examine the coping and performance relationship (Nicholls, Taylor, et al., 2016). The hypothesised model can be viewed within Figure 3.1.

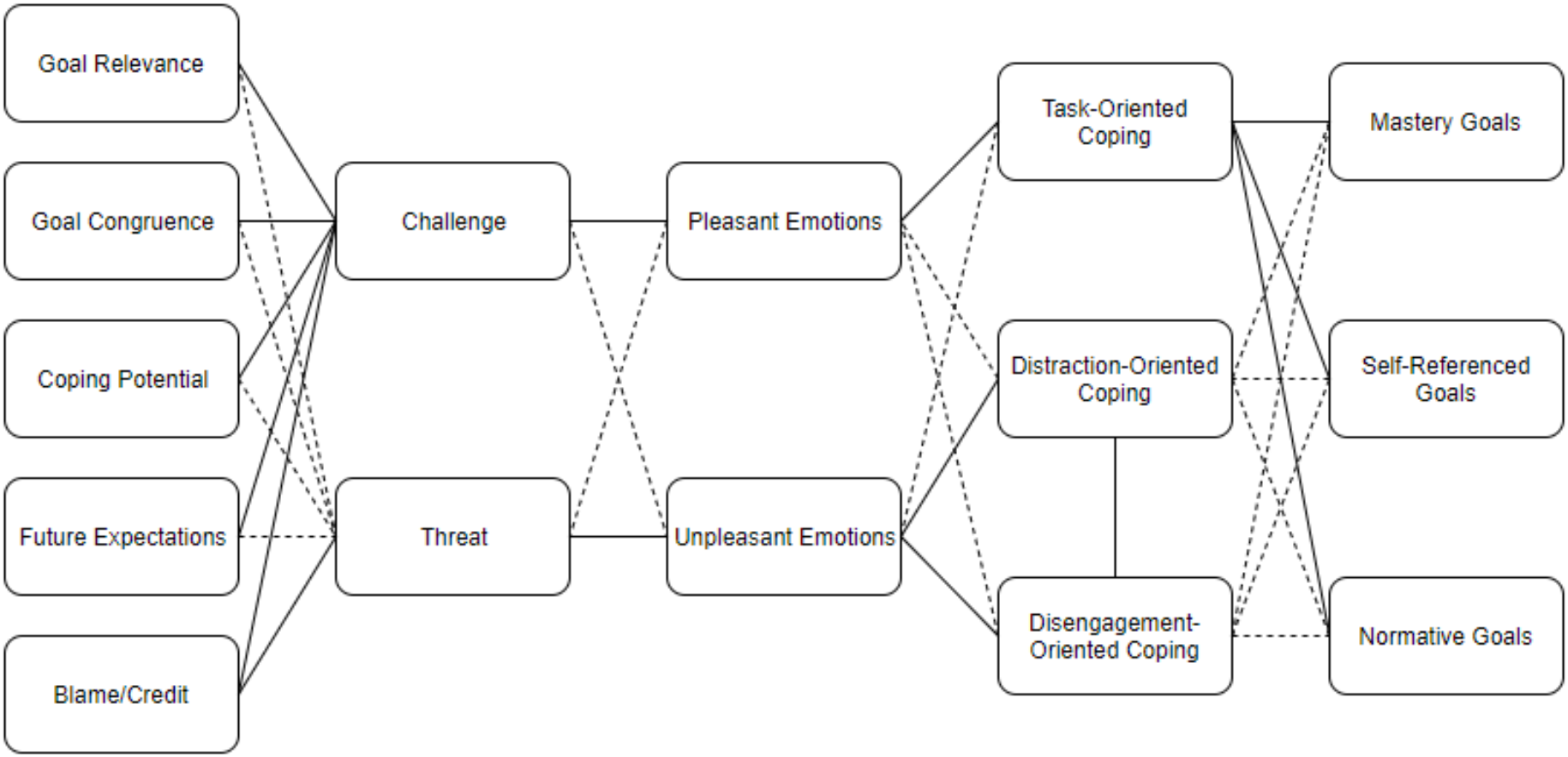


**Figure 3.1.** Hypothesised Model.

## 3.3. Methods

### 3.3.1. Participants

Participants were 192 athletes (male *n* =144, female *n* = 47, unspecified *n* = 1) aged between 16 and 73 (*M* = 23.01, *SD* = 10.32) and with an average playing experience of 9.41 years (*SD* = 6.30). The athletes within my sample competed at international (n = 28), national (n = 23), county (n = 21), club (n = 112), and beginner (n = 8) levels. Athletes took part in both team (e.g. football, basketball) and individual sports (e.g. golf, triathlon).

### 3.3.2. Self-Report Measures

The following self-report measures were presented to participants through use of a questionnaire pack (Appendix A).

The Precompetitive Appraisal Measure (PAM; Wolf, Evans, Laborde, & Kleinert, 2015) is a seven-item questionnaire that measures primary and secondary appraisal on a nine-point Likert-type scale (1 = *strongly disagree* to 9 = *strongly agree*). As I wished to examine coping potential, the decision was taken to include the item 'I have the resources to cope with the upcoming competition', which was not included in the final version of the PAM by Wolf and colleagues. Wolf et al. (2015) found that the PAM reported Cronbach's alpha coefficients ranging from .75 to .80.

The Stress Appraisal Measure (SAM; Peacock & Wong, 1990) assessed challenge and threat primary stress appraisals. The SAM contains four challenge and four threat items, with respondents answering questions such as 'I am keen to compete in my sport tomorrow', on a five-point Likert-type scale (1 = *not at all* to 5 = *extremely*). In their three study paper to assess the validity of the SAM, Peacock and Wong (1990) reported acceptable Cronbach's alpha ratings for both threat (.65 & .75) and challenge (.66 & .74).

The Sports Emotion Questionnaire (SEQ; Jones et al., 2005) measured emotions. The SEQ is a 22-item questionnaire that measures two pleasant emotions (happiness and

excitement) and three unpleasant emotions (anger, anxiety, and dejection) on a five-point Likert-type scale. Jones et al. reported Cronbach's alpha ratings varying between .81 and .87.

The Coping Inventory for Competitive Sports (CICS; (Gaudreau & Blondin, 2002) assessed the use of coping strategies. In the CICS, 10 strategies are organised into three second-order dimensions consisting of task-, distraction-, and disengagement-oriented coping, rated on a five-point Likert-type scale anchored by 1 = *not at all* and 5 = *very strongly*. Participants were asked to rate how much statements such as "I ask someone for advice concerning my mental preparation" corresponded to them. Gaudreau and Blondin reported Cronbach's alpha ratings ranging from .67 to .87.

The Attainment of Sport Achievement Goals Scale (A-SAGS; Amiot et al., 2004) was used to measure perceived goal attainment. The A-SAGS consists of 12 items, measuring three subscales: mastery, self-referenced, and normative goals. Mastery goals ascertain competence from perceived performance proficiency and were measured through use of items such as "mastered the difficulties of the situation", whilst self-referenced goals compare performance to previous efforts and were measured via items such as "did better than my previous performances". Finally, normative goals place emphasis on the extent of one's competitive success and were assessed through items such as "showed that I am superior to other athletes" These constructs were measured on a seven-point scale, anchored by 1 = *not at all* and 7 = *very strongly*. Amiot et al. reported that a global score of goal attainment calculated by regrouping all three subscales resulted in a Cronbach's alpha coefficients of .93.

### 3.3.3. Procedure

Once ethical approval was granted from the university ethics committee (Appendix H), sports clubs were contacted via email and invited to pass details of the study on to their members. Informed consent was obtained from athletes aged 18 and over, whilst parental

consent was gained for athletes aged 16 or 17. Following the granting of consent, participants were handed paper copies of the questionnaire pack, along with full instructions for the questionnaire completion procedure. The PAM (Wolf et al., 2015) and the SAM (Peacock & Wong, 1990) questionnaires were completed the evening before a competition. The SEQ was completed on the morning of the competition, and the CICS (Gaudreau & Blondin, 2002) and A-SAGS (Amiot et al., 2004) were completed within three hours of the competition ending, and within the presence of a trained research assistant.

### 3.3.4. Data Analysis

Data were initially screened for missing data and outliers. Following this, a path analysis was conducted using subscale scores as observed variables. To account for departure from multivariate normality, I employed the robust maximum likelihood (MLR). I examined model fit using standardised parameter estimates, with the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) presented as normed and non-normed incremental fit indices. The Standardized Root-Mean-Square Residual (SRMR) and Root Mean Square Error Approximation (RMSEA) were examined as absolute fit indices. To ascertain whether my model fit was satisfactory, I utilised Hu and Bentler's (1999) fit indices barometers of CFI > .90, TLI > .90, SRMR < .08, RMSEA < .05 for acceptable model fit. Based on the outcome of the path analysis, the model was modified by removing non-significant paths to derive the most parsimonious model.

## 3.4. Results

### 3.4.1. Preliminary Analysis

On inspection, no missing data or outliers were found. No issues were found with univariate skewness (<2) or kurtosis (<2). As Cronbach's alpha assumes tau equivalence, McDonald's (1999) omega (ω) was chosen to measure internal consistency. For the PAM (Wolf et al., 2015), omega coefficients of ω = .85 and ω = .73 for goal relevance and

blame/credit were found respectively. However, as the constructs of goal congruence, coping potential, and future expectations were measured by one item, their omega was not calculated. Analysis of the SAM (Peacock & Wong, 1990) produced coefficients of $\omega = .66$ for threat, and $\omega = .72$ for challenge. In regards to the SEQ (Jones et al., 2005), coefficients of $\omega = .88$ for unpleasant emotions, and $\omega = .88$ for pleasant emotions were found. Further, the CICS (Gaudreau & Blondin, 2002) also revealed acceptable internal reliability, with coefficients of $\omega = .84$, $\omega = .77$, and $\omega = .79$ found for the constructs of task-, distraction-, and disengagement-oriented coping respectively. Finally, examination of the A-SAGS (Amiot et al., 2004) revealed coefficients of $\omega = .82$, $\omega = .90$, and $\omega = .90$ for the constructs of mastery, self-referenced, and normative goals respectively.

### 3.4.2. Path Analysis

A path analysis was conducted using MPlus 7. I investigated the fit of the hypothesised model presented in Figure 3.1. This included paths from primary and secondary appraisals to challenge and threat, to emotions, and from coping strategies to goal attainment. The resultant model fit of $\chi^2(62) = 139.45$, $p < .001$, CFI = .875, TLI = .809, SRMR = .094, RMSEA = .081 (90% confidence interval (CI) = .063, .099) was unsatisfactory. As such, I engaged in the iterative removal of all non-significant paths until all estimated paths were found to be significant, which led to the removal of goal congruence from the model as an exogenous variable. This resulted in a new model fit of $\chi^2(66) = 137.88$, $p < .001$, CFI = .883, TLI = .849, SRMR = .099, RMSEA = .075 (90% CI = .058, .093). With model fit still unsatisfactory, a further iterative process was undertaken in which paths were added based upon their modification index if there was a theoretically justifiable rationale. For example, variables could only be regressed on variables that occur before them in the model (Figure 3.1.). This resulted in four paths being added, culminating in an excellent model fit of $\chi^2(62)$

= 79.28, $p$ = .069, CFI = .972, TLI = .961, SRMR = .070, RMSEA = .038 (90% CI = .000, .061).

Regarding stress appraisals, both goal relevance ($\beta$ = 0.43, $p$ < .001, 95% CI = 0.30, 0.55) and future expectations ($\beta$ = 0.33, $p$ < .001, 95% CI = 0.16, 0.50) were positively linked to challenge, whilst blame/credit ($\beta$ = 0.24, $p$ = .001, 95% CI = 0.11, 0.38) significantly predicted threat. A significant negative relationship was also observed between coping potential and threat ($\beta$ = -0.25, $p$ = .003, 95% CI = -0.41, -0.08).

Significant and positive paths were found between challenge and pleasant emotions ($\beta$ = 0.50, $p$ < .001, 95% CI = 0.39, 0.62), and between threat and unpleasant emotions ($\beta$ = 0.54, $p$ < .001, 95% CI = 0.42, 0.65). In relation to task-oriented coping, significant paths were found with pleasant emotions ($\beta$ = 0.18, $p$ = .008, 95% CI = 0.05, 0.31), goal relevance ($\beta$ = 0.27, $p$ < .001, 95% CI = 0.14, 0.40), and coping potential ($\beta$ = 0.25, $p$ < .001, 95% CI = 0.12, 0.37). Unpleasant emotions were found to significantly relate to both distraction- ($\beta$ = 0.39, $p$ < .001, 95% CI = 0.26, 0.52) and disengagement-oriented coping ($\beta$ = 0.36, $p$ < .001, 95% CI = 0.23, 0.49). As predicted, distraction- and disengagement-oriented coping significantly related to each other ($\beta$ = 0.32, $p$ < .001, 95% CI = 0.19, 0.45). Further, distraction-oriented coping was also found to significantly related to task-oriented coping ($\beta$ = 0.28, $p$ < .001, 95% CI = 0.16, 0.40).

Examination of goal attainment revealed a number of significant paths. Firstly, task-oriented coping significantly related to mastery ($\beta$ = 0.40, $p$ < .001, 95% CI = 0.28, 0.52), self-referenced ($\beta$ = 0.18, $p$ = .01, 95% CI = 0.04, 0.31) and normative goals ($\beta$ = 0.29, $p$ < .001, 95% CI = 0.17, 0.41). Meanwhile, distraction- and disengagement-oriented coping were negatively related to mastery goals (distraction-: $\beta$ = -0.13, $p$ = .015, 95% CI = -0.23, -0.03; disengagement-oriented coping: $\beta$ = -0.23, $p$ < .001, 95% CI = -0.32, -0.14). Self-referenced goals were negatively associated to disengagement-oriented coping ($\beta$ =-0.17, $p$

= .004, 95% CI = -0.28, -0.05). Finally, normative goals negatively related with threat ($\beta$ = -0.20, $p$ < .001, 95% CI = -0.29, -0.10). The resultant path analysis model can be found in Figure 3.2.

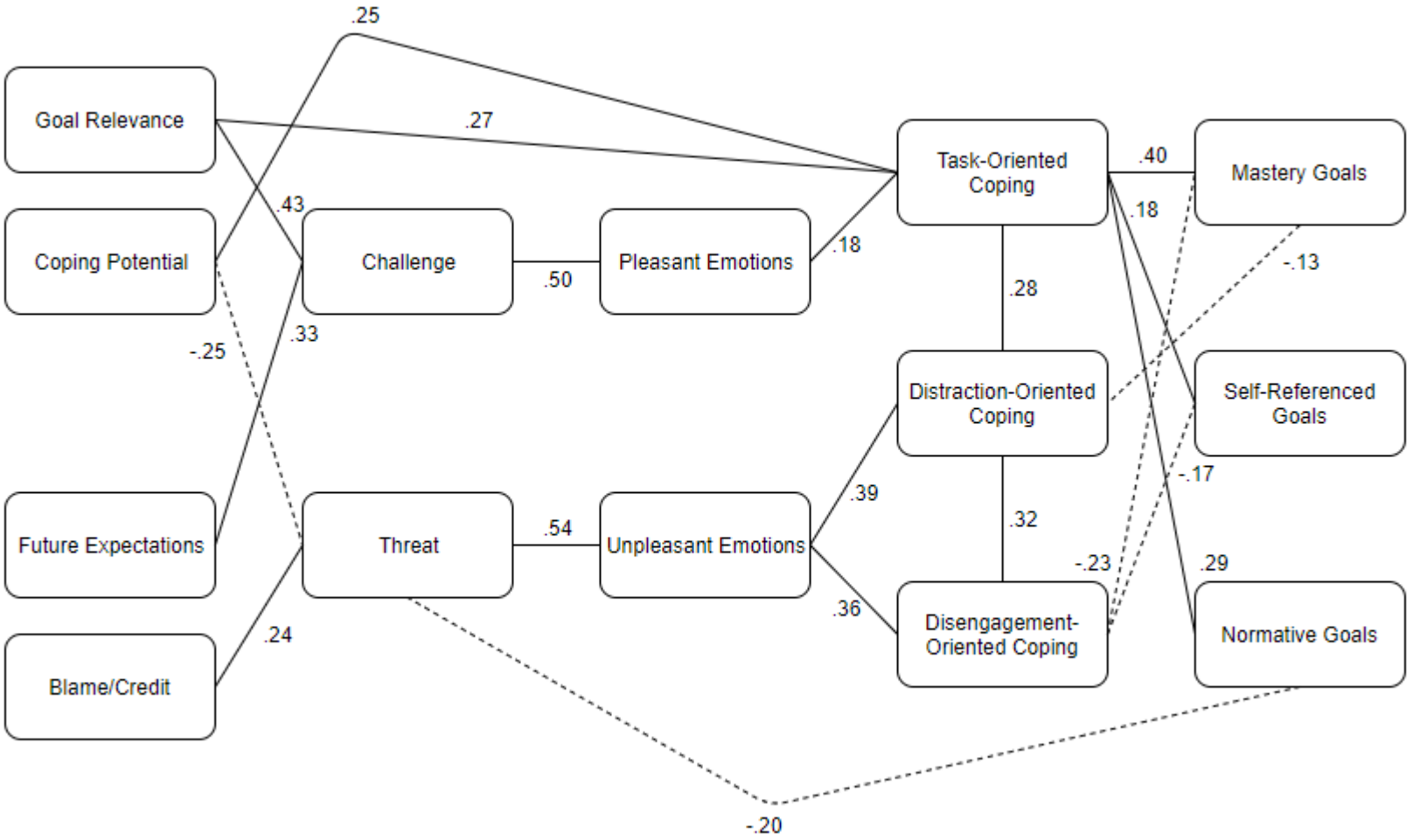


**Figure 3.2.** Final, parsimonious model with standardized parameter estimates.

## 3.5. Discussion

Significant paths were found from primary and secondary appraisal through to goal attainment. This provides further support for the application of the CMR theory of emotions in sport, as well as building upon previous research (Nicholls, Perry, & Calmeiro, 2014) by examining primary appraisals more conceptually aligned to Lazarus' (1991, 1999, 2000) framework, which views stress appraisals, emotions, and coping as a changing process, thus requiring measurement across the course of real-life sporting competitions. Goal attainment was also added to the model, which is important for a sporting context.

The significant paths from challenge stress appraisals through to mastery, self-referenced, and normative goals, along with the negative path from threat through to mastery and self-referenced goals indicate an association between stress appraisals and the attainment of one's goals. This concurs with findings from previous research (Moore et al., 2013), and signifies the importance of athletes endeavouring to generate challenge stress appraisals during stressful competitions.

The examination of individual constructs within the primary appraisals of athletes provide a useful insight into the formation of stress appraisals which are both facilitative and inhibitive for goal attainment. Indeed, it appears the combination of low athlete coping potential, as measured by secondary appraisal, and high levels of blame combine to formulate a threat stress appraisal, which in turn are negatively associated with normative goals. Conversely, coping potential was found to be directly associated with task-oriented coping behaviours, which was itself associated with all three goal types. It may therefore be inferred that an athletes perception of control and their efficacy in undertaking their performance behaviours are a key determinant in stress appraisal formation and subsequent goal attainment (Wolf et al., 2015). Indeed, with perceived external support leading to greater situational control and athletic performance (Freeman & Rees, 2009), practitioners are

advised to furnish their athletes with a number of task-oriented coping strategies, such as seeking support and logical analysis. Further, with goal relevance also directly related to task-oriented coping, it appears that intrinsic motivation predicts task engagement. This is consistent with the literature (Amiot et al., 2004), with coaches found to directly facilitate athlete motivation and consequent performance (Gillet, Vallerand, Amoura, & Baldes, 2010).

Distraction-oriented coping was found to significantly relate to both task- and disengagement-oriented coping. In regards to the former relationship, the employment of distraction-oriented coping may aid the preservation of physical and mental resources required for peak performance (Alberts, Martijn, Nievelstein, Jansen, & De Vries, 2008), as evidenced within athletes (Gaudreau & Blondin, 2004). In relation to the latter, it appears that distraction-oriented coping strategies may supplement disengagement-oriented strategies in an attempt to limit the potentially negative impact of unpleasant emotions. Whilst distraction-oriented strategies did negatively relate to mastery goals (Amiot et al., 2004; Gaudreau & Blondin, 2002), non-significant goal attainment findings have also been found (Gaudreau et al., 2010). The possibility that distraction-oriented coping behaviours act as task- or disengagement-oriented coping facilitators is an exciting and novel avenue for future research activity, as this may provide clarity as to why disengagement-oriented coping strategies are employed by athletes. Currently, no consensus regarding the performance impact of disengagement-oriented coping strategies has been reached within the sport psychological literature, with non-significant (Gaudreau et al., 2010; Laborde, Dosseville, & Kinrade, 2014), negative (Nicholls, Polman, & Levy, 2012), and positive (when combined with task-oriented coping; Gaudreau & Blondin, 2004) relationships between disengagement-oriented coping and athletic performance found.

This study contains some limitations that can be addressed by future research. Firstly, due to insufficient sample size, it was not possible to undertake structural equational

modelling - a multivariate statistical analysis technique utilised by Nicholls et al. (2014). Bentler and Chou (1987) recommended that researchers obtain at least five cases per estimated parameter to examine a hypothesised structural model. However, with a sample of 192 participants, this study fell short of this requirement. Future research may benefit from utilising structural equational modelling as its explicit assessment of measurement error is preferable to the assumption of error free measurement which is inherent in path analyses.

A limitation of this research, and other research in this field (Nicholls, Perry, & Calmeiro, 2014; Nicholls et al., 2012; Moore et al., 2012) is that I did not examine benefit and harm/loss stress appraisals. Whilst a limited amount research has investigated harm/loss stress appraisals (Bartholomew, Arnold, Hampson, & Fletcher, 2017), benefit stress appraisals generated by athletes have only been the subject of one qualitative examination (Nicholls et al., 2011). To provide a more parsimonious understanding of the stress process, both benefit and harm/loss stress appraisals need to be further explored. Development of this understanding would grant athlete stakeholders a greater knowledge of how their athlete may respond emotionally and behaviourally to a recent stimulus, as well as potentially aiding them in efforts to orient their athlete towards more performance facilitative stress appraisals. What is more, researchers would also be able to assess the impact that the temporal orientation (e.g. past- or future-oriented) of a stimulus may have within the stress process.

A further limitation of this study relates to its field-based cross-sectional nature, which is ecologically valid, but lacks definitive causality. Experimental research in which an athlete's person-environment is suitably controlled and manipulated would provide scholars with more confidence that any significant psychological or performance changes were resulting from an athlete's stress appraisal, as opposed to type I error. Whilst some experimental research has been undertaken by Moore and colleagues (Moore et al., 2012, 2013) relating to challenge and threat states, researchers have tended to examine stress

appraisals in relation to closed skill sports, and have widely ignored the effects of stress appraisals on endurance performance. Understanding the implications of stress appraisals on endurance performance is important, so that these athletes can be offered evidence-based techniques. In addition, a controlled environment would also provide scholars with the opportunity to develop psychophysiological profiles through use of physiological stress markers such as cortisol. This is particularly important in relation to past-oriented stress appraisals, with no neuroendocrine or psychophysiological profiles currently existing. Taken together, these limitations within the literature dictate that only half of Lazarus' (1991, 1999, 2000) CMR stress appraisal catalogue has been reliably examined in a controlled environment. It is for these reasons that I decided to undertake the research conducted in Chapter 4: a psychophysiological and performance examination of all four stress appraisals on a laboratory-based cycling task.

To conclude, sequential paths were found from athlete stress appraisals through to goal attainment. These findings suggest that athletes should be aided to form challenge stress appraisals, as these have been found to be facilitative to the experience of pleasant emotion, which itself is linked to the undertaking of task-oriented coping strategies (such as effort expenditure and mental imagery). From this, athletes stand a stronger chance of reaching the performance levels they strive for.

# Chapter 4:
# A Psychophysiological Examination of Lazarus' CMR Theory of Emotions via a Lab-Based 16.1 km Cycling Time Trial Task

## 4.1. Abstract

Athlete's stress appraisals have been associated with athletic performance, which are purported to be mediated by emotions and coping behaviours. However, understanding of how these psychological mechanisms underpin performance is equivocal, with limited experimental research undertaken to establish causality. Further, this dearth of research activity is also extended to past-oriented stress appraisals, with no recorded experimental examinations of benefit or harm/loss stress appraisals. Therefore, the present research assessed the causal psychophysiological and performance impact of past- (e.g., harm/loss and benefit) and future-oriented (e.g., challenge and threat) stress appraisals on performance. Thirty trained and gender-matched athletes were randomly engendered with one of four stress appraisals (challenge, threat, benefit, or harm/loss) or assigned to a control group and completed three 16.1km cycling time trials on an SRM cycle ergometer. Salivary cortisol samples and psychometric assessments (e.g., stress appraisals, emotions, and coping) were collected before and after each time trial. Subsequent analyses showed that stress appraisals significantly influence psychophysiological response and performance, with past-oriented stress appraisals as autonomous and influential as future-oriented stress appraisals. Spikes in cortisol levels in the future-oriented stress appraisal threat, compared to a decline in the past-oriented harm/loss, suggest that the fear of defeat may be physiologically more stressful than losing itself. Practitioners are advised to engender benefit stress appraisals in order to facilitate both psychophysiological benefits and subsequent performance proficiency among their athletes.

## 4.2. Introduction

Along with Chapter 3, the extant theoretical (Miles, Neil, & Barker, 2016; Nicholls, Perry, & Calmeiro, 2014; Nicholls et al., 2012) and laboratory-based literature (Moore et al., 2012, 2013) has established the psychological influence of challenge and threat stress appraisals. These scholars reported that challenge stress appraisals were facilitative to performance, whilst threat stress appraisals were inhibitive. However, the laboratory studies by Moore et al. (2012, 2013) did not include control groups and examined only aiming tasks, while field-based research lacks the enhanced causality of manipulation-based experimental research (Nicholls, Perry, & Calmeiro, 2014). As such, the extent to which stress appraisals causally influence performance in a range of sports remain unknown, as other variables may be at play. What is more, there has also been paucity of research conducted in regards to subsequent neuroendocrine response and resultant endurance performance, whilst past-oriented stress appraisals have never been quantitatively explored in relation to competitive stressors. With Lazarus (1991, 1999, 2000) purporting that appraisal is the fundamental construct within his theory, it must be conceded that CMR theory has yet to be fully examined from a psychophysiological and performance perspective within sport. This is important because the development of accurate psychophysiological stress appraisal profiles could be used to guide athletes and their stakeholders in stress appraisal identification (Parmigiani et al., 2009), as well as monitor the impact of efforts to reinforce or alter the said stress appraisal. From this, athlete stakeholders could subsequently undertake theory-guided actions in order to facilitate both optimum performance and athlete wellbeing.

This Chapter acts as the second instalment of a theoretical and experimental examination of CMR theory within sport (Lazarus, 1991, 1999, 2000). The purpose of this research was to measure stress appraisals, emotions, coping strategies, and objective performance in a controlled, laboratory-based cycling task. With stress appraisal emerging as

a key construct in Chapter 3, I aimed to manipulate this construct within this study and assess its influence on cortisol levels (for a review of psychophysiology and neuroendocrine response within athletes, please refer to sections 2.1.4. and 2.2.4. of the Literature Review within this thesis) and cycling performance. Furthermore, I extended my measurement of CMR theory of emotions in this study by also examining past-oriented stress appraisals of benefit and harm/loss.

### 4.2.1. Hypotheses

I predicted that gain stress appraisals of challenge and benefit would result in superior performance in comparison to the control group, whilst the loss stress appraisals of threat and harm/loss would result in poorer performance when compared to the control group. Further, with scholars such as Harvey, Nathens, Bandiera, & LeBlanc (2010) and Quested et al. (2011) suggesting that challenge and threat stress appraisals suppress and spike cortisol response respectively, I also predicted that both challenge and benefit groups would show significantly less salivary cortisol secretion, whilst threat and harm/loss would show significantly increased physiological response in comparison to the control group. Finally, I predicted that the psychological response of the challenge and threat groups would replicate the findings from Chapter 3. Further, benefit and harm/loss were expected to mirror the results of their respective gain and loss groupings, challenge and threat.

## 4.3. Method

### 4.3.1. Participants

Thirty ostensibly healthy athletes were recruited via email to participate in this study, of which 19 identified cycling as their primary sport. Fifteen were male (age 34.67 ± 10.4; height 178.69 cm ± 7.92 cm; weight 81.71 kg ± 10.36 kg) and 15 were female (age 30.53 ± 9.37; height 167.19 cm ± 6.87 cm; weight 61.79 kg ± 8.65 kg). Participants completed a medical history questionnaire prior to their participation. The study inclusion criteria required

athletes to be aged between 16-55 years, who trained at least three times a week, did not smoke, had no history of cardiovascular illness, and free from the consumption of substances which may affect salivary cortisol secretion at the time of the study. The protocol for this study was approved by a university ethics committee (Appendix H).

### 4.3.2. Self-Report Measures

Self-report measures were compiled into a paper copy questionnaire pack (Appendix B) and completed on each testing day, excluding familiarisation.

Before the cycling task began, participants completed the Precompetitive Appraisal Measure (PAM; Wolf et al., 2015); a seven-item questionnaire assessing primary and secondary appraisal through use of a nine-point Likert-type scale (1 = *strongly disagree* to 9 = *strongly agree*). Again, as I wished to measure participant coping potential, I decided to include the item 'I have the resources to cope with the upcoming competition', which was not included in the final version of the PAM by Wolf and colleagues. The PAM was found by Wolf et al. (2015) to report Cronbach's alpha coefficients ranging from .75 to .80.

Future-oriented stress appraisals were measured before the commencement of the task through use of the Stress Appraisal Measure (SAM; Peacock & Wong, 1990). The SAM is an eight-item, five-point Likert-type scale (1 = *not at all* to 5 = *extremely*) questionnaire which assesses challenge and threat primary stress appraisals through use of questions such as "I can become a stronger person by competing today". Peacock and Wong (1990) stated acceptable Cronbach's alpha ratings for both threat (.65 & .75) and challenge (.66 & .74).

Athlete emotions were assessed via the Sports Emotion Questionnaire (SEQ; Jones et al., 2005) before the beginning of the task. The SEQ measures two pleasant emotions (happiness and excitement) and three unpleasant emotions (anger, anxiety, and dejection) across a 22-item, five-point Likert-type scale (1 = not at all to 5 = extremely). In their research, Jones et al. reported good Cronbach's alpha ratings ranging from .81 to .87.

Following the completion of the cycling time trial (TT), participant's use of coping strategies was measured via an altered version of the Coping Inventory for Competitive Sports (CICS; Gaudreau & Blondin, 2002). In the CICS, 10 strategies are organised into three second-order dimensions consisting of task-, distraction-, and disengagement-oriented coping, rated on a five-point Likert-type scale anchored by 1 = *not at all* and 5 = *very strongly*. However, in order to better fit the study, some items were modified to fit the cycling task, whilst all items relating to 'distancing from others' and 'seeking support' were not deemed relatable to the single person cycling task, and thereby removed. This resulted in a 28-item CICS, with item examples including "I committed myself by giving a consistent effort". Internal reliability of the altered CICS was measured via McDonald's omega, and can be found in section 4.4.3.

Finally, past-oriented stress appraisals were measured post-TT via use of an amended eight-item version of the SAM (Peacock & Wong, 1990). Modifications were made to future-oriented challenge and threat items. For example, the item "I can become a stronger person by competing today" which measured challenge was changed to "I've shown that I am a capable athlete", and thus measured benefit, whilst the item "I think that the outcome of tomorrow's matches/competitions will be negative and that I will lose" which measured threat was changed to "I was not as good as I thought I would be".

### 4.3.3. Physiological Response and Performance

Athletic performance was assessed by calculating the percentage time change between TT2 and TT3 completion times (Halson et al., 2002), whilst physiological response was measured via salivary cortisol levels – a marker commonly used by researchers to explore psychophysiological response to stress over time (Hellhammer et al., 2009). I decided on sampling salivary cortisol levels for a number of reasons. Firstly, due to its non-invasive procedure and more accurate reflection of unbound cortisol (in relation to serum total

cortisol), it is viewed as the gold standard measurement (Vining et al., 1983). As cortisol secretion induced by high intensity exercise takes up to 59 minutes to significantly increase (Jacks et al., 2002), cortisol was deemed a suitable measure of psychological stress during exercise. On the basis of research findings which indicate that menstrual cycle stage and oral contraceptive do not impact cortisol levels (Liening et al., 2010), and given that there were an equal number of males and females within each testing group, participants of both genders underwent the same cortisol sampling procedure. Three saliva samples were taken on each testing day, excluding familiarisation, via salivettes (Sarstedt, Rommelsdorf, Germany). These were taken at baseline (TP1), immediate post-exercise (TP2), and 15 minutes post-exercise (TP3). Salivary cortisol levels peak immediately post prolonged exercise (Powell, DiLeo, Roberge, Coca, & Kim, 2015) and 15 minutes post-HPA activation via psychological stressor (Quested et al., 2011), so there was sufficient time for all manipulations to take effect. Cortisol analysis was conducted via enzyme-linked immunosorbent assay kits as per the manufacturer's instructions (Sigma Aldrich, St Louis, USA).

### 4.3.4. Procedure

Before commencement of the study, a power analysis was conducted via use of G*Power 3.1, which indicated a minimum of 30 participants, equating to six participants per stress appraisal group (i.e., challenge, threat, benefit, harm/loss, and control). Each stress appraisal group was randomly allocated both three males and three females who completed three 16.1km TT's as quickly as possible on an SRM cycle ergometer (Schoberer Rad Mebtechnik, Konigskamp, Germany). With 16.1km TTs commonplace in cycling competitions, this provided ecological validity for my task (Sparks et al., 2016). As task familiarity is an indispensable factor when considering performance variance (Sparks et al., 2016), a familiarisation session (TT1) was provided to all athletes but was not included in the analysis. All testing sessions occurred at the same time of day to avoid diurnal variation and

were separated by at least 72 hours to facilitate recovery. Participants were instructed to attend all testing sessions in a hydrated state, having not consumed caffeine on the day of testing or food one hour before, nor engaged in strenuous activity 24 hours prior.

Once all anthropometrical data had been taken, participants provided their first saliva sample (TP1), and began a five-minute warm up. Once the participant felt ready to start, the TT began. The SRM ergometer software recorded values for heart rate, cadence, power, distance, speed, and time each minute. In order to aid the deception, participants were only provided with how far (KM) they had cycled. Other than the manipulations imparted during TT3 (see Manipulation section), there was no communication between the researcher and participant. Following the TT completion, the TP2 saliva sample was taken. After 15 minutes of rest had elapsed, the final saliva sample was also taken (TP3) and the session ended.

### 4.3.5. Manipulation

Participants received stress appraisal manipulations via a standardised performance feedback (Appendix F). This excluded the control group, who received no feedback. To ensure that stress appraisal manipulations had the greatest possible impact, a number of task engagement measures were implemented. Firstly, whilst the study's purpose was kept intentionally vague, in order to not arouse suspicion of deception, the importance of the TT was constantly emphasised. Secondly, participants were told that they were competing against other cyclists of their gender to win either a £75 prize for first place or a £25 prize for second place. Participants were informed that these prizes would be allocated depending on their mean time for TT2 and TT3, which would also be displayed on an online leader board. Participants were also informed that their performances were to be recorded via video camera that was placed one metre to the front left of the cycle ergometer. Finally, participants were told that the two slowest male and female cyclists would be required to take part in a 30-minute interview to discuss their poor performance. Such measures were implemented to

mimic the social evaluation stressors that high-level athletes constantly face in real life (Noblet & Gifford, 2002).

Participants received three stress appraisal manipulations over the course of the TT3 testing session. These occurred pre-TT, at the halfway point of the TT (8km), and post-TT. The stress appraisal scripts were based on manipulations from previous research (Moore et al., 2012), and related to the participants supposed performance from TT2 and their ongoing performance in TT3. As challenge stress appraisals are gain and future-oriented in nature, challenge group participants were advised that they topped the study leader board, in their gender, at the halfway stage. As such, an impressive, but achievable, performance could result in them potentially being the fastest cyclist overall. Conversely, threat stress appraisal participants were advised that, at the halfway stage of the study, they were in last place in their gender group and were at real risk of being interviewed. Participants placed into the benefit or harm/loss groups were told that they were the last person to participate in the study, thus enabling a past-orientation to their feedback. Benefit participants were told that improving or maintaining their previous performance would see them top the leader board, whilst harm/loss participants were instructed that it was almost inevitable they would finish in the bottom two. At the subsequent manipulation time points, occurring at 8km and immediate post-TT, these stress appraisals were reinforced. Once the final saliva sample was provided fifteen minutes after completing TT3, the study ended and the participant received a full and thorough debrief about the true nature of the study and were asked to keep the study confidential.

## 4.4. Results

### 4.4.1. Demographics

A one-way ANOVA was initially conducted to assess the distribution of the randomisation process. This produced no significant differences across the groups in regard to age (males $p = .54$; females $p = .70$; overall $p = .67$), height (males $p = 1.00$; females $p$

= .70; overall $p$ = .95), weight (males $p$ = .92; females $p$ = .93; overall $p$ = .98), or physical activity levels (males $p$ = .51; females $p$ = 90; overall $p$ = .96).

### 4.4.2. Manipulation Checks

Independent-samples *t*-tests examined if the stress appraisals of challenge, threat, benefit, or harm/loss were engendered in the targeted groups. In accordance with guidelines (Sullivan & Feinn, 2012), all $p$ values were supplemented with Hedges $g$ effect sizes, which are suitable for smaller sample analysis. With no manipulation provided to the control group, no manipulation check via *t*-test was required. Compared with the threat group, challenge produced a significantly larger challenge stress appraisal index value, $t(10) = 4.77$, $p = .001$, $g = 2.54$, and significantly less threat index value, $t(10) = 2.55$, $p = .03$, $g = 1.36$. Benefit was compared against harm/loss, and exhibited significantly higher levels of benefit, $t(10) = 3.57$, $p = .005$, $g = 1.90$, as well as significantly lower levels of harm/loss, $t(10) = 6.40$, $p < .001$, $g = 3.42$.

### 4.4.3. Self-Report Measures

McDonald's omega (ω) was chosen to measure internal consistency. Analysis of the PAM (Wolf et al., 2015) produced coefficients of ω = .69 (TT2) and ω = .85 (TT3) for goal relevance, as well as ω = .86 (TT2) and ω = .85 (TT3) for blame/credit. As in Chapter 3, omega was not calculated for the constructs of goal congruence, coping potential, and future expectations, as they were measured by one item only. The SAM (Peacock & Wong, 1990) revealed omega outputs of ω = .63 (TT2) and ω = .75 (TT3) for threat, along with ω = .65 (TT2) and ω = .79 (TT3) for challenge. Examination of the SEQ (Jones et al., 2005) could not calculate omega for unpleasant emotions at TT2, as there was perfect item agreement, whereby there was no variance among items in the scale. At TT3, unpleasant emotions produced a coefficient of ω = .90. Further SEQ scales yielded ω = .89 (TT2) and ω = .93

(TT3) for pleasant emotions. The revised CICS (Gaudreau & Blondin, 2002) delivered coefficients of ω = .72 (TT2) and ω = .91 (TT3) for task-oriented coping, ω = .91 (TT2) and ω = .89 (TT3) for distraction-oriented coping, and ω = .68 (TT2) and ω = .85 (TT3) for disengagement-oriented coping. Finally, the revised SAM (Peacock & Wong, 1990) produced outputs of ω = .87 (TT2) and ω = .85 (TT3) for harm/loss, as well as ω = .73 (TT2) and ω = .87 (TT3) for benefit. Following the internal consistency analysis, a factorial analysis of variance (ANOVA) was conducted to examine the psychological responses of athletes across the two competitive time trials. To account for any potential type I error resulting from multiple comparisons, Benjamini-Hochberg *q* was derived from determining the False Discovery Rate. The null hypothesis was rejected if and only if $p < q$ and the 95% confidence interval did not contain zero.

### 4.4.4. Primary and Secondary Appraisals

Between-subject tests revealed no significant difference between groups for primary appraisal. However, an effect of $F(4) = 3.49$, $p = .021$, was found for secondary appraisal. This subsequently passed the FDR ($q = .025$). Pairwise comparisons revealed a significantly positive primary appraisal increase for benefit stress appraisal athletes from TT2 to TT3 ($p = .042$, $g = -0.87$), as well as a significant decrease for threat stress appraisal athletes from TT2 to TT3 ($p = .025$, $g = 0.73$). However, with the reported *p* values higher than the FDR *q* value ($q = .02$ and .01 respectively), the null hypothesis was not rejected. Participants in the threat and control groups also scored significantly lower levels of secondary appraisal during TT3 than TT2, with outputs of $p = .006$, $g = 0.90$ and $p = .044$, $g = 0.83$ respectively. Whilst the significance of the threat relationship passed the FDR ($q = .01$), the control group failed ($q = .02$). Finally, the benefit stress appraisal group produced a significantly more positive secondary appraisal for TT3 than both harm/loss ($p = .048$, $g = 2.16$) and threat ($p = .001$, $g = 1.94$), with challenge also significantly higher than threat ($p = .005$, $g = 1.70$). Following

post-hoc analysis, only the relationship between benefit and threat failed the FDR, with respective *q* values of .015, .005, and .001.

### 4.4.5. Challenge and Threat Stress Appraisals

Pairwise comparisons of each stress appraisal grouping produced significantly lower levels of challenge for TT3 (in comparison to TT2) for the groups of threat ($p$ = .003, $g$ = 0.90), harm/loss ($p$ = .015, $g$ = .0.67), and control ($p$ = .042, $g$ = 0.64). Whilst the control group did not pass the FDR ($q$ = .03), both the threat ($q$ = .01) and harm/loss ($q$ = .02) group interactions did. A significant effect was found between challenge and threat for TT3, with challenge group participants displaying higher levels of challenge stress appraisal ($p$ = .011, $g$ = 2.54). However, with an FDR $q$ value of .005, the null hypothesis was not rejected. Lastly, very large effects in relation to challenge stress appraisals were found during TT3 between challenge and the groups of harm/loss and control ($p$ = .071, $g$ = 1.57; and $p$ = .071, $g$ = 1.79 respectively).

### 4.4.6. Pleasant and Unpleasant Emotions

Examination of group pairwise comparisons indicated that the threat group experienced significantly less pleasant emotions during TT3 than TT2 ($p$ = .025, $g$ = 0.99), whilst harm/loss experienced more unpleasant emotions during TT3 than TT2 ($p$ = .025, $g$ = -0.63). Benjamini-Hochburg post-hoc correction for multiple comparisons revealed that both interactions failed the FDR, with $q$ values of .01 and .01.

### 4.4.7. Coping Strategies

Distraction-oriented coping strategies were found to significantly differ across groups, with a main effect of $F(4) = 2.83$, $p$ = .046. However, this $p$ value was not found to be lower than $q$ = .0167. In relation to task-oriented coping, pairwise comparisons revealed a host of significant changes, including after post-hoc analyses, with challenge ($p$ < .001, $g$ = -1.60, $q$

= .02), benefit ($p < .001$, $g = -3.46$, $q = .01$), harm/loss ($p < .001$, $g = -1.15$, $q = .04$), and control ($p < .001$, $g = -1.52$, $q = .03$) all higher during TT3. Threat stress appraisal participants used significantly more disengagement-oriented coping strategies during TT3 than TT2, including after post-hoc testing ($p = .003$, $g = -0.86$, $q = .01$). Harm/loss participants displayed a large increase effect in the amount of disengagement-oriented coping utilised in TT3 compared to TT2, with an output of $p = .057$, $g = -0.81$. A significant effect was also found between challenge and threat in relation to task-oriented coping during TT3, with challenge utilising such strategies more ($p = .045$, $g = 1.48$). This effect was not found to pass the FDR, however ($q = .005$).

### 4.4.8. Benefit and Harm/Loss Stress Appraisals

Significant between-subject effects were found for both benefit ($F(4) = 4.86$, $p = .005$) and harm/loss ($F(4) = 4.23$, $p = .009$), including after Benjamini-Hochberg post-hoc analyses (benefit: $q = .025$; harm/loss $q = .05$). Pairwise comparisons revealed significantly lower levels of harm/loss stress appraisal during TT3 for the benefit group when compared to TT2 ($p = .003$, $g = 1.13$), whilst the threat group portrayed significantly higher levels of harm/loss in TT3 than in TT2 ($p = .037$, $g = -0.53$). Following post-hoc testing, the null hypothesis was rejected in relation to the benefit group interaction ($q = .01$), and not rejected in relation to the threat group interaction ($q = .02$). During TT3, threat and harm/loss participant groups also exhibited significantly stronger harm/loss stress appraisals than challenge (threat: $p = .001$, $g = 1.94$, $q = .001$; harm/loss: $p = .004$, $g = 3.61$, $q = .015$) and benefit (threat: $p = .001$, $g = 1.81$, $q = .005$; harm/loss: $p = .01$, $g = 3.42$, $q = .02$). The threat group also displayed higher levels of harm/loss than the control group for TT3 after post-hoc testing ($p = .01$, $g = 1.38$, $q = .025$).

Including after post-hoc analyses, participants in the challenge and benefit groups exhibited higher benefit scores during TT3 than in TT2 (challenge: $p = .006$, $g = -1.30$, $q$

= .03; benefit: $p$ = .017, $g$ = -1.48, $q$ = .04), whilst threat and harm/loss scored significantly lower in TT3 than in TT2 (threat: $p$ < .001, $g$ = 2.45, $q$ = .02; harm/loss: $p$ < .001, $g$ = 1.65, $q$ = .01). Pairwise comparisons revealed that the high TT3 benefit scores by the benefit participant group produced very large effects in relation to those of the threat ($p$ = .002, $g$ = 3.03) and harm/loss ($p$ = .070, $g$ = 1.90) groups. Regarding the interaction involving the benefit and threat group, this was found to be significant after Benjamini-Hochberg analysis, with a $q$ value equating to .015. Other findings included significantly stronger benefit stress appraisals during TT3 by the challenge group in comparison to both threat ($p$ < .001, $g$ = 4.04) and harm/loss ($p$ < .001, $g$ = 2.94), as well as significantly lower levels for the threat group compared to the control group ($p$ = .002, $g$ = -1.92). These findings were sustained following post-hoc analysis, with respective $q$ values of .005, .01, and .02.

### 4.4.9. Physiological Response

Due to diurnal variation across participants, I took the decision to include only between-group comparisons. In keeping with the cortisol meta-analysis conducted by Denson, Spanovic, and Miller (2009), effect size was deemed the most suitable expression of neuroendocrine response. Table 4.1. provides a summary of athlete physiological response across each time point. Whilst the challenge group did not differ across the first two time points, cortisol levels increased at TT3 TP3 (in comparison to TT2 TP3), creating a moderate effect of $g$ = -0.52. A similar pattern was displayed in the threat group, with TT3 TP3 stress levels heightening to produce a large effect of $g$ = -0.90. The benefit group witnessed an initial cortisol spike of $g$ = -0.45 between TT2 TP1 and TT3 TP1, which decreased to $g$ = -0.29 from TT2 TP3 to TT3 TP3. Participants in the harm/loss group displayed lower levels of cortisol during TT3, with moderate to large effects found at TP1 ($g$ = 0.78) and TP3 ($g$ = 0.74). Finally, moderately higher levels were found across the first two time points of TT3 ($g$

= -0.50 and *g* = -0.57, respectively), which eventually dropped at TP3 to trivial levels (*g* = -0.09).

**Table 4.1.** Stress Appraisal group cortisol levels (ng/ml) and subsequent time point effects.

| Group | Time Point | TT2 Mean and SD (ng/ml) | TT3 Mean and SD (ng/ml) | *p* Value | Effect Size (*g*) |
|---|---|---|---|---|---|
| Challenge | TP1 | 37.47 ± 22.31 | 37.88 ± 13.50 | .95 | -0.02 |
| Challenge | TP2 | 54.17 ± 17.42 | 54.62 ± 19.70 | .96 | -0.02 |
| Challenge | TP3 | 44.75 ± 10.89 | 53.09 ± 18.03 | .39 | -0.52 |
| Threat | TP1 | 12.87 ± 8.51 | 12.87 ± 10.92 | .77 | -0.19 |
| Threat | TP2 | 49.53 ± 24.84 | 45.32 ± 19.09 | .66 | 0.18 |
| Threat | TP3 | 45.74 ± 13.95 | 64.45 ± 23.14 | .06 | -0.90 |
| Benefit | TP1 | 16.01 ± 12.70 | 24.17 ± 19.77 | .24 | -0.45 |
| Benefit | TP2 | 31.59 ± 20.79 | 37.76 ± 27.03 | .51 | -0.24 |
| Benefit | TP3 | 35.46 ± 23.37 | 42.17 ± 18.47 | .49 | -0.29 |
| H/L | TP1 | 22.6 ± 21.49 | 9.3 ± 5.94 | .60 | 0.78 |
| H/L | TP2 | 35.48 ± 19.44 | 38.81 ± 12.76 | .72 | -0.19 |
| H/L | TP3 | 51.7 ± 27.22 | 34.63 ± 12.79 | .08 | 0.74 |
| Control | TP1 | 13.1 ± 13.93 | 21.38 ± 16.50 | .24 | -0.50 |
| Control | TP2 | 21.99 ± 8.79 | 30.34 ± 16.94 | .38 | -0.57 |
| Control | TP3 | 39.63 ± 15.6 | 41.46 ± 22.40 | .85 | -0.09 |

### 4.4.10. Time Trial Performance

As stress appraisal manipulations may have had varying performance impacts across participants, I decided that dichotomous measures of performance change were insufficient, and that a performance trichotomy, which accounted for significant improvement, significant decline, or insignificant performance variation was required. As such, odds ratios calculated through Multinomial Logistic Regression were selected as a suitable expression of performance change. In order to create the nominal values required for the regression, a performance change threshold of 1.1% coefficient of variation (CV; taken from Sparks et al. (2016)) was utilised. Due to its similarity to CV, individual participant performance change was calculated. However, during the analytical process, it was discovered that the perfect

separation of the benefit group (with all participants significantly improving) rendered multinomial logistic regression unsuitable. Therefore in accordance with scholars (Bull, Lewinger, & Lee, 2005), who penalized the maximum likelihood estimation using the Jeffreys Prior, Penalized Multinomial Logistic Regression was conducted for each stress appraisal group (with the control group, and insignificant performance variation acting as reference categories) via the 'pmlr' package in R version 2.15.3.

Whilst it was predicted that challenge stress appraisals would improve TT3 performance, no significant effects were observed. This is in contrast to the performances of the threat group, where both significant improvement ($\beta$ = 3.41, 95% CI = 0.52, 8.54, $p$ = .018) and significant deterioration ($\beta$ = 3.08, 95% CI = 0.06, 8.23, $p$ = .046) were more likely to occur than a neutral change during TT3 (*OR* = 30.33 and 21.67 respectively). Performances from past-oriented stress appraisal groups followed a uniform pattern. Participants in the harm/loss group were found to be significantly more likely to have their performance decline than stay neutral ($\beta$ = 3.15, 95% CI = 0.46, 8.18, $p$ = .019, *OR*= 23.40). Conversely, the benefit group produced an unequivocally positive performance change ($\beta$ = 5.13, 95% CI = 1.90, 10.93, $p$ <.001, *OR* = 169.00). As the control group acted as the counterbalance for odds ratio calculation, no outputs were calculated for its performance change.

## 4.5. Discussion

The purpose of this research was to investigate the psychophysiological and performance influence of stress appraisals. Stress appraisals influenced psychological responses among athletes, with both challenge and benefit groups producing more positive secondary appraisals than their threat stress appraisal counterparts. In accordance with my hypotheses, stress appraisals also dictated the expression of coping behaviours with higher

levels of task-oriented coping being associated with participants engendered with challenge and benefit stress appraisals. This suggests that gain stress appraisals help people direct resources towards behaviours that facilitate performance. Finally, those in the threat group reported higher levels of harm/loss during TT3 than TT2, whilst both the challenge and benefit groups scored significantly higher in relation to benefit stress appraisals. With gain pre-competitive stress appraisals more likely to lead to gain post-competitive stress appraisals, coaches and athletes are encouraged to engender such mind-sets through techniques such as goal adjustment (Nicholls, Levy, et al., 2016) in order to foster potentially higher levels of performance and more facilitative appraisals.

My analyses showed no significant gender differences in performance, psychological, or neuroendocrine response. This contrasts with the extant psychological literature (Nicholls, Polman, Levy, Taylor, & Cobley, 2007), and suggests that males and females behave more similarly during stressful sporting competitions than previously thought, which may explain why there was no performance variance. This similarity may be explained theoretically by the situational hypothesis (Rosario, Shinn, Mørch, & Huckabee, 1988), which suggests that gender coping differences disappear when males and females experience the same stressor under similar conditions. Indeed, empirical support for the situational hypothesis has been discovered by Kaiseler, Polman, and Nicholls (2013), who discovered that the relationships between gender and coping within athletes may be moderated by stress appraisal. If this is true, males and females differ in their stress appraisal of a situation, rather than having gender-defined coping preferences. In an environment where stress appraisals were strictly engendered, it appears that the males and females who participated in this research experienced the same stress appraisals, and therefore employed the same coping behaviours. Finally, regarding neuroendocrine response, my findings reflect the equivocal nature of the cortisol literature. With research studies finding both significant (Obmiński, 2008) and non-

significant (Ceccato et al., 2015) differences in cortisol response between genders, this is an area clearly still not sufficiently understood (Chiodo et al., 2011).

I investigated the extent to which stress appraisals influenced neuroendocrine responses, as measured by salivary cortisol levels. In accordance with Lazarus' (1991, 1999, 2000) CMR theory of emotions, I hypothesised that gain stress appraisals would generate a reduced psychophysiological response in relation to loss stress appraisals. The results of my cortisol analyses did not fully support my hypotheses, though produced some novel findings nonetheless. Firstly, cortisol levels increased uniformly across all groups from pre-TT to immediate post-TT, indicating that cortisol secretion may be more sensitive to high intensity exercise than originally thought in previous research (Jacks et al., 2002). Further, moderate cortisol level increases were discovered during TT3 for both challenge and benefit groups, when compared to TT2. This increase was somewhat unexpected, yet inspection of the neuroendocrine response in sport literature indicates that the prospect of winning is also a physiologically stressful event (Suay et al., 1999). With a perceived chance of winning increasing the pressure on an athlete, this may have subsequently increased their anxiety and effort levels, as indexed by an increase in sympathetic nervous system activation (Cooke, Kavussanu, McIntyre, Boardley, & Ring, 2011). Conversely, significant variation in cortisol secretion was found between the loss stress appraisal groupings of threat and harm/loss. Firstly, a large effect was found in TP3 cortisol levels in the threat group. This might be a consequence of these athletes experiencing higher stress levels due to both their poor performance in comparison to others, as well as the uncertainty of whether they would finish the competition within the bottom two. This finding coincides with both my hypothesis, as well as previous findings (Harvey et al., 2010), where it has been stated that threat stress appraisals lead to increase cortisol response. This effect may be explained by the biopsychosocial model (BPSM; Blascovich, 2008), which posits that both challenge and

threat states cause increased sympathetic nervous system activation. This in turn leads to heightened cardiac output, whilst increased cortisol levels (via HPA axis activation) signal less emphasis to be placed on the parasympathetic-adrenomedullary system. In contrast, harm/loss participants displayed a large decrease in cortisol levels at both TP1 and TP3 on the final testing day. Physiological responses to performance is a complex process, dependent on an athlete's stress appraisal of the situation rather than the outcome itself. Indeed, the fear of losing may be more stressful than actually losing.

I examined the impact of the four stress appraisals on subsequent 16.1km TT performance, predicting that gain stress appraisal groups would improve from TT2 to TT3. Partial support for this hypothesis was observed. It should be noted that although I did not calculate odd ratios for the control group, none of the six participants produced a performance changed above the 1.1% threshold, highlighting the replicability of the 16.1km TT task. However, there was also no significant performance change detected in the challenge group, which contradicts the performance assumptions of the BPSM (Blascovich, 2008). Such a result may potentially be linked to the challenge group's cortisol levels. Participants in the challenge group produced higher levels of cortisol at TP1 in TT2, despite no manipulation having taken place. With previous scholarly work (van de Pol, Kavussanu, & Ring, 2012) highlighting the juxtaposed enjoyably tense nature of competition, challenge group athletes may have been highly aroused for their first competitive TT. As such, any subsequent manipulation may not have had a large enough impact for significant performance improvement. Conversely, all benefit participants produced significantly faster times in TT3, compared to TT2. With benefit participants having received a concrete reassurance of their performance levels, as well as having an imminent and relevant goal, it is likely that their state confidence was enhanced because they were on target to reach their goal (Woodman & Hardy, 2003). Indeed, it has been suggested (Bray, Martin Ginis, Hicks, & Woodgate, 2008)

that such a scenario is likely to free up resources so participants could exclusively focus on maximising their cycling performance. Further, athletes with high levels of confidence have been suggested to be more proficient and effective in the use of their pool of resources (Hays, Thomas, Maynard, & Bawden, 2009).

Finally, I predicted that the time trial performance of the threat and harm/loss stress appraisal participants would decline after their loss stress appraisal manipulations. The TT3 performance of nearly all participants in the harm/loss group deteriorated significantly, supporting my hypothesis. When taken into context with their decreased cortisol levels and increase in disengagement-oriented coping behaviours, it can be inferred that harm/loss participants simply stopped trying to attain their goals. Meanwhile, performances within the threat group varied greatly, with significant performance improvements and deterioration both found. Such intra-group variation may be caused by individual differences, with scholars (Turner et al., 2013) proposing that strong performance from participants exhibiting threat cardiovascular reactivity may be linked to high levels of self-efficacy. With high levels of cognitive anxiety and self-confidence significantly related to competitive sport performance (Woodman & Hardy, 2003), further research into the psychophysiological and performance impact of threat stress appraisals within sport may prove fruitful.

A number of limitations exist in this study. Firstly, due to the variation in participation times between participants, it was not possible to compare physiological response across groups. To further investigate cortisol response, diurnal variation should be controlled for by allocating groups according to natural cortisol levels (measured during a pre-test screening session), as well as testing at the exact same time of day. Further, the revised CICS (Gaudreau & Blondin, 2002) that I used did not include the construct of ‘distancing’, as the items were deemed irrelevant to the task. Future research should look to develop tasks where distancing and social support are relevant and can therefore be measured, such as team-based

sporting tasks (e.g. competitive four-ball golf putting tasks). What is more, only limited significant emotional relationships between constructs were found. This may be due to the small sample used in this study. With the potential psychological and performance benefits of pleasant emotions suggested in models such as broaden-and-build theory (Fredrickson, 2001), future research would do well to assess their applicability in a sporting context. Finally, further whilst the cycle ergometer task was ecologically valid, past-oriented stress appraisals have only now been examined via a closed-skill task. Future research can build upon this work by investigating the impact of stress appraisals on a wide range of problem solving, open-skill, and team-based tasks. Such a diverse approach would also simultaneously widen the range of potential neuroendocrine and cardiovascular measures, which could include (but is not limited to) testosterone, quiet-eye duration, and resilience. This in turn may grant a greater understanding of the stress process.

In summary, the results of this study can be inferred to have highlighted the immediate psychophysiological and performance impact of each of Lazarus' CMR stress appraisal groups, and provide the first psychophysiological and performance profiles for all four stress appraisals, which are challenge, threat, benefit, and harm/loss. Temporal orientation plays a significant role in psychophysiological and performance response, rather than valence alone. Indeed, comparison of the threat and harm/loss stress appraisal groups suggest that the fear of defeat may be physiologically more stressful than losing itself. These findings have applied implications for practitioners and athlete stakeholders. By providing athletes with goal relevant positive feedback that is temporally imminent, practitioners and stakeholders may successfully engender a benefit stress appraisal. From this, athletes may benefit cognitively, somatically, and from a performance perspective.

# Chapter 5:
# Establishing the Validity of the Broaden-and-Build Theory within Sport – a Path Analysis

## 5.1. Abstract

The purpose of this prospective, psychometric based study was to examine the role of emotions in the development or inhibition of dispositional coping behaviours and resilience levels. I predicted that pleasant emotions would be associated with both performance facilitative task-oriented coping behaviours, as well as higher levels of resilience, whereas unpleasant emotions would be associated with disengagement-oriented coping behaviours and diminished levels of resilience. Three hundred and nineteen athletes aged between 16 and 71 completed an online questionnaire pack measuring the above-mentioned constructs, with their data subsequently analysed via path analyses. Pleasant emotions were directly involved with the broadening of thought-action repertoires, whilst pleasant emotions also directly and indirectly contributed to the building of athlete resource pools. Unpleasant emotions narrowed thought-action repertoires and reduced athlete resource levels. This study represents the first evidence of the existence of the broaden and build effects within an athletic population.

## 5.2. Introduction

Happier people are healthier people (Diener & Chan, 2011). Indeed, pleasant emotions have been linked to a host of benefits, including physical health (Cohen et al., 2006), emotional well-being (Fredrickson & Joiner, 2002), life satisfaction (Cohn et al., 2009), and life expectancy (Danner et al., 2001). However, the sport emotional literature has been dominated by the investigation of unpleasant emotions, with anger and anxiety the most commonly researched emotions within sport (Campo et al., 2012). Of these two emotions, anxiety has been cited as the emotion experienced most commonly during training, with anger the most commonly experienced emotion during competition (Nicholls, Hemmings, & Clough, 2010; Nicholls, Jones, Polman, & Borkoles, 2009). More research into the effects of pleasant emotions in sport is therefore needed (Lundqvist & Kenttä, 2010).

### 5.2.1. The Broaden-and-Build Theory of Emotions

The broaden-and-build theory of emotions (BaB; Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) may be a viable theory in which to frame future sports emotional research (McCarthy, 2011; Nicholls, Perry, & Calmeiro, 2014; Tamminen, Crocker, & McEwen, 2014), although it has yet to have been examined within a sporting context. The BaB theory states that the existence and experience of pleasant emotions has been evolutionarily driven to aid the survival of an agent by accruing (or "building") resources for future person-environment interactions, as well as expanding one's attention to offer a "broadened" array of potential coping solutions. Within the confines of a sporting context, this translates to athlete pleasant emotional experiences broadening thought-action repertoires, and thus offering a range of behaviours which may improve performance or aid the development of psychological resources. This would theoretically explain the well-established link between pleasant emotions and the utilisation of task-oriented coping

strategies, observed within research outputs from scholars such as Crocker and Graham (1995) and Ntoumanis, Biddle, and Haddock (1999), as well as within Chapters 3 and 4 of this research. In turn, more creative and flexible options for coping elicited by pleasant emotions may also help the development of physical, intellectual, and social resources (Tugade & Fredrickson, 2004). For example, successful social play can facilitate the experience of excitement and amusement, helping to build social bonds (Aron et al., 2000; Gervais & Wilson, 2005; Lee, 1982), as well as physical resources (Boulton & Smith, 1992), both of which are valuable to team-based athletes.

Of particular importance to athletes and sport psychological scholars is the resource of resilience; a construct highlighted for its importance in withstanding sporting pressures and achieving high levels of performance (Sarkar & Fletcher, 2014). Pleasant emotions have been associated with the long-term accruement of resilience within the mainstream psychological literature by researchers such as Cohn et al. (2009). Over the course of a 28-day research study, Cohn et al. discovered that experiences of pleasant emotions subsequently predicted increases in both trait resilience and life satisfaction. Further, the relationship between pleasant emotions and resilience has been found to be mediated by coping strategies in research conducted with post-doctoral university students (Gloria & Steinhardt, 2016). Research which examines the possibility of athlete pleasant emotional experiences broadening thought-action repertoires and subsequently building coping resources such as resilience could be used to form theory-guided emotional interventions that benefit athletic performance in the short- and long-term. That is, the engendering and monitoring of athlete emotional levels, and their resultant performance and psychological response.

This study is the first part of a three studies to investigate a distinct yet complementary aspect of the BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002). The purpose of this study was to investigate the possibility of the broadening and build

effects in athletes. I grounded the methodological design of this research loosely around that of Fredrickson and Joiner (2002), who measured positive and negative affect, as well as broad-minded coping within undergraduate students across two time points, separated by five weeks. In this present research, I measured the constructs central to BaB theory, that is, emotions and coping strategies. With these constructs theorised to increase resource levels (Fredrickson, Tugade, Waugh, & Larkin, 2003), I also measured participant resilience levels. Finally, the decision was taken to investigate the aforementioned constructs via a dispositional approach, rather than via a process approach. This decision was taken for a couple of reasons. Firstly, with this study intended to be the first data collection stage of a six-month longitudinal study, the research team was interested in identifying potential habitual patterns between emotions, coping, and resilience. As one-shot measures of constructs such as coping are not always an accurate representation of an athletes behaviour (Nicholls, Perry, Jones, Morley, & Carson, 2013), a process approach was deemed unsuitable. Secondly, dispositional coping allows scholars to assess coping in a broader context (Hurst, Thompson, Visek, Fisher, & Gaudreau, 2011); in this case the potential holistic broaden and build effects.

### 5.2.2. Hypotheses

Based upon the theoretical literature, a number of predictions were made. Firstly, after considering the work of Cohn et al. (2009), I anticipated that pleasant and unpleasant emotions would positively and negatively relate to resilience respectively. Further, based upon the findings of Gloria and Steinhardt (2016), I predicted that the effects between emotions and resilience would be mediated by coping orientation. In practice, this would mean that the relationship between pleasant emotions and resilience would be mediated by task-oriented coping, whilst the relationship between unpleasant emotions and resilience would be mediated by both distraction- and disengagement-oriented coping. Following on

from Chapters 3 and 4, I predicted that pleasant emotions would be associated with increased task-oriented coping strategies, which in turn would lead to increased resilience. Further, I also predicted that unpleasant emotions would be associated with distraction- and disengagement-oriented coping strategies, which would be inversely associated with resilience. Finally, with distraction-oriented coping having found to be related to task- and disengagement-oriented coping in Chapter 3's path analysis, it was anticipated that these paths would be replicated in this research. This hypothesised model can be found in Figure 1.

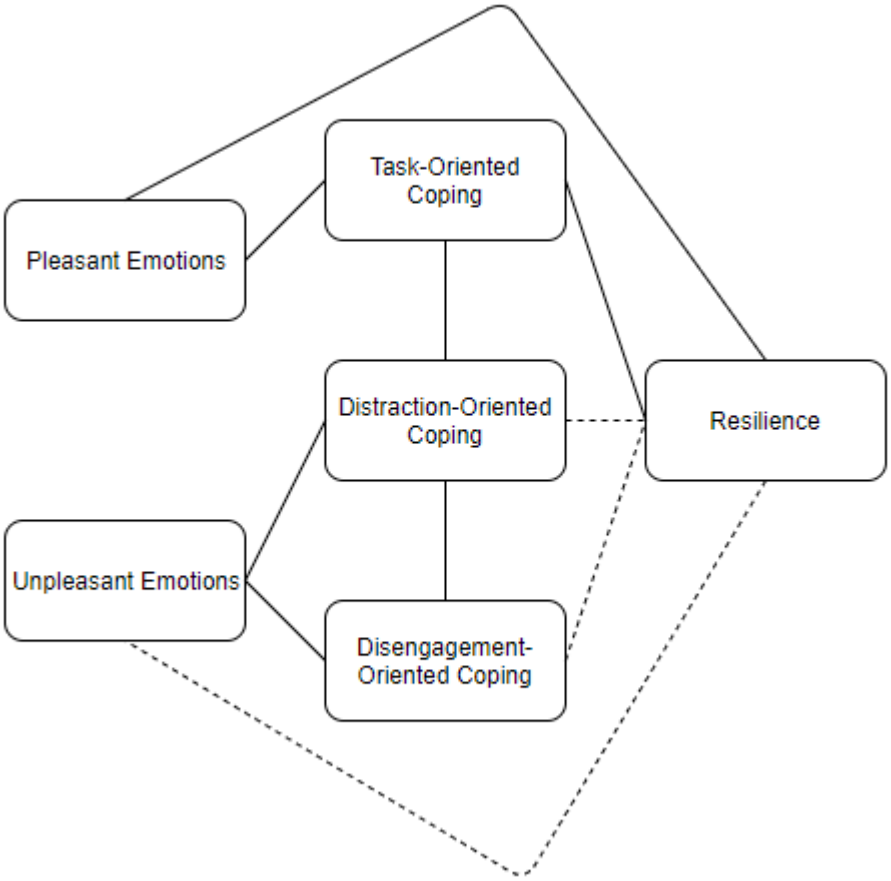


**Figure 5.1.** Hypothesised Model

## 5.3. Methods

### 5.3.1. Participants

I recruited 319 athletes (male *n* = 210, female *n* = 109) aged between 16 and 71 (mean = 28.41, SD = 10.33) from multiple continents (e.g. Europe, North America, Asia). Participants had an average playing experience of 10.43 years (SD = 8.82) and took part in a variety of both team and individual sports (e.g. football, badminton, and long-distance running).

### 5.3.2. Self-Report Measures

As in Chapters 3 and 4, the Sports Emotion Questionnaire (SEQ; Jones et al., 2005) measured athlete emotions. The SEQ comprises of 22-items measuring two pleasant (happiness and excitement) and three unpleasant emotions (anger, anxiety, and dejection) across a five-point Likert-type scale. However, as this study measured the dispositional emotions of athletes rather than their state emotions, the participant instructions were slightly altered. The instruction "indicate on the scale next to each item how you feel right now, at this moment, in relation to your upcoming competition" was modified to read "indicate on the scale next to each item how you normally feel in relation to participating in your chosen sport". McDonald's omega internal reliability coefficients for this amended version of the SEQ can be found in section 5.4.2. The Dispositional Coping Inventory for Competitive Sport (DCICS; Hurst, Thompson, Visek, Fisher, & Gaudreau, 2011) was employed to measure athlete dispositional coping strategies. The DCICS is a 37-item questionnaire in which 10 coping behaviours are categorised into three second-order dispositional dimensions (e.g. task-, distraction-, and disengagement-oriented coping). On a 5-point Likert-type scale (1 = not at all to 5 = very strongly), athletes rated how they would "typically" cope in a sporting situation in relation to statements such as 'I analyse the demands of the competition'. Although Hurst et al. did not report Cronbach's alpha coefficients for a three-factor

classification of coping, they did report coefficients for the ten individual coping strategies, ranging from .60 to .80.

The Revised Connor-Davidson Resilience Scale (RCDRS; (Campbell-Sills & Stein, 2007) was utilised to measure athlete resilience levels. The RCDRS is a 10-item unidimensional scale that employs a 5-point Likert-type scale (1 = not true at all, 5 = true nearly all of the time) to rate the applicability of statements such as 'I am not easily discouraged by failure'. Some items were slightly amended to make them applicable to sport. For example, the item 'can deal with whatever comes' became 'I can deal with whatever comes my way when I'm competing'. Campbell-Sills and Stein reported a Cronbach's alpha rating of .85 for the RCDRS, whilst it has also been validated for use in athletic populations (Gucciardi, Jackson, Coulter, & Mallett, 2011).

### 5.3.3. Procedure

Before data collection commenced, this study received full ethical approval from a university ethics committee (Appendix H). Participants were contacted online via email, as well as via online sportspersons message boards. Recruitment was aided via the offering of a prize draw to win one of three £25 shopping vouchers for participation. If athletes decided that they wished to participate, they were directed to an appropriate web page (hosted at www.onlinesurveys.ac.uk) signed an online consent form, and then completed the questionnaire pack (Appendix C). All questionnaires were completed at the same time.

### 5.3.4. Data Analysis

Once data collection had ended, the raw data was screened for missing data and outliers. I then conducted a path analysis, using sub-scale scores as observed variables, through MPlus 7 (Muthén & Muthén, 2012). In order to not drift from multivariate normality, I employed the robust maximum likelihood (MLR). Model fit was determined through use of

the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI), which were presented as normed and non-normed indices. Further, the Standardized Root-Mean-Square Residual (SRMR) and Root Mean Square Error Approximation (RMSEA) were measured as absolute fit indices. To ascertain whether the model fit was acceptable, I applied Hu and Bentler's (1999) recommendations for fit indices. That is, CFI > .90, TLI > .90, SRMR < .08, RMSEA < .05 represent an acceptable model fit, with CFI and TLI > .95 suggesting an excellent model fit.

## 5.4. Results

### 5.4.1. Preliminary Analysis

No missing data or outliers were found whilst all constructs exhibited acceptable univariate skewness (<2) and kurtosis (<2).

### 5.4.2. Self-Report Measures

With Cronbach's alpha assuming tau equivalence, internal consistency was measured via McDonald's (1999) omega (ω). Firstly, the SEQ (Jones et al., 2005) revealed outputs of ω = .86 for pleasant emotions, and ω = .88 for unpleasant emotions. The DCICS (Hurst et al., 2011) produced coefficients of ω = .86 for task-oriented coping, ω = .77 for distraction-oriented coping, and ω = .76 for disengagement-oriented coping. Finally, the RCDRS (Campbell-Sills & Stein, 2007) produced a coefficient of ω = .86 for resilience.

### 5.4.3. Path Analysis

A Path analysis was conducted using MPlus 7 (Muthén & Muthén, 2012) on the hypothesised model (Figure 5.1.). The analysis of this model subsequently produced a model fit of $\chi^2(14) = 354.412$, $p < .001$, CFI = .982, TLI = .936, SRMR = .034, RMSEA = .07 (90% CI = .015, .124). Within this model, pleasant emotions were positively related to both task-oriented coping ($\beta = .362$, $p < .001$, 95% CI = .206, .517) and resilience ($\beta = .232$, $p < .001$,

95% CI = .125, .338), whilst unpleasant emotions were positively related to distraction- ($\beta$ = .207, $p$ < .001, 95% CI = .110, .304) and disengagement-oriented coping ($\beta$ = .641, $p$ < .001, 95% CI = .575, .708). Unpleasant emotions were also inversely related to resilience ($\beta$ = -.156, $p$ = .007, 95% CI = -.269, -.042). In relation to coping behaviours, task-oriented coping did not significantly relate to distraction-oriented coping ($\beta$ = .124, $p$ = .071, 95% CI = -.011, .259), but positively related to resilience ($\beta$ = .649, $p$ < .001, 95% CI = .383, .597). Distraction- and disengagement-oriented coping were found to both negatively associate with resilience (distraction-: $\beta$ = -.099, $p$ = .026, 95% CI = -.187, -.012; disengagement-: ($\beta$ = -.127, $p$ = .021, 95% CI = -.236, -.019), but positively associated with one another ($\beta$ = .146, $p$ = .010, 95% CI = .036, .257). I also assessed the strength of indirect paths. These paths were from pleasant emotions to resilience via task-oriented coping, as well as two paths from unpleasant emotions through to resilience via distraction- and disengagement-oriented coping respectively. In regards to the indirect path from pleasant emotions to resilience via task-oriented coping, a positive relationship was found ($\beta$ = .177, $p$ < .001, 95% CI = .111, .243). A negative indirect path was found from unpleasant emotions to resilience via disengagement-oriented coping ($\beta$ = -.082, $p$ = .023, 95% CI = -.152, -.011), as well as via distraction-oriented coping ($\beta$ = -.021, $p$ = .049, 95% CI = -.41, 0). This model can be found in Figure 2.

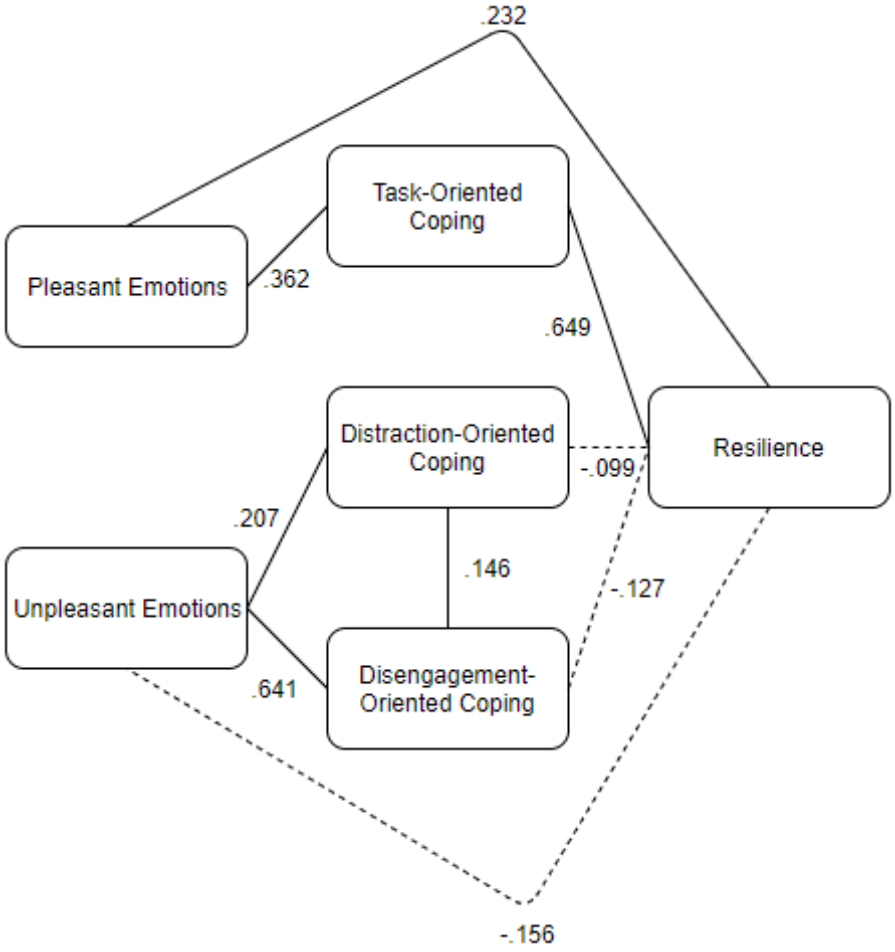


**Figure 5.2.** Final, parsimonious model with standardized parameter estimates.

## 5.5. Discussion

The aim of this research was to assess the applicability of the BaB theory of positive emotions (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) within a sporting population. This was undertaken through a theoretically-based (Gloria & Steinhardt, 2016; Tugade & Fredrickson, 2004) hypothesised model consisting of emotions, coping behaviours, and resilience. The excellent model fit, as well as the significant individual and indirect paths

between constructs found provide initial support for the supposition of the BaB theory that emotions, coping behaviours, and resilience are interrelated.

As predicted, pleasant emotions significantly related to task-oriented coping strategies; a finding which mirrors those of Chapters 3 and 4, as well as within the literature (Crocker & Graham, 1995; Gaudreau & Blondin, 2002; Nicholls, Perry, & Calmeiro, 2014; Ntoumanis et al., 1999). With task-oriented coping behaviours such as logical analysis, mental imagery, and thought control, as measured within the DCICS, theoretically indistinguishable from the "novel lines of thought and action" (Fredrickson & Joiner, 2002) to describe thought-action repertoires, it can be inferred that there is now preliminary evidence for the occurrence of a broadening effect within sporting populations. Further, and as hypothesised, unpleasant emotions were positively related to both distraction- and disengagement-oriented coping. Whilst distraction-oriented coping behaviours may not necessarily be inhibitive by nature (Gaudreau et al., 2010; Laborde, Dosseville, & Kinrade, 2014), disengagement-oriented coping has been linked with decreased performance (Amiot, Gaudreau, & Blanchard, 2004; Gaudreau et al., 2010; Laborde, Dosseville, Guillén, & Chávez, 2014; Schellenberg et al., 2013). With the specific action tendencies of unpleasant emotions such as sadness theorised to distract and disengage oneself from a situation, these direct paths are theoretically consistent with BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002)

I also predicted that pleasant emotions would also positively relate to increased levels of resilience. The results of the path analysis showed that pleasant emotions were both directly and indirectly related to increased resilience, with the latter relationship partially mediated by task-oriented coping strategies. With resilience arguably the key resource within BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002), and dispositional coping viewed as a durable personal resource and a facet of trait resilience (Fredrickson et al., 2003),

these paths represent preliminary evidence that a build effect may exist within sport. Indeed, as theorised by Fredrickson (2001), pleasant emotions appear to help athletes behave in novel and creative ways, which help build personal resources for future person-environment interactions, such as sporting competitions. When combined with the associated increases in task-oriented coping, in theory, pleasant emotional experiences may aid athletes in a variety of ways, including through more efficient use of pleasant emotions to buffer against negative events (Fredrickson et al., 2003), through the increased likelihood of pleasant emotions (Fredrickson & Joiner, 2002), and through increased performance (Doron & Gaudreau, 2014). With this in mind, BaB theory is perhaps one of the most exciting future research theories within sport psychology today. However, for a potential build effect to be comprehensively evidenced, support for the building of coping resources must be displayed via longitudinal design.

Conversely, unpleasant emotions were also directly and indirectly associated with diminished levels of resilience, with the latter relationship mediated by disengagement-oriented coping strategies. In accordance with theory (Fredrickson, 2001, 2013; Fredrickson & Joiner, 2002), it appears that unpleasant emotions do appear to narrow thought-action repertoires, with this exchange appearing to incur a cost to their personal resources. This is important for a number of reasons. Firstly, unpleasant emotions and disengagement-oriented coping strategies are both associated with inhibited performance (Amiot et al., 2004; Erez & Isen, 2002; Gaudreau et al., 2010; Laborde, Dosseville, Guillén, & Chávez, 2014; Lane et al., 2010; Nicholls et al., 2012; Schellenberg et al., 2013; Totterdell, 2000; Uphill et al., 2014), with unpleasant emotions also associated with psychophysiological stress (Smyth et al., 1998), indexed via cortisol levels. What is more, athletes with low resilience are more likely to employ disengagement-oriented coping strategies (Joyce, Smith, & Vitaliano, 2005). With BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) also hypothesising that

unpleasant emotions may predict future experiences of unpleasant emotions, athletes may fall into a long-term "downward spirals" process (Fredrickson & Joiner, 2002). Taken together, these findings reinforce the importance for psychological practitioners to be proactive with efforts to generate pleasant emotions within their athletes as often as possible. From this, athletes will have a greater pool of cognitive resources in which to deal with a situation (Fredrickson, Tugade, Waugh, & Larkin, 2003; Tugade & Fredrickson, 2007), whilst simultaneously being more likely to engage in behaviours facilitative to performance (Doron & Gaudreau, 2014; Gaudreau, Nicholls, & Levy, 2010; Laborde, Dosseville, & Kinrade, 2014; Schellenberg, Gaudreau, & Crocker, 2013)..

Despite the establishment of both broaden and build effects in a sporting population, the BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) could be further used as a framework to explore the relationship between emotions and a range of other psychological processes. Indeed, both pleasant emotions (Fredrickson & Joiner, 2002) and resilience (Ong, Bergeman, & Boker, 2009; Philippe, Lecours, & Beaulieu-Pelletier, 2009) have been associated with the future experience of pleasant emotions. Further, with unpleasant emotions directly related to diminished resilience levels, there still remains no evidence of the "undoing effect" (Fredrickson, 2001) within athletes. The undoing effect suggests that if unpleasant emotions narrow ones thought-action repertoire, the broadening and build effects of pleasant emotions may counteract or even cancel out any incurred losses. Although evidence of the undoing effect has been indexed via physiological measures such as heart rate, peripheral vasoconstriction, and systolic and diastolic blood pressure (Fredrickson, Mancuso, Branigan, & Tugade, 2000), it is also theorised to include psychological constructs. With this stated research suggesting that pleasant emotional experiences increase levels of task-oriented coping and resilience, it stands to reason that low levels of these constructs have the potential to be increased over time. The possibility that longitudinal research may

evidence the broaden, build, and undoing effects within an athletic population is highly exciting, and has thus guided the research design of the study which Chapter 6 consists of.

There are some limitations to the methodological design of this study. Firstly, the results of this study are correlational and as such, no causal relationships can be inferred. Longitudinal and experimental research would help to overcome this barrier and would be beneficial additions to the research literature. Secondly, this study investigated athletes aged between 16 and 71. With coping differences between young and adult athletes (Nicholls & Polman, 2007) and higher levels of resilience displayed in older adults (Gooding, Hurst, Johnson, & Tarrier, 2012), one could assume that there were large variances displayed within the sample. However, I did not investigate age differences in any of the dispositional constructs. It may well be that pleasant emotions may have a larger potential for resource building within younger athletes. However, research is required to establish this. Finally, this study utilised dispositional assessment methods, which relies on athlete recall (Folkman & Moskowitz, 2004). It has been suggested that accurate recall for constructs such as emotions only last for 48 hours (Thomas, Picknell, & Hanton, 2011), which is far shorter than the recall period of athletes within this study. However, this study was designed as the first stage of a longitudinal research project, with the same participants measured six months in the future. As such, a process design which accounted for a large sample of athletes to be in season at both time points was deemed unrealistic.

In conclusion, this study represents the first evidence of the BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) within a sporting population. The experience of pleasant emotions by athletes may broaden one's thought-actions repertoires, making them more likely to engage in task-oriented behaviours which are associated with improved athletic performance. Further, pleasant emotions directly contribute to athlete resource pools by building resilience, a construct key to the future experience of pleasant emotions.

Unpleasant emotions directly narrow thought-action repertoires, whilst also penalising resource pools. The theoretical grounding provided by this research can be used to guide BaB theory studies examining the long-term effects of both pleasant and unpleasant emotions, as well as investigating the possibility of an undoing effect.

# Chapter 6:
# A Six-Month Investigation of Emotions, Coping, and Resilience within Athletic Populations – the Broaden-and-Build Theory in Sport

## 6.1. Abstract

Building upon Chapter 5, this study was designed with the purpose of investigating whether experiences of pleasant emotions would be predictive of high levels of task-oriented coping behaviours, trait resilience levels, as well as further pleasant emotional experiences. One hundred and twenty six athletes completed psychometrics relating to dispositional emotions, coping behaviours, and resilience on two occasions, six months apart via an online form. From this data, a path analysis model was formulated, which highlighted how pleasant emotions and task-oriented coping serially enhance one another over time. Both constructs were also related to increased levels of trait resilience. High levels of pleasant emotions, task-oriented coping, and resilience in turn predicted future high levels of pleasant emotions, task-oriented coping, and resilience. After six months, unpleasant emotions were no longer directly related to resilience, indicating that pleasant emotions may undo lingering cognitive resource losses incurred from previous unpleasant emotions. The results from this study infer preliminary longitudinal support for the applicability of broaden-and-build theory within sporting populations and can be used to guide interventions by coaches and sport psychological practitioners.

## 6.2. Introduction

Research conducted by Cohn, Fredrickson, Brown, Mikels, and Conway (2009) and Fredrickson, Cohn, Coffey, Pek, and Finkel (2008) has provided evidence that pleasant emotions may increase levels of personal resources such as resilience. Notably, these studies all undertook a longitudinal approach in order to explore the potential the long-term benefits of pleasant emotional experiences. This is important, because it is theorised within the broaden-and-build (BaB) theory of emotions (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) that pleasant emotions have been evolutionarily formulated to assist in the long-term development of personal physical, social, and intellectual resources (for a review, please see section 2.4 of the Literature Review). However, one current limitation of the sport psychological literature is that long-term emotional research within sport is still somewhat scarce (McCarthy, 2011).

This study was designed to increase knowledge of the long-term effects of emotions within sport and build upon the previous findings of Chapter 5. As such, I again measured dispositional athlete emotions, coping strategies, and resilience. Further, these constructs were measured at least six months after each athlete had first participated in Chapter 5, in order for any potential broadening or build effects to have fully come to fruition. This six-month longitudinal design also afforded me the possibility of investigating other potential effects theorised by Fredrickson (2001), such as the "undoing effect" and the existence of "upward spirals". The undoing effect refers to the reversal of the physiological and psychological costs incurred from previous experiences of unpleasant emotions, whilst upward spirals refers to the reciprocally deterministic (Bandura, 1978) impact of experiencing pleasant emotions and the resources (Fredrickson & Joiner, 2002) they inherently provide. That is, experiencing pleasant emotions helps broaden attention and build enduring personal resources, which themselves in turn predict future experiences of pleasant

emotions. Benefits acquired from upward spirals include positive reappraisals (Garland, Gaylord, & Fredrickson, 2011), whilst longitudinal evidence exists for reciprocal beneficial interactions between positive emotions, personal resources (indexed by self-efficacy), and organisational resources (indexed by social support and clear goals; Salanova, Bakker, & Llorens, 2006). Further, pleasant emotions have been found to reduce cardiovascular reactivity induced via negative emotional manipulations (Fredrickson et al., 2000), although no investigations regarding the undoing effect in relation to psychological constructs currently exist. This study represents the second part of a trio of studies investigating each aspect of the BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) in sport. In the interests of clarity, the baseline completion of questionnaires shall be known as time point one (TP1), with the following up completion of questionnaires six months later labelled time point two (TP2).

### 6.2.1. Hypotheses

I hypothesised that the findings of this study would mirror those of Chapter 5 at both TP1 and TP2, with pleasant emotions positively relating to task-oriented coping and resilience, and unpleasant emotions positively relating to distraction- and disengagement oriented-coping. Unpleasant emotions were also expected to inversely relate to resilience, whilst distraction-oriented coping was expected to relate with disengagement-oriented coping. At both TP1 and TP2 task-oriented coping was expected to positively relate to resilience, with distraction- and disengagement-oriented coping expected to negatively relate to resilience. Further, based on the theoretical assumptions of BaB theory as set out by Fredrickson (2001) and the research which underpins them (Fredrickson & Branigan, 2005; Fredrickson & Joiner, 2002; Fredrickson et al., 2000), I also made the following hypotheses. In light of the "reciprocal relations" between pleasant emotions and broadened thought-action repertoires constructs stated by Fredrickson (2001), I predicted that pleasant emotions, task-

oriented coping, and resilience would reciprocally relate to one another across TP1 and TP2. Any significant increases in the use of task-oriented coping would be insinuated as evidence of a "broadening" effect (Fredrickson; 2001), as such behaviours typically require novel patterns of thought and concentrated efforts by an athlete. What is more, significant levels of task-oriented coping and resilience six months into the future were to be inferred as evidence for the "build" effect, based upon the work of Fredrickson and Joiner. This is because previous experiences of pleasant emotions may have helped accumulate and compound coping resources via an "upward spiral" effect. Unpleasant emotions were also hypothesised to predict future unpleasant emotions, whilst TP1 task-, distraction-, disengagement-oriented coping, and resilience were anticipated to relate to themselves at TP2. That is, use of such strategies or resources will predict such use of that resource six months into the future. With no psychological evidence for the "undoing effect" (Fredrickson et al., 2000), no hypotheses were made regarding this potential effect. The hypothesised model can be found in Figure 1.

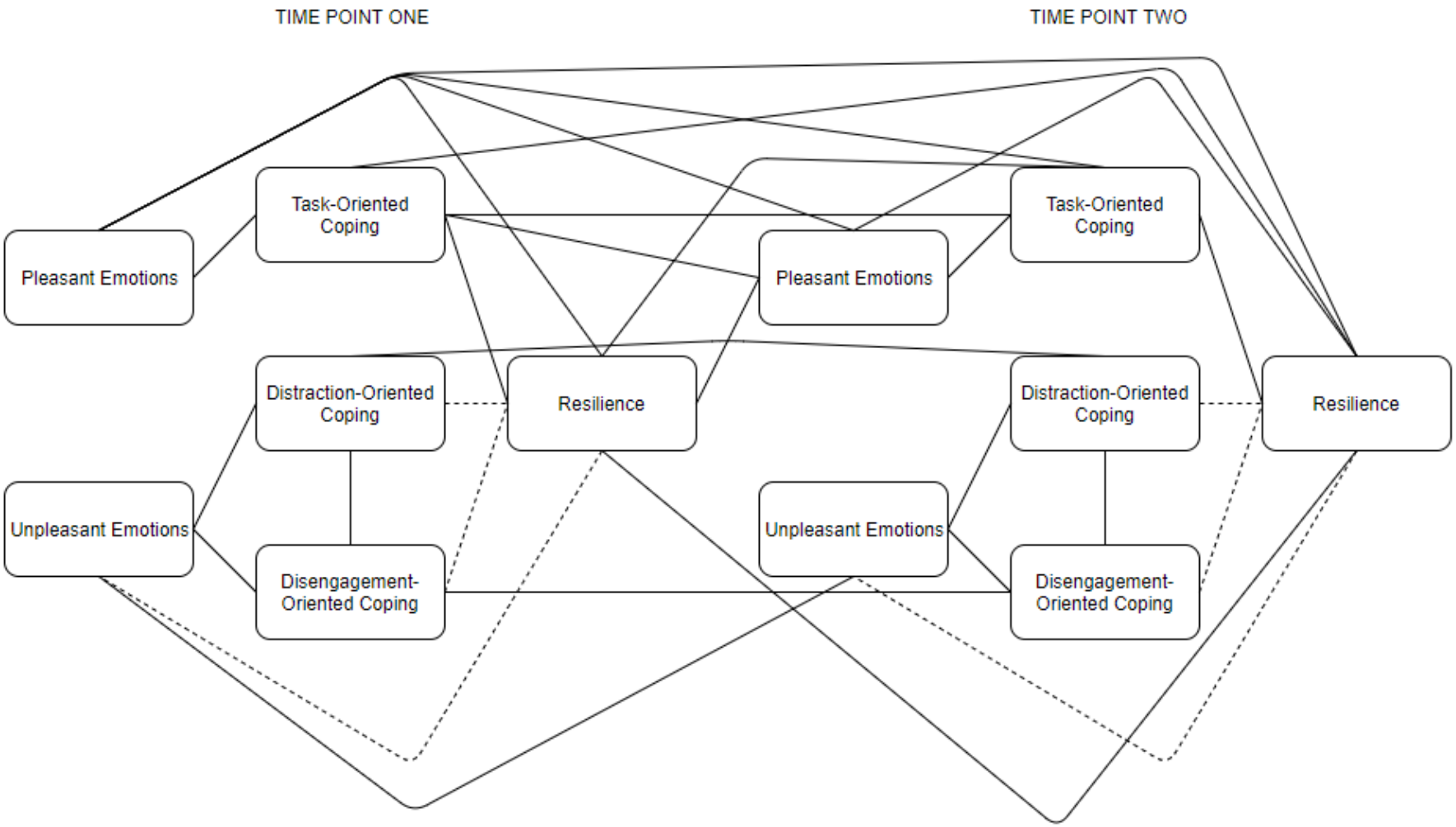


**Figure 6.1.** Hypothesised Model.

## 6.3. Methods

### 6.3.1. Participants

Respondents were 126 athletes (male *n* =85, female *n* = 41) aged between 16 and 71 (mean = 30.08, SD = 11.61) who had also participated in the research study which comprises Chapter 5. Participants had an average playing experience of 10.30 years (SD = 9.25) and took part in team and individual sports (e.g. football, badminton, and long-distance running).

### 6.3.2. Self-Report Measures

The self-report measures utilised mirrored those of Chapter 5. Firstly, athlete dispositional emotions were again examined via the Sports Emotion Questionnaire (SEQ; Jones et al., 2005). The SEQ measures two pleasant emotions (happiness and excitement) and three unpleasant emotions (anger, anxiety, and dejection) across 22-items whilst utilising a five-point Likert-type scale. As in Chapter 5, the instructions given to participants were amended in order to measure athlete dispositional emotions. The instruction "indicate on the scale next to each item how you feel right now, at this moment, in relation to your upcoming competition" was modified to read "indicate on the scale next to each item how you normally feel in relation to participating in your chosen sport". McDonald's omega internal reliability coefficients for the amended SEQ used in this study are listed in section 6.4.2.

Athlete dispositional coping strategies were measured via the Dispositional Coping Inventory for Competitive Sport (DCICS; Hurst et al., 2011). Across 37 items, the DCICS measures three second-order dispositional dimensions (e.g. task-, distraction-, and disengagement-oriented coping) via a 5-point Likert-type scale (1 = not at all to 5 = very strongly). Athletes are asked to assess how they would "typically" cope when competing in sport in regards to statements such as 'I stop believing in my ability to attain my goal'. Cronbach's alpha coefficients have been reported for the DCICS, which range from .60 to .80.

Athlete dispositional resilience levels were assessed via the Revised Connor-Davidson Resilience Scale (RCDRS; Campbell-Sills & Stein, 2007). Through use of a 10-item unidimensional scale, participants are asked to rate how well they correspond to items such as ‘under pressure, I stay focused and think clearly’. Some items were slightly amended to make them applicable to sport. For example, the item ‘can deal with whatever comes’ became ‘I can deal with whatever comes my way when I'm competing’. A Cronbach’s alpha coefficient of .85 was reported by Campbell-Sill and Stein for the RCDRS.

### 6.3.3. Procedure

Full ethical approval was granted from a university ethics committee for this research to be undertaken (Appendix H). Participation was limited to athletes who had completed the previous study in Chapter 5, who were subsequently contacted through email addresses they had supplied. Participants were contacted exactly six months to the day after they had originally completed the questionnaire pack. In order to combat attrition, participation was encouraged through the use of a prize draw for all respondents to win one of three £25 shopping vouchers. As with Chapter 5, participants were directed firstly to an online consent form (www.onlinesurveys.ac.uk), which then routed them to the questionnaire pack (Appendix D). Again, all questionnaires were completed at the same time.

### 6.3.4. Data Analysis

As in Chapters 3 and 5, a path analysis was conducted using sub-scale scores as observed variables, with the same recommended fit indices barometers (CFI > .90, TLI > .90, SRMR < .08, RMSEA < .05; Hu & Bentler, 1999) applied.

## 6.4. Results

### 6.4.1. Preliminary Analysis

There were no issues with missing data or outliers. All constructs demonstrated acceptable univariate skewness (<2) and kurtosis (<2).

### 6.4.2. Self-Report Measures

McDonald's (1999) omega (ω) was employed to measure internal consistency. Examination of the SEQ (Jones et al., 2005) resulted in coefficients of ω = .84 (TP1) and ω = .86 (TP2) for pleasant emotions, as well as ω = .88 (TP1) and ω = .87 (TP2) for unpleasant emotions. The DCICS (Hurst et al., 2011) produced outputs of ω = .80 (TP1) and .85 (TP2) for task-oriented coping, ω = .77 (TP1) and ω = .76 (TP2) for distraction-oriented coping, and ω = .75 (TP1) and ω = .79 (TP2) for disengagement-oriented coping. Finally, the RCDRS (Campbell-Sills & Stein, 2007) reported outputs of ω = .85 (TP1) and ω = .84 (TP2) for resilience.

### 6.4.3. Path Analysis

The hypothesised model was examined via a path analysis undertaken using MPlus 7 (Muthén & Muthén, 2012), which revealed an unsatisfactory model fit of $\chi^2(63) = 533.817$, $p < .001$, CFI = .942, TLI = .899, SRMR = .095, RMSEA = .077 (90% confidence interval (CI) = .044, .108). To improve model fit, further paths were added to the model based upon their modification index in an iterative process. Firstly, TP1 distraction-oriented coping was connected to TP1 task-oriented coping, whilst TP2 distraction-oriented coping was also connected to TP2 task-oriented coping. However, the resulting model fit ($\chi^2(63) = 533.817$, $p < .001$, CFI = .946, TLI = .900, SRMR = .095, RMSEA = .077 (90% CI = .043, .109)) was still unsatisfactory. As such, further modifications were made, with TP1 distraction-oriented coping related to TP1 pleasant emotions, with the same relationship made for these constructs at TP2. Whilst the model fit again improved ($\chi^2(63) = 533.817$, $p < .001$, CFI = .963, TLI = .926, SRMR = .087, RMSEA = .066 (90% CI = .025, .101)), it was still deemed unsatisfactory. Therefore, it was decided that a further iterative process should begin, with a removal of all non-significant paths until model fit could be deemed acceptable. With the paths between resilience and distraction-oriented coping non-significant at both TP1 and TP2,

both of these connections were removed, resulting in an improved model fit of $\chi^2(63) = 533.817$, $p < .001$, CFI = .964, TLI = .929, SRMR = .087, RMSEA = .065 (90% CI = .022, .100). Next, the paths between distraction- and disengagement-oriented coping at TP1 and TP2 were removed from the model, resulting in a model fit of $\chi^2(63) = 533.817$, $p < .001$, CFI = .968, TLI = .941, SRMR = .088, RMSEA = .059 (90% CI = .009, .094). Following this, the path between TP1 task-oriented coping and TP2 resilience was removed, producing a stronger model fit of $\chi^2(63) = 533.817$, $p < .001$, CFI = .970, TLI = .945, SRMR = .089, RMSEA = .057 (90% CI = 0, .092). With the path between TP1 resilience and TP2 pleasant emotions still non-significant, it was removed, and a model fit of $\chi^2(63) = 533.817$, $p < .001$, CFI = .973, TLI = .952, SRMR = .090, RMSEA = .053 (90% CI = 0, .088) resulted. Finally, the non-significant path between TP1 resilience and TP2 task-oriented coping was removed, leading to a final acceptable model fit of $\chi^2(63) = 533.817$, $p < .001$, CFI = .976, TLI = .957, SRMR = .086, RMSEA = .05 (90% CI = 0, .086).

As in Chapter 5, TP1 pleasant emotions significantly related to TP1 task-oriented coping ($\beta = .289$, $p = .001$, 95% CI = .119, .458) and TP1 resilience ($\beta = .214$, $p = .011$, 95% CI = .049, .379), whilst a new negative path to TP1 distraction-oriented coping was discovered ($\beta = -.216$, $p = .005$, 95% CI = -.367, -.066). Further replicating Chapter 5, TP1 unpleasant emotions positively related to both TP1 distraction- ($\beta = .152$, $p = .027$, 95% CI = .017, .287) and TP1 disengagement-oriented coping ($\beta = .539$, $p < .001$, 95% CI = .414, .664), whilst inversely relating to TP1 resilience ($\beta = -.180$, $p = .009$, 95% CI = -.316, -.044). At TP1, task-oriented coping was significantly positively associated with TP1 resilience ($\beta = .414$, $p < .001$, 95% CI = .284, .545), whereas TP1 disengagement-oriented coping was negatively associated to TP1 resilience ($\beta = -.213$, $p = .001$, 95% CI = -.338, -.088). However, distraction-oriented coping at TP1 did not relate to task-oriented coping at TP1 ($\beta = .011$, $p = .887$, 95% CI = -.135, .156). Finally, significant indirect effects were

discovered from TP1 pleasant emotions through to TP1 resilience via TP1 task-oriented coping ($\beta$ = .120, $p$ = .008, 95% CI = .031, .209) and from TP1 unpleasant emotions through to TP1 resilience via TP1 disengagement-oriented coping ($\beta$ = -.115, $p$ = .003, 95% CI = -.191, -.039).

At TP2, pleasant emotions were positively connected with TP2 task-oriented coping ($\beta$ = .258, $p$ = .003, 95% CI = .087, .428) and TP2 resilience ($\beta$ = .184, $p$ = .001, 95% CI = .044, .324), whilst TP2 unpleasant emotions were associated with TP2 disengagement-oriented coping ($\beta$ = .468, $p$ < .001, 95% CI = .320, .617). TP2 unpleasant emotions were not significantly related to TP2 distraction-oriented coping ($\beta$ = .098, $p$ = .392, 95% CI = -.126, .322) or TP2 resilience levels ($\beta$ = -.092, $p$ = .141, 95% CI = -.215, .031). Further, TP2 distraction-oriented coping did not significantly relate to either TP2 pleasant emotions ($\beta$ = .025, $p$ = .773, 95% CI = -.142, .191) or TP2 task-oriented coping ($\beta$ = .107, $p$ = .076, 95% CI = -.011, .225). TP2 task- and disengagement-oriented coping were positively and negatively associated with TP2 resilience respectively (task-: $\beta$ = .423, $p$ < .001, 95% CI = .323, .522; disengagement-: $\beta$ = -.244, $p$ < .001, 95% CI = -.380, -.108). As at TP1, significant indirect effects were also found at TP2. TP2 pleasant emotions positively related to TP2 resilience via TP2 task-oriented coping ($\beta$ = .109, $p$ = .008, 95% CI = .028, .190), whilst TP2 unpleasant emotions inversely related to TP2 resilience via TP2 disengagement-oriented coping ($\beta$ = -.114, $p$ = .004, 95% CI = -.193, -.036).

Significant paths were also found between constructs across the two time points. TP1 pleasant emotions significantly related to subsequent TP2 pleasant emotions ($\beta$ = .503, $p$ < .001, 95% CI = .343, .662) and TP2 resilience ($\beta$ = .185, $p$ = .026, 95% CI = .022, .348), whereas TP1 unpleasant emotions related to TP2 unpleasant emotions ($\beta$ = .495, $p$ < .001, 95% CI = .311, .680). TP1 Task-, distraction-, and disengagement-oriented coping strategies all positively related to their own TP2 measurements (task-: $\beta$ = .608, $p$ < .001, 95% CI

= .492, .725; distraction-: $\beta$ = .620, $p$ < .001, 95% CI = .508, .732; disengagement-: $\beta$ = .378, $p$ < .001, 95% CI = .206, .549), whilst TP1 task-oriented coping also positively related to pleasant emotions at TP2 ($\beta$ = .220, $p$ = .012, 95% CI = .048, .392). TP1 resilience levels positively related to TP2 resilience levels ($\beta$ = .621, $p$ < .001, 95% CI = .507, .735). However, pleasant emotions at TP1 did not significantly relate to task-oriented coping at TP2 ($\beta$ = .064, $p$ = .543, 95% CI = -.142, .270). Figure 2 displays the final parsimonious model with standardized path estimates denoted.

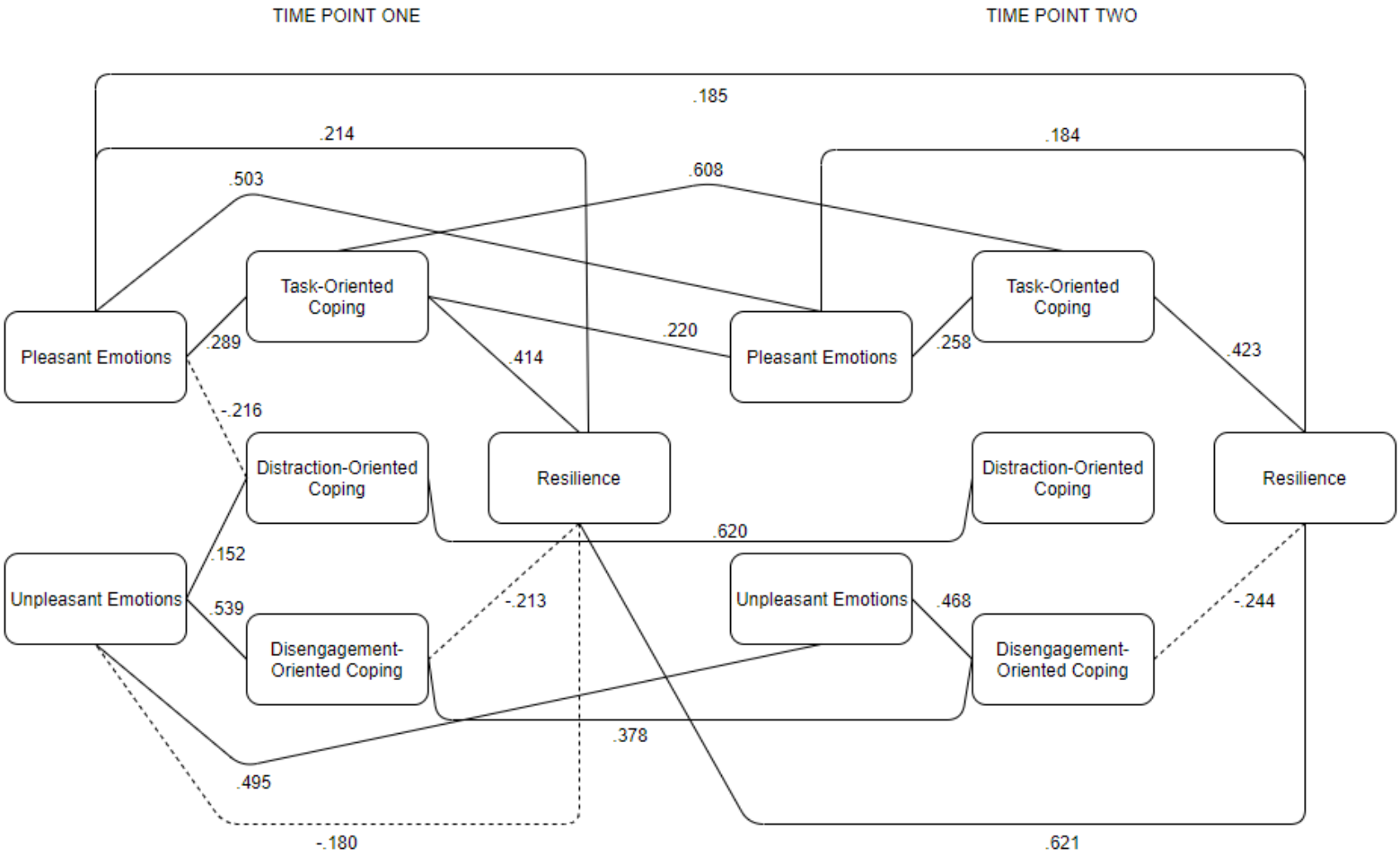


**Figure 6.2.** Final, parsimonious model with standardized parameter estimates.

## 6.5. Discussion

This research was conducted with the purpose of examining within athletes the longitudinal impact of key constructs within the BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002); that is, emotions, coping, and resilience. Pleasant emotions and task-oriented coping strategies were found to predict future episodes of pleasant emotions and task-oriented coping six months later. Taken together, these findings support my hypothesis – that pleasant emotions and task-oriented coping strategies serially enhance one another, a key supposition of BaB theory. This has a number of implications for sport psychological researchers and athletes alike. Firstly, the bidirectional relationship between emotions and coping, as found by scholars (Crocker & Graham, 1995; Gaudreau & Blondin, 2002; Nicholls, Hemmings, & Clough, 2010; Ntoumanis, Biddle, & Haddock, 1999; Pensgaard & Duda, 2003) has been re-established. Secondly, engendering pleasant emotions and facilitating the execution of task-oriented coping strategies can be the catalyst for upward spirals within athletes. That is, pleasant emotions and task-oriented coping reciprocally influence and determine one another over time. Both pleasant emotions (Erez & Isen, 2002; Lane et al., 2010; Nicholls et al., 2012; Totterdell, 2000; Uphill, Groom, & Jones, 2014) and task-oriented coping strategies (Doron & Gaudreau, 2014; Gaudreau, Nicholls, & Levy, 2010; Laborde, Dosseville, & Kinrade, 2014; Schellenberg, Gaudreau, & Crocker, 2013) have been associated with subjective and objective measures of performance, with success likely to encourage further pleasant emotions (Wilson & Kerr, 1999). What is more, both pleasant emotions and task-oriented coping were positively related to resilience levels at both time points, with pleasant emotions at TP1 even predicting resilience levels six months into the future. Finally, pleasant emotions, task-oriented coping, and resilience positively related to themselves six months into the future, thus suggesting that pleasant emotional experiences accumulate and compound over time to build enduring resources. It can be inferred that

pleasant emotions immediately broaden the thought-action repertoires of athletes, indexed by task-oriented coping, and help build their coping and intellectual resource levels, indexed by pleasant emotions and trait coping resources including resilience, which sustain over time. Therefore, even if an athlete does not achieve their sporting aims, they may have built the resource levels required to deal with the situation, and not incur substantial losses. With the broadening and build effects of pleasant emotions demonstrated over six months, the findings of this study provide preliminary support for the use of BaB theory in guiding long-term athlete emotional interventions.

It was hypothesised that unpleasant emotions would continue to be negatively associated with resilience, as seen in Chapter 5. Whilst this effect was sustained at TP1 within this model, unpleasant emotions were not found to relate to resilience six months later. This is important, as the abovementioned upwards spirals created by pleasant emotions may have generated sufficient resilience levels within athletes that they interpreted experiences of unpleasant emotions in a more facilitative fashion. This finding is not new within the psychological literature. Fredrickson, Tugade, Waugh, and Larkin (2003) discovered that individuals with high trait resilience were more likely to experience more positive emotions and find positive meaning in deeply troubling experiences (namely the terrorist attacks in New York on September 11$^{th}$, 2001). In essence, with unpleasant emotions no longer significantly depleting athlete resource levels at TP2, preliminary evidence for a psychological "undoing effect" (Fredrickson et al., 2000) has been found within this study. To my knowledge, this is the first explicit evidence of its kind. Pleasant emotions may not just help athletes create future pleasant experiences; they may also help athletes overcome unpleasant experiences from the past by reducing their psychological resource cost. Although there is no direct psychological evidence within the literature, Fredrickson et al. (2000) did note that high levels of pleasant emotions have been associated with flexible coping, abstract

thinking, and greater emotional distance following difficult experiences (Keltner & Bonanno, 1997; Lyubomirsky & Tucker, 1998; Martin, Kuiper, Olinger, & Dance, 1993; Stein, Folkman, Trabasso, & Richards, 1997). The potential existence of a direct psychological undoing effect within both athletes and the general populace is an exciting direction for future research to follow, particularly within psychophysiological circles. Future research could look to examine emotional response and resilience levels, along with physiological markers including heart rate and blood pressure, as used by Fredrickson et al. (2000).

As in Chapter 5, unpleasant emotions were discovered to relate to disengagement-oriented coping, which itself was inversely related to resilience levels. An indirect effect between unpleasant emotions and resilience via disengagement-oriented coping was also found at both time points. This finding is unsurprising, with the relationship between unpleasant emotions and disengagement-oriented coping well established (Nicholls, Polman, & Levy, 2012; Ntoumanis et al., 1999), whilst a consensus is starting to emerge on the relationship between disengagement-oriented coping and resilience (see Chapter 5, as well as Nicholls, Morley, & Perry, 2016). Whilst the potential benefits of pleasant emotions are heralded, this research suggests that athletes and their entourage should remain vigilant as to the negative consequences of unpleasant emotions. Indeed, unpleasant emotions have been associated with inhibited performance (Nicholls et al., 2012), mental burnout (Gustafsson et al., 2008), and mental illnesses (Hughes & Leavey, 2012). Further, a path was also discovered between unpleasant emotions at TP1, and unpleasant emotions at TP2. This is worrying, as it appears that experiences of unpleasant emotions predict future experiences of unpleasant emotions, indicating that athletes may also experience downward negative spirals. Whilst the negative impact of these experiences can be "undone" over time by pleasant emotional experiences, it is important that coaches and practitioners attempt to minimise unpleasant emotional experiences. Suitable interventions may include athlete reappraisal

(Uphill, Lane, & Jones, 2012), perhaps guided by goal adjustment (Nicholls, Levy, Carson, Thompson, & Perry, 2016).

Use of distraction-oriented coping was found to predict future use of such strategies six months into the future. However, no other significant relationships were found with distraction-oriented coping at TP2. This concurs with the equivocal nature of the extant literature (Gaudreau et al., 2010; Laborde, Dosseville, & Kinrade, 2014), and suggests that scholars may need to consider the categorisation of distraction-oriented coping strategies in future research. For example, such strategies may be better understood through examination of a ten-factor model of coping (Gaudreau & Blondin, 2002). Conversely, with distraction-oriented coping related to task- and disengagement-oriented coping in Chapter 3, and disengagement-oriented coping in Chapter 5, the potential supplementary nature of distraction-oriented coping may not be visible in longitudinal research due to the decreased sensitivity of the analysis employed. Regardless, explicit research into the use of distraction-oriented coping strategies, and their relationships to emotions, coping, and performance is required.

The longitudinal design employed by this research is an undoubted strength. Indeed, the power it affords allows readers to infer a greater degree of causality in the interactions displayed between emotions, coping strategies, and resilience. Further research of this ilk which incorporates further psychological or even psychophysiological constructs may develop knowledge of BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) even further.

With an almost identical methodology to that of Chapter 5, there remain some limitations with this work. Indeed, with age variances not investigated in the analyses, it is possible that there were variances in the emotions, coping behaviours, and/or resilience levels

exhibited across age groups (Gooding et al., 2012; Irion & Blanchard-Fields, 1987). Further, with dispositional psychometrics employed across a six-month period, it is inevitable that some athletes will have been out of season at either TP1 or TP2. As such, recall effects may have influenced participant's answers (Folkman & Moskowitz, 2004). Research which utilises a longitudinal process approach across the entirety of a sporting season, with athletes completing questionnaires post-match, would overcome these limitations. Pragmatically speaking, however, such a study would inevitably be time-consuming, expensive, and subject to high athlete attrition rates.

To conclude, this study has found support for the use of BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) within sporting populations through use of a longitudinal research design. Pleasant emotions predict the future experience of pleasant emotions, help broaden thought-action repertoires to aid the employment of performance-facilitative task-oriented coping strategies, and build trait coping and resilience levels within athletes over six months. Whilst unpleasant emotional experiences do predict the future experience of unpleasant emotions via downward spirals, pleasant emotions can be used to "undo" (Fredrickson et al., 2000) the psychological losses previously incurred. Coaches and psychological practitioners working with athletes are advised to engender pleasant emotions within athletes in order to build long-term coping resources.

# Chapter 7:
# A Psychophysiological Examination of the Broaden-and-Build Theory in Sport via a Lab-Based Reaction Task

## 7.1. Abstract

Current evidence linking pleasant emotions and performance has been criticised for being too methodologically limited to make any substantial claims (McCarthy, 2011). This is partly due to experimental studies often invoking emotions which were experienced after goal acquisition or invoking emotions not relevant to a goal, resulting in low approach motivation (Gable & Harmon-Jones, 2008). Laboratory-based research affords scholars the ability to control extraneous variables, and to engender the exact emotions they wish – incorporating both low and high approach motivation. Following on from Chapters 5 and 6, Chapter 7 was designed to investigate any potential relationship between the constructs of emotions, coping strategies, trait resilience, and athletic performance. Across multiple time-points, emotionally manipulated athletes (e.g. pleasant, and unpleasant emotions) and a non-manipulated athlete control group undertook a sport-specific task designed to measure any immediate or lasting evidence of "broadening" and "building" effects in relation to psychological, neuroendocrine, and performance responses. As such, Chapter 7 represents the first experimental application of the broaden-and-build theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) within sport. Pleasant and unpleasant emotions had an immediate and sustained psychophysiological and performance impact. Whilst the performances of both the pleasant and unpleasant emotions groups improved, the unpleasant emotions group was associated with higher levels of unpleasant emotions, which may theoretically instigate downward spirals within athletes. In line with the extant literature, pleasant emotions appeared to benefit athlete performance and aid the development of psychological resources, both immediately and in a sustained manner.

## 7.2. Introduction

There has been a relative paucity of emotional research interacting with sport performance (Woodman et al., 2009). Whilst superior cricketing performance has been linked to happiness (Totterdell, 2000), Hanin (2007) suggested that positive emotions do not necessarily determine strong performance, nor do negative emotions always predict weak performance. Further, the rigour of emotional-performance research has been lamented as too thin to posit any significant interaction (McCarthy, 2011). As such, McCarthy recommended that scholars need to broadly investigate the effect that pleasant emotions have within sport.

In order to meet McCarthy's recommendations, psychological researchers in sport would do well to emulate the work of leading scholars such as Fredrickson and Joiner (2002), Kok et al. (2013), and Gable and Harmon-Jones (2008). The aforementioned scholars have developed the emotional literature through research which is longitudinal, psychophysiological, and embraces variations in emotional approach motivation respectively. This is key for a number of reasons. Firstly, the full facilitative impact of pleasant emotions appear to be realised over the long-term (Cohn et al., 2009; Fredrickson et al., 2008; Lyubomirsky et al., 2005; Mauss et al., 2011). Secondly, the expression of emotions when an athlete competes in sport are undoubtedly influenced by neurological and endocrine mechanisms (Parmigiani et al., 2009). Indeed, pleasant emotions have been associated with greater cognitive efficiency during problem solving tasks (Isen, Rosenzweig, & Young, 1991) and flexibility in decision-making (Isen, 2001); effects which have been theorised as being caused by increased dopamine in frontal cortical areas resulting from pleasant emotional experiences (e.g. prefrontal cortex and anterior cingulate). This is important as both cognitive efficiency and flexible decision-making are potentially key to an athlete's chances of sporting success. Thirdly, the emotional-performance literature has often produced indeterminable relationships due to the approach motivation of emotions being overlooked (Gable &

Harmon-Jones, 2008). The term approach motivation refers to an urge or action tendency to engage with a stimulus. For example, the emotion of contentment does not encourage one to act and is thus characterised as having low approach motivation. Conversely, the experience of excitement may encourage an individual to approach an object, and thus has high approach motivation. Finally, more needs to be understood about the precise influence discrete emotions have upon athletes (McCarthy, 2011). This includes co-occurring pleasant emotions, as well as any lasting effects – such as "broadening" and "build" effects, as theorised within the broaden-and-build theory of emotions (BaB; Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002). Research which incorporates these factors would at least attempt to encapsulate a more authentic nature of emotions in sport. Indeed, whilst the experience of emotions in sport may be ephemeral by nature, their effects may not.

Whilst Chapters 5 and 6 have empirically investigated the short- and long-term effects of emotions within sport, a limitation of these studies has been the employment of retrospective psychological measures. The purpose of Chapter 7 was therefore to address these shortcomings by examining (a) the short- and long-term effects of athlete emotions, and (b) the psychophysiological and performance impact that they may have. To achieve this aim, Chapter 7 utilised an experimental design in which emotionally manipulated athletes completed a sport-specific reaction time task across week-long time points, whilst also providing psychological and physiological measurements.

### 7.2.1. Hypotheses

I predicted that the reaction time performances of the pleasant emotion group would improve after their emotional manipulation, because pleasant emotions have been linked with greater cognitive efficiency (Isen et al., 1991). For this reason, I theorised that such performance improvement would be sustained within the pleasant emotions group athletes

one week later. With emotion regulation theorised to direct cognitive resources away from the task at hand (Janelle, 2002), and unpleasant emotions associated with distraction- and disengagement-oriented coping (Nicholls, Perry, & Calmeiro, 2014), I theorised that the performances of the athletes within the unpleasant emotions group would diminish immediately after their emotional manipulation; an effect that would sustain for at least one week after. In addition, I examined the relationship between emotions and salivary cortisol secretion. With both positive and negative performance feedback found to invoke a neuroendocrine response in Chapter 4, I hypothesised that significant cortisol spikes would occur immediately post-manipulation in both pleasant and unpleasant emotional groups. However, a sustainment of this effect was only expected within the unpleasant emotions group. Finally, I predicted that the psychological response of athletes would replicate the findings of Chapters 5 and 6. That is, the pleasant emotions group would exhibit heightened levels of pleasant emotions, task-oriented coping, and resilience immediately post manipulation, an effect which would be sustained one week later. In particular, any immediate increase in the use of task-oriented coping strategies would be inferred as evidence of a "broadening" effect occurring (Fredrickson; 2001), due to the inherent attention and creativity required to perform such coping behaviours. Further, based upon the work of Fredrickson and Joiner (2002), sustained levels of task-oriented coping, and resilience would represent accumulated resources for future events, and thus be interpreted as evidence for the "build" effect. I also hypothesised that following the engenderment of unpleasant emotions, the unpleasant emotions group would exhibit immediate decreased resilience levels and increased levels of unpleasant emotions, distraction-, and disengagement-oriented coping. This increase in disengagement-oriented coping was predicted to be sustained one week later. No significant psychophysiological or performance changes were predicted in the control group.

## 7.3. Methods

### 7.3.1. Participants

Twenty-one male athletes aged between 17 and 53 (age 29.67 ± 9.89; height 179.89 cm ± 5.71 cm; weight 80.09 kg ± 11.64 kg) were recruited via email and informational posters to take part in this research, which was conducted over the course of three testing days. To meet the inclusion criteria for the study, athletes were required to be aged from 16-55 years with no history of cardiovascular illness, refrain from smoking, and to participate in competitive sport. Any athletes who consumed medicines which impact upon the secretion of salivary cortisol (e.g. such as corticosteroids; Wlodarczyk, Gibson, & Caeser, 2008) or suffered from any health contraindications were excluded from participation. Participants were instructed to be in a hydrated state and avoid caffeine on the testing day, nor consume any food one hour prior to the testing beginning on each of the three testing days. Strenuous activity was also restricted for 24 hours before testing. The protocol was approved in its entirety by a university departmental ethics committee (Appendix H).

### 7.3.2. Self-Report Measures

Participants completed a paper questionnaire pack on each day of testing (Appendix E). As in Chapters 3 and 4, participants answered items relating to their state emotions via the Sport Emotion Questionnaire (SEQ; Jones et al., 2005). The SEQ is a 22-item questionnaire that measures two pleasant emotions (happiness and excitement) and three unpleasant emotions (anger, anxiety, and dejection) on a five-point Likert-type scale. Jones et al. reported Cronbach's alpha ratings varying between .81 and .87.

The modified Coping Inventory for Competitive Sports (CICS; Gaudreau & Blondin, 2002) utilised in Chapter 4 was also employed in this study. As before, some items were altered to become more relatable to a lab-based task, whilst also removing items concerning the constructs 'seeking support' and 'distancing from others' due to a lack of task relevancy.

This resulted in a 28-item CICS which measured the constructs of task- distraction, and disengagement-oriented coping. McDonald's omega internal reliability coefficients for the modified CICS can be found in section 7.4.3.

Resilience was measured through use of the Revised Connor-Davidson Resilience Scale (RCDRS; Campbell-Sills & Stein, 2007), as it was in Chapters 5 and 6. The RCDRS is a unidimensional 10-item questionnaire which utilises a 5-point Likert-type scale (1 = not true at all, 5 = true nearly all of the time). Participants are required to state how well each item corresponded to them, such as 'under pressure, I stay focused and think clearly'. Some items were slightly amended to make them applicable to sport. For example, the item 'can deal with whatever comes' became 'I can deal with whatever comes my way when I'm competing'. A Cronbach's alpha coefficient of .85 was reported by Campbell-Sill and Stein for the RCDRS.

### 7.3.3. Physiological Response and Performance

Athlete performance was determined by contrasting the average reaction time for each round of reactions across each day of testing. Reaction time includes both the time from the perception of the stimulus and subsequent response initiation (onset time) and the time taken to execute the response (movement time; Pascual-Leone et al., 1993), and is a common dependent variable within psychology (Whelan, 2008).

As in Chapter 4, athlete neuroendocrine response was indexed via salivary cortisol levels. Cortisol is a steroid hormone produced by the HPA axis during sympathetic nervous system activation to aid an individual in a fight or flight situation (Cannon, 1939). With a non-invasive sampling procedure via saliva, and significant changes in cortisol occurring just 15 minutes after a psychological stressor (Quested et al., 2011), cortisol measurement has become increasingly common within psychophysiological research. Laboratory studies have

shown that manipulated negative affect is associated with an increase in cortisol levels, whilst manipulated positive affect is associated with decreased cortisol levels (Buchanan, al'Absi, & Lovallo, 1999).

Through the use of salivettes (Sarstedt, Rommelsdorf, Germany), participants provided three salivary cortisol samples per testing day. Samples were provided at baseline (Sample 1), immediate post-task (Sample 2), and 15 minutes post-task (Sample 3). Analysis of participant cortisol levels was undertaken through the use of enzyme-linked immunosorbent assays (R&D Systems, Minneapolis, USA).

### 7.3.4. Procedure

Each participant was randomly allocated to an emotional group (pleasant emotions, unpleasant emotions, or control group) and took part in three testing sessions involving a FitLight reaction training system (FitLight Sports Corp., Ontario, Canada; see Figure 1). The FitLight reaction training system is a wireless reaction training system which utilises eight LED lights with inbuilt proximity sensors. Through use of a portable tablet, the FitLight can be programmed to create a wide range of working memory, decision making, and agility tasks which require sport-specific movements from athletes. The FitLight has been validated as a novel dual-process task (Laessoe, Grarup, & Bangshaab, 2016), whilst its efficacy in evaluating visual-motor performance in athletes has been evidenced (Zwierko, Florkiewicz, Fogtman, & Kszak-Krzyżanowska, 2014). Further, the FitLight task was chosen because of its low physiological demands of athletes in comparison to closed-skill tasks such as cycling time trials. With Helsen and Starkes (1999) reporting no differences in reaction time between intermediate and expert athletes, the FitLight task was seen as suitable for athletes of varying abilities. As seen in Chapter 4, cortisol levels may significantly increase from participation in moderate to high intensity exercise (that is, 80% maximal oxygen uptake; Hill et al., 2008).

As such, any significant cortisol variations between groups are more likely to be due to the effects of the manipulations implemented.

In order to make the FitLight task as sport-specific as possible, I utilised a similar protocol to that of Zwierko et al. (2014). That is, participants completed 10 rounds of 22 reactions to visual stimuli appearing on the LED lights. With 220 reactions overall in each session, the study protocol met the requirements of 200-300 reactions advised by Sanders (1998) to avoid sequential effects. Each light was placed onto a semi-circle template (see Figure 2) 110cm from the ground, measuring 11 x 80 cm with gaps of 20 cm between each light, and 45 cm from the designated starting point. Using their dominant hand, participants were required to move their hand from the starting point to the relevant activated light as quickly as possible, before returning their hand to the starting point. Each reaction was separated by a time interval ranging from 0.1 to 3.0 seconds, with a period of 5 seconds between each round. In order to limit reaction anticipation, no auditory sounds were included within the stimulus, with no specific standardised interval between reactions (p. 23-24, Sanders, 1998). To ensure each participant faced exactly the same protocol, both the protocol sequence and time intervals between stimuli were devised through the use of a random number generator (www.random.org) and pre-programmed into the FitLight tablet. Each testing session was separated by a week in order to allow for the measurement of any lasting psychological, neuroendocrine, or performance effects from the engendered manipulation in session 2, as well as to reduce the chance of practice effects, which have been found to be non- significant in simple reaction time tasks separated by a week's interval (Falleti, Maruff, Collie, & Darby, 2006). Further, as task familiarity is a necessary consideration when investigating performance variance, a minimum of two

**Figure 7.1.** FitLight Apparatus.

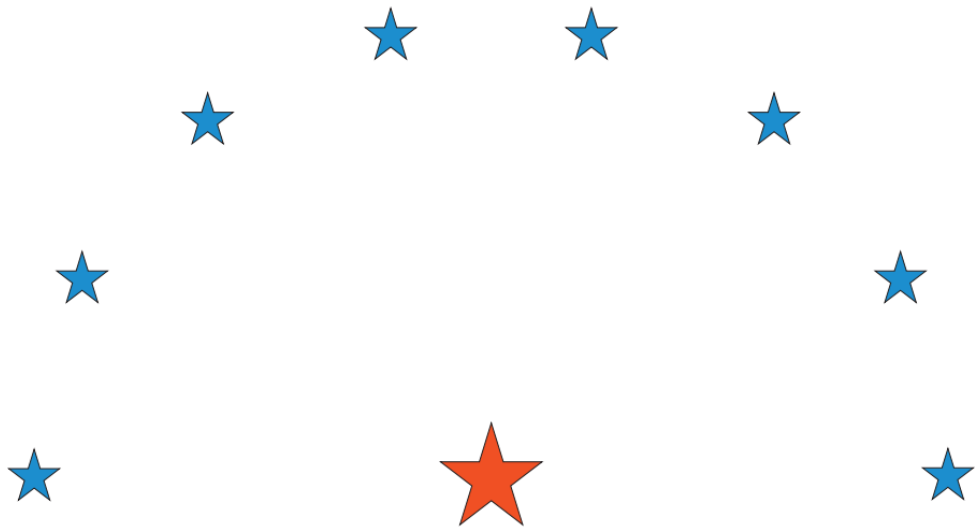

**Figure 7.2.** Template used for FitLight LED Light Placement.

familiarisation rounds were provided before each testing session but were not included in the final analysis. In order to minimise the effects of diurnal variation, testing sessions occurred at the same time and day. All participants were directed to abstain from strenuous physical activity for 24 hours before each day of testing.

Other than the manipulations imparted upon participants during session 2, each testing session was exactly the same. Participants began each session by providing a saliva sample (Sample 1), completing the SEQ, and then undergoing their task familiarisation. Following this, once the participant indicated that they were ready to begin, the experimental task began. The FitLight reaction time software recorded values for average and total reaction time per round. To assist the emotional manipulations, participants were not provided with any indication of their performance during the task. Once the 10$^{th}$ round was complete, participants provided their second saliva sample (Sample 2) and completed the remaining CICS and RCDRS questionnaires. Finally, participants provided their final saliva sample 15 minutes later (Sample 3), and the testing session concluded.

### 7.3.5. Manipulation

Emotional manipulations were engendered within all participants via the use of pre-recorded imagery scripts (Appendix G). These scripts were based on those used by Woodman et al. (2009), and devised to contain a high level of detail in relation to a sporting event in order to elicit an appropriate psychophysiological response (Cumming, Olphin, & Law, 2007). The pleasant emotional group were presented with a script which intended to elicit the emotions of happiness and excitement, whilst the unpleasant emotional group experienced a script intended to elicit the emotions of anger, anxiety, and dejection. These emotions were expressly targeted for two reasons. Firstly, they are the exact emotions measured in Jones et al.'s (2005) SEQ, which was employed in this study. Further, the use of

co-occuring emotional groups would result in athletes experiencing aspects of both high and low approach motivation (Gable & Harmon-Jones, 2008), which more adequately encapsulates the wide emotional profile an athlete may experience during the course of a competitive sporting event. Investigating a broader spectrum of emotions has been recommended within the sports psychological literature, with McCarthy (2011) noting that the biggest scientific rewards may be "harvested" through such an approach. Participants within the control group received a neutral emotional script which discussed the process of brushing one's teeth (Kavanagh & Hausfeld, 1986). A control group was included within this study for a number of reasons. Firstly, the inclusion of the control group allowed for the investigation of any practice effects within the FitLight task. Further, the results of the control would highlight any potential treatment effects (Collie, Maruff, Darby, & McStephen, 2003; Collie, Maruff, Falleti, Silbert, & Darby, 2002). All scripts were played to participants through use of a CD player placed within the laboratory, which was activated whilst the researcher was outside of the room. Once the manipulation had finished, participants completed the relevant psychometrics, provided their first salivary cortisol sample, and began their warm-up for the FitLight task.

## 7.4. Results

### 7.4.1. Demographics

To check whether the randomisation process was effective, a one-way ANOVA was undertaken. The results showed no significant differences in relation to age ($p$ = .57), height ($p$ = .38), weight ($p$ = .97), or amount of physical activity ($p$ = .77).

### 7.4.2. Manipulation Checks

Independent Samples t-tests were conducted to test whether the pleasant and unpleasant groups had been engendered with the relevant emotions. As the control group were not manipulated with an emotional imagery script, manipulation check t-tests were

deemed unnecessary. All t-tests examined data from session 2 only, as this was when all manipulations were provided. In regards to pleasant emotions, the pleasant emotions group were found to score significantly higher than the unpleasant emotions group: $t$ (12) = 3.34, $p$ = 0.006, $g$ = 2.55. Further, the unpleasant emotions group exhibited a significantly larger unpleasant emotions index value than the pleasant emotions group: $t$ (12) = 2.53, $p$ = 0.026, $g$ = 0.87.

### 7.4.3. Self-Report Measures

McDonald's (1999) omega (ω) measured internal consistency. When examining the SEQ (Jones et al., 2005), it was revealed that there was no variance in the scores of unpleasant emotions items 2, 7, 12, and 22 for session 1, nor for the unpleasant emotions items 1, 2, 4, 7, 9, 12, and 14 for session 3. As such, their ω values could not be reported. The SEQ's coefficients were ω = .92 (session 1), ω = .94 (session 2), and ω = .96 (session 3) for pleasant emotions, and ω = .92 (session 2) for unpleasant emotions. Due to a lack of variance in item 27 of the modified CICS (Gaudreau & Blondin, 2002), no ω output was recorded for disengagement-oriented coping for session 1. Nonetheless, coefficients of ω = .70 (session 1), ω = .89 (session 2), and ω = .87 (session 3) were found for task-oriented coping, ω = .31 (session 1), ω = .93 (session 2), and ω = .81 (session 3) for distraction-oriented coping, and ω = .85 (session 2) and ω = .90 (session 3) for disengagement-oriented coping. Lastly, analysis of the RCDRS (Campbell-Sills & Stein, 2007) revealed coefficients of ω = .88 (session 1), ω = .90 (session 2), and ω = .93 (session 3). Once the internal consistency tests had been applied, a repeated-measures analysis of variance (ANOVA) was undertaken to assess any potential psychological changes in the participating athletes over the course of the three testing sessions. The possibility of type I error resulting from multiple comparisons was corrected through the use of Benjamini-Hochberg $q$, which was obtained from calculating the

False Discovery Rate (FDR; Benjamini & Hochberg, 1995). If $p < q$ and the 95% confidence interval did not contain zero, the null hypothesis was rejected.

### 7.4.4. Pleasant and Unpleasant Emotions

Pairwise comparisons revealed that on the second day of testing the pleasant emotions group displayed significantly higher levels of pleasant emotions than on the first day of testing ($p = .033$, $g = .51$), although this finding did not pass the FDR ($p > q$). Further, participants in the pleasant emotions group reported significantly higher pleasant emotions than those in both the unpleasant emotions group ($p = .003$, $g = 1.67$) and the control group ($p = .007$, $g = 1.52$) during session 2, a finding which also satisfied the FDR ($q = .006$ and .011 respectively). Conversely, the unpleasant emotional group exhibited significantly lower levels of pleasant emotions during the 2nd session than during the 1st ($p = .017$, $g = .72$), although this finding failed to satisfy the FDR ($p > q$). A medium effect was also discovered between the 2nd and 3rd sessions, with the unpleasant emotional group experiencing less pleasant emotions in session 2 ($p = .051$, $g = .58$).

A significant between-subject effect was found for unpleasant emotions ($F$ (2) = 7.66, $p = .004$), which sustained following post-hoc testing ($q = .007$). Participants within the unpleasant emotions group displayed higher levels of unpleasant emotions during session 2 than on session 1 ($p = .004$, $g = 1.07$) and session 3 ($p < .000$, $g = 1.15$), whilst participants within the pleasant emotions group displayed higher unpleasant emotional levels during session 1 than session 3 ($p = .015$, $g = 2.64$). All three of these findings passed the FDR, with outputs of $q = .017$, .033, and .017 respectively. Finally, the unpleasant emotions group exhibited significantly higher levels of unpleasant emotions during session 2 than the pleasant emotions ($p = .007$, $g = 1.27$) and the control ($p = .005$, $g = 1.31$) group. The resultant $q$ outputs of $q = .017$ and .006 meant that the null hypothesis was rejected for both findings. This same relationship was also found during session 3, with the unpleasant emotions group

again significantly higher than the pleasant emotions ($p$ = .009, $g$ = 1.21) and control ($p$ = .006, $g$ = 1.31) group. Both $p$ values subsequently passed the FDR, with $q$ = .022 and .011 respectively.

### 7.4.5. Coping Strategies

A large coping effect was found between the pleasant emotions group and the control group during session 2, with the pleasant emotion group using more task-oriented coping strategies ($p$ = .064, $g$ = 1.26). During session 3 the pleasant emotions group also utilised significantly more task-oriented coping strategies than both the unpleasant emotions ($p$ = .034, $g$ = 1.16) and the control ($p$ = .028, $g$ = 1.13), although in both cases $p > q$. The unpleasant emotions group also displayed significantly less task-oriented coping strategies during session 3 than they had done in session 1 ($p$ = .002, $g$ = 0.87), with $q$ = .017 indicating that this result was post-hoc significant.

One final significant effect discovered in relation to coping strategies involved distraction-oriented coping strategies. During session 1, the control group exhibited higher levels of distraction-oriented coping than the pleasant emotions group ($p$ = .048, $g$ = 1.19), although this did not pass the FDR ($p > q$).

### 7.4.6. Resilience

Group pairwise comparisons revealed that both the pleasant and unpleasant emotions groups displayed higher levels of resilience during session 1 than the control group, with large effects found (pleasant emotions: $p$ = .014, $g$ = 1.18; unpleasant emotions: $p$ = .051, $g$ = 1.28). A medium effect was found during session 2, with the unpleasant emotions group displaying higher levels of resilience than the control group ($p$ = .051, $g$ = .56). However, none of the aforementioned findings satisfied the FDR ($p > q$).

### 7.4.7. Physiological Response

As in Chapter 4, the decision was taken to only measure between-group comparisons due to diurnal variation across participants (Hayes, Grace, Kilgore, Young, & Baker, 2012), whilst effect size was used to express neuroendocrine response, as recommended by Denson, Spanovic, and Miller (2009). The descriptive statistics for each group's cortisol levels are detailed in Table 1, whilst Tables 2 and 3 list the subsequent effect sizes within sessions and across sessions respectively.

**Table 7.1.** Descriptive statistics for each experimental group's salivary cortisol levels.

| Group | Time Point | Session 1 Mean and SD (ng/ml) | Session 2 Mean and SD (ng/ml) | Session 3 Mean and SD (ng/ml) |
|---|---|---|---|---|
| Pleasant Emotions | TP1 | 12.58 ± 15.84 | 8.78 ± 5.83 | 7.43 ± 2.34 |
| Pleasant Emotions | TP2 | 4.45 ± 2.32 | 5.20 ± 2.02 | 8.72 ± 6.24 |
| Pleasant Emotions | TP3 | 6.39 ± 4.37 | 5.42 ± 3.55 | 11.15 ± 5.68 |
| Unpleasant Emotions | TP1 | 4.46 ± 4.15 | 9.93 ± 10.32 | 6.65 ± 9.60 |
| Unpleasant Emotions | TP2 | 7.15 ± 6.59 | 10.89 ± 11.72 | 3.82 ± 2.08 |
| Unpleasant Emotions | TP3 | 7.64 ± 7.98 | 7.17 ± 6.09 | 5.90 ± 3.21 |
| Control | TP1 | 10.92 ± 11.07 | 10.87 ± 10.17 | 5.34 ± 4.54 |
| Control | TP2 | 12.20 ± 16.18 | 13.74 ± 13.50 | 5.86 ± 2.74 |
| Control | TP3 | 9.21 ± 5.37 | 9.69 ± 8.45 | 6.96 ± 2.35 |

During session 1, the cortisol levels of the pleasant emotions group decreased from TP1 to TP2, creating a medium effect of $g$ = .67. Medium effects were also found from TP1 to TP3 ($g$ = .50) and TP2 to TP3 ($g$ = .52). Similar medium effects were discovered during session 2, with cortisol levels within the pleasant emotions group dropping from TP1-TP2 ($g$ = .77) and TP1-TP3 ($g$ = .65). During session 3, a spike in cortisol levels within the pleasant emotions group from TP1-TP3 was sufficient to generate a large effect size of $g$ = .80. Finally, a cortisol level increase within the unpleasant emotions group between TP2 and TP3 produced a moderate effect of $g$ = .72.

**Table 7.2.** Effect size for each experimental group's salivary cortisol levels within sessions.

| | Session 1 | Mean Difference (ng/ml) | Effect Size (*g*) | Session 2 | Mean Difference (ng/ml) | Effect Size (*g*) | Session 3 | Mean Difference (ng/ml) |
|---|---|---|---|---|---|---|---|---|
| Pleasant Emotions | TP1 - TP2 | 8.13 | 0.67 | TP1 - TP2 | 3.58 | 0.77 | TP1 - TP2 | -1.29 |
| | TP1 - TP3 | 6.19 | 0.5 | TP1 - TP3 | 3.36 | 0.65 | TP1 - TP3 | -3.72 |
| | TP2 - TP3 | -1.94 | 0.52 | TP2 - TP3 | -0.22 | 0.07 | TP2 - TP3 | -2.43 |
| Unpleasant Emotions | TP1 - TP2 | -2.69 | 0.46 | TP1 - TP2 | -0.96 | 0.08 | TP1 - TP2 | 2.83 |
| | TP1 - TP3 | -3.18 | 0.47 | TP1 - TP3 | 2.76 | 0.3 | TP1 - TP3 | 0.75 |
| | TP2 - TP3 | -0.49 | 0.06 | TP2 - TP3 | 3.72 | 0.37 | TP2 - TP3 | -2.08 |
| Control | TP1 - TP2 | -1.28 | 0.09 | TP1 - TP2 | -2.87 | 0.22 | TP1 - TP2 | -0.52 |
| | TP1 - TP3 | 1.71 | 0.18 | TP1 - TP3 | 1.18 | 0.12 | TP1 - TP3 | -1.62 |
| | TP2 - TP3 | 2.99 | 0.23 | TP2 - TP3 | 4.05 | 0.34 | TP2 - TP3 | -1.1 |

A number of medium to large effect sizes were discovered across sessions, also. When TP1 salivary samples were contrasted, an increase in cortisol levels was discovered between sessions 1 and 2 for the unpleasant emotions group, producing an effect of $g$ = .65. Conversely, cortisol levels within the control group for TP1 were lower during session 3 than sessions 1 and 2, with effects of $g$ = .62 and $g$ = .66 respectively. For TP2, the pleasant emotions group exhibited higher levels of cortisol during their third Session. Analysis showed that this increase was enough for a large effect size in comparison to session 1 ($g$ = .85), and a moderate effect size in comparison to session 2 ($g$ =.71). In regards to the unpleasant emotions group, a decrease in TP2 cortisol levels from session 1 to session 3 was enough for a moderate effect ($g$ = .64), as was a decrease from session 2 to session 3 ($g$ = .79). Medium effects were also observed at TP2 between sessions 1 and 3 ($g$ = .51)

and sessions 2 and 3 ($g$ = .76) for the control group. Finally, TP3 cortisol levels with the pleasant emotions group produced two large effects. It was found that the session 3 TP3 levels increased substantially in comparison to session 1 ($g$ = .88) and session 2 ($g$ = 1.13). A medium effect was also found for this time point in the control group between sessions 1 and 3 ($g$ = .51).

**Table 7.3.** Effect size for each experimental group's salivary cortisol levels across sessions.

| Time Point | Group | Session | Session | Mean Difference (ng/ml) | Standard Error | *p* value | Effect Size (*g*) |
|---|---|---|---|---|---|---|---|
| TP1 | Pleasant Emotions | 1 | 2 | 3.8 | 4.52 | 0.41 | 0.3 |
| | | 1 | 3 | 5.15 | 4.74 | 0.29 | 0.43 |
| | | 2 | 3 | 1.35 | 2.59 | 0.61 | 0.28 |
| | Unpleasant Emotions | 1 | 2 | -5.47 | 4.52 | 0.24 | 0.65 |
| | | 1 | 3 | -2.19 | 4.74 | 0.65 | 0.28 |
| | | 2 | 3 | 3.28 | 2.59 | 0.22 | 0.31 |
| | Control | 1 | 2 | 0.05 | 4.52 | 0.99 | 0 |
| | | 1 | 3 | 5.58 | 4.74 | 0.25 | 0.62 |
| | | 2 | 3 | 5.531* | 2.59 | 0.05 | 0.66 |
| TP2 | Pleasant Emotions | 1 | 2 | -0.75 | 3 | 0.8 | 0.32 |
| | | 1 | 3 | -4.27 | 4.16 | 0.32 | 0.85 |
| | | 2 | 3 | -3.52 | 4.21 | 0.41 | 0.71 |
| | Unpleasant Emotions | 1 | 2 | -3.74 | 3 | 0.23 | 0.37 |
| | | 1 | 3 | 3.33 | 4.16 | 0.43 | 0.64 |
| | | 2 | 3 | 7.07 | 4.21 | 0.11 | 0.79 |
| | Control | 1 | 2 | -1.53 | 3 | 0.62 | 0.1 |
| | | 1 | 3 | 6.34 | 4.16 | 0.14 | 0.51 |
| | | 2 | 3 | 7.87 | 4.21 | 0.08 | 0.76 |
| TP3 | Pleasant Emotions | 1 | 2 | 0.96 | 2.24 | 0.67 | 0.23 |
| | | 1 | 3 | -4.77 | 3.04 | 0.13 | 0.88 |
| | | 2 | 3 | -5.727* | 2.67 | 0.05 | .1.13 |
| | Unpleasant Emotions | 1 | 2 | 0.47 | 2.24 | 0.84 | 0.06 |
| | | 1 | 3 | 1.74 | 3.04 | 0.57 | 0.27 |
| | | 2 | 3 | 1.27 | 2.67 | 0.64 | 0.24 |
| | Control | 1 | 2 | -0.48 | 2.24 | 0.83 | 0.06 |
| | | 1 | 3 | 2.25 | 3.04 | 0.47 | 0.51 |
| | | 2 | 3 | 2.73 | 2.67 | 0.32 | 0.41 |

### 7.4.8. Reaction Time Performance

Athlete performance on the FitLight task was calculated via the average reaction time across the course of each testing session. Analyses showed that the performances of the pleasant emotions group were significantly better during sessions 2 and 3 than they were during session 1 (session 2: $p < .001$, $g = .55$; session 3: $p = .001$, $g = .58$). These effects were sustained following post-hoc analyses, with $q = .017$ and .033 respectively. The unpleasant emotions group exhibited similar performance improvement, with sessions 2 and 3 also significantly quicker on average than session 1 (session 2: $p = .003$, $g = .56$; session 3: $p = .004$, $g = .70$). Both of these performance improvements subsequently satisfied the FDR ($q = .017$ and .033 respectively). No significant performance changes were found within the control group, with all effect sizes also found to be trivial. The mean performance time of each group across sessions 1 to 3 can be viewed in Figure 7.3.

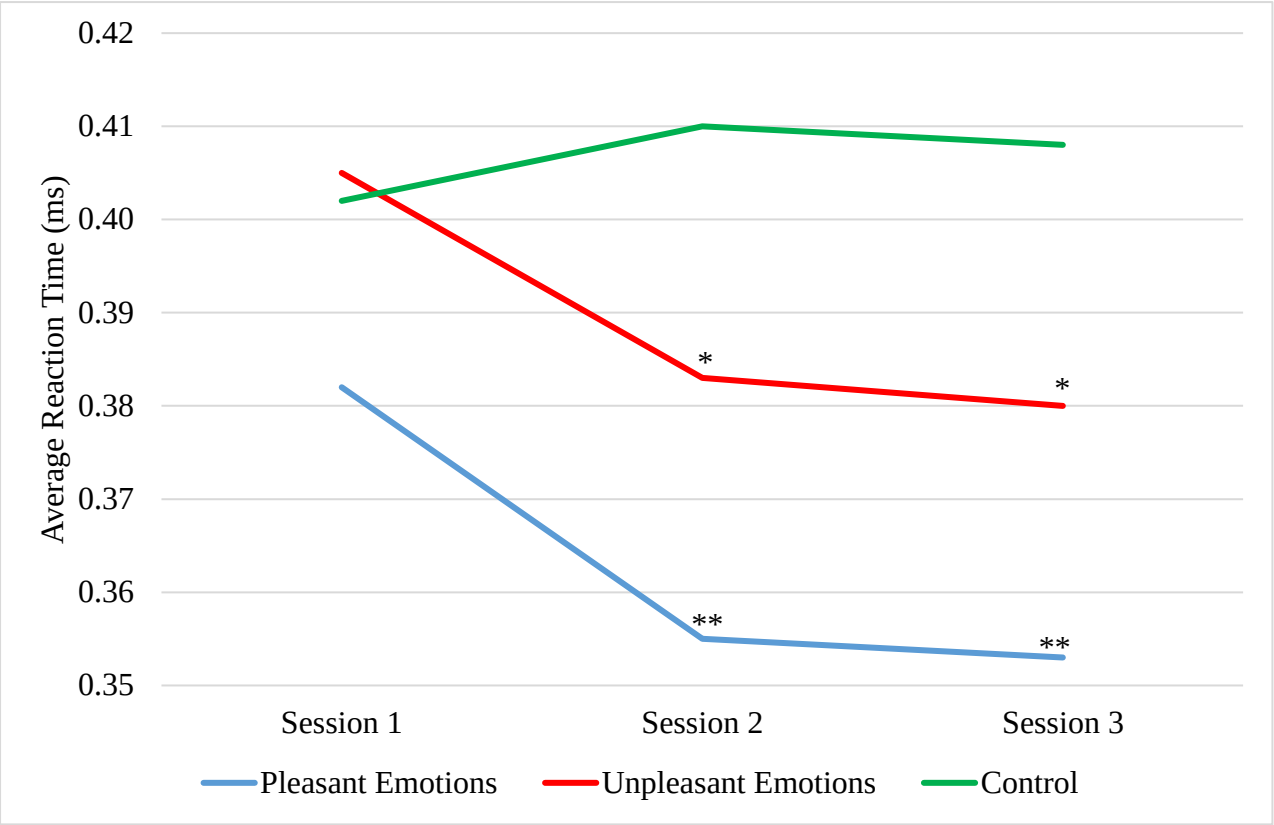


**Figure 7.3.** Average Group Reaction Time across sessions. ** denotes significant difference from session 1 ($p \leq 0.01$); * denotes significant difference from session 1 ($p \leq 0.05$).

Group Pairwise comparisons revealed that whilst there was no significant performance difference between the groups during the baseline day of testing, there were some performance differences during sessions 2 and 3. Participants within the pleasant emotions produced performances that were significantly better than the control group during sessions 2 and 3 (session 2: $p = .003$, $g = 1.11$; session 3: $p = .035$, $g = 1.01$), both with notably large effect sizes. However, neither of these results satisfied the FDR ($p > q$).

## 7.5. Discussion

This research was undertaken in order to investigate whether emotional manipulations would have both an immediate and sustained impact on participants' subsequent

psychophysiological response and performance on a reaction-time task. Based on the extant psychological literature (Isen, 2001; Isen et al., 1991), I hypothesised that athletes within pleasant emotions group would exhibit improved athletic performance following their emotional manipulation. The results demonstrate that engendered pleasant emotions improved athletic performance immediately, with performance benefits sustained a week later. This finding supports my hypothesis and concurs with the sport psychological literature that pleasant emotions benefit athletic performance (Erez & Isen, 2002; Lane et al., 2010; Nicholls et al., 2012; Totterdell, 2000; Uphill et al., 2014), perhaps due to subsequent increases in concentration (Vast, Young, & Thomas, 2010) or improved sensorimotor skills (Vast, Young, & Thomas, 2011). With pleasant emotions broadening coping repertoires and building resources over the long-term (Thompson, Chapter 6), as well as improving athletic performance, it is advised that sport psychological practitioners could therefore take all opportunities to engender pleasant emotions within their athletes to facilitate the development of psychological resources and chances of optimal performance. Methods to engender pleasant emotions can include through facilitating gain stress appraisals (as seen in Chapter 4) via encouraging feedback, or via imagery scripts of a pleasant valence (Cumming & Williams, 2012).

It was also hypothesised that unpleasant emotions would negatively impact upon both immediate and sustained athletic performance, indexed respectively by performance during sessions 2 and 3, due to the cognitive inhibition of emotional regulation (Janelle, 2002). Contrary to my predictions, unpleasant emotions facilitated athletic performance, an effect which was sustained a week later. Such an effect may be explained by the concept of emotional approach motivation (Gable & Harmon-Jones, 2008). Whilst unpleasant emotions may narrow ones thought-action repertoires, as theorised within BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) and exhibited within Chapters 5 and 6, unpleasant

emotions high in approach motivation such as anger may still benefit performance. This is because the specific action tendency (Lazarus, 1999) of an emotion may match the movements required by the sporting task (Skinner & Brewer, 2004; Woodman et al., 2009). Indeed, the emotion of anger possesses the action tendency to attack (Lazarus, 2000a), which can be inferred to mirror the FitLight task kinetic requirements of a lashing motion. With unpleasant emotions engendered athletes potentially experiencing anger before the FitLight task, they may have subsequently been physiologically prepared for a lashing out movement, as indexed by their increased post-manipulation cortisol levels during session 2. This high activation arousal would explain their strong post-manipulation performance, with moderate cortisol increases associated with improved performance (Eubank et al., 1997). It can therefore be inferred that both pleasant and unpleasant emotions are both potential performance catalysts, with both constructs capable of facilitating the achievement of sporting goals. However, there are inherent psychophysiological costs associated with the experience of unpleasant emotions, including anxiety (Campo et al., 2012), and heightened cortisol levels (Filaire et al., 2007; Smyth et al., 1998), which may result in long-term health implications (Burns, 2006). When compared with the aforementioned benefits of pleasant emotions, it is clear that athlete stakeholders should always look to facilitate pleasant emotional experiences over unpleasant experiences.

No significant effects were hypothesised in relation to the control group within this study. The analyses conducted revealed no significant performance, psychological, or salivary cortisol change, supporting my hypotheses. A number of conclusions can be drawn from these non-significant results. Firstly, it can be inferred that both the task and the neutral manipulation engendered within the control group do not induce any psychological or neuroendocrine response within athletes. Further, with no performance change detected over three days of testing, it can be determined that no practice effect exists within this research.

This suggests that the psychophysiological and performance changes witnessed within the pleasant and unpleasant emotional groups were solely due to the manipulations engendered. This further validates the FitLight as an effective and useful laboratory-based performance measure for psychophysiologists, as suggested by Laessoe et al. (2016) and Zwierko et al. (2014).

Based upon the findings presented within Chapters 5 and 6, it was hypothesised that further evidence would be found for the existence of the "broaden" and "build" (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) effects. The "broaden" effect was anticipated to be indexed by increased use of task-oriented coping strategies immediately post-manipulation, whilst evidence of the "build" effect could be suggested by increased levels task-oriented coping or resilience one week later within the pleasant emotions group. However, only limited findings were discovered in my analyses. Increases in task-oriented coping by the pleasant emotions group in relation to the control group were observed in sessions 2 and 3 (as well as the unpleasant emotions group during session 3), although these did not satisfy post-hoc testing criteria. However, very large effect sizes were observed in all three cases, providing partial support for the existence of such effects. The immediate increase and sustained usage of task-oriented coping strategies by the pleasant emotions group suggest that pleasant emotions may broaden one's attention to novel coping behaviours, which may build resources for future encounters. Research which possesses a greater sample of participants may subsequently have enough power to satisfy post-hoc tests to turn the partial support of this research for the broaden and build effects into potentially causal findings.

A number of interesting psychological and neuroendocrine responses were also evidenced within the analyses. Firstly, cortisol levels within the pleasant emotions group were found to spike during session 3, with levels gradually heightening across the session. Indeed, cortisol levels at the final sampling point were found to be larger than sessions 1 and

2 by very large effects. These findings suggest that the prospect of success is physiologically stressful when it is temporally close, and concurs with the findings of the neuroendocrine research conducted within Chapter 4. With heightened neuroendocrine response in relation to sporting success not heavily evidenced within the extant literature (Suay et al., 1999), the replication of this finding is significant and exciting. It is plausible that this stress may arise in an athlete through both the excitement of being close to achieving sporting success and the rewards that brings, as well as a potential fear that they make a crucial mistake and clutch defeat from the jaws of victory. Future research into the stress of winning, and what specifically elicits it, is essential. Finally, the unpleasant emotions group exhibited cortisol spikes during session 2 in comparison to sessions 1 and 3, indicating a correlation between unpleasant emotional experiences and heightened neuroendocrine response. It is notable that when unpleasant emotional experiences subsided from their high during session 2 back to lower levels during session 3, athlete cortisol levels followed suit. As such, whilst immediate neuroendocrine response was detected within this study, no long-term effects were found.

Participants within the pleasant emotions group also exhibited significantly lower levels of unpleasant emotions during their final testing session, providing tentative evidence of the "undoing effect" (Fredrickson et al., 2000) theorised within the BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002). Pleasant emotional experiences may therefore not only predict future experiences of pleasant emotions (as evidenced within Chapter 6), but also lessen the chance of future unpleasant emotional experiences. When considered in the context of the pleasant emotions salivary cortisol levels detailed above, such an effect suggests that cortisol spikes are potentially related high approach motivation pleasant emotions such as excitement (Gable & Harmon-Jones, 2008). Investigations into the exact relationship between specific emotions such as happiness, excitement, anger, and dejection, and subsequent psychophysiological response may aid psychological practitioners

in the development of tailored interventions for athletes. Such interventions may potentially be used to help athletes reach optimum psychological, approach motivation, and physiological states for performance.

Sustained psychological effects of unpleasant emotions were found within the unpleasant emotions group during session 3, concurring with predictions of BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002). Indeed, whilst the level of unpleasant emotions experienced during session 2 was significantly higher than sessions 1 or 3, session 3 levels were still significantly above those experienced by athletes within both the pleasant emotions and control group. What is more, it was discovered that athletes engendered with unpleasant emotions exhibited significantly lower levels of task-oriented coping strategies during session 3 than in session 1, despite no longer experiencing significantly high levels of unpleasant emotions. Whilst the experience of unpleasant emotions may be transient (Fredrickson, 2013, p. 3) and significantly decrease over time, their psychological and behavioural impact may not. With unpleasant emotions potentially leading to decreased usage in task-oriented coping strategies (as seen in Chapters 3, 4, 5, & 6), which themselves are associated with strong athletic performance, athlete performance and psychological resources may decrease over time. As such, decreases in task-oriented coping may be viewed as indicative of early downward spirals within athletes. Practitioner monitoring of athlete emotions via psychometrics and/or observation may therefore help prevent the negative impact of unpleasant emotions before they have the chance to exert an influence.

No significant results were found regarding athlete resilience levels across this research study. This finding may be due to the fact that trait resilience, rather that process-oriented resilience, was measured. This decision was taken as the RCDRS (Campbell-Sills & Stein, 2007) is currently the only measure of resilience within sport which has been validated among athletes (Gucciardi et al., 2011). However, reliance on a trait approach has been

criticised by scholars (Bonanno, 2012), with arguments made that resilience is a construct which develops in the context of person-environment interactions (Egeland, Carlson, & Sroufe, 1993; Fletcher & Sarkar, 2013). Indeed, there may not have been enough time between testing sessions for any significant "building" of trait resilience to take effect. The development of a process-oriented resilience scale for athletes would be of great use to the sport psychological literature (Galli & Gonzalez, 2015).

Further limitations of this research may be addressed within future studies. Firstly, whilst the FitLight is a novel sport-specific task for researchers to employ, its use does incur some methodological weaknesses. For example, with the sequence of each round randomly generated, some rounds may have favoured an athlete with a particular dominant hand. Further, a template in which athletes are required to move the entirety of their body would make the task more ecologically valid. To conduct such research, participant height and dominant hand would have to be controlled for. Whilst this was considered in the design of this study, space and time constraints dictated a more conservative use of the FitLight apparatus. Follow up research could examine a sport-specific laboratory task that allows the measurement of coping strategies such as "distancing". As in Chapter 4, the FitLight task was deemed unsuitable to accurately measure the coping strategies "distancing" and "seeking support". Follow up research that allows for these strategies to be employed whilst in a controlled environment will enable researchers to better understand the relationship between emotions, coping, and performance. Finally, a number of potentially interesting comparisons in neuroendocrine response across groups may have been missed within this study due to a lack of control of diurnal variation. An experimental pre-assessment which arranged participants according to baseline cortisol levels, who would then undergo the FitLight task at the same time of day would allow for comparisons to be made across manipulation groups. These comparisons would then allow for a direct assessment of the psychophysiological

impact of the emotional manipulations engendered and may uncover some key relationships. Such constraints would, however, be inevitably laborious.

To conclude, both pleasant and unpleasant emotions have a lasting psychophysiological and performance impact within athletes on an ecologically valid laboratory-based sporting task. Whilst emotions in general appear to be a significant performance catalyst regardless of orientation, unpleasant emotions are associated with long-term inhibitors of psychological resources and performance, such as downward spirals or unpleasant emotions. In contrast, pleasant emotions are not associated with such inhibitors. This represents the first experimental assessment regarding the suitability of the BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) within sport. Finally, the temporal imminence of success was again found to spike salivary cortisol levels. Athletes and their stakeholders are advised to undertake behaviours that increase the likelihood of pleasant emotional experiences in order to aid the achievement of athletic goals.

# Chapter 8:
# General Discussion

## 8.1. Summary

In this chapter, I discuss the aims, key findings, and implications of each of the studies conducted within this thesis, before acknowledging research limitations, and offering future research recommendations for scholars. Finally, concluding remarks are presented.

## 8.2. Epilogue

The research which underpins this thesis was undertaken within athletic populations to address the following aims: 1 – determine, if any, the psychological effects of stress appraisals and emotions; 2 - determine, if any, the neuroendocrine effects of stress appraisals and emotions; 3 - determine, if any, the performance impact of stress appraisals and emotions; and 4 – determine whether any of the aforementioned potential effects sustained over time.

This thesis is divided into five distinct, yet complimentary studies: two cross-sectional and psychometric-based studies, one longitudinal psychometric-based study, and two experimental laboratory-based sporting task studies. For the purposes of this research, three seminal psychological and psychophysiological theories guided the development of my study designs. My exploration of athlete stress appraisals was informed by Lazarus' (1991, 1999, 2000) cognitive-motivational-relational theory of emotions (CMR), whilst the potential longitudinal effects of emotions were influenced by the broaden-and-build theory of emotions (BaB; Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002)). Finally, the biopsychosocial model of challenge and threat states (BPSM; Blascovich, 2008) guided my psychophysiological study designs.

Chapter 3 consisted of a cross-sectional path analysis across the course of each participating athlete's relevant sporting competition. A sequential link from stress appraisals through to subjective measures of performance was found via athlete emotions and coping

behaviours. With past-oriented stress appraisals (that is, benefit and harm/loss) not measured in this study, both the findings and limitations of Chapter 3 guided the development of Chapter 4 – an experimental psychophysiological and performance analysis of Lazarus' (1991, 1999, 2000) full catalogue of stress appraisals via a laboratory-based cycling task. Stress appraisals significantly influenced psychophysiological response and performance, with past-oriented stress appraisals as autonomous and influential as future-oriented stress appraisals.

Given the importance of emotions within the stress process (Nicholls, Perry, & Calmeiro, 2014), Chapter 5 represents the first study to examine the applicability of BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) within athletes. On the basis of these findings, Chapter 6 was designed to mirror and build upon the findings of Chapter 5 through a six-month longitudinal design. It was established that pleasant emotions appear to be influential over the short- and long-term, including via an "undoing effect" (Fredrickson et al., 2000).

The empirical support for the BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) provided by Chapters 5 and 6 prompted the development of an experimental protocol, to examine whether emotions also influenced psychophysiological and performance response. This study was the basis of Chapter 7, and it was concluded that both unpleasant and pleasant emotions have psychophysiological and performance effects – both immediately, and sustained.

For the readers convenience, below I have concisely detailed the current understanding of the literature in relation to psychological, neuroendocrine, and performance response, before stating the contribution of this thesis to knowledge in these areas. As chapters within this thesis represent the first forays into particular concepts, such as the

causal psychophysiological and performance investigation of past-oriented stress appraisals, and the examination of BaB theory within sporting populations, the impact of this work is primarily considered with scholars from the field of sport psychology in mind. Indeed, it is hoped that this work and the findings within it shall encourage future research into promising concepts such as the influence of temporal orientation, with the view that the replication of such findings may then influence the dissemination of theory-guided interventions to coaches and athletes alike.

## 8.3. The Psychological Effects of Stress Appraisals and Emotions

### 8.3.1. Current Understanding of the Psychological Literature

Until recently, the extant literature (Nieuwenhuys, Hanin, et al., 2008; Raedeke & Smith, 2004; Thatcher & Day, 2008; Vast et al., 2010) had tended to investigate the key constructs within CMR theory (Lazarus, 1991, 1999, 2000) separately. However, scholars such as Nicholls et al. (2014) have begun to utilise statistical methodology such as structural equational modelling and path analysis to measure CMR theory as a sequential unit. Despite this, gaps still remain within the literature, especially in regards to past-oriented stress appraisals, which have only been investigated via qualitative methods (Didymus, 2017; Nicholls et al., 2011). Finally, whilst BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) has long been suggested as a potentially viable theory for an exploration of the effects of pleasant emotions within sporting populations (McCarthy, 2011; Nicholls, Perry, & Calmeiro, 2014; Tamminen et al., 2014), it has still not been empirically tested with athletes. This is despite the fact that a number of theorists have argued that pleasant emotions have a hugely important bearing on cognitive efficiency, performance, and psychological resources (Doron & Gaudreau, 2014; Estrada, Isen, & Young, 1997; Gaudreau et al., 2010; Laborde, Dosseville, & Kinrade, 2014; Schellenberg et al., 2013; Troop, Holbrey, & Treasure, 1998).

### 8.3.2. Contribution of this Thesis to Theoretical Understanding

In accordance with CMR theory (Lazarus, 1991, 1999, 2000), stress appraisals were found to have a sequential effect upon emotions and coping behaviours in Chapter 3, with partial support discovered within Chapter 4. As expected, challenge stress appraisals were associated with pleasant emotions and task-oriented coping strategies, whilst threat stress appraisals were associated with distraction- and disengagement-oriented coping strategies. Support for the impact of emotions on coping was found within Chapter 5, whilst the bi-directional nature of coping theorised by Folkman and Lazarus (1988) was evidenced by the longitudinal path analysis conducted within Chapter 6. Further, the research conducted within Chapter 4, relating to the stress appraisals of benefit and harm/loss, represents the first experimental investigation of psychological profiles for past-oriented stress appraisals. Taken together, these results provide unequivocal support for both the psychological influence of stress appraisals, and the application of CMR theory within sporting populations. The implications from this are simple – athlete stakeholders can apply stress appraisal interventions relating to athlete gains, or observe that an athlete may be formulating a loss stress appraisal, and subsequently have an expectation of the emotional and coping response that their athlete will exhibit. Such interventions to encourage gain stress appraisals can be based upon performance feedback, as witnessed within Chapter 4, or upon mental skills techniques such as imagery (Williams et al., 2010). Indeed, there is an extensive literature (Morris, Spittle, & Watt, 2005; Paivio, 1985; Smith, Wright, Allsopp, & Westhead, 2007) which details the employment of imagery inside and outside of the sporting arena, as well as its facilitative impact upon performance. For this purpose, stakeholders are referred to the PETTLEP model (Holmes & Collins, 2001) to develop an appropriate imagery-based stress appraisal intervention among athletes.

Cross-sectional and longitudinal evidence for the "broaden" and "build" effects (Fredrickson, 2001) was found within Chapters 5 and 6, with partial psychological support found within the experimental investigation undertaken within Chapter 7. Pleasant emotions were found to predict task-oriented coping, resilience, and future pleasant emotional experiences six months later, whilst task-oriented coping predicted resilience, future pleasant emotional experiences, and future task-oriented coping behaviours. Resilience positively predicted future resilience levels six months after the first assessment. Conversely, unpleasant emotions were related to disengagement-oriented coping (as witnessed in Chapter 3), lessened resilience, and future unpleasant emotional experiences. Clearly, whilst pleasant emotional experiences have been championed by both the BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) and this research, the possibility that unpleasant emotions may act as a catalyst towards narrowed attention and downward spirals should not be discounted by athletes and their stakeholders. Indeed, when these constructs are considered together, a plausible downward spiral cycle is not difficult to theorise. For example, a single experience of anger during a poor sporting display, whilst occasionally facilitative to performance, may cause an athlete to approach a stressor that they may be better off tactically evaluating first. A subsequent lack of success in dealing with the said stressor may result in an extreme level of unpleasant emotions and cortisol response, both of which are associated with decreased performance (Elloumi et al., 2008; Kivlighan et al., 2005; Nieuwenhuys, Hanin, et al., 2008). With past experiences influencing future stress appraisals (Lazarus; 1991, 1999, 2000), an athlete may be subsequently engendered with a threat stress appraisal, which as suggested within this thesis are associated with further unpleasant emotions and inhibitive coping strategies. Over time, such downward spirals will also decrease an athlete's resource levels. Taken together, such a path serves to highlight the influential nature of

unpleasant emotions, and the importance of pleasant emotional experiences in preserving psychological resources and high-performance levels.

Perhaps the most interesting finding, in light of the above downward spirals instigated by unpleasant emotions, was the discovery within Chapter 6 that the initially inverse relationship between unpleasant emotions and resilience was found to diminish over the six-month period. From this, it can be inferred that the increase of pleasant emotional experiences, and the broadened attention and heightened resource levels that resulted, gave rise to an "undoing" effect (Fredrickson et al., 2000) of pleasant emotions. Indeed, it appears that whilst unpleasant emotions may be the most frequently experienced emotions within sport (Nicholls, Hemmings, & Clough, 2010; Nicholls, Jones, Polman, & Borkoles, 2009), that pleasant emotions, with their "broadening", "building" (Fredrickson, 2001) and "undoing" effects (Fredrickson et al., 2000) may possess the ability to negate the inhibitive effects of unpleasant emotions – both in the short- and long-term.

The abovementioned chapters are, to the author's knowledge, the first examinations of BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) within sporting populations. It is hoped that this research shall inspire other scholars to investigate the potential of pleasant emotions within sport, which have remained under-investigated in relation to their unpleasant emotional counterparts.

## 8.4. The Neuroendocrine Effects of Stress Appraisals and Emotions

### 8.4.1. Current Understanding of the Psychological Literature

The BPSM of challenge and threat states (Blascovich, 2008) posits that threat states are the catalyst for hypothalamic–pituitary–adrenocortical (HPA) axis activation, leading to cortisol spikes. With HPA activation not occurring within a challenge state, cortisol response is inhibited. There has been some research which supports the claim that challenge stress appraisals quell cortisol levels (Quested et al., 2011), whilst threat stress appraisals increase

cortisol levels (Harvey et al., 2010). With challenge and threat stress appraisals intrinsically linked with pleasant and unpleasant emotions respectively, it is unsurprising that pleasant emotions have been related to lower cortisol levels (Smyth et al., 1998), with unpleasant emotions associated with heightened levels (Filaire et al., 2007). However, it has been noted that the act or potential of winning in sport may be linked to heightened neuroendocrine response (Suay et al., 1999), while subtle increases in cortisol levels may prepare an athlete for upcoming competition by facilitating a greater level of available energy during the start of their competitive experience (Salvador et al., 2003). Finally, as scholars have not investigated past-oriented stress appraisals from a psychophysiological perspective, there were no neuroendocrine profiles established for benefit or harm/loss athlete stress appraisals.

### 8.4.2. Contribution of this Thesis to Theoretical Understanding

In contrast to the literature, cortisol rises were discovered for both challenge and benefit stress appraisals within Chapter 4. Further, whilst the engendering of pleasant emotions appeared to reduce cortisol levels during the second testing session within Chapter 7, it was also observed that the pleasant emotions group exhibited a cortisol spike during their final session. With the cortisol spikes of the challenge, benefit, and pleasant emotions groups all occurring during the last day of testing, when the prospect of winning in their task was temporally imminent, this thesis represents the most replicable evidence of 'success stress' to date. As slight increases in cortisol levels are potentially beneficial to performance (Eubank et al., 1997), it is plausible that the HPA axis activation within athletes of these experimental groups may have helped athletes reach an ideal performance state (Salvador et al., 2003), especially when performance improvements were observed in the benefit and pleasant emotions groups. There are a number of credible explanations for the experience of 'success stress'. Firstly, emotions which are believed to be facilitative for performance, such as the excitement of potentially winning, may elicit a level of neuroendocrine response as an agent

directly engages with a stimulus due to a high level of approach motivation. Secondly, the appraisal that one is close to their goal may elicit a level of fear that they may lose – placing the individual in a clutch or choke situation (Otten, 2009). Thirdly, the aforementioned two scenarios could occur simultaneously – an athlete may be hopeful that they may win, whilst simultaneously fearing choking at the end. Indeed, Lazarus (2000) himself stated that the experience of an emotion of hope is often paired with that of anxiety – an emotional blend (Martinent et al., 2012) which encapsulates the theoretical experience of an athlete above. With these scenarios in mind, it would be particularly interesting to investigate potential cortisol response in relation to the experience of specific emotions (e.g. happiness, excitement, anger, sadness) in an attempt to narrow down or eliminate potential sources of 'success stress'. Finally, whilst Chapter 4 represents the first neuroendocrine profiling of benefit stress appraisals, there remains a host of other physiological measures on offer for future investigation. Indeed, future research could attempt to further profile benefit and harm/loss stress appraisals via both neuroendocrine and physiological markers. These markers include testosterone, heart rate variability, and quiet eye duration. Further, such markers could also be used to investigate the possibility of 'success stress'.

The increase in salivary cortisol levels within the threat and unpleasant emotions groups concurs with the extant literature. When an athlete is presented with a personally relevant situation in which their resources do not match the demands of the environment, they are likely to appraise the situation as a threat, and experience unpleasant emotions (Lazarus, 1991, 1999, 2000). This subsequently leads to HPA axis activation, resulting in an increased cortisol response (Seery, 2011). Interestingly, the harm/loss stress appraisal group did not follow such a pattern, with diminished cortisol levels reported in Chapter 4. This finding is particularly noteworthy, as it insinuates that temporal orientation may have a neuroendocrine influence which can override valence. With no neuroendocrine research conducted in regards

to harm/loss stress appraisals, Chapter 4 represents the first evidence of a potential harm/loss psychophysiological profile. If the findings reported are replicated in future studies, then distinct psychophysiological profiles for past-oriented stress appraisals may exist, with models such as the BPSM (Blascovich, 2008) having to be extended beyond solely future-oriented stress appraisals (e.g. challenge and threat) as a result. Admittedly, extensive future research would have to be conducted into past-oriented stress appraisals. Nonetheless, it is hoped that this thesis encourages further research into this prospect.

## 8.5. The Performance Effects of Stress Appraisals and Emotions

### 8.5.1. Current Understanding of the Psychological Literature

Numerous studies have been conducted in relation to the relationship between future-oriented stress appraisals and performance. Generally, challenge stress appraisals have been associated with improved performance, with threat stress appraisals associated with inhibited sporting performance (Freeman & Rees, 2009; Moore et al., 2012, 2013). However, some studies have found that a threat stress appraisal is associated with improved performance. In a study with high-level cricketers, Turner et al. (2013) discovered that whilst challenge stress appraisal participants generally performed better than athletes engendered with a threat stress appraisal, there were some athletes who bucked this trend. Athletes who possessed high levels of self-efficacy but were engendered with a threat stress appraisal still produced stronger sporting performance than some challenge stress appraisal participants. Turner and colleagues theorised that a resource such as self-efficacy may allow an athlete to react to a threatening situation in a way which maintained or improved performance but did not specify how one may do so. Finally, the relationship between the past-oriented stress appraisals of benefit and harm/loss and sporting performance has yet to be researched.

As with challenge and threat stress appraisals, pleasant and unpleasant emotions have been associated with improved and inhibited performance respectively (Erez & Isen, 2002;

Lane et al., 2010; Nicholls et al., 2012; Totterdell, 2000; Uphill et al., 2014). However, improved performance by athletes experiencing unpleasant emotions has been observed in some studies (Robazza & Bortoli, 2007; Skinner & Brewer, 2004; Terry & Slade, 1995; Woodman et al., 2009). Indeed, Woodman and colleagues discovered that the experience of anger was associated with enhanced gross muscular peak force performance, yet happiness produced no significant effect. This finding has in part been attributed to "approach motivation" (Gable & Harmon-Jones, 2008), where the specific action tendency of an emotion matches the demands of the sporting task (e.g. anger helping in a muscular strength task). Further, attention broadening emotions such as happiness may widen athlete attention on to stimuli irrelevant to the demands of a task. For example, the experience of happiness suggests a comfortable, stable environment which may help build long-term resources (Fredrickson, 2001), rather than providing an individual with an urgent need to focus on a particular stimuli.

### 8.5.2. Contribution of this Thesis to Theoretical Understanding

Challenge stress appraisals and pleasant emotions were associated with improved athletic performance in Chapters 3 and 7, with benefit stress appraisals also associated with improved performance in Chapter 4. These findings may be attributed to the increased levels of task-oriented coping behaviours undertaken by athletes experiencing gain stress appraisals and/or pleasant emotions, with higher levels of such strategies observed in Chapters 3, 4, 5, and 6. Whilst no coping strategy is universally performance facilitative (Folkman, 1992), task-oriented coping behaviours have been associated with improved performance in a range of studies (Doron & Gaudreau, 2014; Gaudreau et al., 2010; Laborde, Dosseville, & Kinrade, 2014; Nicholls, Taylor, et al., 2016; Schellenberg et al., 2013). Further, and as noted above, moderate increases in cortisol levels observed within the challenge and benefit participant groups may have also helped athletes reach a facilitative physiological performance state

(Salvador et al., 2003). This thesis therefore provides near unanimous support for the performance benefits of gain stress appraisals and pleasant emotions, and aligns itself with the majority of the sport psychological literature. Further, this thesis represents the first documentation of the performance impact of benefit stress appraisals.

The performance impact of threat stress appraisals was mixed. Whilst the results of Chapter 3 portrayed an unanimously negative impact upon performance, the results of Chapter 4 suggested that such appraisals can be both facilitative and detrimental to performance. Taken as a whole, this reflects the nature of the current literature, and suggests that there may be underlying traits such as self-efficacy that influence the impact of stress appraisals. Unfortunately, self-efficacy was not examined, and remains an avenue that scholars may wish to investigate in the future. Finally, in relation to stress appraisals, the engenderment and experience of harm/loss stress appraisals in Chapter 4 was almost unanimously inhibitive to sporting performance. This is of particular interest to sport psychological researchers, as when compared to the cycling performance of the threat group in Chapter 4, it suggests temporal orientation may have a significant performance impact, even when valence is taken into account. Indeed, highlighting the potential impact temporal orientation may have on psychological, neuroendocrine, and performance response is arguably the strongest contribution to knowledge made within this thesis, with future research into its influence highly recommended to scholars.

In regards to unpleasant emotions, a performance improvement was detected within Chapter 7. Firstly, this finding reinforces the use of the terminology of "pleasant" and "unpleasant" emotions, as directed by Jones, Lane, Bray, Uphill, and Catlin (2005), as unpleasant emotions do not necessarily prove deleterious to performance proficiency. Secondly, further support can be inferred for the concept of "approach motivation" (Gable & Harmon-Jones, 2008) influencing sporting performance. For example, the specific action

tendency of the highly approached motivated emotion anger is to “attack in anger” (Fredrickson & Branigan, 2005), which such a striking motion potentially similar to the actions undertaken by athletes within the FitLight task. Future research into both pleasant and unpleasant emotions could further knowledge through use of open- and closed-skill tasks in which strong performance requires either broadened or narrowed attention. What is more, scholars should look to engender a range of both pleasant and unpleasant emotions further distinguished by their approach motivation, in order to see both their psychophysiological and performance effects. It is hoped that research such as this could establish specific performance facilitative emotions for specific sporting tasks.

Notably, there was no performance change in the control groups examined within Chapters 4 and 7. This lack of performance change serves to further highlight the potentially causal nature of both stress appraisals and emotions on subsequent sporting performance. Furthermore, the consistent performances produced both on the 16.1km SRM cycling task and FitLight reaction time task provide a level of validation for the use of these protocols in examining laboratory-based athletic performance. With one-shot physiological performance protocols such as those employed within Hatzigeorgiadis (2006) open to extraneous influences such as glycogen depletion, and skill tasks such as free-throw basketball shooting tasks vulnerable to performance variability outside of stress appraisal or emotional manipulation (Vast, Young, & Thomas, 2011), the longitudinal and controlled nature of both experimental protocols employed within this thesis are a particular strength. Scholars are advised to consider both tasks as potentially fruitful to any future stress appraisal and/or emotionally-based performance research.

## 8.6. Thesis Limitations

The failure to include benefit and harm/loss in the path analysis conducted in Chapter 3 is an opportunity missed for potentially helping to form the psychological profile of these stress appraisals. With a sample of 192 athletes, the increased power that this would have yielded may have helped the discovery of concrete paths between past-oriented stress appraisals, emotions, coping, and goal attainment. Scholars may wish to address this scientific lacuna through the use of psychometrics across the course of multiple matches or competitions.

While both experimental Chapters were subject to power analyses, it could be contended that the sample sizes of these studies could have been larger. With samples of six and seven per experimental group in Chapters 4 and 7 respectively, it is plausible that a single confounding participant could have an influence on the outcomes derived from either the SRM or FitLight studies. This could in part explain why there were some partial psychological findings observed, such as in relation to task-oriented coping strategies within Chapter 7. Ultimately, the generality of research that greater the power of a sample, the greater the generalisability of the findings remains. Of course, the reality of acquiring suitably qualified participants during the course of a research period means that this statement is still a generality.

Individual variation in natural cortisol levels (Hruschka, Kohrt, & Worthman, 2005) limited the investigations of cortisol response within Chapters 4 and 7. Due to the inherent difficulties of allocating participants to experimental groups based on cortisol levels presumably measured during a pre-testing screening, the decision was taken to exclude neuroendocrine response comparisons across groups. Development of stress appraisal and

emotional neuroendocrine profiles could occur through use of pre-testing screening, whilst standardising participant wake-up and testing times might also be considered.

As documented within the literature review of this thesis, the use of dispositional assessment methods is dependent on athlete recall (Folkman & Moskowitz, 2004). This methodology has limitations as accurate recall for psychological constructs may be reliable for as little as 48 hours (Thomas et al., 2011). Unfortunately, the recall period of some athletes within Chapters 5 and 6 will have undoubtedly exceeded this. The decision to employ dispositional assessments was taken after much due consideration of both the benefits and limitations of this methodology (please refer to the discussion sections of Chapters 5 and 6, 5.5 and 6.5 respectively, for a critical review of this matter). Ultimately, it was decided that the use of a process-oriented design across a period as long as six months would lead to significant participant attrition, especially with athletes having to be in season at both measurement points. Whilst a number of interesting and robust paths were found in the resulting path analyses, perhaps the decision to employ a dispositional approach was somewhat cautious.

Upon reflection, I feel that the exploration of gender differences in sporting performance and psychophysiological response is a fruitful area for future research, and one that should have received more attention during my research. Whilst the research within Chapter 4 did examine gender differences and found no psychophysiological or performance differences, the research conducted within Chapters 3, 5, 6, and 7 could have further contributed to an area where knowledge is equivocal. Indeed, with emotion theorised by Lazarus (1999) to be a superordinate system including stress, emotion, and coping, the longitudinal examination of the BaB theory of emotions (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) within Chapter 6 may have had sufficient time for gender differences in emotions and coping to become apparent. This could have led to a significant

contribution to knowledge in the literature, and as such, is an area highly recommended for future empirical attention.

## 8.7. Future Research Recommendations and Directions

With repeated developments in the sampling and analysis of neuroendocrine and physiological markers, along with gaps of knowledge relating to physiological profiles of stress appraisals, there has never been a more opportune moment for psychophysiological scholars to develop the extant literature. Along with cortisol, other psychophysiological markers include: testosterone, which has been associated with faster reaction time, assertiveness, and cardiovascular efficiency (Neave & Wolfson, 2005); heart rate variability, a physiologic substrate used as a stress marker and indicator of cognitive processing (Laborde et al., 2011); and quiet eye duration, in which athlete attentional efficiency can be monitored (Moore et al., 2012). Contemporary research has even moved towards genetics research, with the serotonin transporter promoter polymorphism '5HTTLPR' associated with decreased emotional resilience (Stein, Campbell-Sills, & Gelernter, 2009). Aside from testosterone, the remaining psychophysiological markers mentioned have rarely (if at all) been researched in relation to stress appraisals and emotions in sport. Research in which stress appraisals and/or emotions are engendered within athletes and measured across the course of a real-life or laboratory-based sporting competition could aid understanding of how sympathetic-adrenomedullary (SA) and HPA axis activation relates to athlete reappraisal, emotional experiences, coping behaviours undertaken, task performance, and the temporal imminence of potential success (or 'success stress'). The development of psychophysiological stress appraisal and emotional profiles has been repeatedly suggested throughout this thesis for the real-world implications this could have for modern-day athletes. Indeed, it is plausible that elite-level sporting teams would be able to use such psychophysiological markers to monitor their athletes to try and ensure they are in an optimum performance state. For example,

knowledge of how stress appraisals and emotions influence SA and HPA axis activation could be used to engender a specific approach-motivated emotion labelled as a HPA axis catalyst in order to raise salivary cortisol levels to performance beneficial levels (Eubank et al., 1997). While this level of knowledge within the sport psychophysiological literature is a long way off, the abovementioned techniques offer undoubted opportunities for scholars to make key contributions.

This thesis represents the first laboratory-based psychological examination of past-oriented stress appraisals. As with the physiological profiles described above, there is real-life value to the development of psychological profiles and their subsequent psychophysiological and performance effects. However, there is much research, both in the field and in the laboratory, to be done in relation to the development of psychological profiles for past-oriented stress appraisals. Until such work is undertaken, there will not be a thorough understanding of Lazarus' (1991, 1999, 2000) full stress appraisal catalogue derived from CMR theory for its application within sport. Fortunately, the experimental protocols used within this thesis have shown promise as reliable recreations of sporting tasks and environments, whilst the use of one-shot psychometric path analyses or structural equational modelling (Nicholls, Perry, & Calmeiro, 2014; Nicholls et al., 2012) are becoming the gold standard for sport psychological field research. Scholars would do well to utilise and build upon such techniques in order to increase knowledge of CMR theory.

Researchers within the field of sport psychology may also wish to consider the combination of trait and state approaches within a singular research design. For example, research could examine how consistent personality constructs such as those within the "Big Five" (i.e. conscientiousness, agreeableness, neuroticism, openness, & extraversion; Goldberg, 1993) may impact subsequent appraisal, or alternatively how appraisal may override personality traits. Indeed, when one considers the negative impact personality types

such as type D (Polman, Borkoles, & Nicholls, 2010) can have upon athletes (such as burnout and athlete withdrawal), state-based interventions could offer a positive and adaptive solution to athletes. Scholars within the literature have already begun to advocate a combined state-trait approach to athlete coping behaviours (Anshel & Si, 2008; Gaudreau & Miranda, 2010).

Following on from the lack of investigation into gender differences listed in the Thesis Limitations section above (8.6), a strong recommendation for sport psychological researchers is to explore gender differences in appraisal through the lens of the situational hypothesis (Rosario, Shinn, Mørch, & Huckabee, 1988). The situational hypothesis suggests that when males and females experience a stressor under the same conditions, gender coping differences dissipate. With no gender differences discovered within the research of Chapter 4, where stress appraisals were engendered within a controlled environment, this research joins the work of Kaiseler, Polman, and Nicholls (2013) in providing preliminary support for the situational hypothesis. Future research could look to further causally examine the situational hypothesis within the confines of a controlled laboratory environment across a range of sporting tasks (e.g. free-throw basketball shooting task), which may alter how individuals of both genders subsequently cope.

As identified within Chapter 7, this thesis employed a dispositional measurement of athlete resilience levels through use of the Revised Connor-Davidson Resilience Scale (RCDRS; Campbell-Sills & Stein, 2007). At the time of writing, the RCDRS is the only validated measure of resilience levels within sporting populations, which lead to the decision to use it within this research. Unfortunately, contemporary research has recommended a shift away from dispositional measures of resilience (Bonanno, 2012) in favour of a process approach (Fletcher & Sarkar, 2013). Considering these findings, a validated process-oriented scale of resilience levels within athletes is undoubtedly required. The development of such a psychometric would be of great benefit to both field and laboratory-based researchers,

particularly in relation to potential interactions between pleasant emotions and resources such as resilience, as theorised within BaB theory (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002).

## 8.8. Conclusion

This research programme was undertaken with the predominant aim of furthering extant knowledge in relation to the potential psychological, neuroendocrine, and performance influence of athlete stress appraisals and emotions. A series of eight chapters have introduced the subject area, examined the existing literature and identified theoretical niches within it, and developed five complimentary studies rooted within CMR (Lazarus; 1991, 1999, 2000) and BaB (Fredrickson, 1998, 2001; Fredrickson & Joiner, 2002) theories. The results of these studies present the first experimentally based support for the full catalogue of stress appraisals within CMR theory, as well as the first applications of BaB theory within sporting populations, and can be viewed as novel contributions. Further, there is detailed evidence of a potential 'success stress' physiological response, as well as a longitudinal examination of emotions in sport and their subsequent psychological influence. Past-oriented stress appraisals may be viewed as autonomous from future-oriented stress appraisals, with their own psychophysiological profiles. The engenderment of pleasant emotions broadens athlete attention towards more facilitative coping, builds enduring coping resources, aids performance, and potentially undoes inhibitive psychological effects from previous unpleasant emotional experiences. Threat stress appraisals and unpleasant emotions may initially aid performance, but are associated with increased psychophysiological stress, which may have long-term negative effects. Policy makers within a sporting context should consider ways to promote team environments and climates which facilitate the long-term development of pleasant emotions within athletes. Sport psychological practitioners and athlete stakeholders should also look to monitor athlete stress appraisals and emotional states, and

attempt to orient their client in ways that facilitate challenging yet pleasant future person-environment interactions. This may include, but is not limited to, performance feedback and/or mental imagery.

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# Appendices

## Appendix A: Questionnaire Pack (Chapter 3)

# Goals, Stress Appraisals, Emotions, Coping, and Goal Attainment

Instructions:

1. Please read the participation information sheet and complete the consent form

2. Complete **Questionnaires 1 & 2 the night before the competition, Questionnaire 3 up to three hours before the competition starts, and Questionnaires 4 & 5 within 3 hours of the competition finishing**

THANK YOU FOR YOUR PARTICIPATION

## Participant Information Sheet

**Purpose and Background:**

**The purpose of this study is to how sport participants cope and think about competition. This information will be useful for sport psychology researchers because it will enable us to understand more about how coping and thoughts are related to performance. The results of this study will help in the development of psychological skills training programmes which aims to improve sport performance.**

**Procedures:**

The study would involve you completing five short questionnaires. It should take you no longer than 15 minutes to complete each questionnaire. If you wish to participate in this study, please sign the consent form provided.

**Benefits:**

The information collected will be analysed and written up in a report. This report should contain information to help coaches and sport psychologists better understand psychological aspects sport participation.

**Risks:**

The only risk associated with participation in this questionnaire study relates to the potential disclosure of personal or sensitive information.

**Confidentiality:**

To ensure anonymity, personal information will be coded by number and stored in a locked office to which only the investigators will have access. Data will be retained for a period of five years after publication, after which they will be destroyed. No information reported will ever be directly attributed to you.

**Freedom to withdraw:**

You are free to withdraw at any time with no questions asked. If you decline to continue, or if you withdraw from the project your information will be removed from the study.

## *CONSENT FORM*

Do you understand that you have been asked to be in a research study? Yes No

Have you received and read a copy of the Information Letter? Yes No

Do you understand that you are free to refuse to participate, or to withdraw from the study at any time, without consequence? Yes No

Do you understand that your information will be withdrawn from the Study at your request? Yes No

Has the issue of confidentiality been explained to you? Yes No

_____ _____ _____

Signature of Research Participant Printed name Date

## *DEMOGRAPHIC INFORMATION*

**In order for us to describe the people we collect data from we need some background information. This information is completely confidential.**

Age: _____ Gender (please circle): MALE / FEMALE Sport: _____

Position:_____ Team_____ Years played_____

**Highest playing level** (please circle):

BEGINNER CLUB/UNIVERSITY COUNTY NATIONAL INTERNATIONAL

**Ethnic Group**: Please indicate which ethnic group most closely resembles your ethnic origin

| | | | |
|---|---|---|---|
| Asian or Asian British - Indian | | Mixed Black Caribbean and White | |
| Asian or Asian British - Pakistani | | Mixed Black African and White | |
| Asian or Asian British - Bangladeshi | | Mixed Asian and White | |
| Chinese | | Other Mixed | |
| Other Asian Background | | Other Ethnic Group | |
| Black or Black British – Caribbean | | White – British | |
| Black or Black British - African | | White – Irish | |
| Other Black Background | | Other White | |

We realise that this coding system may not be fully representative of all ethnic groups and therefore if you would like to indicate an alternative ethnic group please do so below:

**Precompetitive Appraisal Measure (PAM)**

Questionnaire 1 –Goals Questionnaire

| The following statements ask about the thoughts and feelings you are having about your upcoming competition right now. Please circle the appropriate number to the right of each statement to indicate to what extent you agree with this statement. | **Strongly Disagree** | | | | | | | | **Strongly Agree** |
|---|---|---|---|---|---|---|---|---|---|
| 1. The upcoming competition is important to me | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 2. In the upcoming competition, there is a lot at stake | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 3. Performing well in the upcoming competition is desirable to me | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 4. I'm in control of the upcoming competition | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 5. I'm responsible for the upcoming competition | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 6. I have the resources to cope with the upcoming competition | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 7. The upcoming competition is likely to result in a positive outcome for me | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

**Stress Appraisal Measure (SAM)**

Questionnaire 2 – Appraisal in Sport

| This survey is concerned with your thoughts about competing in sport. Please rate the degree to which the following statements apply to you. | **Not at all** | **Slightly** | **Moderately** | **Considerably** | **Extremely** |
|---|---|---|---|---|---|
| 1. Thinking about competing tomorrow is making me feel anxious | 1 | 2 | 3 | 4 | 5 |
| 2. I feel positive about tomorrow's competition | 1 | 2 | 3 | 4 | 5 |
| 3. I think that the outcome of tomorrow's matches/competitions will be negative and that I will lose | 1 | 2 | 3 | 4 | 5 |
| 4. I am keen to compete in my sport tomorrow | 1 | 2 | 3 | 4 | 5 |
| 5. I feel threatened and worried about tomorrow's competition | 1 | 2 | 3 | 4 | 5 |
| 6. I can become a stronger person by competing tomorrow | 1 | 2 | 3 | 4 | 5 |
| 7. Competing tomorrow has negative consequences for me | 1 | 2 | 3 | 4 | 5 |
| 8. I am excited about playing in the competition tomorrow | 1 | 2 | 3 | 4 | 5 |

**Sports Emotion Questionnaire (SEQ)**

Questionnaire 3: Emotions in Sport

Below you will find a list of words that describe a range of feelings that sport performers may experience. Please read each one carefully and indicate on the scale next to each item how you feel *right now, at this moment, in relation to your upcoming competition.* There are no right or wrong answers. Do not spend too much time on any one item, but choose the answer which best describes your feelings right now in relation to the upcoming competition.

| | **Not at all** | **A little** | **Moderately** | **Quite a bit** | **Extremely** |
|---|---|---|---|---|---|
| Uneasy | 1 | 2 | 3 | 4 | 5 |
| Upset | 1 | 2 | 3 | 4 | 5 |
| Exhilarated | 1 | 2 | 3 | 4 | 5 |
| Irritated | 1 | 2 | 3 | 4 | 5 |
| Pleased | 1 | 2 | 3 | 4 | 5 |
| Tense | 1 | 2 | 3 | 4 | 5 |
| Sad | 1 | 2 | 3 | 4 | 5 |
| Excited | 1 | 2 | 3 | 4 | 5 |
| Furious | 1 | 2 | 3 | 4 | 5 |
| Joyful | 1 | 2 | 3 | 4 | 5 |
| Nervous | 1 | 2 | 3 | 4 | 5 |
| Unhappy | 1 | 2 | 3 | 4 | 5 |
| Enthusiastic | 1 | 2 | 3 | 4 | 5 |
| Annoyed | 1 | 2 | 3 | 4 | 5 |
| Cheerful | 1 | 2 | 3 | 4 | 5 |
| Apprehensive | 1 | 2 | 3 | 4 | 5 |
| Disappointed | 1 | 2 | 3 | 4 | 5 |
| Energetic | 1 | 2 | 3 | 4 | 5 |
| Angry | 1 | 2 | 3 | 4 | 5 |
| Happy | 1 | 2 | 3 | 4 | 5 |
| Anxious | 1 | 2 | 3 | 4 | 5 |
| Dejected | 1 | 2 | 3 | 4 | 5 |

**Coping Inventory for Competitive Sports (CICS)**

Questionnaire 4: Coping in Sport

Each question represents things that athletes can do or think during sport. For each question your must indicate the extent to which it corresponds to ***what you did during your competition***.

1. Does not correspond at all to what I did or thought
2. Corresponds a little to what I did or thought
3. Corresponds moderately to what I did or thought
4. Corresponds strongly to what I did or thought
5. Corresponds very strongly to what I did or what I thought

| | Not At All | A Little | Moderately | Strongly | Very Strongly |
|---|---|---|---|---|---|
| 1. I visualised that I am in total control of the situation | 1 | 2 | 3 | 4 | 5 |
| 2. I use swear words loudly or in my head in order to expel anger | 1 | 2 | 3 | 4 | 5 |
| 3. I keep my distance from others | 1 | 2 | 3 | 4 | 5 |
| 4. I commit myself by giving a consistent effort | 1 | 2 | 3 | 4 | 5 |
| 5. I occupy my mind in order to think about other things than the competition | 1 | 2 | 3 | 4 | 5 |
| 6. I try not to be intimidated by other athletes | 1 | 2 | 3 | 4 | 5 |
| 7. I ask someone for advice concerning my mental preparation | 1 | 2 | 3 | 4 | 5 |
| 8. I try to relax my body | 1 | 2 | 3 | 4 | 5 |
| 9. I analyse my last performance | 1 | 2 | 3 | 4 | 5 |
| 10. I lose all hope of attaining my goal | 1 | 2 | 3 | 4 | 5 |
| 11. I mentally rehearse the execution of my movements | 1 | 2 | 3 | 4 | 5 |
| 12. I get angry | 1 | 2 | 3 | 4 | 5 |
| 13. I retreat to a place where it is easy to think | 1 | 2 | 3 | 4 | 5 |
| 14. I give a relentless effort | 1 | 2 | 3 | 4 | 5 |
| 15. I think about another hobby in order not to think about the competition | 1 | 2 | 3 | 4 | 5 |

| | | | | | |
|---|---|---|---|---|---|
| 16. I try to get rid of my doubts by thinking positively | 1 | 2 | 3 | 4 | 5 |
| 17. I ask other athletes for advice | 1 | 2 | 3 | 4 | 5 |
| 18. I try to reduce the tension in my muscles | 1 | 2 | 3 | 4 | 5 |
| 19. I analyse the weaknesses of my opponents | 1 | 2 | 3 | 4 | 5 |
| 20. I let myself feel hopeless and discouraged | 1 | 2 | 3 | 4 | 5 |
| 21. I visualise myself doing a good performance | 1 | 2 | 3 | 4 | 5 |
| 22. I express my discontent | 1 | 2 | 3 | 4 | 5 |
| 23. I keep all people at a distance | 1 | 2 | 3 | 4 | 5 |
| 24. I give my best effort | 1 | 2 | 3 | 4 | 5 |
| 25. I entertain myself in order not to think about the competition | 1 | 2 | 3 | 4 | 5 |
| 26. I replace my negative thoughts with positive ones | 1 | 2 | 3 | 4 | 5 |
| 27. I talk to a trustworthy person | 1 | 2 | 3 | 4 | 5 |
| 28. I do some relaxation exercises | 1 | 2 | 3 | 4 | 5 |
| 29. I think about possible solutions to manage the situation | 1 | 2 | 3 | 4 | 5 |
| 30. I wish that the competition would end immediately | 1 | 2 | 3 | 4 | 5 |
| 31. I visualise my all time best performance | 1 | 2 | 3 | 4 | 5 |
| 32. I express my frustrations | 1 | 2 | 3 | 4 | 5 |
| 33. I search for calmness and quietness | 1 | 2 | 3 | 4 | 5 |
| 34. I try not to think about my mistakes | 1 | 2 | 3 | 4 | 5 |
| 35. I talk to someone who was able to motivate me | 1 | 2 | 3 | 4 | 5 |
| 36. I relax my muscles | 1 | 2 | 3 | 4 | 5 |
| 37. I analyse the demands of the competition | 1 | 2 | 3 | 4 | 5 |
| 38. I stop believing in my ability to attain my goal | 1 | 2 | 3 | 4 | 5 |
| 39. I think about my family or friends to distract myself | 1 | 2 | 3 | 4 | 5 |

**Attainment of Sport Achievement Goals Scale (A-SAGS)**

Questionnaire 5: Goal Attainment

| Using the scale below, indicate the extent to which the following items correspond to your performance **competition today.** | **Not At All** | | | | | | **Very Strongly** |
|---|---|---|---|---|---|---|---|
| 1. Executed my movements correctly | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. Did my best performance of the season | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. Showed that I am superior to other athletes | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. Provided a quality effort | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. Did better than my usual performances | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. Outperformed other athletes | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. Concentrated on the task at hand | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. Did better than my previous performances | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. Showed that I am part of the best | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. Mastered the difficulties of the situation | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 11. Performed better than my personal standards | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 12. Did better than most other athletes | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**Appendix B: Questionnaire Pack (Chapter 4)**

# Goals, Stress Appraisals, Emotions and Coping

Instructions:

3. Please read the participation information sheet and complete the consent form

4. Complete **Questionnaires 1, 2, & 3 before the time trial, and Questionnaire 4 & 5 after the time trial.**

THANK YOU FOR YOUR PARTICIPATION

**Precompetitive Appraisal Measure (PAM)**

Questionnaire 1 –Goals Questionnaire

| The following statements ask about the thoughts and feelings you are having about your upcoming task right now. Please circle the appropriate number to the right of each statement to indicate to what extent you agree with this statement. | **Strongly Disagree** | | | | | | | | **Strongly Agree** |
|---|---|---|---|---|---|---|---|---|---|
| 1. The upcoming task is important to me | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 2. In the upcoming task, there is a lot at stake | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 3. Performing well in the upcoming task is desirable to me | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 4. I'm in control of the upcoming task | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 5. I'm responsible for the upcoming task | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 6. I have the resources to cope with the upcoming task | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 7. The upcoming task is likely to result in a positive outcome for me | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

**Stress Appraisal Measure (SAM)**

Questionnaire 2 – Appraisal in Sport

| This survey is concerned with your thoughts about competing in this task. Please rate the degree to which the following statements apply to you. | **Not at all** | **Slightly** | **Moderately** | **Considerably** | **Extremely** |
|---|---|---|---|---|---|
| 1. Thinking about competing today is making me feel anxious | 1 | 2 | 3 | 5 | 5 |
| 2. I feel positive about today's task | 1 | 2 | 3 | 5 | 5 |
| 3. I think that the outcome of today will be negative and that I will lose | 1 | 2 | 3 | 5 | 5 |
| 4. I am keen to compete today | 1 | 2 | 3 | 5 | 5 |
| 5. I feel threatened and worried about today's task | 1 | 2 | 3 | 5 | 5 |
| 6. I can become a stronger person by competing today | 1 | 2 | 3 | 5 | 5 |
| 7. Competing today has negative consequences for me | 1 | 2 | 3 | 5 | 5 |
| 8. I am excited about participating today | 1 | 2 | 3 | 4 | 5 |

**Sports Emotion Questionnaire (SEQ)**

Questionnaire 3: Emotions in Sport

Below you will find a list of words that describe a range of feelings that someone may experience during this task. Please read each one carefully and indicate on the scale next to each item how you feel *right now, at this moment, in relation to this task.* There are no right or wrong answers. Do not spend too much time on any one item, but choose the answer which best describes your feelings right now in relation to the task.

| | **Not at all** | **A little** | **Moderately** | **Quite a bit** | **Extremely** |
|---|---|---|---|---|---|
| Uneasy | 1 | 2 | 3 | 4 | 5 |
| Upset | 1 | 2 | 3 | 4 | 5 |
| Exhilarated | 1 | 2 | 3 | 4 | 5 |
| Irritated | 1 | 2 | 3 | 4 | 5 |
| Pleased | 1 | 2 | 3 | 4 | 5 |
| Tense | 1 | 2 | 3 | 4 | 5 |
| Sad | 1 | 2 | 3 | 4 | 5 |
| Excited | 1 | 2 | 3 | 4 | 5 |
| Furious | 1 | 2 | 3 | 4 | 5 |
| Joyful | 1 | 2 | 3 | 4 | 5 |
| Nervous | 1 | 2 | 3 | 4 | 5 |
| Unhappy | 1 | 2 | 3 | 4 | 5 |
| Enthusiastic | 1 | 2 | 3 | 4 | 5 |
| Annoyed | 1 | 2 | 3 | 4 | 5 |
| Cheerful | 1 | 2 | 3 | 4 | 5 |
| Apprehensive | 1 | 2 | 3 | 4 | 5 |
| Disappointed | 1 | 2 | 3 | 4 | 5 |
| Energetic | 1 | 2 | 3 | 4 | 5 |
| Angry | 1 | 2 | 3 | 4 | 5 |
| Happy | 1 | 2 | 3 | 4 | 5 |
| Anxious | 1 | 2 | 3 | 4 | 5 |
| Dejected | 1 | 2 | 3 | 4 | 5 |

**Coping Inventory for Competitive Sport (CICS) - Amended**

Questionnaire 4: Coping in Sport

Each question represents things that someone may think or do during this task. For each question your must indicate the extent to which it corresponds to ***what you did during your time trial***.

1. Does not correspond at all to what I did or thought
2. Corresponds a little to what I did or thought
3. Corresponds moderately to what I did or thought
4. Corresponds strongly to what I did or thought
5. Corresponds very strongly to what I did or what I thought

| | Not At All | A Little | Moderately | Strongly | Very Strongly |
|---|---|---|---|---|---|
| 1. I visualised that I was in total control of the situation | 1 | 2 | 3 | 4 | 5 |
| 2. I used swear words loudly or in my head in order to expel anger | 1 | 2 | 3 | 4 | 5 |
| 3. I committed myself by giving a consistent effort | 1 | 2 | 3 | 4 | 5 |
| 4. I occupied my mind in order to think about other things than the task | 1 | 2 | 3 | 4 | 5 |
| 5. I lost all hope of attaining my goal | 1 | 2 | 3 | 4 | 5 |
| 6. I tried to relax my body | 1 | 2 | 3 | 4 | 5 |
| 7. I analysed my performance as the task progressed | 1 | 2 | 3 | 4 | 5 |
| 8. I got angry | 1 | 2 | 3 | 4 | 5 |
| 9. I focussed on my own performance | 1 | 2 | 3 | 4 | 5 |
| 10. I gave a relentless effort | 1 | 2 | 3 | 4 | 5 |
| 11. I thought about other things in order not to think about the task | 1 | 2 | 3 | 4 | 5 |
| 12. I tried to reduce the tension in my muscles | 1 | 2 | 3 | 4 | 5 |
| 13. I let myself feel hopeless and discouraged | 1 | 2 | 3 | 4 | 5 |
| 14. I tried to get rid of my doubts by thinking positively | 1 | 2 | 3 | 4 | 5 |
| 15. I expressed my discontent | 1 | 2 | 3 | 4 | 5 |

| | | | | | |
|---|---|---|---|---|---|
| 16. I visualised myself doing a good performance | 1 | 2 | 3 | 4 | 5 |
| 17. I gave my best effort | 1 | 2 | 3 | 4 | 5 |
| 18. I entertained myself in order not to think about the task | 1 | 2 | 3 | 4 | 5 |
| 19. I thought logically about how to manage my performance | 1 | 2 | 3 | 4 | 5 |
| 20. I replaced my negative thoughts with positive ones | 1 | 2 | 3 | 4 | 5 |
| 21. I wished that the competition would end immediately | 1 | 2 | 3 | 4 | 5 |
| 22. I visualised a winning performance | 1 | 2 | 3 | 4 | 5 |
| 23. I expressed my frustrations | 1 | 2 | 3 | 4 | 5 |
| 24. I tried not to think about my fatigue | 1 | 2 | 3 | 4 | 5 |
| 25. I relaxed my muscles | 1 | 2 | 3 | 4 | 5 |
| 26. I analysed the demands of the task | 1 | 2 | 3 | 4 | 5 |
| 27. I stopped believing in my ability to attain my goal | 1 | 2 | 3 | 4 | 5 |
| 28. I thought about others to distract myself | 1 | 2 | 3 | 4 | 5 |

**Stress Appraisal Measure (SAM) - Amended**

Questionnaire 5 – Appraisal in Sport

| This survey is concerned with your thoughts about competing in this task. Please rate the degree to which the following statements apply to you. | **Not at all** | **Slightly** | **Moderately** | **Considerably** | **Extremely** |
|---|---|---|---|---|---|
| 1. I was not able to perform how I wanted | 1 | 2 | 3 | 4 | 5 |
| 2. I've shown that I have the resources to be successful | 1 | 2 | 3 | 4 | 5 |
| 3. I was not as good as I thought I would be | 1 | 2 | 3 | 4 | 5 |
| 4. I handled today's task well | 1 | 2 | 3 | 4 | 5 |
| 5. I felt stressed because I wanted to perform better | 1 | 2 | 3 | 4 | 5 |
| 6. I've shown that I am a capable athlete | 1 | 2 | 3 | 4 | 5 |
| 7. I felt disappointed with my performance | 1 | 2 | 3 | 4 | 5 |
| 8. I've exceeded the standards that I set myself | 1 | 2 | 3 | 4 | 5 |

## Appendix C: Questionnaire Pack (Chapter 5)

# Broaden-and-Build Theory of Positive Emotions study

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You are invited to take part in a research study by a Sport Psychology PhD Researcher at The University of Hull.

Please take time to read this Participant Information Sheet and discuss it with others if you wish. If you have any queries, please email the principal investigator (mark.thompson@hull.ac.uk).

In Psychology, it has been suggested that experiencing positive emotions may increase confidence, aid concentration on tasks, and broaden one's thoughts. This flexible thinking may lead to even more pleasant experiences in the future (this is known as the 'Broaden-and-Build theory of Positive Emotions'). The results of this study will examine this theory and, through publication in a relevant scientific journal, will help in the development of psychological skills training programmes which aim to improve sport performance.

You have been chosen as a participant as we are interested your sporting experiences. You are under no obligation to participate, and may withdraw from the study at any time without giving reason. To ensure anonymity, personal information will be coded by number and stored in a locked office to which only the investigators will have access. Data will be retained for a period of 5 years after publication, after which it will be destroyed. No information reported will ever be directly attributed to you.
If you would like to take part, please complete the consent form on the following page. The questionnaires will take around 10 minutes to complete. You will then be required to complete the same questionnaires again six months later. **Participation in this study automatically enters you into a prize draw where you can win one of three £25 Amazon Gift vouchers!**

Thank you for your participation,

Mark Thompson
Sport Psychology PhD Candidate
University of Hull

- Next

# Broaden-and-Build Theory of Positive Emotions study

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16% complete

## Consent Sheet

I can confirm that I have read and understood the Participant Information Sheet for this study, and that any questions I have raised have been answered.

I can also confirm that I am aged 18 or above, or am aged 16 or 17 and have gained parental consent to participate.

I understand that all data I provide will be accessible only by the research team, that this data will be held securely in accordance with University Ethical Guidelines, and that my participation in this study is completely confidential. Finally, I agree to participate in this research. *Required*

- Yes
- No

- Next

# Broaden-and-Build Theory of Positive Emotions study

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33% complete

## Demographic Information

In order for us to describe the people we collect data from, we need some background information. This information is completely confidential.

1. What is your name?

2. What is your age?

3. What is your gender?

4. What is your email address? This is so that you may be contacted in 6 months to complete the remainder of this study and to inform you if you have won a prize for participation.

Please enter a valid email address.

5. What is today's date?

6. What sports do you play, and which teams do you play for?

7. How many years have you played your chosen sports?

8. To what level have you played your chosen sports? (Beginner/Club or University/County/National/International)

9. Please indicate which ethnic group most closely resembles your ethnic origin.

10. We realise that the above coding system may not be fully representative of all ethnic groups and therefore if you would like to indicate an alternative ethnic group, please do so below:

- Next

**Dispositional Coping Inventory for Competitive Sport (DCICS)**

# Broaden-and-Build Theory of Positive Emotions study

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## Coping in Sport

In this section, each question represents things that athletes can think or do during sport. For each of the items, you must indicate the extent to which an item corresponds to what you typically do during your competitions to manage stress. A score of 1 indicates that the item does not correspond at all to what you think or do, whilst a score of 5 indicates that the item corresponds very strongly to what you think or do. There are no right or wrong answers.

1. I visualise that I am in total control of the situation.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

2. I use swear words loudly or in my head in order to expel anger.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

3. I keep my distance from others.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

4. I commit myself by giving a consistent effort.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

5. I occupy my mind in order to think about other things than the competition.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

6. I try not to be intimidated by other athletes.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

7. I ask someone for advice concerning my mental preparation.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

8. I try to relax my body.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

9. I analyse my last performance.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

10. I lose all hope of attaining my goal.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

11. I mentally rehearse the execution of my movements.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

12. I get angry.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

13. I give a relentless effort.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

14. I think about another hobby in order not to think about the competition.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

15. I try to get rid of my doubts by thinking positively.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

16. I ask other athletes for advice.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

17. I try to reduce the tension in my muscles.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

18. I analyse the weaknesses of my opponents.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

19. I let myself feel hopeless and discouraged.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

20. I visualise myself doing a good performance.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

21. I express my discontent.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

22. I keep all people at a distance.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

23. I give my best effort.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

24. I entertain myself in order not to think about the competition.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

25. I replace my negative thoughts with positive ones.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

26. I talk to a trustworthy person.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

27. I do some relaxation exercises.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

28. I think about possible solutions to manage the situation.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

29. I wish that the competition would end immediately.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

30. I visualise my all time best performance.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

31. I express my frustrations.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

32. I try not to think about my mistakes.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

33. I talk to someone who is able to motivate me.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

34. I relax my muscles.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

35. I analyse the demands of the competition.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

36. I stop believing in my ability to attain my goal.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

37. I think about my family or friends to distract myself.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

- Next

**Sports Emotion Questionnaire (SEQ) - Amended**

# Broaden-and-Build Theory of Positive Emotions study

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## Emotions

Below you will find a list of words that describe a range of feelings that you may experience when participating in sport. Please read each one carefully and indicate on the scale next to each item how you normally feel in relation to participating in your chosen sport. A score of 1 would indicate that you do not feel this emotion at all, whilst a score of 5 means you feel this emotion extremely strongly. There are no right or wrong answers.

1. Uneasy

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

2. Upset

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

3. Exhilarated

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

4. Irritated

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

5. Pleased

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

6. Tense

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

7. Sad

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

8. Excited

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

9. Furious

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

10. Joyful

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

11. Nervous

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

12. Unhappy

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

13. Enthusiastic

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

14. Annoyed

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

15. Cheerful

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

16. Apprehensive

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

17. Disappointed

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

18. Energetic

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

19. Angry

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

20. Happy

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

21. Anxious

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

22. Dejected

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

- Next

**Revised Connor-Davidson Resilience Scale (RCDRS) - Amended**

# Broaden-and-Build Theory of Positive Emotions study

83%

83% complete

## Resilience

This questionnaire measures your ability to cope with adversity when participating in sport. Please indicate your response by selecting the appropriate number. A selection of 1 would indicate that the statement is not true at all in relation to you, whilst a selection of 5 would indicate that the statement is true nearly all of the time for you. Please answer these items carefully, thinking about how you are generally when participating in sport. There are no right or wrong answers.

1. I am able to adapt to different demands within my sport.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

2. I can deal with whatever comes my way when I'm competing.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

3. Even when under pressure during competition, I still try to see the humorous side of things.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

4. Dealing with the stress in sport makes me a stronger person.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

5. I tend to bounce back after illness, injury, or hardships in sport.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

6. I believe I can achieve my sporting goals, even if there are obstacles.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

7. Under pressure, I stay focused and think clearly.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

8. I am not easily discouraged by failure.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

9. I think of myself as a mentally strong athlete when dealing with the pressure of competition.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

10. I can keep unpleasant or painful feelings like sadness, fear or anger under control during competition.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

- Finish

# Broaden-and-Build Theory of Positive Emotions study

100%
100% complete

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Thank you for completing the questionnaires.

You will receive an email 6 months from now asking you to fill in the questionnaires again. This is to examine how one's coping, emotions and resilience changes over time.

Many thanks!

Mark Thompson
Sport Psychology PhD Candidate
University of Hull

## Appendix D: Questionnaire Pack (Chapter 6)

# Broaden-and-Build Theory of Positive Emotions study (2nd Completion)

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0% complete

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You are invited to complete your 2nd half of questionnaires in a Sport Psychology research study at The University of Hull.

Please take time to read this Participant Information Sheet and discuss it with others if you wish. If you have any queries, please email the principal investigator (mark.thompson@hull.ac.uk).

In Psychology, it has been suggested that experiencing positive emotions may increase confidence, aid concentration on tasks, and broaden one's thoughts. This flexible thinking may lead to even more pleasant experiences in the future (this is known as the 'Broaden-and-Build theory of Positive Emotions'). The results of this study will examine this theory and, through publication in a relevant scientific journal, will help in the development of psychological skills training programmes which aim to improve sport performance.

You have been chosen as a participant as we are interested your sporting experiences. You are under no obligation to participate, and may withdraw from the study at any time without giving reason. To ensure anonymity, personal information will be coded by number and stored in a locked office to which only the investigators will have access. Data will be retained for a period of 5 years after publication, after which it will be destroyed. No information reported will ever be directly attributed to you.
If you would like to take part, please complete the consent form on the following page. The questionnaires will take around 10 minutes to complete. **Participation in this study automatically enters you into a prize draw where you can win one of three £25 Amazon Gift vouchers!** As this is the second time you will have completed these questionnaires, your participation in this study will finish afterwards.

Thank you for your participation!

Mark Thompson
Sport Psychology PhD Candidate
University of Hull

- Next

# Broaden-and-Build Theory of Positive Emotions study (2nd Completion)

16%

16% complete

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## Consent Sheet

I can confirm that I have read and understood the Participant Information Sheet for this study, and that any questions I have raised have been answered.

I can also confirm that I am aged 18 or above, or am aged 16 or 17 and have gained parental consent to participate.

I understand that all data I provide will be accessible only by the research team, that this data will be held securely in accordance with University Ethical Guidelines, and that my participation in this study is completely confidential. Finally, I agree to participate in this research. *Required*

- Yes
- No

- Next

# Broaden-and-Build Theory of Positive Emotions study (2nd Completion)

33%

33% complete

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## Demographic Information

In order for us to describe the people we collect data from, we need some background information. This information is completely confidential.

1. What is your name?

2. What is your age?

3. What is your email address? This is so that you can be informed if you have won a prize for participation.

Please enter a valid email address.

4. What is today's date?

- Next

**Dispositional Coping Inventory for Competitive Sport (DCICS)**

# Broaden-and-Build Theory of Positive Emotions study (2nd Completion)

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50% complete

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## Coping in Sport

In this section, each question represents things that athletes can think or do during sport. For each of the items, you must indicate the extent to which an item corresponds to what you typically do during your competitions to manage stress. A score of 1 indicates that the item does not correspond at all to what you think or do, whilst a score of 5 indicates that the item corresponds very strongly to what you think or do. There are no right or wrong answers.

1. I visualise that I am in total control of the situation.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

2. I use swear words loudly or in my head in order to expel anger.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

3. I keep my distance from others.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

4. I commit myself by giving a consistent effort.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

5. I occupy my mind in order to think about other things than the competition.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

6. I try not to be intimidated by other athletes.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

7. I ask someone for advice concerning my mental preparation.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

8. I try to relax my body.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

9. I analyse my last performance.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

10. I lose all hope of attaining my goal.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

11. I mentally rehearse the execution of my movements.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

12. I get angry.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

13. I give a relentless effort.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

14. I think about another hobby in order not to think about the competition.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

15. I try to get rid of my doubts by thinking positively.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

16. I ask other athletes for advice.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

17. I try to reduce the tension in my muscles.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

18. I analyse the weaknesses of my opponents.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

19. I let myself feel hopeless and discouraged.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

20. I visualise myself doing a good performance.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

21. I express my discontent.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

22. I keep all people at a distance.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

23. I give my best effort.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

24. I entertain myself in order not to think about the competition.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

25. I replace my negative thoughts with positive ones.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

26. I talk to a trustworthy person.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

27. I do some relaxation exercises.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

28. I think about possible solutions to manage the situation.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

29. I wish that the competition would end immediately.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

30. I visualise my all time best performance.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

31. I express my frustrations.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

32. I try not to think about my mistakes.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

33. I talk to someone who is able to motivate me.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

34. I relax my muscles.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

35. I analyse the demands of the competition.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

36. I stop believing in my ability to attain my goal.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

37. I think about my family or friends to distract myself.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Very Strongly |

- Next

**Sports Emotion Questionnaire (SEQ) - Amended**

# Broaden-and-Build Theory of Positive Emotions study (2nd Completion)

66%
66% complete

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## Emotions

Below you will find a list of words that describe a range of feelings that you may experience when participating in sport. Please read each one carefully and indicate on the scale next to each item how you normally feel in relation to participating in your chosen sport. A score of 1 would indicate that you do not feel this emotion at all, whilst a score of 5 means you feel this emotion extremely strongly. There are no right or wrong answers.

1. Uneasy

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

2. Upset

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

3. Exhilarated

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

4. Irritated

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

5. Pleased

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

6. Tense

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

7. Sad

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

8. Excited

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

9. Furious

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

10. Joyful

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

11. Nervous

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

12. Unhappy

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

13. Enthusiastic

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

14. Annoyed

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

15. Cheerful

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

16. Apprehensive

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

17. Disappointed

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

18. Energetic

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

19. Angry

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

20. Happy

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

21. Anxious

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

22. Dejected

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | ☐ | ☐ | ☐ | ☐ | ☐ | Extremely |

- Next

**Revised Connor-Davidson Resilience Scale (RCDRS) - Amended**

# Broaden-and-Build Theory of Positive Emotions study (2nd Completion)

83%
83% complete

## Resilience

This questionnaire measures your ability to cope with adversity when participating in sport. Please indicate your response by selecting the appropriate number. A selection of 1 would indicate that the statement is not true at all in relation to you, whilst a selection of 5 would indicate that the statement is true nearly all of the time for you. Please answer these items carefully, thinking about how you are generally when participating in sport. There are no right or wrong answers.

1. I am able to adapt to different demands within my sport.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

2. I can deal with whatever comes my way when I'm competing.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

3. Even when under pressure during competition, I still try to see the humorous side of things.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

4. Dealing with the stress in sport makes me a stronger person.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

5. I tend to bounce back after illness, injury, or hardships in sport.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

6. I believe I can achieve my sporting goals, even if there are obstacles.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

7. Under pressure, I stay focused and think clearly.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

8. I am not easily discouraged by failure.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

9. I think of myself as a mentally strong athlete when dealing with the pressure of competition.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

10. I can keep unpleasant or painful feelings like sadness, fear or anger under control during competition.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not true at all | ☐ | ☐ | ☐ | ☐ | ☐ | True nearly all of the time |

- Finish

# Broaden-and-Build Theory of Positive Emotions study (2nd Completion)

100%
100% complete

---

Thank you for completing the questionnaires for a second time. This means you have now completed this study.

You will receive an email in due course that debriefs your involvement in this study. You will also be emailed if you have won a prize for participating in this study.

Many thanks again,

Mark Thompson
Sport Psychology PhD Candidate
University of Hull

**Appendix E: Questionnaire Pack (Chapter 7)**

# Emotions, Resilience, and Coping

Instructions:

1. Please read the participation information sheet and complete the consent form

2. Complete **Questionnaire 1 after the audio clip, and Questionnaires 2 and 3 after using the FitLight.**

THANK YOU FOR YOUR PARTICIPATION

**Sports Emotion Questionnaire (SEQ)**

Questionnaire 1: Emotions in Sport

Below you will find a list of words that describe a range of feelings that sport performers may experience. Please read each one carefully and indicate on the scale next to each item how you feel *right now, at this moment, in relation to the upcoming task.* There are no right or wrong answers. Do not spend too much time on any one item, but choose the answer which best describes your feelings right now in relation to the upcoming task.

| | **Not** | **A** | **Moderately** | **Quite a bit** | **Extremely** |
|---|---|---|---|---|---|
| Uneasy | 1 | 2 | 3 | 4 | 5 |
| Upset | 1 | 2 | 3 | 4 | 5 |
| Exhilarated | 1 | 2 | 3 | 4 | 5 |
| Irritated | 1 | 2 | 3 | 4 | 5 |
| Pleased | 1 | 2 | 3 | 4 | 5 |
| Tense | 1 | 2 | 3 | 4 | 5 |
| Sad | 1 | 2 | 3 | 4 | 5 |
| Excited | 1 | 2 | 3 | 4 | 5 |
| Furious | 1 | 2 | 3 | 4 | 5 |
| Joyful | 1 | 2 | 3 | 4 | 5 |
| Nervous | 1 | 2 | 3 | 4 | 5 |
| Unhappy | 1 | 2 | 3 | 4 | 5 |
| Enthusiastic | 1 | 2 | 3 | 4 | 5 |
| Annoyed | 1 | 2 | 3 | 4 | 5 |
| Cheerful | 1 | 2 | 3 | 4 | 5 |
| Apprehensive | 1 | 2 | 3 | 4 | 5 |
| Disappointed | 1 | 2 | 3 | 4 | 5 |
| Energetic | 1 | 2 | 3 | 4 | 5 |
| Angry | 1 | 2 | 3 | 4 | 5 |
| Happy | 1 | 2 | 3 | 4 | 5 |
| Anxious | 1 | 2 | 3 | 4 | 5 |
| Dejected | 1 | 2 | 3 | 4 | 5 |

**Coping Inventory for Competitive Sport (CICS) - Amendd**

Questionnaire 2: Coping in Sport

Each question represents things that someone may think or do during this task. For each question your must indicate the extent to which it corresponds to ***what you did during your FitLight trial***.

1. Does not correspond at all to what I did or thought
2. Corresponds a little to what I did or thought
3. Corresponds moderately to what I did or thought
4. Corresponds strongly to what I did or thought
5. Corresponds very strongly to what I did or what I thought

| | Not At All | A Little | Moderately | Strongly | Very Strongly |
|---|---|---|---|---|---|
| 1. I visualised that I was in total control of the situation | 1 | 2 | 3 | 4 | 5 |
| 2. I used swear words loudly or in my head in order to expel anger | 1 | 2 | 3 | 4 | 5 |
| 3. I committed myself by giving a consistent effort | 1 | 2 | 3 | 4 | 5 |
| 4. I occupied my mind in order to think about other things than the task | 1 | 2 | 3 | 4 | 5 |
| 5. I lost all hope of attaining my goal | 1 | 2 | 3 | 4 | 5 |
| 6. I tried to relax my body | 1 | 2 | 3 | 4 | 5 |
| 7. I analysed my performance as the task progressed | 1 | 2 | 3 | 4 | 5 |
| 8. I got angry | 1 | 2 | 3 | 4 | 5 |
| 9. I focussed on my own performance | 1 | 2 | 3 | 4 | 5 |

| | | | | | |
|---|---|---|---|---|---|
| 10. I gave a relentless effort | 1 | 2 | 3 | 4 | 5 |
| 11. I thought about other things in order not to think about the task | 1 | 2 | 3 | 4 | 5 |
| 12. I tried to reduce the tension in my muscles | 1 | 2 | 3 | 4 | 5 |
| 13. I let myself feel hopeless and discouraged | 1 | 2 | 3 | 4 | 5 |
| 14. I tried to get rid of my doubts by thinking positively | 1 | 2 | 3 | 4 | 5 |
| 15. I expressed my discontent | 1 | 2 | 3 | 4 | 5 |
| 16. I visualised myself doing a good performance | 1 | 2 | 3 | 4 | 5 |
| 17. I gave my best effort | 1 | 2 | 3 | 4 | 5 |
| 18. I entertained myself in order not to think about the task | 1 | 2 | 3 | 4 | 5 |
| 19. I thought logically about how to manage my performance | 1 | 2 | 3 | 4 | 5 |
| 20. I replaced my negative thoughts with positive ones | 1 | 2 | 3 | 4 | 5 |
| 21. I wished that the competition would end immediately | 1 | 2 | 3 | 4 | 5 |
| 22. I visualised a winning performance | 1 | 2 | 3 | 4 | 5 |
| 23. I expressed my frustrations | 1 | 2 | 3 | 4 | 5 |
| 24. I tried not to think about my mental or physical fatigue | 1 | 2 | 3 | 4 | 5 |
| 25. I relaxed my muscles | 1 | 2 | 3 | 4 | 5 |
| 26. I analysed the demands of the task | 1 | 2 | 3 | 4 | 5 |
| 27. I stopped believing in my ability to attain my goal | 1 | 2 | 3 | 4 | 5 |
| 28. I thought about other things to distract myself | 1 | 2 | 3 | 4 | 5 |

**Revised Connor-Davidson Resilience Scale (RCDRS) - Amended**

Questionnaire 3 – Resilience

| This questionnaire measures your ability to cope with adversity when participating in sport. Please indicate your response by selecting the appropriate number. A selection of 1 would indicate that the statement is not true at all in relation to you, whilst a selection of 5 would indicate that the statement is true nearly all of the time for you. Please answer these items carefully, thinking about how you are generally when participating in sport. There are no right or wrong answers. | **Not at all true** | | | | **True nearly all the time** |
|---|---|---|---|---|---|
| 1. I am able to adapt to different demands within my sport. | 1 | 2 | 3 | 4 | 5 |
| 2. I can deal with whatever comes my way when I'm competing. | 1 | 2 | 3 | 4 | 5 |
| 3. Even when under pressure during competition, I still try to see the humorous side of things. | 1 | 2 | 3 | 4 | 5 |
| 4. Dealing with the stress in sport makes me a stronger person. | 1 | 2 | 3 | 4 | 5 |
| 5. I tend to bounce back after illness, injury, or hardships in sport. | 1 | 2 | 3 | 4 | 5 |
| 6. I believe I can achieve my sporting goals, even if there are obstacles. | 1 | 2 | 3 | 4 | 5 |
| 7. Under pressure, I stay focused and think clearly. | 1 | 2 | 3 | 4 | 5 |
| 8. I am not easily discouraged by failure. | 1 | 2 | 3 | 4 | 5 |
| 9. I think of myself as a mentally strong athlete when dealing with the pressure of competition. | 1 | 2 | 3 | 4 | 5 |
| 10. I can keep unpleasant or painful feelings like sadness, fear or anger under control during competition. | 1 | 2 | 3 | 4 | 5 |

# Appendix F: Appraisal Manipulation Scripts (Chapter 4)

### Challenge Instructions (Prior to TT3)

We will shortly ask you to complete your final cycling time trial which requires you to complete a distance of 16.1km as quickly as possible. This is the most important part of the experiment and it is very important that you try, ideally, to complete this task as quickly as you can. Do you have any questions?

The mean times from your last time trial this time trial and your upcoming time trial will be calculated for each participant and placed on a leader board. At the end of the study the leader board will be emailed to all participants and displayed on a noticeboard, as well as online. The top two performers for both male and female groups will be awarded cash prizes of £75 and £25, respectively. The worst two performers will be interviewed for around 30 minutes to discuss their poor performance in the task. Further, please note that each time trial will be recorded on a digital video camera and may be used to aid teaching and presentations in the future. Currently around 15 out of the 30 people required have completed their time trials. Based on your performance on the first time trial, you have a strong chance of placing in the top two come the end of this experiment if you maintain your high level of performance. Whilst you will have to perform well and push yourself to your limits, it is highly likely that you will place in the top two. You have already shown that you are more than capable of meeting today's challenge.

### Threat Instructions (Prior to TT3)

We will shortly ask you to complete your final cycling time trial which requires you to complete a distance of 16.1km as quickly as possible. This is the most important part of the

experiment and it is very important that you try, ideally, to complete this task as quickly as you can. Do you have any questions?

The mean times from your last time trial this time trial and your upcoming time trial will be calculated for each participant and placed on a leader board. At the end of the study the leader board will be emailed to all participants and displayed on a noticeboard, as well as online. The top two performers for both male and female groups will be awarded cash prizes of £75 and £25, respectively. The worst two performers will be interviewed for around 30 minutes to discuss their poor performance in the task. Further, please note that each time trial will be recorded on a digital video camera and may be used to aid teaching and presentations in the future. Currently around 15 out of the 30 people required have completed their time trials. Based on your performance on the first time trial, you are currently residing in the bottom two of the current performance table. Therefore, there is a chance that we will need to interview you after your task. Further, you will find it very difficult to place in the top two at the end of this study, and therefore receive the cash reward.

**Benefit Instructions (Prior to TT3)**

We will shortly ask you to complete your final cycling time trial which requires you to complete a distance of 16.1km as quickly as possible. This is the most important part of the experiment and it is very important that you try, ideally, to complete this task as quickly as you can. Do you have any questions?

The mean times from your last time trial this time trial and your upcoming time trial will be calculated for each participant and placed on a leader board. At the end of the study the leader board will be emailed to all participants and displayed on a noticeboard, as well as online.

The top two performers for both male and female groups will be awarded cash prizes of £75 and £25, respectively. The worst two performers will be interviewed for around 30 minutes to discuss their poor performance in the task. Further, please note that each time trial will be recorded on a digital video camera and may be used to aid teaching and presentations in the future. After 7 months of research, you are the final participant in the entirety of this study. Based on your performance on the first time trial, you have are currently residing in the top two positions in our leader board. This means that if you improve or maintain your previous performance, you will win the cash reward. Your performance was notably strong in comparison to the rest of the field – well done!

**Harm Instructions (Prior to TT3)**

We will shortly ask you to complete your final cycling time trial which requires you to complete a distance of 16.1km as quickly as possible. This is the most important part of the experiment and it is very important that you try, ideally, to complete this task as quickly as you can. Do you have any questions?

The mean times from your last time trial this time trial and your upcoming time trial will be calculated for each participant and placed on a leader board. At the end of the study the leader board will be emailed to all participants and displayed on a noticeboard, as well as online. The top two performers for both male and female groups will be awarded cash prizes of £75 and £25, respectively. The worst two performers will be interviewed for around 30 minutes to discuss their poor performance in the task. Further, please note that each time trial will be recorded on a digital video camera and may be used to aid teaching and presentations in the future. After 7 months of research, you are the final participant in the entirety of this study. Based on your performance on the first time trial, you are currently residing in the bottom

two positions in our leader board and are not in contention for either cash prize. Speaking honestly – it appears that you are destined to finish within the bottom two participants, which will mean we are required to interview you as to your struggles during this task. Despite this setback, please continue to try your best. There are a number of strong competitors in this study that have produced some exceptionally fast times, but unfortunately, you were not one of them.

**Challenge Manipulation (8km mark during TT3)**

You have already gone past the halfway point. Keep going - you can still place in the top 2, and win the cash reward, if you continue to work hard and perform well.

**Threat Manipulation (8km mark during TT3)**

You have only just reached the halfway point. At the moment, you are in real danger of finishing in the bottom 2. Keep trying your best.

**Benefit Manipulation (8km mark during TT3)**

You have already gone past the halfway point through your final trial and are still comfortably in the top 2 for the cash reward.

**Harm Manipulation (8km mark during TT3)**

With 8 kilometres left, you are still firmly placed in the bottom 2.

**Challenge Manipulation (Post TT3 and before final saliva sample)**

You stand a chance of finishing in the top two and winning the cash prize, based upon on the performances of other participants who have completed Trial 1.

**Threat Manipulation (Post TT3 and before final saliva sample)**

You stand a chance of finishing in the bottom two, and may be required to conduct the interview if nobody ends up being slower than you. There are a number of strong participants still to finish their final trial.

**Benefit Manipulation (Post TT3 and before final saliva sample)**

You have finished first. Congratulations!

**Harm Manipulation (Post TT3 and before final saliva sample)**

Unfortunately, you have finished last out of all participants. We shall conduct your 30 minute interview as soon as you have given in your final saliva sample.

# Appendix G: Emotional Manipulation Scripts (Chapter 7)

**No Emotion**

Sit back and make yourself comfortable, close your eyes, focus all of your attention on my voice. Let yourself sink into the chair and become completely absorbed in the things I am telling you. In a moment, I want you to use your imagination. I want you to think about brushing your teeth, like I asked you to think about earlier… To picture it so vividly that it might feel like you are brushing your teeth right now… To feel the same inside now. Think about the situation now. Imagine it as vividly as you can. Make the picture come alive. See all the details. Picture the surroundings as clearly as possible. See yourself, see your toothbrush. Hear the sounds, experiencing the event exactly as it's happening to you… Thinking the same thoughts… feeling the same feelings… letting yourself react as if you were actually there.

As you imagine that you are brushing your teeth you realize you are feeling incredibly calm. Your mind is clear of any emotions… You are feeling completely unemotional about everything. As you continue to focus all of your attention on the experience, feel even more unperturbed about surrounding events… You are feeling completely unemotional… When you are ready and while you continue to imagine the situation of brushing your teeth, open your eyes.

**Pleasant Emotions (Excitement and Happiness)**

The imagery script that you are about to listen to is intended to elicit certain pleasant emotions within you. Due to your excellent performance on your first day of testing, you have been allocated to the pleasant emotion group. Therefore, over the course of the next few

minutes, you will be asked to imagine a sporting event in which you experience both excitement and happiness. Sit back and make yourself comfortable, close your eyes, focus all of your attention on my voice. Let yourself sink into the chair and become completely absorbed in the things I am telling you.

Excitement is the feeling you get in the changing room before a crucial competitive match with butterflies in your stomach because you are energised by the thought of what you can achieve. You have the belief that by upping your game just a bit today, you can win. As you imagine the situation, you realize you are feeling very excited… That the goals that you have dreamed of are now within reach. You want to want to do well… You really believe that this is going to be a good experience… Deepen this feeling even more, feeling full of excitement.

Your excitement is well-founded, and only serves to increase your confidence in your ability. You win the match. As the match ends, you realise that you have performed exactly how you wanted to, and made good progress towards achieving your sporting goals. You feel an overwhelming sense of excitement and happiness. You look around the field of play and feel completely content. Deepen this feeling even more, feeling warm, content, and incredibly happy.

I want you to think about the match experiences I have just detailed. To picture it so vividly that you actually feel excitement and happiness right now… To feel the same inside now. Think about the situation; imagine it as vividly as you can. Make the picture come alive; see all the details; picture the surroundings as clearly as possible. See the people, the objects. Hear the sounds, experiencing the event exactly as it was happening to you. Thinking the same thoughts, feeling the same feelings, let yourself react as if you are actually there now.

When you are ready, whilst continuing to imagine the situation and holding on to the pleasant feelings, open your eyes.

**Unpleasant Emotions (Anxiety, Anger, & Dejection)**

The imagery script that you are about to listen to is intended to elicit certain unpleasant emotions within you. Due to your poor performance on your first day of testing, you have been allocated to the unpleasant emotion group. Therefore, over the course of the next few minutes, you will be asked to imagine a sporting event in which you experience anxiety, anger, and dejection. Sit back, close your eyes, and focus all of your attention on my voice. You are to become completely absorbed in the things I am telling you.

Anxiety is the feeling you get in the changing room just minutes before a crucial competitive match, where the butterflies in the pit of your stomach are almost unbearable. Your muscles are tight, and your heart is racing faster and faster. These feelings only intensify as you become aware of everything that is at stake. Deeping this feeling even more, feeling full of nervous energy.

The match begins. Immediately, it becomes clear that things aren't going as planned. It's not long before you are losing. The opposition grows in confidence. In one particular moment, your opponent uses their skill, and makes you look silly. You feel angry, incredibly angry – they have purposefully humiliated you. Inside, you have a powerful impulse to counterattack your opponent to gain revenge. Your muscles are tense and blood rushes to your face as you focus all your attention on the experience. Deepen this feeling even more, feeling full of aggression.

However, you do not get the opportunity. The match ends, and you have lost. As you look around the field of play, you see your opponent celebrating, and feel an overwhelming sense of anger and dejection. You know you have not done yourself justice, and your feelings intensify as you become aware of everything that you have failed to achieve. Deepen this feeling even more, feeling full of dejection.

I want you to think about the match experiences I have just detailed. To picture it so vividly that you actually feel anxious, angry, and dejected right now… To feel the same inside now. Think about the situation; imagine it as vividly as you can. Make the picture come alive, see all the details, picture the surroundings as clearly as possible. See the people, the objects. Hear the sounds, experiencing the event exactly as it was happening to you. Thinking the same thoughts, feeling the same feelings, let yourself react as if you were actually there now. Hold on to all of these feelings.

When you are ready, while continuing to imagine the situation and holding on to the unpleasant feelings, open your eyes.

# Appendix H: Ethical Clearances

Each research study conducted within this thesis was approved by a University ethics committee. The ethical approval reference numbers for chapter can be found below:

| Chapter | Title | Reference Number |
|---|---|---|
| 3 | Stress Appraisals, Emotions, Coping, and Perceived Goal Attainment – a Path Analysis. | 1415060 |
| 4 | A Psychophysiological Examination of Lazarus' CMR Theory of Emotions via a Lab-Based 16.1 km Cycling Time Trial Task. | 1516153 |
| 5 | Establishing the Validity of the Broaden-and-Build Theory within Sport – a Path Analysis. | 1415222 |
| 6 | A Six-Month Investigation of Emotions, Coping, and Resilience within Athletic Populations – the Broaden-and-Build Theory in Sport. | 1415222 |
| 7 | A Psychophysiological Examination of the Broaden-and-Build Theory in Sport via a Lab-Based Reaction Task. | 1617066 |