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The Self-Efficacy Construct in the Endurance Sport Domain:  
Formation, Measurement, and Malleability

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A thesis presented for the degree of Doctor of Philosophy in  
Sport and Exercise Science and Sports Therapy



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## **Abstract**

Self-efficacy has been associated with superior performance in a variety of endurance sports. Despite this positive relationship, there is a lack of understanding regarding how these beliefs may be formed, altered, and measured. This lack of understanding prevents the development and delivery of effective interventions to help enhance self-efficacy. As a result of this, the focus of the current thesis was to gain an increased understanding of the formation, measurement, and malleability of self-efficacy within the endurance sport domain. There were three main research aims. First, this thesis aimed to gain an understanding of the sources of self-efficacy beliefs in endurance sport. Semi-structured interviews were conducted with endurance athletes to gain an insight into the formation of their beliefs. The importance of cumulative experiences and the congruence between expected and experienced physiological sensations were identified as key sources of self-efficacy. Second, this thesis aimed to improve our ability to measure self-efficacy beliefs for endurance sport. Through a process of three studies which followed best practice for psychometric design, an 11-item unidimensional scale named the 'Endurance Sport Self-Efficacy Scale' (ESSES) was developed and validated. Third, this thesis aimed to gain an understanding of the dynamicity and malleability of these self-efficacy beliefs. Using an experimental laboratory setting, the effects of a change in perceived task difficulty on self-efficacy was examined. An increase in perceived task difficulty was demonstrated to lead to a reduction in self-efficacy strength, but not self-efficacy level. To gain a further understanding of the malleability of self-efficacy, the effects of two web-based brief interventions on self-efficacy and other outcome variables were examined using a randomised control trial. Although no effects were found on most outcome variables, the interventions were found to be useful and the athletes were satisfied with the

delivery of them. Taken together, the findings of this thesis provide a series of theoretical and practical implications. Regarding theory, the current thesis advances four key tenets of self-efficacy theory, specifically: the interaction between proximal and distal sources of self-efficacy and the need to distinguish appropriately the dimensionality of self-efficacy beliefs. Additionally, the current thesis provides the first proposed model for the sources of self-efficacy in relation to endurance sport. These theoretical implications also provide clear directions for future research, such as the further investigation and testing of the proposed sources model through mixed-methods enquiry. Regarding practice, the current thesis provides several insights and potential benefits to applied practitioners, coaches, and athletes. The ESSES can be used as a useful tool in highlighting areas of low self-efficacy, which can be targeted via intervention. The current thesis also provides novel insight into the delivery of these interventions via the internet.

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## Preface

This thesis includes published manuscripts, manuscripts submitted for publication, and work that has contributed to published manuscripts. Therefore, there may be some repetition in the description of theories and past research in each introduction which has been adapted from the published or prepared article.

Peer-reviewed publications:

Anstiss, P. A., Meijen, C., Madigan, D. J., & Marcora, S. M. (2018). Development and initial validation of the Endurance Sport Self-Efficacy Scale (ESSES).

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McCormick, A., Meijen, C., Anstiss, P. A., & Jones, H. S. (2018). Self-regulation in endurance sports: Theory, research, and practice. *International Review of Sport and Exercise Psychology*, 1–30.

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Conference presentations:

Anstiss, P. A., Meijen, C., & Marcora, S. (2017, May). Development and initial validation of the Endurance Sport Self-Efficacy Scale (ESSES). Paper presented at the meeting of the British Association of Sport and Exercise Sciences (BASES), Student Conference, Plymouth, UK.

Anstiss, P. A., Meijen, C., & Marcora, S. (2016, December). The sources of self-efficacy in experienced recreational endurance athletes. Paper presented at the meeting of the British Psychological Society (BPS) Division of Sport and Exercise Psychology (DSEP), Cardiff, UK.

## Ethical Approval Reference Numbers

Chapters, 2, 3, 4, and 5 were ethically approved by the University of Kent School of Sport and Exercise Sciences Research Ethics and Governance Committee.

Table i. Ethical Approval Reference Numbers for Chapters 2, 3, 4, and 5.

	Original Ethics Reference Number	Amendment Ethics Reference Number(s)
Chapter 2	Prop_98_2015_2016	Prop_131_2015_2016
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Chapter 4	Prop 128_2015_2016	
Chapter 5	Prop_130_2016_17	Prop_48_2017_2018



# **Chapter 1: Introduction**

Life is arduous, difficult, a perpetual struggle. It calls for gigantic courage and strength. More than anything, perhaps, creatures of illusion as we are, it calls for confidence in oneself. Without self-confidence we are babes in the cradle.

Virginia Woolf

Confucius, Virgil, Dumas, Keller, Woolf, Ford, and Gandhi have all at one point espoused the need for belief in one's self. According to these individuals, when one possesses belief in their own capabilities, this will lend itself to success and achievement, whereas a belief in one's incapability, lends itself only to failure. Given the variety of those who have espoused its virtue, self-belief appears to be a concept that is common across continents, cultures, and centuries. This shared notion across so many different contexts, suggests that self-belief is a central component to the human psyche, and that it is likely to play a key role in our understanding of behaviour.

Given this precedence of self-belief, it is not surprising that several early psychological theories included it as a core concept. Achievement motivation (McClelland, Atkinson, Clark, & Lowell, 1953), effectance motivation (White, 1959), locus of control (Rotter, 1966), and learned helplessness (Abramson, Seligman, & Teasdale, 1978) all have central to them the role of perceived capability (i.e., what an individual believes themselves capable of). These theories, however, have often failed to conceptualise self-belief into a falsifiable and measurable construct, and in turn often lacked a clear hypothesis for how this self-belief may result in achievement or success (Kirsch, 1985). It was not until Albert Bandura, that the concept of self-belief was formally conceptualised into a falsifiable and measurable construct known as self-efficacy (Bandura, 1977). Although several definitions for self-efficacy have been provided, the most commonly accepted is that self-efficacy represents "the belief in one's capabilities to organize and execute the courses of action required to produce

given attainments” (Bandura, 1997, p. 3). It does not merely represent the skills or abilities that an individual believes themselves to possess, but rather how well they believe they can utilise those skills or abilities in various scenarios and contexts (Bandura, 1997). To put it simply self-efficacy represents what an individual believes they can do.

These beliefs are developed and derived through a series of cognitive appraisals and reflections relating to various sources of information (Bandura, 1997; Gist & Mitchell, 1992). Once these beliefs are formed, they can have a powerful effect on an individual’s cognitions and behaviours. Specifically, when an individual perceives themselves as having a high level of capability (i.e., a high level of self-efficacy), they set themselves more challenging goals, invest more effort in the pursuit of these goals, are willing to persevere for longer in pursuit of these goals, and are not easily dissuaded by obstacles and setbacks (Bandura, 1997). In comparison, when an individual perceives themselves as having a low level of capability (i.e., a low level of self-efficacy), they are less likely to set themselves challenging goals, they are often unwilling to invest effort into tasks, and they often disengage from these tasks when encountering difficulty (Bandura, 1997).

Since its initial conception in 1977, research on self-efficacy has amassed across the broad domains of human functioning (Bandura, 1997; 2001). Self-efficacy has been linked with superior functioning, behaviour, performance, and achievement across the domains of education (Pajares & Urdan, 2005; Schunk & Pajares, 2002; Usher & Pajares, 2008), healthcare (Bandura, 1997; O’Leary, 1985; Schwarzer, 1997), work (Lent, 2006; Locke & Latham, 2002), and sport (Feltz et al., 2008; Moritz, Feltz, Fahrback, & Mack, 2000). This thesis aims to examine self-efficacy in a domain where an individual’s perception of their capability is often challenged by

the demands they face, and where the concepts of effort and perseverance are synonymous with the name of the domain itself: endurance performance.

### **Endurance Performance**

Endurance performance is characterised by the performance of continuous, dynamic, whole-body, sub-maximal exercise tasks that are performed over middle or long distances (Burnley & Jones, 2007; McCormick, Meijen, Anstiss, & Jones, 2018). Such a characterisation lends itself to a large variety of disciplines and events such as: running, swimming, cycling, rowing, canoeing, speed-skating, skiing, and speed-walking (McCormick, Meijen, & Marcora, 2015). Alongside this variety in mode of movement, there also exists a large variety in the duration that these movements must be carried out for. Endurance events can range from minutes (e.g., a 1500m race), to multiple days (e.g., the Tour De France), and can take place in some of the most inhospitable locations on earth (e.g., The Marathon Des Sables). Throughout these durations, endurance athletes must deal with a variety of demands and challenges to achieve their performance goals.

Individuals engaging in endurance events and sport encounter a variety of demands and challenges that are common across other performance related domains. For instance, demands relating to organisational stressors (Fletcher, Hanton, & Wagstaff, 2012; McCormick, Meijen, & Marcora, 2016), managing emotions (Lane et al., 2016; Lane & Wilson, 2011; Wagstaff, 2014), performance anxiety (Hill & Shaw, 2013; Ruiz-Juan, Zarauz Sancho, & Flores-Allende, 2016), injury concern (Clancy, Herring, MacIntyre, & Campbell, 2016; Nixdorf, Frank, & Beckmann, 2015), and maintaining motivation (Appleton & Hill, 2012; Harwood, Keegan, Smith, & Raine, 2015), are frequently seen across performance related domains. Central and unique to endurance performance, is the concept of pacing. Pacing refers to the

regulation of work rate that endurance athletes must carry out in order to ensure a successful performance (Elferink-Gemser & Hettinga, 2017; Mauger, 2014). Endurance athletes must typically adopt a work rate that will enable them to finish the event as quick as possible, before other competitors, or both, but that is also sustainable for the duration of the event. Pacing is a complex skill and behaviour which involves a variety of both physiological and psychological factors (Jones et al., 2014; Tucker, 2009; Williams et al., 2014), and is a commonly researched area (Williams et al., 2015). During this process of pacing, endurance athletes must counteract and resist a variety of exercise induced sensations. Commonly encountered sensations include exercise-induced pain (Mauger, 2014), perception of effort (Pageaux, 2016), and fatigue (Noakes, 2012). These sensations, and the athlete's response to them, form the basis for various endurance performance theories such as the psychobiological model of endurance (Marcora, 2009; Marcora & Bosio, 2007), the sensory-tolerance limit (Hureau, Romer, & Amann, 2018), and the integrative-governor model (St Clair Gibson, Swart, & Tucker, 2017). Both experimental (Astokorki & Mauger, 2016; Marcora, 2009; McCormick, Meijen, & Marcora, 2015) and qualitative (Antonini Philippe, Rochat, Vauthier, & Hauw, 2016; Appleby & Dieffenbach, 2016; Kress & Statler, 2007) research has consistently identified the tolerance of these exercise induced sensations as a key determinant of endurance performance.

Success in endurance performance, therefore, can be viewed in part as being a combination of both effort (e.g., the production and maintenance of a workload) and perseverance (e.g., withstanding the exercise induced sensations). As self-efficacy is primarily believed to influence behaviour through its influence on effort and perseverance (Bandura 1997; Feltz et al. 2008), this provides a clear theoretical rationale for self-efficacy being an influential construct in endurance performance.

Additionally, a recent systematic review on the psychological determinants of endurance performance identified self-efficacy as a potential determinant of endurance performance (McCormick et al., 2015).

A beneficial aspect of self-efficacy is that it has been demonstrated to be a dynamic and malleable construct (Gist & Mitchell, 1992; Short & Ross-Stewart, 2009). Higher levels of self-efficacy can be promoted and encouraged through the use of various interventions, and these improvements in self-efficacy can in turn bring about desired behavioural and performance changes (Bandura, 1997; Villani, Caputo, Balzarotti, & Riva, 2017). The ability to promote more adaptive self-efficacy beliefs in endurance athletes could have a range of benefits. For competitive endurance athletes, improving self-efficacy could help influence important competitive outcomes, such as their finishing position. For non-competitive individuals, enhancing self-efficacy could lead to continued training and participation in events (McAuley & Courneya, 1992), which is important given the wide range of benefits associated with regular aerobic exercise (e.g., Chomistek, Cook, Flint, & Rimm, 2012).

This chapter aims to provide an overview of the self-efficacy construct and its relationship with endurance performance. The first stage in understanding the self-efficacy construct is to consider the theoretical framework in which it is embedded, social cognitive theory (Bandura, 1986; 2001).

### **Social Cognitive Theory and Self-Efficacy**

Social cognitive theory (formerly known as social-learning theory) represents an agentic perspective on human behaviour, which suggests that rather than being shaped by the environment (e.g., behaviourism) or inner forces (e.g., the psychodynamic approach), individuals have the capacity for self-control over their cognitions, emotions, motivation, and behaviour (Bandura, 1986; 2001). This capacity

for agency resides on four core properties; intentionality, forethought, self-reactiveness, and self-reflectiveness (Bandura, 1986; 2001). Intentionality represents an individual's active decision to engage in certain behaviours, and forethought represents an individual's ability to anticipate the outcome of these behaviours. Once these behaviours are being carried out, self-reactiveness allows an individual to regulate this behaviour to achieve their desired goal. Self-reflectiveness refers to an individual's ability to reflect and evaluate their behaviours, providing them with information to learn from for future occurrences. To demonstrate these properties, consider a runner who signs up to a marathon. They make an active decision to engage in the marathon and the training required for it (intentionality). They believe that training for and completing the marathon will be good for both their physical health but also their self-esteem (forethought). In the training for this marathon the runner will attempt to manage competing demands relating to their work and social life (self-reactiveness) and will often evaluate how their training is progressing (self-reflectiveness). In social cognitive theory, individuals also possess the ability for symbolisation and vicarious modelling. The process of symbolisation allows individuals to assign weight and meaning to non-experienced events and create internal models of experience (e.g., their view of themselves and their own capabilities). Vicarious modelling is a further socio-cognitive mechanism, which occurs through the observation of other individual's actions and consequences. Through this observation individuals gain information which can help guide subsequent behaviours and cognitions (Bandura, 1986; 2001).

To explain the relationship and interaction between an individual's behaviour, cognitions, and their environment, Bandura proposed a model of triadic reciprocal determinism (Bandura, 1986; 2001). Importantly, the environment does not just

consist of the physical location of where an individual is, but it extends to the social environment as well (Maddux, 1995). In triadic reciprocal determinism, each component (i.e., the environment, cognitions, behaviour) interacts upon each other reciprocally, and the interaction between these three components help to explain an individual's behaviour. To demonstrate consider a runner who performs well in a race (their behaviour). This performance leads them to receiving praise and encouragement from others around them (their environment). This praise and encouragement led them to have a heightened sense of belief about their own capability (their cognitions). This change in cognition encourages them to seek out a club to train with, in turn further changing their environment and subsequent cognitions and emotions.

Through this interaction between the environment, cognitions, and behaviour, individuals develop a series of intertwined and dynamic beliefs about themselves and the world around them. Of these beliefs, self-efficacy is understood to be the key mechanism behind understanding an individual's capacity for control over their cognitions, emotions, motivation, and behaviour (Bandura, 1997).

### **Self-Efficacy**

Self-efficacy beliefs represent “the belief in one's capabilities to organize and execute the courses of action required to produce given attainments” (Bandura, 1997, p.3). Self-efficacy does not merely represent the skills or abilities that an individual believes themselves to possess, but rather how well they perceive themselves in applying those skills and abilities in challenging situations (Bandura, 1997). A swimmer may perceive themselves to have excellent form and technique, but if they do not perceive themselves capable of utilising this in a competitive setting or in rough seas, then this belief counts for little. Importantly, self-efficacy does not predict behaviour and performance in every situation. For self-efficacy to be a valid predictor



of behaviour, individuals must possess something they wish to achieve in relation to the task (i.e., they have a goal), and that they perceive there to be a beneficial outcome from engaging in the task (e.g., a sense of accomplishment) (Bandura, 1997). Rather than being a unidimensional construct, self-efficacy beliefs are multidimensional and there exists several types of self-efficacy.

### **Types of Self-Efficacy Belief**

Perhaps the most commonly encountered type of efficacy belief is ‘task self-efficacy’ or ‘performance self-efficacy’ which refers to an individual’s belief in their ability to successfully complete a task or a certain performance level, and perhaps is the most like Bandura’s 1997 definition of self-efficacy (Feltz et al., 2008). Examples of task or performance self-efficacy that are commonly used in endurance research are: “How confident are you that you complete the race in a time of x”, or “How confident are you that you improve upon your own previous performance?”. Whilst task or performance self-efficacy may be easily applied to more simple tasks (e.g., maintaining a contraction on a hand-grip dynamometer), Feltz et al. (2008) cautioned that ‘tasks’ in sport and exercise contexts are much more complex and task self-efficacy may not be the most applicable measurement. Asking how confident athletes are of achieving a time of “X” or a finishing place of “Y”, fails to account for the complex and difficult behaviours which must be performed first. It is therefore important to examine other self-efficacy beliefs as well.

Coping efficacy (or ameliorative efficacy) refers to an individual’s belief in their own capability to cope with threats and difficulties through the utilisation of various coping skills (Bandura, 1997). Coping efficacy is likely to be particularly important in the endurance performance domain, as research has highlighted the need for effective coping and coping strategies during endurance performance (Zepp,

2016). A coping self-efficacy scale was developed by Chesney et al. (2006) in order to assess the perceived coping ability of individuals when faced with life challenges and is made up of three subscales: use problem-focused coping, stop unpleasant emotions and thoughts, and get support from friends and family. Since its initial conception the coping self-efficacy scale has been linked with improved subjective performance and decreased levels of cognitive anxiety in individual and team sport players (Nicholls, Levy, Grice, & Polman, 2009), but no research has explicitly investigated the role of coping self-efficacy in endurance performance.

Self-regulatory efficacy represents an individual's belief in their own capability to control their motivations, thoughts, emotions and behaviours to complete a task (Feltz et al., 2008). It differs to coping efficacy, in that it focuses on how well an individual can control their thoughts, emotions, and behaviour in pursuit of a goal, and not just how well they are able to respond to various stressors. In an endurance context, self-regulatory efficacy may be closely related to adhering to a training regime, and pacing during events (Martin, 2002).

Preparatory efficacy focuses on an individual's belief in their own ability to prepare for an upcoming competition or event. In an endurance context, this could include factors such as adhering to a training regime, their perceived ability to taper effectively, and their perceived ability to ensure adequate nutrition and hydration (Jeukendrup, 2011). As an important distinction between other forms of self-efficacy, Bandura (1997; 2012) suggested that high levels of preparatory efficacy would lead to poor performances. Individuals who possessed a high level of preparatory efficacy, would likely prepare less thoroughly than those individuals who possessed some doubt over their ability. Some recent experimental evidence has also supported this notion. In a muscular endurance task Ede, Sullivan, and Feltz (2017) demonstrated that lower

levels of preparatory efficacy were associated with superior performance in a plank task than high levels of preparatory efficacy. Whilst no such research has examined this in an aerobic endurance context, it is a plausible notion that a certain level of doubt during the preparation phase will likely be beneficial for performance.

The existence of distinct types of self-efficacy belief, however, has been contested by some self-efficacy researchers (e.g., Maddux & Gosselin, 2003). These researchers claim that distinct efficacy beliefs (e.g., coping vs preparatory) do not exist, but rather this apparent distinction represents the variety of domains and scenarios in which self-efficacy is being measured. Further evidence for the existence of different types of self-efficacy, is apparent from studies which have performed factor analysis on self-efficacy scales (e.g., Chesney, Neilands, Chambers, Taylor, & Folkman, 2006; Myers et al., 2012). These studies reveal that self-efficacy scales are typically multi-dimensional, and there appears to exist distinct self-efficacy beliefs. Regardless of whether there exist different efficacy beliefs, an awareness and understanding of multidimensional nature of self-efficacy is beneficial for those interested in investigating self-efficacy, as it helps promote increased levels of validity. Each of these types of efficacy belief also exist across three dimensions; level (magnitude), strength, and generality (Bandura, 1997).

### **Dimensions of Self-Efficacy Beliefs**

Level of efficacy beliefs refers to an individual's perception of performance attainments at different levels of difficulty (Bandura, 1997). For example, a runner will report different perceptions of belief in their ability to run a marathon in four hours as compared to three hours. In the endurance performance domain, the range in the level of self-efficacy (i.e., the different levels of performance attainment possible) may be more restricted than in other sports domains. For instance, if an individual can

throw a dart to hit the bullseye on a dartboard, they are in theory capable of achieving this on every subsequent throw. Although this is likely not to occur due to a variety of reasons (e.g., expertise, attentional focus), the possibility remains. In the endurance performance domain, however, the possible ceiling of performance attainment is largely constrained by an individual's physical fitness and various physiological parameters such as maximal oxygen consumption ( $V_{O2max}$ ), lactate threshold, and movement economy (Joyner & Coyle, 2008). Such ceiling effects make the measurement of self-efficacy level in an endurance context potentially problematic, particularly in physiologically heterogeneous samples.

The strength of self-efficacy, refers to the certainty in that belief, ranging from complete uncertainty to complete certainty. Two rowers might both believe they can achieve a new personal best on a 2000m row, but one may have a greater level of strength in this belief. According to Bandura (1997) strong efficacy beliefs lend themselves to increased effort and perseverance, and in turn success. When discussing self-efficacy beliefs in a sporting context, Bandura often referred to athletes requiring 'resilient' and 'robust' self-efficacy beliefs (Bandura, 1997). These terms were never truly conceptualised by Bandura, but what they appear to represent is the possession of beliefs which are stable over time, and that are not easily changed by conflicting information (e.g., a series of poor performances, unexpected weather conditions). The possession of robust self-efficacy beliefs is also apparent in the mental toughness (e.g., Bull, Shambrook, James, & Brooks, 2005), and sport confidence (e.g., Thomas, Lane, & Kingston, 2011) literature. The differences and similarities between self-efficacy and sport confidence will be discussed later in this chapter, but regardless, the possession of a robust sense of self-efficacy is likely to be beneficial for endurance athletes.

The generality of a self-efficacy belief focuses on its potential transferability across different tasks or domains. Although self-efficacy beliefs are often characterised as task specific beliefs, transferability of these occur when tasks or situations are deemed similar (Bandura, 1997). This capacity for generalisation occurs when an individual can identify various similar sub-skills that underpin performance across the tasks. For instance, a runner who decides to take up rowing might have higher initial levels of self-efficacy compared to a former gymnast, as they already perceive themselves capable of pacing themselves, and coping with various exercise induced sensations. The dimension of generality, and the concept that self-efficacy beliefs can be transferable has led three approaches to conceptualising and measuring self-efficacy beliefs: situation-specific, domain-specific, and general (Bandura, 2006; Grether, Sowislo, & Wiese, 2018).

### **Approaches towards Self-Efficacy Conceptualisation and Measurement**

Situation-specific efficacy beliefs are measured in regard to one particular event or context (e.g., a certain cross-country race) and focus on an individual's perceived capability for that one performance or behaviour. Such an approach most closely resembles Bandura's initial definition of self-efficacy, and situation-specific efficacy beliefs report higher levels of predictive power regarding behaviour and performance than other approaches (Feltz et al., 2008; Moritz et al., 2000). Such an approach is also beneficial in highlighting how contextual and temporal factors (e.g., temperature, weather, perceptions of tiredness) can influence upon self-efficacy. Because of the high levels of specificity, task-specific self-efficacy scales often possess poor generalisability and offer a limited insight into the wider range of antecedents of self-efficacy beliefs (Pajares et al., 2003).

Domain-specific efficacy beliefs, in comparison, utilise the concept of generality, and measure self-efficacy beliefs for performance in a certain domain. Although Bandura initially conceptualised self-efficacy as being highly task-specific (Bandura, 1977), he conceded that "some kinds of experiences create only limited mastery expectations, where still others instil a more generalized sense of efficacy that extends beyond the specific aspect" (Bandura, 1986; p. 84-85). No clear definition of 'domain' has been provided in the self-efficacy research, researchers have instead frequently operationalised domain as relating to the specific topic of interest (Woodruff & Cashman, 1993). The measurement and investigation of domain-specific efficacy is common among educational, organisational, and health care related research (Bandura, 2006). For instance, the mathematics self-efficacy scale (Pajares & Miller, 1995) measures student's self-efficacy pertaining to the domain of mathematics, and is not specific to any particular task or situation (e.g., an upcoming maths test). Such an approach allows a further examination of the more general antecedents (e.g., past experiences, vicarious influences, social support) and consequences (e.g., goal setting, effort, coping) of these self-efficacy beliefs. Additionally, concurrent positive relationships between domain-specific and task-specific efficacy beliefs have been shown repeatedly in the literature (Chen, Gully, & Eden, 2001; Pajares & Urda, 2005; Woodruff & Cashman, 1993).

General self-efficacy beliefs measure an individual's perceived capability across several domains. The existence and measurement of general self-efficacy beliefs is a controversial area among self-efficacy researchers (e.g., Bandura, 1997; Grether, Sowislo, & Wiese, 2018), with opponents arguing that general self-efficacy beliefs rarely represent a true global perspective, and that individuals often judge their capabilities in the context in which they are being examined (Bandura, 2006).

Research has also demonstrated that both task-specific and domain-specific efficacy beliefs are stronger predictors of behaviour and performance (Feltz et al., 2008). Nevertheless, general self-efficacy is still a commonly researched (Gilad Chen, Gully, & Eden, 2001; Luszczynska, Scholz, & Schwarzer, 2005), with researchers arguing that it is a beneficial approach when investigating behaviour across domains (e.g., vocational, social, educational; Scherbaum, Cohen-Charash, & Kern, 2006).

The 'optimal' approach towards self-efficacy therefore depends on the research question being asked (Bandura, 2006). In understanding the explanatory and predictive capability of self-efficacy in the endurance sport domain, a combination of both task-specific and domain-specific approaches are likely to be most appropriate. Alongside this understanding of the types of efficacy belief, the dimensions of these beliefs, and the approaches to measuring these beliefs, it is also important to understand the relationship between self-efficacy beliefs and other similar psychological constructs.

### **Self-efficacy and Related Constructs**

In order for a psychological construct to be able to demonstrate exploratory and predictive power, it is important that such a construct is able to be distinguished from other related constructs (Strauss & Smith, 2009). This next section explores the relationship between self-efficacy and three often conflated constructs: sport confidence, outcome expectancies, and self-esteem (Feltz et al., 2008).

**Sport confidence.** Sport confidence (Vealey, 1986) is the construct that is perhaps most similar to self-efficacy, and is often used inter-changeably in sport psychology research (Feltz et al., 2008). Sport confidence has several clear similarities with self-efficacy; they both represent a cognitive evaluation by an individual of their perceived capability, they both are multidimensional constructs, they both are formed

through numerous sources of experiences, and they both are hypothesised to have powerful downstream effects on behaviour and cognition (Bandura, 1997; Feltz et al., 2008; Vealey & Chase, 2008). These similarities are not surprising given that sport confidence was formulated on the idea that self-efficacy needed to be conceptualised to the sport domain (Vealey, 1986).

The difference between sport confidence and self-efficacy is generally perceived as occurring in the frame of reference in which an individual perceives their capabilities. Sport confidence is typically measured regarding a more general approach (i.e., How confident are you in your abilities as an athlete), whereas self-efficacy is typically more situation and context focused (i.e., How confident are you that you can score two goals today?). Self-efficacy's situation and context focus lends itself to greater predictive power, as a meta-analysis by Moritz et al. (2000) revealed that measures of self-efficacy were greater predictors of performance than measures of sport confidence.

The idea, however, that what separates self-efficacy and sport confidence is the frame of reference is problematic when considering that self-efficacy beliefs can, and often are, measured at a domain specific level as well (Feltz et al., 2008). Vealey's initial reasons for conceptualising sport-confidence was that self-efficacy was not a construct specific to the sporting domain (Vealey, 1986). This point, however, is relatively moot as self-efficacy is not specific to any domain of functioning, it is instead understood to be a construct that underpins behaviour in all domains (Bandura, 1997). Additionally, an examination of other domains in which self-efficacy has been frequently studied (e.g., education, industry, healthcare) has revealed no attempts to further conceptualise self-efficacy into another construct (e.g., academic confidence or behavioural change confidence).



Does sport confidence then represent a distinct and separate construct from self-efficacy? Or does it instead represent the measure of self-efficacy beliefs at a more domain level? If this were to be the case, rather than being separate constructs, sport confidence and self-efficacy may instead represent points on the same continuum. Exploring and examining this relationship between self-efficacy and sport confidence is beyond the scope of the current thesis, but it represents an interesting theoretical debate, and could have implications for how findings from studies which examined self-efficacy and sport confidence are generalised.

**Outcome expectancies.** In his initial conception of self-efficacy in 1977, Bandura also outlined the construct of outcome expectancies. As opposed to self-efficacy beliefs, which represent the perceived capability to perform a behaviour, outcome expectancies are judgements about the likely outcomes that arise from that behaviour (Bandura, 1977). Later work by Bandura (e.g., Bandura, 1997; 2001) argued there to be three major types of outcome expectancy: physical outcomes, social reactions, and self-evaluative reactions. Physical outcomes refer to physical changes that may occur due to engaging in the behaviour (e.g., an improvement in muscle composition), social reactions refer to how other individuals may respond to the behaviour (e.g., praise, encouragement, disapproval), and self-evaluative reactions refers to how an individual will judge themselves (e.g., a sense of accomplishment, a sense of failure). Bandura contested that whilst self-efficacy beliefs can and do influence outcome expectancies, outcome expectancies do not causally influence self-efficacy beliefs (Bandura, 1997). Additionally, whilst outcome expectancies do contribute towards an individual behaviour, self-efficacy is still the dominant construct in predicting behaviour, and research has largely supported this claim (Bandura 1995; 2002).

The distinction and relationship between self-efficacy and outcome expectancies has been heavily contested since their initial conception, with several authors arguing that outcome expectancies can and do have a causal effect on self-efficacy beliefs (Borkovec, 1978; Corcoran, 1991; Kirsch, 1985, 1995). Research by Kirsch, for example highlighted that self-efficacy beliefs to engage with a phobic stimulus (e.g., a snake phobic handling a snake) were higher when participants were offered monetary incentives to engage in the behaviour. According to self-efficacy theory the offering of monetary rewards should not change an individual's perceived capability to perform a task, although it may change the likelihood of them performing it (Bandura, 1997). A recent critical piece by Williams and Rhodes (2016) argued that this conflation between self-efficacy and outcome expectancies, means that the current conceptualisation of self-efficacy is flawed, and the common way of assessing self-efficacy (i.e., How confident are you that you can...), rather than measuring perceived capability actually assesses potential motivation. An important caveat to consider is that the Williams and Rhodes (2016) paper was approached from the perspective of health psychology, and the potential generalisations of these ideas to the sports domain could be problematic. As mentioned, self-efficacy beliefs are only valid predictors of behaviour when an individual possess a goal to achieve, and they perceive beneficial outcomes from engaging in that behaviour (Bandura, 1997), and both aspects are likely to be higher in athletes than in individuals engaged in health psychology research (e.g., sedentary inactive individuals, smokers).

**Self-esteem.** Like self-efficacy, self-esteem represents an appraisal of the self, but it represents an affective judgement, rather than a cognitive one (Schunk & Pajares, 2002). Self-esteem is focused on perceptions of 'worthiness', whereas self-efficacy is based on perceived capability to carry out a task (Bandura, 1997). An individual, for

example, may have low levels of self-efficacy for a specific task, but can still retain high levels of perceived 'worthiness' if they do not deem that performance on that task to be an integral part of their self-worth. When examining contexts in which individuals are likely to derive a sense of self-worth from their performances (e.g., endurance athletes engaging in their endurance sport), however, the two constructs are likely to be conflated (Feltz et al., 2008). For instance, the 'Physical Self-efficacy Scale', was a scale developed to measure an individuals perceived physical capabilities (Ryckman, Robbins, Thornton, & Cantrell, 1982), and was found to be a predictor of performance in a variety of physical tasks, including marathon running (Gayton, Matthews, & Burchstead, 1986). Further examination of the scale, however, revealed that the scale was instead more closely related to perceptions of physical self-esteem rather than self-efficacy (Feltz et al., 2008). This highlights the need to be aware of the possibility of conflation, in order to promote higher levels of internal validity (Bandura, 2006).

Importantly, self-esteem can, and often does influence self-efficacy as well. Individuals who possess low levels of global self-esteem, report lower levels of self-efficacy across a variety of tasks and domains compared to high global self-esteem individuals (Afari, Ward, & Khine, 2012). As an explanation for this, low self-esteem individuals are hypothesised to have an elevated self-attentional focus (i.e., concern about their anxieties and inadequacies) that can diminish self-efficacy and in turn performance (Bandura, 1997). Additionally, low self-esteem individuals are hypothesised to attribute successful performances to more external and unstable factors. This appraisal and attributional process is a key stage in the formation of self-efficacy beliefs (Gist & Mitchell, 1992), and the next section of this chapter will examine how self-efficacy beliefs are formed and altered.

## **Formation of Self-Efficacy Beliefs**

Self-efficacy beliefs are generated through a series of cognitive processes involving the selection, interpretation, and integration of several sources of efficacy information (Gist & Mitchell, 1992; Bandura, 1997). These cognitive processes are a dynamic process, with changes occurring as new and relevant information is identified and internalised. In order to understand the formation and alteration of self-efficacy beliefs Gist and Mitchell (1992) outlined a three-stage process that consisted of analysis of task requirements, attributional explanations for previous performances, and analysis of situational or personal resources.

The first stage in the formation of self-efficacy beliefs is an analysis of the task requirements. As self-efficacy represents a perceived capability, individuals must first gain an understanding of what they are required to do. A cyclist, for example, will consider the physiological, tactical, and psychological requirements of achieving a certain finishing time in an upcoming road race, and the perceived difficulty or ease of these requirements will influence their self-efficacy. Perceived task difficulty is likely to be a key factor in this initial stage of formation. A recent study by Sides, Chow and Tenenbaum (2017) revealed that changes in perception of task difficulty (e.g., a change in the intensity of a hand-grip exercise) led to lower levels of self-efficacy for that task. In the endurance performance domain these perceptions of task difficulty could relate to several factors such as: terrain, other competitors, weather, and familiarity. These task difficulty perceptions help highlight the role of the environment, and further reinforce the process of triadic reciprocal determinism which underpins social-cognitive theory.

As individuals gain more experience with tasks and situations, this assessment of task demands becomes more of an automated process, and individuals are instead likely to rely on their interpretation of the causes of previous performance (Bandura,

1989, 1997; Gist & Mitchell, 1992). The attributional analysis of experience involves individuals seeking to understand why a performance level occurred. According to Weiner's attribution theory (1985, 1992), individuals attribute their performance across three key dimensions: locus of causality, stability, and controllability. Locus of causality refers to whether the causes of performance are internal or external to the person, stability refers to the extent that a cause is likely to change, and controllability refers to whether a cause can be modified by a person (Weiner, 1985). Perceptions of stability and controllability have been demonstrated to be the two most important attributions in regards to self-efficacy (Coffee & Rees, 2008; Gernigon & Delloye, 2003). For instance, in a sample of 62 sprinters, Gernigon and Delloye (2003) reported that self-efficacy was increased when unexpected positive results were attributed to controllable causes. This attributional research, however, has largely relied on novel tasks (e.g., blindfolded dart-throwing – Coffee & Rees, 2008), and no studies have examined the attribution-self-efficacy link in an endurance context.

The last level of analysis requires individual to assess the availability of specific resources or constraints for performing the task. This assessment considers personal factors (e.g., ability level, fitness level, anxiety, available effort, and desire to perform well) as well as situational factors (e.g., competing demands, distractions, difficulties) that would influence performance on the task (Gist & Mitchell, 1992). It is hypothesised that the more perceived personal resources an individual possesses the greater their self-efficacy belief (Bandura, 1987). This assessment of personal and situational factors is likely to be an ongoing process during tasks (Gist & Mitchell, 1992). In an endurance performance context, this assessment of personal resources might relate to perceptions of fitness, fatigue, and other various exercise induced sensations (e.g., perception of effort, pain; Samson, 2014).

Importantly, the level of processing at which these three stages may occur, may not always remain constant. A study by LaForge-Mackenzie and Sullivan (2014) suggested that there may be differences in the formation of self-efficacy beliefs when comparing continuous to non-continuous conditions. In continuous conditions (e.g., continuous running), cognitive processing relating to changes in self-efficacy beliefs are likely to be largely automatic and based on current performance of the task. Comparatively, in non-continuous conditions individuals are likely to have the time to engage in more analytical processing and may draw on a variety of other sources of information (e.g., their physiological states, how they have seen someone else do the task). Although the task they used (basketball dribbling), lacks generalisability to endurance performance, it raises important questions regarding how self-efficacy may change during performance. Although all endurance sports are performed continuously, and as such non-continuous performance does not occur in endurance sport, it may instead be that the physical intensity the sports are performed at may influence the level of processing which occurs. Intensity is generally highest over shorter distances and durations (e.g., sprint triathlon, 5000m run), and it may be in these events that these cognitive appraisals and analyses are more automatic. Comparatively in less intense distances (e.g., ultramarathon), it may be that these cognitive processes are more in depth and analytical. Such an explanation could relate to factor such as cerebral oxygenation, which is decreased in higher intensity exercise (Bhambhani, Malik, & Mookerjee, 2007). Gaining an awareness of the level at which these cognitive processes occur would be an important step in understanding the dynamicity of self-efficacy beliefs, and in turn the possibility for intervention. Assessing and measuring such changes in cognitive processes is difficult due to a variety of technical and logistical reasons, but the use of “Think Aloud” protocols

could enable this to occur, as they have been demonstrated to be useful in assessing the cognitions of competitive cyclists (Samson, Simpson, Kamphoff, & Langlier, 2017; Whitehead et al., 2017).

To carry out these cognitive appraisals and analyses, individuals draw on various sources of efficacy information. Bandura initially outlined four sources of self-efficacy information: enactive mastery experiences (also known as past performance experiences), vicarious influences, verbal persuasions and physiological states (Bandura, 1977). The number of sources has varied over time with some authors adding imaginal experiences as a separate source (e.g., Maddux, 1995), and others arguing for a separation of physiological and emotional states (e.g., Feltz et al., 2008). The current thesis intends to focus on five sources of self-efficacy, as there are the most frequently discussed in the literature (e.g., Feltz et al., 2008; Samson, 2014) past performance experiences, vicarious influences, verbal and social persuasions, physiological states, and emotional states.

### **The Sources of Self-Efficacy**

Before examining the specific sources of self-efficacy, it is important to consider the temporal frame in which these sources are appraised. Maddux (1995) suggested that experiences and information could be separated into ‘distal’ and ‘proximal’ sources of self-efficacy. Distal sources are those based on experiences and informed received in the past. This could consist of previous performances or previous feedback and praise received from a coach. In comparison, proximal sources are the immediate and current sources that inform perceived capability when engaging in a task. For instance, a marathon swimmer may consider their current performance progression and be aware of various exercise induced sensations they are feeling. The interaction between distal and proximal sources has surprisingly received little

attention in the self-efficacy literature, with most research only focusing on distal sources of self-efficacy (e.g., Chase et al., 2003; Feltz et al., 2008; Samson, 2014). Only focusing on distal sources of self-efficacy is problematic, because it means that potentially useful proximal sources of information are not identified in the literature. An awareness of these proximal sources could help with the design and delivery of interventions to aid self-efficacy and endurance performance. For example, a cyclist who currently perceives themselves to be progressing poorly on the task (a proximal source of self-efficacy) could be encouraged using various psychological skills to instead focus more on a prior successful performance (a distal source of self-efficacy). With an awareness of distal and proximal sources now provided, the next sections will now examine the proposed sources of self-efficacy.

**Past performance experiences.** An individual's own prior performance experiences are hypothesised to be the most powerful source of efficacy, as they possess the most salience to the individual (Bandura, 1997). Generally, repeated successes are hypothesised to lead to increases in self-efficacy, whereas repeated failures are hypothesised to lead to decreases in self-efficacy. Importantly, it is not the objective outcome of the performance, but an individual's perception of the performance that dictates how that performance contributes towards self-efficacy. For instance, an individual may win a race, but if they believe this to only have occurred due to other competitors failing to perform well, their self-efficacy is likely to be unaffected. There exists a wide range of contextual variables which can also influence how a performance experience may contribute towards self-efficacy. Variables such as task difficulty, external support, and occurrence of failure, can all influence how much a performance experience may influence a self-efficacy belief (Bandura, 1997; Gist & Mitchell, 1992). In the endurance sport domain, exercise induced sensations



(e.g., perception of effort and pain) may be further key variables mediating the relationship between performances and self-efficacy, and this in turn links with the source of physiological states. Decreased levels of perception of effort at a set a pace or output (i.e., the task feels less effortful than previously), could indicate to individuals' higher levels of perceived capability and vice versa. There is some evidence from the exercise psychology literature supporting this relationship, with McAuley and colleagues demonstrating that perception of effort during a task is a significant predictor of post-exercise self-efficacy (McAuley & Courneya, 1992; McAuley & Blissmer, 2000). There is, however, a lack of research investigating how these exercise-induced sensations may interact with performances in endurance athletes.

The claim that past performance experience is the most powerful source of self-efficacy has received extensive support from both the quantitative and qualitative literature. Quantitative studies in sport psychology have revealed strong positive correlations between an individual's experience level and their self-efficacy (Bandura, 1997; Ericsson & Anders, 2006), and regression studies have consistently revealed that past-performance experience is generally the most powerful predictor of future self-efficacy beliefs (Gilson, Chow, & Feltz, 2012; LaForge-MacKenzie & Sullivan, 2014; Warner, Schüz, Knittle, Ziegelmann, & Wurm, 2011). Several qualitative studies have also revealed that past performance experiences are the most cited source of self-efficacy, and that athletes often consider their own experiences the key aspect of their self-efficacy (Samson, 2014; Valiante & Morris, 2013). In an endurance context, a qualitative study by Samson (2014) revealed that past performance experiences were the third most frequently cited source of self-efficacy in a group of marathon runners, potentially contradicting Bandura's initial claim. When, however,

excluding individuals who lacked prior experience (i.e., it was their first marathon), past-performance experiences became the most cited source of self-efficacy. Such a finding helps to demonstrate the need to be aware of participant experience levels when examining the sources of self-efficacy, but also to consider what sources novice or beginner athletes may draw on.

**Vicarious influences.** When an individual lacks prior experiences with a task, they are likely to gain efficacy information through the observation and modelling of others, which represents the source of vicarious influences. Through watching and observing other people engage in tasks, individuals infer information about their own capabilities (Bandura, 1997). Watching someone, for example, persevere with a difficult task, can help develop self-efficacy towards the task, if the observer feels the modeller is similar to them (e.g., sex, age, skill level; Bandura, 1997; Mitchell & Gist, 1992). Conversely, watching an individual who is perceived to have high levels of competence fail or struggle on a task, can decrease levels of self-efficacy (Bandura, 1997).

As well as modelling, vicarious influences can also contribute to self-efficacy through observation and social comparison. When engaging in competitive settings, individuals often attempt to appraise the strength of their competitors, and this perception of strength can alter self-efficacy for the upcoming task, as it influences the perceived task difficulty and demands (Bandura, 1997). In one of the first studies conducted examining self-efficacy and physical performance, Weinberg and colleagues demonstrated that self-efficacy was increased for a leg extension task when individuals perceived themselves to be competing against an injured athlete, but self-efficacy was decreased when individuals perceived themselves to be competing against a collegiate athlete (Weinberg, Gould, & Jackson, 1979; Weinberg, Gould,

Yukelson, & Jackson 1981). Such social comparisons are likely to be commonplace in endurance sport, where athletes may attempt to gauge the strength and weakness of other competitors or athletes in their training group. These social comparisons could occur prior to events, where athletes may make comparisons based on perceptions of fitness (e.g., body fat percentage, physique) or equipment (e.g., the cost and make of a specialist road bike). Social comparisons could also occur during events as well. A runner who overtakes a rival who appears to have laboured breathing, may infer from this that they have a higher level of capability than their opponent, and their self-efficacy to beat them may be raised. Whilst there exists some research examining these social comparisons (Greenlees, Buscombe, Thelwell, Holder, & Rimmer, 2005), there is no research explicitly examining it in relation to endurance sport.

A well-researched area in relation to vicarious influences in endurance performance is through the concept of self-modelling. Self-modelling refers to the observation of oneself performing, and therefore combines elements of both past performance experiences and vicarious influences (Bandura, 1997). Williams et al. (2017) asked participants to match a digital avatar on a virtual cycling course. The cyclists were told that the avatars represented their previous performance level, but on two trials the avatars were altered to be 2% or 5% faster. Both the 2% and 5% condition led to improvements in performance, however, self-efficacy to maintain the current pace was lower in the 5% condition. Such findings help demonstrate novel ways of examining and assessing self-modelling in an endurance context.

**Verbal and social persuasions.** Verbal and social persuasions offer a further source of information for the formation of self-efficacy beliefs. When an individual receives positive feedback and praise about their capabilities, their self-efficacy is likely to be raised, whereas abject criticism is likely to undermine self-efficacy beliefs

(Bandura, 1997; Feltz et al., 2008). In a sporting context, a key source of verbal and social persuasions is likely to be coaches and training partners, and several qualitative studies have supported that these individuals play a pivotal role in contributing to efficacy beliefs (Chase et al., 2003; Valiante & Morris, 2013). Alongside feedback, praise and criticism, the expectations that athletes believe people have about them is also likely to contribute towards self-efficacy (Feltz et al., 2008). Regarding contextual factors, the perceived credibility and expertise of the provider is hypothesised to influence how much the verbal persuasion may influence self-efficacy (Bandura, 1997). Rather than influencing efficacy beliefs directly, Bandura (1997) argued that verbal and social persuasions contribute to self-efficacy primarily through their reinforcement of past performance experiences. This hypothesis has received some support, as a study by Wise and Trunnell (2001), revealed that verbal persuasion following a successful performance, led to greater increases in self-efficacy than various other combinations of self-efficacy information for a weightlifting task. Research has not however examined such a hypothesis regarding an aerobic endurance task.

Verbal persuasions can also be provided by the self, with self-talk being a common strategy for enhancing self-efficacy used by individuals. Self-talk represents the words or phrases that an individual says to themselves (Hatzigeorgiadis, Zourbanos, Goltsios, & Theodorakis, 2008), and several studies have demonstrated that increases in positive self-talk can lead to increases in self-efficacy (Hatzigeorgiadis et al., 2008; Zetou, Vernadakis, Bebetos, & Makraki, 2012). Self-talk may act in a similar way to verbal persuasions received from others, in that it can help reinforce capability (Feltz et al., 2008). In relation to endurance performance, self-talk interventions have been demonstrated to lead to improvements in cycling

performance (Blanchfield, Hardy, De Morree, Staiano, & Marcora, 2014; Wallace et al., 2017). In the study by Wallace et al. (2017) a self-talk intervention focusing on using motivational self-talk to counteract the effects of exercising in a heat chamber, revealed that cyclists not only improved their performance but were also able to increase their core body temperature. When considering the cognitive appraisals and processes in the formation of efficacy beliefs, it may be that self-talk can help promote perceived resources and distract away from potential constraints (e.g., the heat). Although none of these experimental laboratory studies measured self-efficacy, it could be plausible that self-efficacy could have acted as a mediating variable explaining this relationship, however future research is needed to investigate this.

**Physiological states.** Individuals also gain efficacy information through appraising their physiological states. Physiological states refer to a variety of physiological and psychophysiological states such as perceptions of strength, arousal, pain, exertion, discomfort, effort, and fatigue (Bandura, 1997; Feltz et al., 2008). In his initial conceptualisation of physiological states, Bandura focused on the concept of physiological arousal and somatic anxiety (Bandura, 1977; 1981), but later work has come to focus on a variety of physiological sensations (Feltz et al., 2008).

The salience of physiological states as a source of efficacy, is hypothesised to be dependent on the physical demands of the task (Bandura, 1997), with increased salience for physiological states as physical demands increase. This hypothesis has received some support as Chase, Feltz, and Lirgg (2003) demonstrated that physiological states was the second most cited source of self-efficacy across a basketball season, and Samson (2014) demonstrated that physiological states was the most frequently cited source of self-efficacy for an upcoming marathon. Additionally, research examining the sources of self-efficacy beliefs in less physically demanding

sports, such as golf, has often failed to evidence the importance of physiological states (Valiante & Morris, 2013). Research, however, has often failed to identify what specific physiological states (e.g., perception of effort, pain, and fatigue) may contribute to or undermine self-efficacy.

Whilst most of the research has focused on how physiological states may contribute to self-efficacy for a specific event or competition, physiological states are likely to be a key factor in the alterations that occur to self-efficacy during performances. During endurance performance, athletes may compare what they are currently feeling (e.g., perception of effort) to what they expect to be feeling based off past performance experiences. This monitoring of the current physiological state (interoception) and the appraisal between current physical sensations and expected sensations has been highlighted and documented in several areas of research relating to endurance performance (Brick, MacIntyre, & Campbell, 2016; Tucker, 2009). Severe dissonance between these proximal and distal sources might lead to individuals perceiving that they do not possess the capabilities to achieve their goals and therefore they might disengage from the task. Evidence comes from research into ultramarathons where unexpected pain at early stages was one of the most significant predictors of withdrawal from the event (Hoffman & Fogard, 2011).

Given the physical demands of endurance sport, it is likely that the sources of past performance experiences and physiological states are highly correlated together. Importantly, this supports a key tenet of self-efficacy theory, in that the sources of self-efficacy do not represent distinct separate entities, but that there often exists a considerable amount of overlap between them (Bandura, 1997). An understanding of what specific physiological perceptions contribute to self-efficacy in endurance athletes, and the interaction between distal and proximal sources of self-efficacy could

prove highly beneficial in gaining an understanding of how self-efficacy beliefs are formed and altered in endurance athletes.

**Emotional states.** An individual's perception of their emotional state can also contribute towards self-efficacy. Research has indicated that efficacy beliefs are often increased through positive emotions and decreased through negative emotional states (Gist & Mitchell, 1992; Kavanagh & Bower, 1985; Martin, 2002). This may be because more positive affect may encourage a more positive viewing of potential resources and capability, whereas negative affect may promote more attention towards the situational demands and difficulties (Feltz et al., 2008). A key difficulty in understanding the emotional states – self-efficacy relationship, is that emotional states act as both a source of efficacy beliefs, but also an outcome of them (Bandura, 1997). For instance, research by McAuley and colleagues in exercise settings has revealed that individuals with higher levels of self-efficacy are more likely to report more positive affect during strenuous exercise than those with low levels of self-efficacy, yet at the same time positive affect during exercise is a significant predictor of future self-efficacy beliefs (McAuley & Blissmer, 2000; McAuley & Courneya, 1992).

In an endurance context, the experience of positive emotions, such as feelings of happiness, excitement and calmness have been linked with increased levels of self-efficacy in road wheelchair racing (Martin, 2002). Other research investigating the sources of self-efficacy for endurance sport, has often failed to find evidence for emotional states being an important source of efficacy information (Samson, 2014). In a similar way to physiological states, it may be that emotional states contribute most to self-efficacy beliefs when examined at the proximal level (i.e., in event).

**Other sources of self-efficacy.** Within the sport confidence literature, there have been several attempts to identify sources of sport confidence that are not apparent

in regards to the initial sources of self-efficacy. Vealey et al. (1998) through a series of studies with high school and collegiate athletes, identified nine sources of sport confidence: mastery, demonstration of ability, physical and mental preparation, physical self-presentation, social support, vicarious experience, coaches' leadership, environmental comfort, and situational favourableness. Similarly, Hays et al. (2007) adopting a qualitative research design, also identified nine sources of sport confidence in 'World Class' athletes: preparation, performance accomplishments, coaching, social support, innate factors, experience, perceived competitive advantage, trust, and self-awareness. Several of the sources identified by Vealey and Hays clearly fit into Bandura's initial proposed sources of self-efficacy, most likely because self-efficacy was used as the basis for sport confidence. For instance, "social support", "coaches' leadership", "social support", and "coaching" all can be considered part of the social and verbal persuasions source (Feltz et al., 2008).

Several of the sources identified by Vealey et al. (1998) and Hays et al. (2007), however, do not appear to fit into any of the proposed sources. For instance, Hays et al. (2007) identified a source of "innate ability" which referred to an athlete's belief that they had been born with certain positive characteristic that benefitted them in their sport. Whereas such a finding may at first appear to indicate the existence of further sources not identified by Bandura (1997), what it instead represents is an example of the appraisal and attributional processes which lead to the formation of self-efficacy beliefs. The belief in "innate ability" may be a way for athletes to attribute their performances to internal, stable, and uncontrollable causes, which has been previously demonstrated to lead to increases in self-efficacy (Gernigon & Delloye, 2003). These findings help demonstrate the need to not only understand what information



contributes to self-efficacy beliefs, but also why and how this information may contribute.

Whilst the findings of Vealey et al. (1998) and Hays et al. (2007), do not reveal the presence of any additional sources, they do emphasise the need to attempt to identify sources of self-efficacy that are domain specific. Whilst the study by Samson (2014) demonstrated the potential salience of the different sources of self-efficacy in the endurance performance domain, it failed to identify the specific information within these sources that contribute towards self-efficacy. An understanding of these specific experiences or perceptions, would be beneficial in the design and delivery of interventions designed to enhance self-efficacy. For interventions to be worthwhile, however, they must aim to influence a variable which influences key outcomes such as performance, satisfaction, or coping. The next section of this chapter will examine the relationship between self-efficacy and endurance performance.

### **Self-Efficacy and Endurance Performance**

Both narrative (Feltz et al., 2008) and systematic (Moritz et al., 2000) reviews have consistently revealed that self-efficacy is positively associated with sport performance. This relationship between self-efficacy and performance is also apparent across a wide variety of endurance sports. In distance running, Okwumabua (1985) revealed that pre-event self-efficacy strength explained 46% of the variance in marathon performance time in a sample of ninety runners. When examining the relationship between self-efficacy and athletic performance, Bandura cautioned that athletes should possess sufficient information and experience to base their efficacy beliefs on, in order for the results to be considered valid. This was the case in the study by Okwumabua (1985) as the runners had 4.8 years of running experience on average, and on average had completed at least two prior marathons. Similar findings for

distance running, were also demonstrated by Laguardia and Labbé (1993), who found that self-efficacy was negatively correlated with performance time across a range of track running distances (1500m, 5000m, 10000m) in a sample of 63 club level athletes. Martin and Gill (1991) also investigated the role of self-efficacy in distance running in a sample of 73 high school distance runners. Their findings revealed that outcome self-efficacy (i.e., the perceived capability of achieving a certain finishing place), but not performance self-efficacy (i.e., the perceived capability of achieving a certain finishing time), was correlated with finishing time and finishing place. Reasons for this finding could relate to the relative lack of experience in the High School distance runners, but it could also reflect the requirements of performing well. When competing against other athletes in head to head competition, the goal of the athlete is often to win the race, not necessarily run a personal best (which was how performance self-efficacy was conceptualised in the study). This reveals the need for congruence between how self-efficacy is assessed, and the performance variable measured (e.g., finishing time or finishing place). In support of this distinction between outcome self-efficacy and performance self-efficacy, Martin (2002) also demonstrated that outcome self-efficacy was significantly correlated with finishing place in a sample of 51 wheelchair road races, but no relationship was found for performance self-efficacy. Self-efficacy has also been demonstrated to be a powerful predictor of performance in Ironman Triathlon. Through regression analysis, Burke and Jin (1996) revealed that performance self-efficacy was a more powerful predictor of performance for Ironman triathlon than previous performance history, maximal oxygen consumption or measures of sport confidence in a sample of 40 experienced Ironman Triathletes.

Whilst the previous studies have predominately relied on correlational and regression analyses, experimental research has also demonstrated a beneficial effect

of self-efficacy. Miller (1993) experimentally manipulated performance self-efficacy using false performance feedback in a sample of 84 competitive swimmers. The results revealed that increases in self-efficacy were associated with superior performance, and decreases in self-efficacy were associated with diminished performance. Experimental research by Stoate, Wulf, and Lewthwaite (2012) and Montes, Wulf, & Navalta (2017), has also revealed that experimentally manipulated self-efficacy can influence running economy and maximal oxygen consumption respectively. In both studies, increases in self-efficacy led to improvements in the physiological variable, and while by themselves these do not constitute 'endurance performance', they demonstrate how self-efficacy can influence physiologically relevant mechanisms (Joyner & Coyle, 2008). Self-efficacy beliefs of course do not directly alter physiological functions, rather it is hypothesised to influence performance through a variety of other cognitive and behavioural mechanisms. An understanding of these mechanisms, can help provide further rationale for the role of self-efficacy in endurance performance.

### **Mechanisms of Self-Efficacy**

A variety of cognitive and behavioural mechanisms have been proposed through which self-efficacy may exert its influence on behaviour and performance (Bandura, 1997; Feltz et al., 2008). The following section will examine three proposed mechanisms through which self-efficacy may feasibly influence endurance performance; goal setting and motivation, perception of effort, and pain tolerance.

**Increased goal setting and goal attainment.** One of the ways in which self-efficacy is proposed to influence behaviour is through its effect on goal setting, and subsequent goal attainment. A key tenet of self-efficacy theory is that individuals with higher levels of self-efficacy set themselves more challenging goals, and are more willing to invest effort in order to achieve these goals (Bandura, 1997; Maddux, 1995).

The setting of these challenging goals helps to promote a positive feedback loop for self-efficacy beliefs, as the achievement of these goals help further raise self-efficacy. Studies in sport settings have supported this tenet, with athletes possessing high levels of self-efficacy setting themselves more challenging goals (Kane, Marks, Zaccaro, & Blair, 1996; Theodorakis, 1995). The setting of these challenging goals is proposed to encourage athletes to invest more effort into tasks, and such a proposition has also been supported in the research literature (Howle, Dimmock, & Jackson, 2016; Hutchinson, Sherman, Martinovic, & Tenenbaum, 2008; Weinberg, Hughes, Critelli, England, & Jackson, 1984).

In an endurance sport context Bueno, Weinberg, Fernández-Castro, and Capdevila (2008) investigated how self-efficacy would influence the response to perceived poor progress towards goal achievement in a 1500m run. When presented with poor task progress, individuals high in self-efficacy responded by maintaining their current goal and increasing their effort, whereas low self-efficacy individuals lowered their goals and reduced their effort into the task (Bueno et al., 2008). How endurance athletes respond to perceived task progression could also have potential implications for pacing strategy and pacing profiles as well. The study by Bueno et al. (2008), however, only examined the relationship between self-efficacy and goals in an acute setting. The relationship between self-efficacy and goal setting is, however, proposed to be more prolonged, with the setting and achievement of goals over a long period of time contributing to increased levels of self-efficacy, and in turn performance (Feltz et al., 2008). There is, however, a lack of studies investigating this long term effect of goal setting and performance on sport performance in general, not just endurance.

**Reductions in perception of effort.** Perception of effort represents the subjective sensation of how hardy, heavy, or strenuous an exercise task feels, and acts as a key determinant of endurance performance (Marcora, Bosio, & de Morree, 2008; McCormick et al., 2015; Pageaux, 2016). Accordingly, perception of effort is often a targeted variable in interventions designed to improve endurance performance, and research has consistently demonstrated that reductions in perception of effort lead to superior endurance performance.

Earlier in this chapter perception of effort was discussed as a potential source of self-efficacy, but research has also suggested that self-efficacy beliefs can influence perception of effort as well. For instance, McAuley and Courneya (1992), found that after controlling for physical fitness, self-efficacy explained a significant proportion of the variance in RPE during a fixed rate cycling task. Other research has suggested a negative relationship between self-efficacy and perception of effort, with higher levels of self-efficacy being associated with decreased levels of perception of effort (McAuley & Blissmer, 1992; Motl et al., 2007; Tenenbaum & Hutchinson, 2012). Several possible mechanisms through which self-efficacy may influence perception of effort have been proposed, which include improvements in positive affect, attentional focus, and perceived coping ability (McAuley & Courneya, 1992; Tenenbaum & Hutchinson, 2012).

This body of research, however, has predominately focused on either sedentary or untrained individuals, and there is no research examining the relationship between self-efficacy and perception of effort in well trained or experienced endurance athletes. Although caution is warranted in generalising results from non-trained and non-competitive individuals, it is not implausible that self-efficacy may interact with perception of effort in more experienced and well-trained individuals.

**Improved pain tolerance.** Exercise-induced pain refers to the acute unpleasant sensory or emotional experience which arises from the performance of high intensity exercise (Mauger, 2014). Alongside perception of effort, exercise-induced pain has also been demonstrated to be an important determinant of endurance performance (Astokorki & Mauger, 2016). The relationship between self-efficacy and pain is well established, with self-efficacy being associated with superior pain tolerance in a variety of contexts (Lirgg, 1992; O’Leary, 1985; Peerdeman, van Laarhoven, Peters, & Evers, 2016). In regards to exercise-induced pain research has revealed that both pre-existing and experimentally induced self-efficacy can influence an individual’s pain tolerance (Baker & Kirsch, 1991; Weinberg et al., 1984). These studies have suggested that self-efficacy influences pain tolerance through increased levels of perceived control, and through the promotion and engagement of more adaptive coping strategies.

Endurance athletes also display greater levels of self-efficacy for pain management and tolerance than non-endurance individuals (Johnson, Stewart, Humphries, & Chamove, 2012). Importantly, in Johnson et al. (2012) participants were exposed to a type of pain (potassium iontophoretic), which is hypothesised not to be affected by muscular development, blood flow, and vasomotor activity (Benjamin & Helvey, 1963). This means that it is likely that this improved pain tolerance is caused by a psychological adaptation, rather than a physiological one. As noted by the authors, causality of this relationship was out of the scope of their study, but nevertheless it demonstrates the potential effects of self-efficacy on pain tolerance and management.

## **Limitations of the Self-Efficacy and Endurance Performance Research**

Despite the apparent strength of research supporting the relationship between self-efficacy and endurance performance, there are several limitations that must be considered. These limitations relate to an overreliance on hierarchical and unidimensional scales for measuring self-efficacy, a tendency to only investigate self-efficacy at the between-subject level, and a false assumption of a positive linear relationship between self-efficacy and performance.

Most studies investigating the self-efficacy – endurance performance relationship has predominately relied on hierarchical measures of self-efficacy (e.g., Burke & Jin, 1996; LaGuardia & Labbé; Okwumbua, 1985). Hierarchical measures consist of a series of ascending or descending times or distances and are a common approach to self-efficacy measurement in the sports and exercise psychology literature (Feltz et al., 2008). Feltz et al. (2008), however, cautioned against an overreliance on such scales as it simplifies complex performances. Performance in endurance sport is not just about the execution of continuous physical motor skills, but it is also about the execution of a variety of technical, logistical, and psychological skills (Taylor, 1995). Additionally, whereas such scales can be useful for providing evidence for the link between self-efficacy and performance, they often possess limited practical benefit for practitioners, coaches, and athletes. For instance, two athletes could both perceive themselves not capable of achieving a certain time for a race. For one athlete, this may be due to them believing that their training has not been appropriate, whereas the second athlete may believe themselves not capable of coping with the exercise-induced pain. A hierarchical scale would detect that both athletes perceive themselves incapable of that time, but it would not be able to highlight the potentially problematic area, and this therefore limits the possibility of intervention (Bandura, 1997; Feltz et al., 2008).

An overreliance on hierarchical scales also often fails to account for the multidimensionality of self-efficacy beliefs (Bandura, 1997). Only Martin (2002) attempted to account for the multidimensionality of self-efficacy beliefs, through the measurement of self-regulatory and training self-efficacy alongside performance self-efficacy. Taking a more holistic approach to measuring self-efficacy beliefs, will likely provide further theoretical and practical information to both researchers and practitioners interested in self-efficacy in the endurance sport domain.

A second limitation is that the studies investigating the self-efficacy – endurance performance relationship have only examined it at the between-subject level. According to several researchers, a focus on self-efficacy at the between-subject level, has led to an artificial positive relationship between self-efficacy and performance (Sitzmann & Yeo, 2013; Vancouver, 2012; Vancouver & Kendall, 2006). Proponents of this claim argue that the effects of self-efficacy on performance are relatively null, and that past performances are the key predictor of future performance. A meta-analysis by Sitzmann and Yeo (2013), which examined longitudinal studies of self-efficacy and performance at the within-subjects level, supported this claim by finding that changes in performance had substantial, positive effects on subsequent self-efficacy beliefs, but, self-efficacy's relationship with subsequent performance was null after controlling for past performance. Although some research into athletic performance has refuted this claim (e.g., Gilson et al., 2012) it still represents a potentially problematic area for self-efficacy research.

A focus on the between-subjects level of analysis in endurance performance may be particularly problematic due to the role of physiology in dictating possible performances. As discussed previously in the chapter, physiological variables (e.g., VO<sub>2</sub>max, lactate threshold, economy) can help set a 'ceiling' of what an athlete is



capable of achieving and are likely to be heavily correlated with previous performances (Joyner & Coyle, 2008). Although some of the studies have attempted to control for physiological variance (e.g., Burke & Jin, 1996 measured maximal oxygen consumption), other studies have often utilised physiologically heterogeneous groups (e.g., Okuwumbua, 1985). The lack of within-subject analyses makes it difficult to draw strong conclusions on the relationship between self-efficacy and endurance performance. Longitudinal studies which examine the relationship between self-efficacy and endurance performance at the within-subject level, or studies which look to use physically homogenous samples at the between-subject level, would help provide further evidence for this.

A third limitation and related to the reliance on between-subjects level of analysis, is the idea that self-efficacy is always beneficial for performance. A growing body of research has begun to argue that given certain situational contexts (e.g., ambiguous performance feedback), self-efficacy can have a null, or negative effect on performance, and that the assumption of a monotonic relationship between self-efficacy and performance is false (Halper & Vancouver, 2016; Vancouver, 2005; Vancouver & Kendall, 2006). Such null or negative effects of self-efficacy on performance have been demonstrated in golf putting (Beattie, Fakehy, & Woodman, 2014), cognitive tasks (Vancouver & Kendall, 2006), and muscular endurance tasks (Halper & Vancouver, 2016). Explanations for these negative or null effects are largely grounded in Powers' (1973) perceptual control theory. According to perceptual control theory, when individuals possess high levels of self-efficacy, and performance feedback is ambiguous, they are likely to place less effort into the task, as they believe that performance is easily achievable (Powers, 1973). Such claims have also received support from the self-efficacy literature, with (Ede et al., 2017) demonstrating that

lower levels of self-efficacy were associated with superior muscular endurance on a plank task, which was hypothesised to occur due to decreases in effort allotment from higher self-efficacy individuals.

These studies, however, are not without limitations. Several criticisms have been levied at the work of Vancouver and colleagues, primarily for using novel tasks in which participants lack experience to draw on, and for not measuring self-efficacy appropriately (Bandura, 2012). A further aspect to consider, is the potential relevance of these findings to the endurance sport domain. A key requirement for these negative effects of self-efficacy on performance is a lack of performance feedback. When competing in endurance events or sports, however, athletes often have several sources of feedback information available to them including: comparisons with other athletes, pacers, lap splits, watches, mile markers, and the use of technology (e.g., GPS trackers) (Brick et al., 2014). The potential for self-efficacy to have a negative effect on endurance performance, therefore remains unclear. An understanding and awareness of potential contextual or situational characteristics which may promote this, however, is required for a greater understanding of the self-efficacy performance relationship.

### **Summary of the Chapter, Research Philosophy, and Aims of the Thesis**

This chapter has provided an overview of the self-efficacy construct and discussed the research which has examined self-efficacy and endurance performance. Despite several limitations in the current body of research, self-efficacy is likely to play an influential role in endurance performance, as evidenced by both the observational and experimental research, and the existence of both feasible and experimentally supported mechanisms. To progress the understanding of self-efficacy and endurance performance, the current thesis aims to address three key areas of

research inquiry. In addressing these areas of inquiry, it is necessary to first outline the research philosophy which underpins the current thesis.

The current thesis was approached from a critical realist perspective. Critical realism is a meta-theory of ontology and epistemology that attempts to describe the interaction between the natural (i.e., the physical) and the social worlds (Collier, 1994). Through this awareness of the interactions, individuals can attempt, in part, to understand the reality around them. Opposed to positivism which posits that there is a singular observable reality, and constructivism which posits that reality is only constructed through social discourse, critical realism posits that there exists different 'levels' of reality. Some of these levels of reality can be directly viewed (i.e., behaviour), whereas others can never truly be viewed, and inquiry must occur from alternative methods (e.g., a person's lived experiences). Critical realism, in addition, focuses on promoting a holistic understanding of constructs or phenomena, and attempts to avoid the potential from reductionism which might come from more traditional positivist views. Accordingly, within critical realism, behaviour and its associated constructs is viewed as a complex ever-changing phenomenon, and that while theories can provide us with some understanding, they do not necessarily dictate what will happen or occur (i.e., a nomothetic view; Collier 1994; Fletcher, 2017).

What do such assumptions therefore mean regarding inquiry into self-efficacy in the endurance sport domain? First, it promotes the use of a mixed-methods approach. Aligned with its post-positivist assumptions, both qualitative and quantitative research methodologies are deemed acceptable within critical realism for gaining understanding and knowledge. Second, it promotes attempts to understand self-efficacy from a more holistic perspective. Such an endeavour requires considering the different levels of reality that self-efficacy may exist at, such as the directly

observable (e.g., the behavioural outcomes), and the unobservable (e.g., individuals' experiences that lead to the formation of self-efficacy). Consequently, the current thesis utilises a mixed-methods approach towards investigating self-efficacy, and in promoting a holistic understanding of self-efficacy, focuses on three key aspects: formation, measurement, and malleability. These three aspects, in turn, represent the three aims of this thesis.

Regarding the formation of self-efficacy beliefs, the first aim of this thesis is to gain an increased understanding and awareness of the specific sources that underpin self-efficacy in the endurance performance domain. The sources of self-efficacy as proposed by Bandura, represent broad general categories which are meant to be applicable to all domains (Bandura, 1997). Additionally, as outlined in this Chapter, initial work on identifying the sources of self-efficacy has simply focused on the frequency of sources (i.e., Samson, 2014), and not necessarily the key information within them. Identifying the specific sources of information which contribute to self-efficacy, and gaining an understanding of why these might change, would be beneficial in the design and delivery of interventions to enhance self-efficacy. This aim is examined in Chapter 2, where the sources of self-efficacy are examined using a qualitative design employing the use of semi-structured interviews with experienced competitive endurance athletes.

Regarding the measurement of self-efficacy beliefs, the second aim of this thesis relates to developing a valid measure of self-efficacy for endurance sport and endurance performance. As evidenced throughout this Chapter, there are several measurement issues relating to self-efficacy, and there is a lack of suitable quantitative measures of self-efficacy for endurance sport. The development and validation of such measurement techniques also allows the further testing and refinement of theory,

which acts as a key outcome in research which is approached from a critical realist perspective. Additionally, such a new measurement would be beneficial as it could provide further practical implications for the design and delivery of self-efficacy interventions, as well as allowing further exploration of both the theoretical determinants (e.g., the sources of self-efficacy, task difficulty) and outcomes (e.g., perception of effort, coping, performance) of self-efficacy beliefs. This aim is examined in Chapter 3, where utilising a multi-study approach, the psychometric development and initial validation of a non-hierarchical scale of endurance self-efficacy is presented.

Regarding the malleability of self-efficacy, the third aim of this thesis relates to investigating how self-efficacy may be changed and altered. As discussed in this Chapter, there are several factors which may cause changes and alterations to self-efficacy. Proximal sources of self-efficacy that athletes may experience while performing (e.g., perception of effort) and perceptions of task difficulty may influence them. Although some research has begun to explore how perceptions of task difficulty may influence self-efficacy (e.g., Sides, Chow, & Tenenbaum, 2017), there is still a lack of understanding of how changes in perceived task difficulty in well-known tasks may lead to changes in self-efficacy. This aim is examined in Chapter 4, where utilising an experimental repeated-measures design, the effects of an unknown change in task difficulty on self-efficacy and attributions are examined in experienced distance runners. In further extending the third aim of this thesis, the effects of two brief psychological interventions on self-efficacy are examined in Chapter 5. Utilising pre-post randomised control trial, the effects of a motivational self-talk and implementation intentions intervention on self-efficacy, coping, and endurance performance are examined.

## **Chapter 2**

# **The Sources of Self-Efficacy in Experienced Competitive Endurance Athletes**

## Abstract

**Objectives:** Endurance athletes draw on several sources of self-efficacy, but there is a limited understanding of what information within these sources specifically contributes towards self-efficacy. An increased understanding and awareness of the sources of self-efficacy for endurance performance would allow the design and delivery of more effective self-efficacy interventions. The aim of the current study was to identify sources of self-efficacy specific to the endurance sport domain. **Method:** Semi-structured interviews were conducted with twelve experienced competitive endurance athletes who had been competing in their endurance sport for an average of  $12.2 \pm 6.25$  years. Interviews were recorded, transcribed verbatim, and analysed using deductive thematic analysis. **Results:** Past performance experiences, physiological states, social/verbal persuasions and emotional states were generated as initial themes. Within these themes, six sub-themes were identified: cumulative experiences, challenge and adversity, physical familiarity, social support, self-talk, and doubt and worry. **Conclusions:** Our results indicate that endurance athletes make use of several sources of self-efficacy in the formation and maintenance of their self-efficacy beliefs. Specifically, the culmination of experiences, experiences of overcoming challenge and adversity, and a sense of physical familiarity appeared to key sources in the endurance sport domain.

Given the positive relationship between self-efficacy and endurance performance that was outlined in Chapter 1, the possession of robust and accurate self-efficacy beliefs is likely to be a desired outcome in endurance athletes. To achieve this, it is necessary to gain a greater understanding of the formation and maintenance of self-efficacy beliefs.

### **The Sources of Self-Efficacy**

Self-efficacy beliefs are generated through a series of cognitive processes involving the selection, interpretation, and integration of several sources of information (Bandura, 1997; Maddux, 1995). An individual's experiences and success are hypothesised to be the most powerful source of self-efficacy information (Bandura, 1997). If these past experiences are perceived to have been successes, this will result in an increase in self-efficacy, whereas if past experiences are perceived to have been failures, this will undermine self-efficacy. Factors such as task difficulty, external support, and occurrences of failure can all contribute to the efficacy value assigned to a past performance (Bandura, 1997). Research has consistently found that past performance experiences is one of the most cited sources of self-efficacy in sporting settings (Chase, Feltz, & Lirgg, 2003; Samson, 2014).

Vicarious influences are another source of self-efficacy information, and these are based around learning and modelling from others. Watching someone persevere with a difficult task can help develop self-efficacy towards this task, if the observer feels the person they are watching, the modeller, is like them (i.e., sex, skill level, age) (Bandura, 1997). This can have implications relating to pacing in endurance events, where individuals may choose to make decisions based on how others around them are performing (Corbett, Barwood, Ouzounoglou, Thelwell, & Dicks, 2012).



Social and verbal persuasions act as a third source of self-efficacy. These can represent feedback and support from coaches and training partners, expectations from others, and self-talk. In regards to the appraisal of verbal persuasion as a source, the expertise and credibility of the provider, the framing of the performance feedback and the degree of disparity between what is said and the individuals own beliefs regarding their capabilities are all influential factors (Bandura, 1997; Stoate, Wulf, & Lewthwaite, 2012).

Physiological states refer to feelings of strength, arousal, pain, fitness, and fatigue that are cognitively appraised by individuals to ascertain their ability to successfully meet the task at hand. Bandura (1997) hypothesised that the more physically demanding a task, the greater the contribution towards self-efficacy that physiological states would make. This hypothesis has received some support as distance runners preparing for a marathon cited physiological states most often (Samson, 2014), and physiological states have been infrequently discussed in research examining the sources of self-efficacy in less physically demanding sports such as golf (Valiante & Morris, 2013).

The last proposed source of self-efficacy relates to an individual's perceptions of their emotional states. Similarly, to physiological states, individuals appraise and interpret their emotional state and they consider how this relates to their experiences. Self-efficacy beliefs are often enhanced through positive emotions and decreased through negative emotional states (Kavanagh & Bower, 1985; Martin & Gill, 2002). In an endurance context, the experience of positive emotions, such as feelings of happiness, excitement and calmness have been linked with increased levels of self-efficacy in road wheelchair racing (Martin, 2002). It is difficult, however, to ascertain

whether these positive emotions were a determinant of the self-efficacy beliefs or an outcome (Martin, 2002).

Alongside these sources of self-efficacy, it is also necessary to consider research which has examined sources of sport-confidence. The sport-confidence model was proposed by Vealey (1986), in response to the need for sport specific models of self-confidence. Sport-confidence differs from self-efficacy in that it represents a more general sense of confidence (e.g., I am a confident athlete) as opposed to being related to a specific task (e.g., I am confident in my ability to do well in this race). Vealey et al. (1998), through a series of studies with high school and collegiate athletes, identified nine sources of sport-confidence. Similarly, Hays et al. (2007) also identified nine sources of sport-confidence in 'World Class' athletes. Several of the sources identified by Vealey and Hays demonstrate an overlap with Bandura's sources of self-efficacy, most likely because self-efficacy was used as the basis for sport-confidence. For instance, "coaches' leadership", "social support", and "coaching" all can be considered part of the social and verbal persuasions source (Feltz et al., 2008). Several of the sources identified, however, did not appear to fit into any of the proposed sources. For instance, Hays et al. (2007) identified a source of "innate ability" which referred to an athlete's belief that they had been born with certain positive characteristic that benefitted them in their sport. Whereas such a finding may at first appear to indicate the existence of further sources not identified by Bandura (1997), what it instead may represent is an example of the appraisal and attributional processes which accompany the formation of self-efficacy beliefs. The belief in "innate ability" may be a way for athletes to attribute their performances to internal, stable, and uncontrollable causes, which has been previously demonstrated to lead to increases in self-efficacy (Gernigon & Delloye, 2003). These findings help

demonstrate the need to not only understand what information contributes to self-efficacy beliefs, but also why and how this information may contribute.

Although there are likely to be similarities in the sources of self-efficacy across the sporting domain, such as the importance of training, coaching, and previous winning experience, there is also likely to be substantial variation in both the salience of the sources, and the information within these sources that contribute to self-efficacy (Feltz et al., 2008). For instance, the source of “physiological states” may have increased salience for more physically demanding sports such as distance running, compared to less physically demanding sports such as archery. The only study to date to examine the sources of self-efficacy in an endurance sport context is by Samson (2014), who investigated the sources of self-efficacy in a group of distance runners who were engaging in a training program for an upcoming marathon. Physiological states, verbal and social persuasions, and past performance experiences were the three most frequently cited sources of self-efficacy for the athletes. Whereas the study helped to identify the salience of the different sources and provided further evidence that athletes draw on a range of sources, it did not identify what information within these sources contributes towards self-efficacy, and also how and why this may occur. Identification of the sources of self-efficacy beliefs in the endurance sport would be an important step in the development and delivery of self-efficacy interventions (Short & Ross-Stewart, 2009).

In line with the first aim of this thesis, the current study sets out to investigate the sources of self-efficacy in the endurance sport domain. Specifically, three research questions are proposed:

1. What is the salience of the different sources in the endurance sport domain?

2. What specific information within these sources contributes towards self-efficacy for the endurance sport domain?
3. How and why does this information contribute to self-efficacy beliefs for the endurance sport domain?

## **Method**

### **Research Philosophy**

The current study was approached from a critical realist perspective. Central to critical realism is that ontology is not reducible to epistemology, and that human knowledge only captures a small part of a deeper reality (Fletcher, 2017). As opposed to positivist or constructivist perspectives, critical realism treats the world as theory-laden, but not theory-determined (Fletcher, 2017). Those who adopt a critical realist perspective can gain knowledge ‘in terms of theories, which can be more or less truth like’ (Danermark, Ekstrom, Jakobsen, & Karlsson, 2001, p. 10). Given the current study’s focus on Bandura’s social-cognitive theory (Bandura, 2001), critical realism was deemed an appropriate perspective.

### **Research Design**

The current study employed a qualitative design, using semi-structured interviews for data collection. Semi-structured interviews help provide an understanding of an individual’s perceptions and experiences and allow a more in-depth investigation of these than can be achieved in focus group settings. Given that the sources of self-efficacy are predominately represented by an individual’s perceptions (e.g., physiological states) or their experiences (e.g., past performance experiences), this provided a justification for the use of semi-structured interviews (Bandura, 1997). Semi-structured interviews have been successfully used previously

to identify sources of self-efficacy in academic (Britner & Pajares, 2006) and sporting contexts (Samson, 2014; Valiante & Morris, 2013) as well.

### **Participants**

Following university ethical approval, twelve experienced competitive endurance athletes (seven males, five females) were recruited for the study. Participants were recruited through prior completion of an online survey ( $n = 5$ ), social media ( $n = 5$ ) and from emails ( $n = 2$ ). Four endurance sports were represented: distance running ( $n = 4$ ), triathlon ( $n = 4$ ) swimming ( $n = 2$ ) and cycling ( $n = 2$ ). Eligibility criteria for the study required participants to have been competing in an endurance sport for at least five years, to have completed at least two competitive events, races or competitions over the previous year, and to be currently training at least three times week. Participants had a mean age of  $40.76 \pm 12.25$  years, had been competing in their chosen endurance sport for an average of  $12.2 \pm 6.25$  years, and trained for  $11.58 \pm 2.81$  hours a week. Seven of the participants were age-group competitors, three were club level athletes, and two were current age record holders.

### **Interview Protocol Development**

The first stage in the development of the interview protocol was to consult previous research which had investigated the sources of self-efficacy using a qualitative approach (Britner & Pajares, 2006; Samson, 2014; Valiante & Morris, 2013). Examination of the interview protocols used in these studies revealed a common pattern of asking participants for their confidence in the specific domain being investigated, and then exploring the participant's rationale for the score that they gave, using the sources of self-efficacy as follow up questions. A similar approach was therefore adopted for the current study.

In line with the recommendations of Marshall and Rossman (2014), initial questions in the interview were designed to access descriptive information before addressing questions specific to the study. During these initial questions, participants were also encouraged to discuss why they had taken up their endurance sports, their reasons for taking part, and what they enjoyed about it. Following this, participants were asked to rate the confidence they had in their abilities to perform well in their endurance sport on a scale of 0 (no confidence at all) to 100 (completely confident). Participants were asked why they gave the confidence rating that they did. The semi-structured questions then focused around the five sources of self-efficacy. Examples of questions used were: “To what extent do you think your past experiences contribute to your confidence rating?”, “Are there any people who influence your confidence rating?” “How does how you feel physically contribute towards your confidence rating?” After the discussion on the proposed sources of self-efficacy, participants were also asked if there were any other factors that influenced their belief in themselves. For those participants who reported a lower level of self-efficacy in their own abilities, they were asked an additional question “What would need to occur for your confidence rating to increase?” In line with qualitative practice, open rather than closed questions were used to encourage elaboration (Marshall & Rossman, 2014). The interview protocol was piloted with two endurance athletes, who gave feedback and comments on the clarity of questions. Potentially leading questions were rephrased and additional information explaining the confidence rating were added. The full interview protocol is in Appendix B.

### **Procedure**

Prior to the start of the interviews all participants provided informed written consent. Ten of the 12 interviews were conducted through either phone (n = 4) or

Skype calls (n = 6), the other two interviews were conducted in person at the lead researchers University Department office. Although some disadvantages of Skype interviewing have been noted in the literature (e.g., missing social cues, technical issues), the advantages of online interviews (e.g., allowing contact with geographically distant participants) are established (Sparkes & Smith, 2009). The beginning of the interview was spent establishing guidelines, and what to expect in terms of questions. Participants were also told that they would receive a copy of the interview transcript to check for accuracy. All interviews were carried out by the lead researcher and recorded by a Dictaphone. The lead researcher took notes throughout the interview in order to ensure adequate pacing, and to highlight areas for further probing.

Recordings were transcribed verbatim. Interview length ranged from 35 to 52 minutes. All transcripts were proofread and checked for accuracy by the lead investigator. Only minor discrepancies related to misheard geographical place names were reported by participants checking for accuracy. This transcription process generated 120 pages of single-spaced text.

### **Analysis**

Analysis was carried out using Nvivo software (Version 10) using a deductive thematic analysis that involved six phases: familiarisation with data (reading and re-reading the data, noting initial ideas); generating the initial codes (identifying the proposed sources of self-efficacy, collating data relevant to each source); searching for themes (collating codes into potential themes, gathering all data relevant to each potential theme); reviewing themes (checking if the themes work across participants and endurance sports); defining and naming themes (refining specifics of each theme and sub-theme, generating clear definitions and names for each sub-theme, generating

clear inclusion and exclusion criteria); and producing the results (selecting illustrative extract examples, relating the analysis to the research questions and the theoretical background; Braun & Clarke, 2006). Each sub-theme was judged to capture “something important about the data in relation to the research question(s), and represents some level of patterned response or meaning within the data set” (Braun & Clarke, 2006, p. 82). Deductive thematic analysis was chosen as the current study had clear theoretical links (socio-cognitive and self-efficacy theory), was approached from a critical realist perspective, and the research questions pertained to the a priori established sources of self-efficacy (Bandura, 1997). Thematic analysis was also deemed suitable as the research questions related to the sources of self-efficacy across endurance sport, and thematic analysis allows for an understanding of patterns across individuals (Braun & Clarke, 2006).

To help promote trustworthy and credible data, several procedures were carried out by the research team. First, throughout the analysis process, an audit trail was kept by the lead researcher in the Nvivo program. This audit trail detailed information pertaining to how and why raw information was coded, and also information pertaining to the generation of themes. This process helped encourage greater levels of reflection and promoted a consistent logical approach to the analysis. Second, a process of critical dialogue between the lead researcher and other members of the research team was employed. The purpose of this critical dialogue was to encourage reflection upon, and exploration of, the different interpretations of the transcribed data (Smith & McGannon, 2018). This process led to the refinement of several of the themes. Third, to promote resonance in the work, illustrative quotes are provided in the results section, to enable readers to interpret the data in the most meaningful and transferable way to them (Braun & Clarke, 2006).



## **Results**

Past performance experiences, physiological states, social and verbal persuasions, and emotional states were identified as themes, and six sub-themes within these four themes were identified from the analysis. ‘Cumulative experiences’ and ‘challenge and adversity’ were identified as sub-themes in the theme of past performance experiences. A sub-theme named ‘physical familiarity’ was identified drawing from both past performance experiences and physiological states. From social and verbal persuasions, two sub-themes were identified, ‘social support’ and ‘self-talk’. One sub-theme was identified from emotional states which was ‘doubt and worry’. No theme was identified for vicarious influences. The themes and their sub-themes are presented in Table 1.

Table 1. Overview of Themes and Sub-Themes

<b>Themes (Sources of Self-Efficacy)</b>	<b>Essence of theme (Bandura, 1997)</b>	<b>Sub-themes</b>	<b>Essence of the sub-theme</b>
Past Performance Experiences	Any references to the athletes' past experiences in their endurance sport. This included experiences in training and competition.	Cumulative Experiences	Experiences build on each other in helping to provide an accurate and stable framework of perceived capability.
		Challenge and Adversity	Experiences of encountering and/or overcoming challenges and adversity.
Physiological States	Any references to perceptions of physical states.	Physical Familiarity	An endurance athlete's awareness of what their body should be feeling, when engaging in their endurance sport and what this meant regarding their capabilities.
Social/Verbal Persuasions	Any references made about encouragement and/or support received from either others or oneself.	Social Support	Support received from both sporting related and non-sporting related others.
		Self-talk	Attempts made to enhance perceived capability using self-talk
Emotional States	Any references to emotions, feelings or affect	Doubt and Worries	Sense of worry and doubt over performance ability both prior to and while competing.

## **Past Performance Experiences**

Past performance experiences were described as a powerful source of self-efficacy. The athletes talked about how their experiences in training and in competitions, races, and events contributed towards their self-efficacy. Past performance experiences were the core ‘framework’ of their self-efficacy beliefs as it gave them clear examples and reference points of what they were capable of achieving. The training process was also mentioned, as participants felt that their confidence in their own abilities arose from knowing that what they completed in training could be translated to more competitive environments. Within past performance experiences the first sub-theme that was identified was cumulative experiences.

**Cumulative experiences.** Rather than focusing on one event or success, the endurance athletes drew on the volume and consistency of their experiences and successes. This focus had led to a gradual increase in self-efficacy over time, with each new event and experience adding to the already existing framework of experiences. R1, a distance runner, described this occurrence:

I think its gradually increased over time - as I've increased the distance... so I've done 10 mile runs and 10k runs, and then you're thinking well I'll do a half-marathon and I think with each race you gain more confidence.

This culmination of experiences and successes enabled endurance athletes to gain an accurate awareness of their own performance capabilities. S1, a marathon swimmer, described this process when discussing one of their most difficult swims:

I didn't jump in immediately and say I was going to swim the channel, or I am going to swim round {redacted}, which I did last year, which is 44 miles. I incrementally increased year upon year. As I could push the boundaries out of what I was achieving I knew I could do a little bit more, it gave me the ability in the self-

belief to know that actually let's have a go swimming around {redacted}, let's do 44 miles.

Further support for the role of cumulative experiences in helping raise self-efficacy was provided by T3, a triathlete, who discussed having a low level of self-efficacy in their own ability. When asked what would help raise this, they commented:

I think for that confidence to increase is just a matter of time, and just a matter of competing more at half ironman distance or stepping up to full ironman distance. I think it is a matter.... just a matter of time. The sheer number of races.

**Challenge and adversity.** In addition to the volume and consistency of experiences, the second sub-theme identified centred on the experiences of having persevered and/or worked through challenging or adverse situations. The role and importance of these experiences was raised by T2, a triathlete:

So I think in triathlon you can draw on races that have been hard or times that you have struggled and knowing that you have overcome them and managed to finish it, or do better than you think anyway - so I think those experiences definitely, definitely are really important.

Several of the endurance athletes also mentioned drawing on experiences of overcoming adversity from outside the endurance sport domain. This included experiences in other sports and exercise settings, but also other non-exercise related experiences including childbirth, bereavement, and redundancy from work. Each of the experiences helped provide the athletes with an understanding of their own coping capabilities. T4, a triathlete, discussed how their experiences as a multi-sport athlete during their childhood and adolescence contributed to their beliefs:

I was an athlete as a kid, so there's some of that that's given me that confidence as well. You know I know how to push through these things ... You know softball and basketball aren't quite triathlon, but you still have confidence in your athletic ability. Say even though it's not from endurance sport per sé, knowing that you can push through difficulties, issues and negative aspects from softball and basketball, that's what's helped.

### **Physiological States**

Physiological states were also discussed as a powerful source of self-efficacy. The athletes described both the sensations they feel when taking part in their endurance sport (e.g., pain, fatigue, cramping) but also those which occur more chronically, such as the sensations felt in the build up to an event. The athletes reinforced that how their body was feeling was an important factor in their perceived capability for what they were about to engage in. To guide this process, the athletes described comparing their current sensations to those that they had experienced previously. These points helped form the basis of the sub-theme of physical familiarity.

**Physical familiarity.** When performing in their endurance sport the endurance athletes were constantly engaged in an appraisal process of their physical sensations (e.g., pain, discomfort, fatigue, exertion). This appraisal was based on an athlete's own prior experience of knowing what their body should be feeling and a knowledge of the work required to complete their task. Therefore, it represented a combination between the sources of past performance experiences and physiological states. Dissonance between the perceived and the expected could result in a lowering of self-efficacy, as it could suggest that the athlete was not capable of meeting the demands of the task or their own expectations. R2, a distance runner, discussed this awareness of their own body:

I'm kind of very, very aware of feelings within my own body - in terms of what feels right and what feels wrong. What feels bad and what feels good. I do know if that I get to 1k or 2k in a 5k race, and I feel like I'm running through treacle already it's probably not going to be a good result.

In comparison, congruence between the current sensation and the expected sensation ensured that self-efficacy remain unchanged even when faced with 'negative' physiological sensations as pain, fatigue, and exertion. S2, a marathon swimmer, spoke about the sensations of pain that they often encountered during long swimming events:

I know that for example after about 8 hours the biceps of my arms get really sore and I know that after 9 hours I would have swum through it. So when I get to that point, I say to myself you can just keep going you know this is going to go, and you just keep doing it.

### **Verbal and Social Persuasions**

Verbal and social persuasions were described as playing an important role in the reinforcement of efficacy beliefs by the endurance athletes. Verbal and social persuasions were most impactful following a successful experience, as it helped reinforce that experience for the athlete. The athletes also described the use of self-talk as a method of reinforcing their own perceived capabilities.

**Social support.** Endurance athletes drew social support from both domain specific sources (coaches/training partners) but also from friends and family. For those athletes who trained with coaches or training partners, the perceived credibility and expertise of the social support was important in the both formation and

reinforcement of efficacy beliefs. T4 recalled the support they received from their coach and training partner before a major event:

Having the girl I train with and my coach telling me that I'm the fittest I've ever been, that "It's your day - Go and do it, and show us what you can do". And when you know that someone of that ability is saying that to you - then you know that you can do it... and it kind of gives you the belief that you can do it

As well as reinforcing existing self-efficacy beliefs, verbal persuasions were also beneficial in challenging an athlete's own conceptions of their ability. T2 discussed how their coach encouraged them to alter their belief on what they can do, using a combination of verbal encouragement and performance experiences.

And I said 'no I can't do it' and they said 'yes you can'. So I did and when it was all done I ran 8'10s (mile pace) or something stupid and now I'm like 'ooh I can do it'. So you know. That's how my coach works on trying to show me. You do have the ability, but you talk yourself down. So that's kind of how they try to lift me is by showing me that I can do it.

Outside of coaches, training partners and significant others were also an important source of verbal persuasion. C2 raised the importance of verbal confirmation from their training partners and girlfriend:

I would say listening to the people who I train with and the listening to my girlfriend it does affect me. It affects me in a positive way because it's given me an uplift and if people can see it in me, then I think that's got to be there, obviously that reinforces the positive feelings of I can.

**Self-talk.** Self-talk was primarily used to help reinforce an individual's capability for performing a task and the athletes suggested they used it most frequently

in difficult or challenging situations. C1, a cyclist, mentioned how self-talk was important for reaffirming their ability during difficult periods in a race:

There always is that sort of conflict in your own mind... when the race is hard, you try to tell yourself, 'it's going to get easier', or 'I can push through this'. I've gone harder, I've gone harder.

The type of self-talk (instructional/motivational) used also changed based on the situation. When athletes believed they were capable of performing well in a situation, self-talk was more likely to become positive and confirmatory, reinforcing the current experiences. Conversely, in situations where an athlete may have low self-efficacy (for example the swimming component of a triathlon) athletes instead often adopted motivational self-talk. T3, a triathlete, raised how the type of self-talk varied during triathlon:

It's very much situational based. If for example, I'm swimming, my swimming is my weakest discipline so particularly in open water I consider myself very inexperienced as an open water swimmer so I will be trying to give myself motivation, remind myself of the technique, remind myself of the bigger picture rather than actually allowing the self-doubt, the negativity to creep in. Whereas something like cycling I've got a much better understanding of what my cycling abilities are and what my limits are. Again, under those circumstances I talk to myself much less. But when I do, it's more around "Yeah this is a really quick ride" or "things are going well".

### **Emotional States**

Although the athletes felt that both positive and negative emotions were constant in their endurance sport, they felt that these did not contribute significantly towards the creation or reinforcement of their own efficacy beliefs. Despite this, doubt



and worry were identified as a sub-theme in relation to the feelings of the athletes prior to an important competition, race or event.

**Doubt and worry.** Doubt and worry primarily occurred when athletes were attempting to push the boundaries of their own performance, as they did not have the prior experience of success to draw on. These sensations of anxiety could in turn influence self-efficacy beliefs. T1, a triathlete who was making the change from Olympic triathlon to Ironman triathlon, remarked on this feeling:

Its inexperience right, I haven't biked 180 Km ever, which is the bike portion of the race, and it gets me a bit worried sometimes. Running a marathon as well like it is just sort of, running a marathon is like this huge social thing whatever, it is a bit worrying....

However, doubt and worry were not always regarded as a negative. In comparison, many of the athletes felt that the sensations of doubt and worry they experienced led to better levels of preparation and performance. R3, discussed this:

In my view you need to have that bit of doubt, that bit of doubt you see keeps you on edge, keeps you sharp, it keeps you just at the sweet spot, that you know for example in a full marathon you know you have got to prep. You know what you have got to take on, you know you got to fuel properly, you know you have got to do all your things that prepare. Being cavalier about it leads to too many things that could go wrong.

## **Discussion**

This study investigated the sources of self-efficacy in endurance athletes. In line with previous research (Samson, 2014), the findings highlighted that endurance athletes drew on several sources in the formation and maintenance of their self-

efficacy beliefs, past performance experiences, physiological states, social and verbal persuasions, and emotional states. Within these sources, cumulative experiences, challenge and adversity, physiological familiarity, social support, self-talk, and doubt and worry were identified as sub-themes. No consistent theme was identified for vicarious experiences.

Past performance experiences were identified as the key source of self-efficacy for the endurance athletes in the current study. This finding is in line with both theory (Bandura, 1997; Maddux, 1995) and prior research (Feltz et al., 2008; Valiante & Morris, 2013), which has established past performance experiences as being the most powerful source of self-efficacy. Singular dramatic experiences have been suggested to be a key factor in the formation of efficacy beliefs (Ericsson & Anders, 2006) but in the current study the athletes alluded more to both the volume and consistency of their own experiences. These cumulative experiences helped provide the athletes with a clear understanding of their own capabilities, which resulted in gradual increases in self-efficacy over time. This gradual increase in self-efficacy may also result from the perceptual and physiological adaptations which occur over time due to training. Future researchers which examine the relationship between self-efficacy and perceptual/physiological adaptations from training is warranted.

Experiences of challenge or adversity was also identified as a central source of self-efficacy. Bandura (1997) claimed that successes that occurred despite difficulties and adversity would contribute more towards self-efficacy than success that came without difficulty. Although the majority of the athletes drew on experiences from within the endurance sport domain, several also discussed drawing on experiences from other non-sporting related domains. Self-efficacy theory hypothesises that experiences which occur within a specific domain will be the most powerful

contributor towards self-efficacy (Bandura, 1997), but, as the present study clearly demonstrates, other non-domain experiences can also contribute. This contribution from non-domain experiences is likely to occur when individuals are able to identify shared subskills between the experiences (Bandura, 1997). Specifically, this focus on adversity related experiences may be related to coping self-efficacy. Coping self-efficacy is hypothesised to be more generalizable than other forms of self-efficacy (Bandura, 2002; Chesney et al., 2006), where if an individual believes they can utilise various coping skills when faced with stressors, this belief is likely to generalise across domains. Caution must be taken, however, when considering the role of adversity related experiences in helping form self-efficacy beliefs. Overcoming adversity has been suggested to lead to positive improvements in several psychological constructs (Sarkar, Fletcher, & Brown, 2015), but it may also be that the reason for overcoming the adversity was the presence of initial constructs, such as self-efficacy (Savage, Collins, & Cruickshank, 2017). Therefore, it may be that adversity related experiences help reinforce self-efficacy beliefs, rather than create new ones, and only individuals who already possess robust self-efficacy beliefs may be successful.

Previous researchers have examined the role of physiological states has largely focused on perceptions before an event (Chase, Feltz, & Lirgg, 2003; Samson, 2014). In the current study, however, physiological states were predominately mentioned in relation to performing the task itself. Rather than a discussion on particular states or sensations, what was identified from the analysis was a concept of constant physical appraisal. This constant appraisal of current physiological states represents what is known as a ‘proximal’ source of self-efficacy (Maddux, 1995). Proximal sources of self-efficacy are immediate and current sources that inform perceived capabilities when engaging in a task (Maddux, 1995). This appraisal focused on a comparison

between the current sensations (proximal) and the expected sensations which were based on previous experiences. These previous experiences in turn represent a ‘distal’ source of self-efficacy. Distal sources are those based on experiences and information received in the past. This concept of physical familiarity, and its drawing together of physiological states and past performance experiences also reinforces the theoretical prediction that the sources of self-efficacy are inter-correlated (Bandura, 1997). The relationship between distal and proximal sources of self-efficacy has, surprisingly, not received much explicit attention in the self-efficacy literature (Maddux, 1995). In comparison, this monitoring of the current physiological state (interoception) and the appraisal between current physical sensations and expected sensations has been highlighted and documented in several areas of research relating to endurance performance (Brick, MacIntyre, & Campbell, 2016; Tucker, 2009). Research has not, until this study, explicitly linked this process to self-efficacy. Given that this process can provide individuals with an understanding of their current progress towards a task and their capabilities for achieving this, it is likely to directly influence self-efficacy. Severe dissonance might lead to individuals perceiving that they do not possess the capabilities to achieve their goals and therefore they might disengage from the task. Evidence comes from research into ultramarathons where unexpected pain at early stages was one of the most significant predictors of withdrawal from the event (Hoffman & Fogard, 2011). Possession of a high level of self-efficacy, however, may help counteract this as it could encourage greater levels of perseverance and the engagement of coping strategies for longer periods of time (Bueno et al., 2008; Feltz et al., 2008).

Social support and verbal encouragement have been previously demonstrated to be effective tools to help raise an athlete’s self-efficacy (Feltz et al., 2008) and the

current results support this. Central to the role of social support and verbal encouragement were both the perceived expertise of the provider and the relationship with the athlete. These two mediating factors have also been supported by prior research into self-efficacy (Valiante & Morris, 2013) and social support (Rees & Freeman, 2007). Self-talk was also identified as a key source of self-efficacy. This finding links with prior research which has demonstrated that both distance runners (Samson, 2014) and professional golfers (Valiante & Morris, 2013) make use of self-talk to help maintain their efficacy beliefs.

Emotional states were not as widely discussed as the other sources of self-efficacy, with only worry and nerves emerging as a consistent sub-theme. This result is not entirely surprising, as other researchers have often failed to demonstrate a clear impact of emotional states on self-efficacy (Samson, 2014; Valiante & Morris, 2013). This, however, does not mean that emotional experiences are not present in endurance performance, but rather that how they contribute to self-efficacy remains unclear. It has been argued that emotional states may better be understood as a moderating factor on the relationship between past performance experiences and self-efficacy rather than existing as a standalone source (Feltz et al., 2008; Maddux, 1995).

Although some athletes discussed making comparisons with other competitors, no consistent themes were identified within the source of vicarious influences. Other research has also often failed to find an impact of vicarious influences on self-efficacy in experienced athletes (Samson, 2014; Valiante & Morris, 2013). This may be because vicarious influences are hypothesised to contribute most to self-efficacy when individuals are first engaging in a behaviour, as they lack suitable past experiences to draw on (Bandura, 1997).

## **Implications**

From these findings the current study offers several theoretical implications. First, it provides a novel model of the sources of self-efficacy in endurance athletes. Compared to other models of sources seen in the sporting domain (e.g., Chase et al., 2003; Feltz et al., 2008), the current model focuses on four sources of self-efficacy (previous experiences, physiological states, verbal and social persuasions, and emotional states). Additionally, within this model, the sources of self-efficacy are not distinct entities as is often represented in the self-efficacy literature (Bandura, 1997). Rather, these sources are intertwined together, with their contribution to self-efficacy coming from their interaction together. A clear example of this interaction was the identified theme of physical familiarity. An athlete's interpretation of their physical state was guided largely by their past performance experiences (i.e., what they had felt previously). This interaction between the sources of self-efficacy, while appearing logical, has not been previously demonstrated in the research literature and therefore demonstrates a novel aspect of the current research. It may therefore be worthwhile for researchers to begin to move away from considering the sources of self-efficacy as 'distinct' entities but rather begin to focus on the experiences and information that individuals receive in a more holistic manner. A consideration of specific experiences and information, and the cognitive processes that accompany these, could provide more theoretically informed interventions than those which only focus on specific sources of self-efficacy (Feltz et al., 2008; Short & Ross-Stewart, 2009)

Second, advancing the work of Vealey et al. (1998) and Hays et al. (2007), the current study is the first to identify sources of self-efficacy specific to the endurance sport domain. This examination of the sources of self-efficacy in a specific domain

(i.e., endurance sport) is a logical progression from research which examines the sources of self-efficacy more generally (e.g., Chase et al., 2003; Samson & Solmon, 2013).

Alongside the theoretical implications, the current study also offers applied implications. First, the model of the sources of self-efficacy identified within this study, could be an effective starting point for practitioners working with endurance athletes. For example, practitioners may wish to discuss with endurance athletes their strategies and/or processes for when they encounter a sense of physiological discrepancy based on the expected and the experienced physical sensations (e.g., pain or perception of effort). This provides an advantage over the more general targeting of the sources of self-efficacy, as it focuses directly on a process which is specific to endurance performance and sport (McCormick et al., 2018). First, interventions aimed at increasing self-efficacy should look to cover several of the sources of self-efficacy preferably in unison (Short & Ross-Stewart, 2009). To achieve this, it may be beneficial to either expose athletes to experiences which contain several of the sources or ask them to reflect on experiences which have. Specifically, reflection on experiences of overcoming challenge or adversity may be particularly beneficial to endurance athletes. Athletes who do not possess enough endurance sport domain experience in managing common endurance sport demands such as pain and discomfort (McCormick et al., 2016), could reflect on their experiences in other domains. Most individuals have likely overcome some difficulty or adversity in an aspect of their life and being able to encourage athletes to draw on these experiences could be beneficial and help improve or reinforce an individual's self-efficacy, particularly related to coping.

## **Limitations and Future Research**

It is also important to consider the limitations of the current study. The use of one-off semi-structured interviews as a data collection technique may have resulted in an over-simplified understanding of the sources of self-efficacy. Additionally, research investigating the sources of self-efficacy has often attempted to include both individuals high and low in self-efficacy (Pajares & Urdan, 2005), but the majority of participants in the current study reported high levels of self-efficacy in their own abilities. It may be that the formation and maintenance of self-efficacy beliefs in high self-efficacy individual could be qualitatively different than low self-efficacy individuals.

The findings discussed in this study offer several avenues for future research. Research which attempts to examine if these findings are replicated in different samples of endurance athletes (e.g., elites or athletes with lower levels of self-efficacy) would help demonstrate if the sources of self-efficacy identified in this study are common across the whole endurance sport domain. Additionally, whereas the current study attempted to and succeeded in identifying shared sources of self-efficacy across endurance sports, future research could attempt to identify discipline or distance specific sources of self-efficacy. For example, in sports such as cycling there may be sources of self-efficacy related to the technical and mechanical care of the bike, and this can play a key part in performance. Understanding these sport specific sources is the next logical step from the current study and would allow further refinement of interventions and promotion of self-efficacy in endurance athletes. Future research could also investigate how self-efficacy beliefs may change during endurance events. Given that endurance events or competitions can last between several hours to several days, this provides ample time for changes in self-efficacy to happen (Gist & Mitchell,



1992). A greater understanding of these in event changes, potentially relating to the relationship between proximal and distal sources of self-efficacy would provide both theoretical and practical implications. Alongside these changes of self-efficacy during performance, future researchers could also examine longitudinal changes in self-efficacy across competitive seasons. For instance, the theme of cumulative experiences identified in the current study, suggests that self-efficacy is likely to display small incremental increases as performances amass. It may be possible for researchers to conduct brief interviews across a competitive season and examine how their self-efficacy may change based on their experiences. Such research would also provide insights regarding the within-subject relationship between self-efficacy and performance which was previously discussed as a limitation of the existing self-efficacy literature in Chapter 1.

In conclusion, the current study helps meet the first aims of the current thesis regarding the formation of self-efficacy beliefs, through its identification of domain specific sources of self-efficacy for endurance athletes. Furthermore, the current study reinforces several key tenets of self-efficacy theory, specifically, how the salience of the sources may change based on task demands, and the overlap between the sources of self-efficacy. Within these domain specific sources of self-efficacy, the role of cumulative experiences, experiences of challenge and adversity and a sense of physical familiarity were identified as key sources of endurance athlete's self-efficacy. These findings clearly relate to the first aim of the thesis which was to gain an increased understanding of the formation of self-efficacy in endurance sport. The identification of these sources and their proposed relationships represents a novel contribution to the research literature and acts as an effective starting place for future self-efficacy-based interventions and research in endurance athletes.

**Chapter 3: Development and initial validation  
of the Endurance Sport Self-Efficacy Scale  
(ESSES)**

## **Abstract**

Self-efficacy is likely to be an important psychological construct for endurance sport performance. Research into the role of self-efficacy, however, is limited as there is currently no validated measure of endurance sport self-efficacy. Consequently, the purpose of the present research was to develop and validate the Endurance Sport Self-Efficacy Scale (ESSES). In Study A, an initial item pool was developed following a review of the literature. These items were then examined for content validity by an expert panel. In Study B, the resultant 18 items were subjected to exploratory factor analyses. These analyses provided support for a unidimensional scale comprised of 11 items. Study B also provided evidence for the ESSES's convergent validity. In Study C, using confirmatory factor analyses, further support was found for the 11-item unidimensional structure. Study 3 also provided evidence for the ESSES's convergent and concurrent validity. The present findings provide initial evidence that the ESSES is a valid and reliable measure of self-efficacy beliefs in endurance sports.

As outlined in Chapter 1, self-efficacy is an important factor for endurance performance. The assessment of this importance, however, is contingent on being able to adequately measure relevant self-efficacy beliefs. Here several limitations are evident in the existing literature. First, previous studies have not followed recommendations for self-efficacy scale development (Bandura, 1997, 2006). For example, Stoaite, Wulf, and Lethwaite (2012) measured self-efficacy using a scale which conceptualised self-efficacy in the form of “will” rather than “can”. This is problematic because “will” generally refers to an individual’s intention as opposed to an individual’s perceived capability (Bandura, 2006). This mixing of psychological constructs (i.e., intention versus belief) is a common occurrence in the measurement of self-efficacy (Williams & Rhodes, 2014) and it severely limits the ability of research to identify specific antecedents and outcomes of self-efficacy.

Second, for those studies which have employed multi-item scales, self-efficacy was typically assessed in terms of ascending or descending performance times (Burke & Jin, 1996; LaGuardia & Labbé, 1993) or distances (Bueno et al., 2008). Such scales are known as hierarchical self-efficacy scales (Feltz et al., 2008). Whereas this approach is common in sport and exercise settings, Feltz and colleagues (2008) cautioned against an overreliance on such scales as they result in an oversimplification of complex performances. Hierarchical scales are popular as they typically report high levels of scale score reliability (Feltz et al., 2008) and they do not require a deep understanding of the demands in that domain and, therefore, they can easily be adapted to various study designs and scenarios.

Whereas such scales have helped provide evidence for the link between self-efficacy and performance, they often possess limited practical benefit for practitioners, coaches, and athletes. For instance, two athletes could both perceive themselves as not

capable of achieving a certain time for a race/to cover a certain distance in a given time. For one athlete, this may be due to the belief that they are unable to pace themselves appropriately, whereas for the other athlete this may be due to the belief they are not capable of tolerating exercise-induced pain. A hierarchical scale would not allow us to differentiate between these two reasons and instead would merely suggest that both athletes perceive themselves incapable of achieving that time or covering that distance. This approach thus limits the possibility of accurate interventions (Bandura, 1997; Feltz et al., 2008). The measurement of these behaviours and skills would be best served using a non-hierarchical scale.

Non-hierarchical scales look to assess an individual's self-efficacy across the full range of subskills that underpin performance in that domain (Feltz et al., 2008). Given the similarities in the demands and determinants of performance across endurance sports (Brick, MacIntyre, & Campbell, 2016; McCormick et al., 2016; Renfree et al., 2014), it is likely that there are common subskills which underpin performance across all endurance sports. Therefore, the development of an endurance sport-specific scale would be beneficial because it would provide practical implications for the design and delivery of self-efficacy interventions, as well as allowing further exploration of both the theoretical determinants (e.g., the sources of endurance self-efficacy as identified in Chapter 2) and outcomes (e.g., perception of effort, perseverance, performance) of self-efficacy beliefs.

Additionally, the development of a non-hierarchical scale closely aligns with a critical realist approach. Because in critical realism some aspects of reality are not directly observable (i.e., one's belief in their own capabilities) it is necessary to ensure that there are appropriate ways of measuring some component of these aspects (Fletcher, 2017). While the development of a self-efficacy questionnaire cannot

capture the full breadth and complexity of the self-efficacy construct, it can help capture specific aspects which are deemed important. In this instance, these aspects relate to the different sub-skills which underpin endurance performance, and as such would provide a greater level of understanding than those typically provided by hierarchical scales.

### **The Present Research**

There is currently no validated non-hierarchical scale of self-efficacy for endurance sports. Given the potential importance of self-efficacy in endurance performance, the development of such a scale would be beneficial for both practical and theoretical reasons. Consequently, the aim of the current study was to develop the Endurance Sport Self-Efficacy Scale (ESSES) that measures self-efficacy specific to the endurance sport domain. We also sought to provide preliminary evidence for the validity and reliability of the ESSES. In so doing, a series of three studies are presented.

### **Study A**

The purpose of Study A was for initial item and scale development. First, in line with Bandura's (2006) recommendations for self-efficacy scale development, factors relating to endurance performance were identified through literature searches and the research teams' own conceptual knowledge, and items relating to these factors were developed. Next, the items and scale were subjected to an expert panel for review to ensure high levels of content validity.

### **Method**

### **Development of the Initial Item Pool**

In the construction of self-efficacy scales, Bandura (2006) urged that scales should be specific to the chosen domain, and researchers should attempt to identify the key factors relating to performance in these domains. Once these key factors have been identified, items relating to these factors should be created allowing the measurement of specific self-efficacy beliefs. This approach can help promote a scale which demonstrates improved sensitivity to individual differences in self-efficacy beliefs and promotes a greater level of validity in that domain (Bandura, 2006).

Performance in endurance sport is a complex mixture of physical, technical, and psychological factors (Taylor et al., 1995). Relating to the physical factors, endurance athletes aim to ensure they are physically prepared for their endurance sport (Jones & Carter, 2000) and they aim to manage exercise-induced sensations such as exercise pain, injury pain, discomfort and exertion (Christensen, Brewer, & Hutchinson, 2015; Samson et al., 2017; Schumacher, Becker, & Wiersma, 2016). In regards to the technical aspect, endurance athletes must ensure they pace themselves appropriately to help ensure high levels of performance (Renfree et al., 2014), ensure appropriate technique and form (Novacheck, 1998), and they must also be able to maintain high levels of concentration to aid this and other related decision-making processes (Brick, MacIntyre, & Campell, 2014). Psychologically, endurance athletes must cope with a variety of stressors (Fletcher, Hanton, & Mellalieu, 2006; Martin, 2002; McCormick et al., 2016), and ensure they manage any unwanted thoughts (Holt, Lee, Kim, & Klein, 2014) and emotions (Lane & Wilson, 2011) which may impede their performance.

From these physical, technical, and psychological factors, and based on relevant literature, an initial pool of 20 items was developed. Following Bandura's (2006) guidance, it was ensured that these items were related to behaviours and skills that

were rooted in the context of performing in endurance sport. Rather than focusing on a specific situation, a general domain focus was instead decided upon. Although several self-efficacy researchers have cautioned against attempts to measure "general" self-efficacy which exists across domains (Bandura 1997; Maddux & Gosselin, 2003), domain specific self-efficacy scales are a common approach to conceptualisation and measurement of self-efficacy beliefs (Bandura, 2006; Feltz et al., 2008). In a sport setting the Coaching Self-efficacy Scale (Feltz, Chase, Moritz, & Sullivan, 1999), the Collective Team Efficacy Scale (Short, Sullivan, & Feltz, 2005), and the Refereeing Efficacy Scale (Myers, Feltz, Guillén, & Dithurbide, 2012) all utilise a similar domain approach. Furthermore the development of a more general domain scale can in turn inform and facilitate the development of more specific self-efficacy scales (e.g., a running self-efficacy scale, or triathlon self-efficacy scale). For example, the Coaching Self-efficacy Scale (Feltz et al., 1999) has been successfully adapted to be specifically focused on high school coaches (Myers, Feltz, Chase, Reckase, & Hancock, 2008) and youth sport coaches (Myers, Chase, Pierce, & Martin, 2011).

Additionally, whereas situation specific self-efficacy scales report greater predictive power for performance (Moritz et al., 2000), they in turn possess less generalisability, and instead can reflect more on the task and transient information (e.g., weather, perceptions of energy), rather than the underlying self-efficacy beliefs (Bandura, 2006). As the primary aim of the scale was not solely the prediction of performance, but instead to allow the examination of theoretical determinants and outcomes (e.g., the sources of self-efficacy identified in Chapter 2), adopting a general domain focus was justified. In order to promote a high level of content validity, self-efficacy was operationalised in the scale using 'can' (Bandura 2006). Regarding the response scale, a 0-100 response scale separated with 10-point intervals was chosen.



Such a scale is commonly used in self-efficacy research (Bandura, 2006; Feltz et al., 2008) and has been suggested to report higher levels of predictive power than those scales which use fewer intervals (Pajares, Hartley, & Valinate, 2001). Considering the general domain focus, the use of the word ‘can’ and the 0-100 response scale, the scale stem which preceded the items was:

“Below you will find a list of actions and skills that are important for endurance performance. When you are taking part in your endurance sport, how confident are you that can do the following things. In each case please rate your degree of confidence from 0 (cannot do at all) to 100 (completely certain can do).”

### **Expert Review**

For the purpose of content validation, two steps were undertaken. First, and in line with best practice for the development of psychological questionnaires (e.g., Hill, Appleton, & Mallinson, 2016) the question stem, the initial list of items, and the response options was submitted to an independent panel of experts via email. The panel consisted of three academics and two endurance sport coaches. The three academics were from different institutions than the research team and had published research either relating to endurance psychology ( $n = 2$ ) or self-efficacy scale development ( $n = 1$ ) in international peer reviewed journals. The two endurance sport coaches had 18 and 22 years of coaching in running and triathlon respectively. This step was conducted to obtain information on each item’s perceived clarity and relevance, as well as highlighting any possible missed items (Dunn, Bouffard, & Rogers, 1999).

Alongside this, following institutional ethical approval, interviews were conducted to gain insight into how endurance athletes understood, processed, and responded to the question stem, generated items, and response options (Dietrich &

Ehrlenspiel, 2010). This was deemed a particularly important aspect of the scale development, as endurance athletes would be the end-user of the scale. Six competitive endurance athletes (runners = 2, cyclists = 2, triathletes = 2), who had been competing in their endurance sport for an average of 11.85 years ( $SD = 2.81$ ) were recruited at this stage. To facilitate this process of understanding, verbal probing was employed. Verbal probes were aimed at comprehension and interpretation (e.g., what does this mean to you?), and at judgment and decision making (e.g., how did you arrive at your answer?).

### **Results and Discussion**

Comments from the expert panel supported the inclusion of 17 of the 20 items submitted. Two items were suggested to be removed due to perceived similarity (e.g., ‘Taper appropriately’ was deemed too similar to ‘Prepare physically’ and therefore ‘Taper appropriately’ was removed), and one item was removed due to a perceived lack of relevance across endurance sports (‘Deal with difficult terrain’). Additionally, feedback from the expert panel suggested the splitting of one item “Ensure appropriate nutrition and hydration” into two separate items - “Ensure appropriate nutrition” and “Ensure appropriate hydration”. Although some further items were recommended for inclusion into the scale (e.g., Respond to other competitors pacing decisions), these were not added as it was felt that these were not common across the endurance sport domain. The scale stem and response scale were deemed to be satisfactory.

The interviews with the athletes suggested that the scale was clear and measured appropriate factors relating to endurance performance. When probed about the reason they gave the answers they provided, the athletes stated that they did so based on their own prior experiences. As self-efficacy beliefs are hypothesised to primarily be determined through prior experiences (Bandura, 1997), this was taken as

an indication of appropriate content validity. Overall this process resulted in an 18-item scale, named the 'Endurance Sport Self-efficacy Scale' (ESSES), which covered a range of different behaviours and skills relating to endurance performance.

## **Study B**

The primary purpose of Study B was to explore the factor structure and scale score reliability of the 18-item version of the ESSES. The secondary purpose was to provide evidence for the initial convergent validity of the ESSES. This was achieved via an examination of its relation with other validated self-efficacy scales.

## **Method**

### **Participants and Procedures**

Following institutional ethical approval, participants completed an online survey, hosted on the Bristol Online Survey system and were recruited either through social media (Facebook and Twitter) or emails to endurance sport clubs. Three hundred and forty three (233 male, 108 female, 2 other) participants completed the survey. The mean age was 38.42 years ( $SD = 14.29$ ) and participants had been taking part and competing in their endurance sport for an average of 10.97 years ( $SD = 12.29$ ). Of the 343 participants, 137 were runners, 52 were rowers, 50 were triathletes, 49 were cyclists, 49 were swimmers, and 7 were 'other'. These 'others' consisted of three cross country skiers, two race-walkers, and two participants who did not specify their endurance sport.

### **Measures**

The 18-item ESSES was administered with the same question stem and response format as listed during Study 1. As there are no other validated measure of endurance self-efficacy, other measures which were hypothesised to correlate with

endurance self-efficacy were chosen in order to assess the convergent validity of the ESSES. The following four instruments were used:

**General Self-Efficacy Scale (GSES).** The GSES is a 10-item scale that is designed to assess optimistic self-beliefs to cope with a variety of difficult demands in life (e.g., “I can solve most problems if I invest the necessary effort”) (Schwarzer & Jerusalem, 1995). Participants responded to each item on a four-point Likert scale which ranges from 1 (Not true at all) to 4 (Exactly true). The scale reported acceptable scale score reliability ( $\alpha = .78$ ).

**Coping Self-Efficacy Scale (CSES).** The CSES is a 26-item scale that is designed to assess a person's perceived ability to cope effectively with life challenges and to employ effective use of coping strategies (Chesney et al., 2006). It has three subscales: use of problem-focused coping (e.g., “I can make a plan of action and follow it when confronted with a problem”), use of emotion-focused coping (e.g., “I can keep from feeling sad), and received social support (e.g., “I can get friends to help me with the things I need”). Participants responded to each item on a ten-point scale ranging from 1 (Cannot do at all) to 10 (Completely certain can do). All the subscales were internally consistent ( $\alpha = .77 — .85$ ).

**Barriers to Training Self-Efficacy Scale (BTSES).** The BTSES is an 18-item scale (Bandura, 2006) that is designed to assess a person's perceived ability to maintain training when faced with various stressors (e.g., “After recovering from an injury that prevented me from training”). Participants responded to each item on an eleven-point scale ranging from 0 (Cannot do at all) to 100 (Completely certain can do). Good levels of internal consistency were reported ( $\alpha = .91$ ).

**Athletic Coping Skills Inventory (ACSI-28).** The ACSI-28 is a 28-item scale that is designed to measure coping use and effectiveness in athletes (Smith,

Schutz, Smoll, & Ptacek, 1995). It comprises seven sport specific subscales: coping with adversity (e.g., “I handle unexpected situations in my sport very well”), peaking under pressure (e.g., “To me, pressure situations are challenges that I welcome), goal setting and mental preparation (e.g., “I set my own performance goals for each training”), concentration (e.g., “It is easy for me to direct my attention and focus on a thing”), freedom from worry (e.g., “I worry quite a bit about what others think of my performance”), confidence and motivation (e.g., “I feel confident that I will perform well”), and coach ability (e.g., “I improve my skills by listening carefully to advice and instruction from coaches and peers”). Participants responded to each item on a four-point scale ranging from 0 (Almost never) to 3 (Almost always). All the subscales were internally consistent ( $\alpha = .72 — .93$ ).

### **Data Analysis**

In order to ascertain the factor structure of the ESSES, exploratory factor analysis (EFA) was conducted in line with common recommendations (e.g., Costello & Osborne, 2005; Fabrigar, Wegener, MacCallum, & Strahan, 1999; Tabachnick & Fidell, 2007). Factor solutions and retention was explored using principal axis factoring (PAF) with a promax rotation, and was assessed using parallel analysis (using O’connor, 2000)). PAF was chosen as it is not dependent on assumptions of multivariate normality (Costello & Osborne, 2005). A promax rotation was chosen as self-efficacy beliefs are hypothesised to be correlated (Bandura, 1997). Such a rotation is commonly used in self-efficacy scale development (e.g., Chesney et al., 2006; Feltz et al., 1999). Factor solutions were then assessed upon theoretical interpretability, structural and pattern coefficients ( $> .40$ ), interpretability of cross-loadings, and communalities ( $> .20$ ; Tabachnick & Fiddell, 2007).

Reliability was assessed using Cronbach's  $\alpha$ . Initial convergent validity was assessed using correlational analysis between the ESSES, GSES, CSES, BTSES, and ACSI-28. Cohen's (1992) guidelines of small ( $r = .10$ ), medium ( $r = .30$ ), and large ( $r = .50$ ) were used when interpreting correlations.

## **Results and Discussion**

### **Exploratory Factor Analysis**

The initial analyses based on the parallel analysis suggested the possibility of either a one, two, or three factor solution (actual  $\lambda_1 = 6.19$ ,  $\lambda_2 = 1.42$ ,  $\lambda_3 = 1.27$  vs.  $\lambda_1 = 1.42$ ,  $\lambda_2 = 1.34$ ,  $\lambda_3 = 1.28$  from parallel analysis). All possible factor solutions were investigated considering item-loadings and the theoretical interpretability of the factors. Ultimately, a one factor (i.e., unidimensional) solution was adopted. This decision was based on several reasons. First, in all the possible factor solution combinations, most of the items primarily loaded onto the first factor. Second, the other items tended to display high levels of cross-loading with this first factor. Third, although both the second and third factors were theoretically interpretable, they were only formed from four and three items respectively.

In the process of scale refinement, seven items were removed. These items related to skills and behaviours that are carried out prior to performance (e.g., Item-16 "Prepare physically for demanding events"). Once removed, the unidimensional scale related to a variety of behaviours and skills which are carried out during endurance sport performance. This included behaviours and skills relating to psychological factors (e.g., Item-8 "Manage my thoughts during events), physical factors (e.g., Item-1 "Deal with non-injury related pain), and technical factors (e.g., Item-12 "Pace myself appropriately"). The final 11-item one-factor solution is presented in Table 2.

Table 2. Factor Solution for Final Exploratory Factor Analysis (PAF)

<b>Item No.</b>	<b>ESSES Item</b>	<b>M</b>	<b>SD</b>	<b>EC</b>	<b>F1</b>
14.	Maintain my concentration	80.56	16.75	.62	<b>.79</b>
18.	Perform well in challenging events	81.14	16.57	.58	<b>.77</b>
17.	Deal with feelings of effort and exertion	85.16	16.29	.53	<b>.73</b>
4.	Manage my emotions during events	80.03	19.39	.50	<b>.71</b>
8.	Manage my thoughts during events	79.88	18.63	.49	<b>.69</b>
10.	Manage and deal with unexpected events	76.33	17.58	.38	<b>.61</b>
2.	Ensure appropriate technique and form	74.71	16.78	.33	<b>.56</b>
12.	Pace myself appropriately	75.96	18.67	.31	<b>.55</b>
13.	Manage and deal with unexpected weather	79.91	19.13	.30	<b>.55</b>
1.	Manage non-injury related pain	82.39	17.51	.28	<b>.50</b>
5.	Manage injury related pain	68.92	22.77	.26	<b>.49</b>
				Eigenvalue	5.02

Note. EC = Extracted Communalities.

### **Reliability and Validity**

After establishing the factor structure of the ESSES, the next stage was to assess the reliability and validity of the scale. In terms of scale score reliability, the ESSES displayed acceptable Cronbach's alpha ( $\alpha = .88$ ). In terms of convergent validity, correlations between the ESSES, the CSES, GSES, BTSES, and ACSI-28 are presented in Table 3. Examination of the correlations between the ESSES and other scales revealed significant positive relations, and these relations were typically medium and medium-to-large in size. This provides initial evidence for the convergent validity of the ESSES.

In conclusion, Study B provided initial evidence for the ESSES as a measure of self-efficacy for endurance sport. The unidimensional scale demonstrated good levels of scale score reliability and convergent validity.



Table 3. Correlations for the ESSES, GSE, CSE, BTSE, and ACSI-28 (n = 343)

Variable	1	2	3	4	5	6	7	8	9	10	11
1. ESSES											
2. General Self-efficacy	.45**										
3. Coping Self-efficacy	.55**	.63**									
4. Barriers to Training Self- efficacy	.52**	.33**	.43**								
5. Coping with Adversity (ACSI)	.65**	.39**	.58**	.34**							
6. Coachability (ACSI)	.41**	.23**	.35**	.21**	.39**						
7. Concentration (ACSI)	.63**	.38**	.38**	.36**	.55**	.36**					
8. Confidence and Motivation (ACSI)	.52**	.38**	.39**	.48**	.43**	.28**	.48**				
9. Goalsetting and Mental Preparation (ACSI)	.32**	.25**	.27**	.29**	.29**	.13*	.26**	.47**			
10. Peaking under Pressure (ACSI)	.48**	.38**	.32**	.23**	.48**	.49**	.37**	.41**	.26**		
11. Freedom from Worry (ACSI)	.22**	.06	.24**	.05	.29**	.19**	.13*	-.03	-.06	-.04	

Note. \*\* =  $p < .01$ ; \* =  $p < .05$

## **Study C**

Study C had two aims. The first aim was to confirm the 11-item unidimensional structure of the ESSES using confirmatory factor analysis (CFA). The second aim was to provide further evidence for the validity of the ESSES. Specifically, the scale was assessed for its concurrent and criterion-related validity, by examining the relation between marathons completed and maximal oxygen uptake (VO<sub>2</sub>max) with the ESSES, using structural equation modelling (SEM).

## **Method**

### **Participants and procedures**

As in Study B, following institutional ethical approval, participants completed an online survey which was hosted on the Bristol Online Survey system. Participants were recruited through social media (Facebook & Twitter) and contacting endurance sport clubs in the United Kingdom.

Participants for Study C consisted of two samples. Sample 1 consisted of 115 marathon runners (89 males) with a mean age of 39.84 years ( $SD = 10.25$ ) who had been competing in distance running for 12.47 years ( $SD = 11.59$ ). Sample 2 consisted of 105 endurance athletes (63 males) with a mean age of 42.38 years ( $SD = 11.78$ ). Thirty-six of the endurance athletes were runners, 17 were cyclists, 45 were triathletes, five were swimmers and three were racewalkers. The athletes had been competing in their endurance sport for an average of 11.32 years ( $SD = 10.03$ ).

### **Measures**

The 11-item ESSES was administered with the same question stem and response format as listed during Study A and Study B. In addition, in Sample 1, marathon runners were asked to indicate their completed number of marathons. The

purpose of this was to help provide criterion validity for the ESSES, as experience is hypothesised to be a key determinant of self-efficacy beliefs (Bandura, 1997).

For Sample 2, participants were asked questions to estimate VO<sub>2</sub>max. VO<sub>2</sub>max was estimated using formulas for men (Malek, Housh, Berger, Coburn, & Beck, 2005a), and women (Malek, Housh, Berger, Coburn, & Beck, 2005b). Reported age (years), weight (kg), height (cm), hours per week of exercise, duration that participants had consistently (no more than one month without exercise) been exercising (in years), and a typical session rating of perceived exertion (6-20 scale) was used to determine the VO<sub>2</sub>max. VO<sub>2</sub>max is the maximum capacity of the body to consume oxygen during maximal exertion and is considered an important physiological determinant in endurance performance (Joyner & Coyle, 2008). As a further measure of concurrent validity, it was hypothesised that the ESSES would correlate with estimated VO<sub>2</sub>max

### **Data Analysis**

Model fit was assessed via confirmatory factor analysis (CFA) using Mplus 8.0 (Muthén & Muthén, 2012) and robust maximum likelihood estimation. Multiple indexes were used to assess model fit for the CFA:  $\chi^2(df)$  statistic, comparative fit index (CFI), tucker-lewis index (TLI), and root mean square error of approximation (RMSEA). The following criteria were indicative of acceptable model fit:  $>.90$  CFI,  $>.90$  TLI, and  $<.09$  RMSEA (Marsh, Hau, & Wen, 2004). SEM was then used to examine the relation between the number of marathons completed, estimated VO<sub>2</sub>max, and scores on the ESSES in each of the relevant samples.

## Results and Discussion

### Assessment of Factorial Structure

The initial CFA provided an adequate fit to the data ( $\chi^2$  (df) = 108.47(44)  $p < .001$ , CFI = .92, TLI = .90, RMSEA = .08). These findings provide further support for the 11-item unidimensional structure of the ESSES. Moreover, an examination of the standardised parameter estimates from the CFA indicated that all loadings were significant and meaningful (i.e.,  $> .04$ ). The factor loadings and uniqueness's of the CFA are reported in Table 4.

Table 4. Standardised Factor Loadings for Final CFA Solution

Item	CFA	
	Factor Loading	Uniqueness's
13	.62***	.62***
17	.77***	.40***
1	.60***	.64***
14	.79***	.38***
10	.64***	.59***
5	.47***	.79***
12	.52***	.73***
2	.47***	.77***
18	.67***	.56***
4	.72***	.49***
8	.84***	.30***

Note. \*\*\*  $p < .001$

### Validity

The results of the SEM based on Sample 1 revealed that the number of marathons completed significantly predicted scores on the ESSES ( $\beta = .28$ ,  $p = .025$ ).

Additionally, the results of the SEM based on Sample 2 revealed that estimated VO<sub>2</sub>max significantly predicted scores on the ESSES ( $\beta = .32, p = .001$ ). Taken together, these findings provide further evidence for the concurrent and criterion-related validity of the ESSES.

### **General Discussion**

Self-efficacy is likely to be an important factor in endurance performance (e.g., Burke & Jin, 1996; LaGuardia & Labbé, 1992). To date, however, no non-hierarchical self-efficacy measure has been developed for the endurance sport domain. To address this deficit, the Endurance Sport Self-Efficacy Scale (ESSES) was developed and validated. Through three rigorous studies, aligned with best psychometric practice, an 11-item scale that assesses self-efficacy beliefs related to endurance performance was derived.

The ESSES captures the breadth of physical, psychological, and technical facets associated with endurance performance. For example, the management of exercise induced sensations is often identified as a key demand of endurance performance in both quantitative and qualitative research (Astokorki & Mauger, 2016; Marcora, 2009; McCormick et al., 2016; Simpson, Post, Young, & Jensen, 2014). Similarly, intrusive thoughts and unwanted emotions are commonly reported by endurance athletes and may interfere with performance (Holt, Lee, Kim, & Klein, 2014; Lane & Wilson, 2014). Self-efficacy to control and manage exercise induced sensations and intrusive thoughts and emotions is likely to be an important factor in understanding and enhancing endurance performance.

Although endurance performance is underpinned by several different performance-related facets, the ESSES was found to be unidimensional. This may be because of the overlap that exists between the facets associated with endurance

performance. For instance, exercise-induced sensations have been demonstrated to be related to pacing decisions, ability to maintain concentration, and the occurrence of unwanted thoughts and emotions (Mauger, 2014; McCormick, Meijen, Anstiss, & Jones, 2018; Whitehead et al., 2017). This level of overlap between the facets, means that it is unlikely to identify distinct separate factors, and that instead the ESSES can be best understood as relating to behaviours and skills which occur during performance. It is this level of overlap that also resulted in the removal of seven items generated in Study A that related to preparatory aspects of endurance performance. Interestingly, this overlap between different self-efficacy beliefs draws a parallel with the overlap observed between the sources of self-efficacy in Chapter 2. The observation of these overlaps provides further evidence for the avoidance of reductionist perspectives in studying self-efficacy, as it demonstrates the complexity of the self-efficacy construct. Furthermore, as the goal of the current research was to develop a self-efficacy scale for endurance sport performance, not preparation, this does not represent a major limitation.

The findings illustrate that the ESSES may be a reliable and valid measure. Regarding reliability, we consistently reported high levels of scale score reliability. In addition, several forms of validity were supported. For convergent validity, endurance sport self-efficacy correlated positively with related self-efficacy beliefs (e.g., barriers to training) and use of coping skills during competition. This is in line with research that has demonstrated that self-efficacy is associated with the use and maintenance of adaptive coping strategies during competition (Kane et al., 1996). Regarding concurrent validity, in line with previous research (e.g., Okwumabua, 1985), the number of marathons an athlete had completed predicted ESSES scores. This provides further evidence for the association between self-efficacy and prior experiences. This

is important because prior success is hypothesised to be the key source of self-efficacy (Bandura, 1997; Feltz et al., 2008). Regarding criterion-related validity, estimated  $VO_{2max}$  was a significant predictor of endurance sport self-efficacy. Because of the physiological demands of endurance sports (Joyner & Coyle, 2008), the possession of high levels of physical fitness (e.g., high  $VO_{2max}$ ), are likely to lead to increased perceived capability. This provides further support for research linking levels of physical fitness and self-efficacy (Caruso & Gill, 1992).

### **Limitations and Future Research**

The present research has two main limitations. First, the measure was derived from cross-sectional data. This meant that no evidence for the criterion or predictive validity of the ESSES was able to be provided. It also meant that the test-retest reliability could not be examined. To address these issues, researchers should examine the predictive, criterion and test-retest reliability validity of the ESSES in future studies. Second, for all three studies, convenience sampling was used. Whereas this is common practice for research in sport, it may have biased the sample (i.e., resulted in only individuals who already had an interest in the psychological aspects of endurance performance participating in the study). In the same vein, it may be possible that endurance athletes with low levels of self-efficacy, such as novices, lacked a strong athletic identity (Brewer, Van Raalte, & Linder, 1993), which may have meant that they would not have considered themselves “endurance athletes”, and therefore they would not have participated in the current research.

These limitations aside, the ESSES could make a valuable contribution to future self-efficacy research. In recent years, there has been an increased focus on the self-efficacy-outcome relationship at the within-person level (Gilson et al., 2012). The ESSES could be used to examine the relationship between self-efficacy and various

outcomes such as performance, coping, and satisfaction. This could also be combined with the longitudinal assessment of self-efficacy detailed in Chapter 2. Specifically, through using a combination of the ESSES, standard hierarchical self-efficacy scales, and qualitative interviews at specific time-points, likely causal mechanisms of self-efficacy change could be identified. This would help provide valuable insight into the malleability of self-efficacy beliefs and provide evidence for how they may change in response to factors such as training, tapering, and competitive performances (Feltz et al., 2008).

Additionally, the ESSES could be used to facilitate future qualitative research as well. For instance, endurance athletes could complete the ESSES prior to a semi-structured interview. Interview questions could then focus on reasons for high scores for various sub-skills, but also reasons for low scores. Such an approach would help strengthen a limitation of the study in Chapter 2, in which not much attention was paid to reasons for low self-efficacy.

Alongside these directions for future research, the ESSES can act as a useful tool for practitioners, coaches, and athletes. Given the strength of the relations between self-efficacy and performance (Moritz et al., 2000), high levels of self-efficacy are likely to be desirable for athletes. The ESSES provides practitioners and coaches with the opportunity to identify low and/or weak self-efficacy beliefs relating to endurance performance. This could help provide clear starting points for targeted interventions and discussions with athletes. While caution should be applied in attempting to classify athletes as 'high' or 'low' in self-efficacy (Feltz et al., 2008), the ESSES could nevertheless provide an effective starting discussion point for intervention-based practice. Furthermore, the ESSES could be used by coaches in order to develop more effective training plans, which help reinforce an athlete's weaker self-efficacy beliefs.



This would align with the theme of cumulative experiences identified in Chapter 2, which suggests that small incremental increases in self-efficacy could be achieved using effective goal setting. Overall, the ESSES provides the opportunity for more targeted interventions. Such interventions may result in greater performance benefits than common “one-size-fits-all” approaches (cf. McCormick et al., 2018).

### **Conclusion**

The current study provides initial evidence for the validity and reliability of the 11-item Endurance Sport Self-Efficacy Scale (ESSES). The ESSES is the first non-hierarchical self-efficacy scale developed specifically for the endurance sport domain. This development of the ESSES addresses the second aim of the current thesis, which was to develop an effective measurement technique for self-efficacy. The ESSES provides researchers, practitioners, coaches, and athletes with a means to assess and understand self-efficacy beliefs in endurance sports.

**Chapter 4: The effect of perceived task  
difficulty on self-efficacy and attributions in  
experienced distance runners**

## Abstract

**Objectives:** Two key determinants of self-efficacy for an upcoming task are the perceived task difficulty, and the causal attributions for previous performances. An understanding of these determinants and associated variables (e.g., perception of effort), would help enhance our knowledge relating to the malleability and alteration of self-efficacy. To facilitate this understanding, the current study examined how a task difficulty manipulation may influence both self-efficacy and post-performance attributions in distance runners. **Method:** A single-blind, within-subject, counterbalanced design was employed. Eighteen (six female) distance runners visited an exercise laboratory on four occasions. Visit one consisted of familiarisation, and visits two, three, and four consisted of a six-minute preload at a fixed workload, followed by a self-paced 5km time trial. The task difficulty manipulation consisted of an increase in the treadmill incline from 1% to 2%. Measures of affect, heart rate, perception of effort, self-efficacy, performance, and attributions were taken during each visit. **Results:** Repeated measures-ANOVAS revealed a significant effect of condition on task self-efficacy and performance self-efficacy strength, but not performance self-efficacy level. RM-ANOVAS also revealed a significant effect of condition on post-performance attributions. **Conclusions:** The current study examines how a task difficulty manipulation may influence self-efficacy and attributions in distance runners. The findings provide evidence for the malleability of self-efficacy beliefs, and the use of a task difficulty manipulation to alter attributions and self-efficacy in experienced individuals.

As explored and discussed in Chapter 2, self-efficacy beliefs for endurance performance are derived from several sources of information (Bandura 1997; Feltz et al., 2008; Samson & Solmon, 2014). The first and most powerful source of self-efficacy is an individual's own prior performance experiences (Bandura, 1997). If an individual perceives themselves to have been successful previously, self-efficacy will likely be raised, whereas previous failure will likely lower self-efficacy (Bandura, 1997). The second source of self-efficacy is vicarious influences, which represents the observation, modelling, and social comparisons made with others. The third source of self-efficacy are social and verbal persuasions which incorporates information provided by feedback from coaches and training partners and self-talk from the athlete themselves (Feltz, 2008). Although traditionally conceptualised as the same source (e.g., Bandura, 1977), perceptions of physiological and affective state represent the fourth and fifth sources of self-efficacy respectively. Perception of physiological states refers to an individual's perception of their own physical state (e.g., pain, fatigue, and energy), and similarly affective states refer to an individual's perception of their affective state (e.g., happiness, fear, and anxiety).

These sources, however, do not directly contribute to the formation and alteration of self-efficacy beliefs. Instead, they are involved in a series of cognitive appraisals and analyses. Gist and Mitchell (1992) outlined a three-stage process of analysis that explains how these sources of information lead to the formation and alteration of self-efficacy beliefs. These three stages involve an understanding of the task requirements, the causal explanation of previous performances, and an understanding of one's own personal resources (Gist & Mitchell, 1992).

The first stage in the formation of self-efficacy involves an analysis of task requirements and task difficulty. As self-efficacy represents an individual perceived

capability, they must first gain understanding of what they are comparing their capability against (Gist & Mitchell, 1992). When considering task difficulty, it is important to distinguish between objective and subjective difficulty. Objective difficulty relates to the objective changes in effort or ability required to perform, such as running on a steep incline as opposed to a flat service. In the endurance-performance domain this objective difficulty also relates to physical exercise-capacity such as peak running speed or peak power output (Kearon, Summers, Jones, Campbell, Killian, 1991). Subjective difficulty, comparatively, relates to what an individual perceives about the task, and as such subjective task difficulty will be referred to as perceived task difficulty throughout this article. Although objective and perceived task difficulty are likely to be strongly correlated (e.g., Sides, Chow, & Tenenbaum, 2017), when considering self-efficacy, it is the perceived task difficulty which is most important (Gist & Mitchell, 1992). There is evidence to support this relationship between perceived task difficulty and self-efficacy with Sides, Chow, and Tenenbaum (2017) demonstrating that increases in perceived task difficulty (which were brought about by an increase in objective task difficulty; e.g., an increase in intensity on a hand grip dynamometer) led to lower levels of self-efficacy for that task.

In the exercise-domain these perceptions of task difficulty likely relate to perception of effort. Perception of effort represents how hard, heavy, or strenuous a task is deemed to be (Marcora, 2010) and it is proposed that perception of effort is likely to be highly related to perceived task difficulty. This proposition is based on several strands of evidence. First, perception of effort has been demonstrated to be an important determinant of self-efficacy beliefs for endurance based exercise in a cycling task (Matsuo et al., 2015). Second, theoretical perspectives have argued that an important aspect of perceived effort is that it provides information about task

difficulty (Preston & Wegner, 2009). Third, the verbal anchors on the most commonly used measure of perception of effort (the Borg 6-20 scale, Borg, 1998) can be viewed as corresponding to task difficulty (e.g., easy, somewhat hard, hard, very hard).

As individuals gain more experience with tasks and situations, they are less likely to focus on the demands and perceived difficulty of the task, but they instead rely on their interpretation of the causes of previous performance (Bandura, 1989; 1997; Gist & Mitchell, 1992). The attributional analysis of experience involves individuals seeking to understand why a performance level occurred and represents the second stage of analysis. According to Weiner's attribution theory (1985, 1992), individuals attribute their performance across three key dimensions: locus of causality, stability, and controllability. Locus of causality refers to whether the causes of performance are internal or external to the person, stability refers to the extent that a cause is likely to change, and controllability refers to whether a cause can be modified by a person (Weiner, 1985, 1992). Perceptions of stability and controllability have been demonstrated to be the two most important attributions regarding self-efficacy (Bond et al., 2001; Gernigon & Delloye, 2003; Coffee & Rees, 2009). Research examining self-efficacy and attributions, however, has largely relied on novel tasks (e.g., blindfolded dart-throwing – Coffee & Rees, 2009), and no studies have examined the attribution-self-efficacy link in an endurance context. An increased understanding of how the attributional causes for performance may link to self-efficacy in an endurance context, is particularly warranted given the strength of evidence demonstrating that attributions can be changed through intervention (e.g., Rees et al., 2009).

The last stage of analysis in the formation and alteration of self-efficacy beliefs requires individuals to assess the availability of specific resources or constraints for

performing the task (Gist & Mitchell, 1992). This assessment considers personal resources (e.g., ability level, fitness level, anxiety) as well as situational factors (e.g., competing demands, other competitors, weather) that would likely influence performance on the task and is in accordance with key tenets of social cognitive theory (Bandura, 1986; 2001). In the endurance performance domain, this assessment of personal resources is likely to relate to perception of effort. For example, if a runner is aware of the perceived effort experienced while running at a certain speed, and then when running at this speed there is an incongruence between the expected (i.e., what was experienced before) and the experienced perceived effort (i.e., what is experienced now), this could suggest a change in an individual's resources. If the perceived task difficulty was harder (as evidenced through an increase in perceived effort), and there was no discernible change in the objective task difficulty (e.g., running up a hill), this could suggest some personal resource has changed (e.g., energy, fitness, or motivation), and as such self-efficacy for the task may decrease or be altered altogether. This interaction between the expected and the experienced physical sensations was identified in Chapter 2 under the theme of 'Physical Familiarity'. While the participants in Chapter 2 discussed how this could influence their self-efficacy, there has been no research to date that has attempted to examine this using an experimental methodology.

The three stages of analysis outlined by Gist and Mitchell (1992) offer a clear avenue for understanding how self-efficacy beliefs are altered and maintained in endurance sports. To investigate these stages experimentally, it is important that we possess valid manipulations and methodologies. One approach could be using a task difficulty manipulation. An increase in objective task difficulty (e.g., through raising the incline of a treadmill) is expected to lead to an increase in perception of effort and

a decrease in performance (Rejeski, 1981). If individuals were not aware of this change in objective task difficulty, and they understood their expected perception of effort for the task based on their prior experiences, the change in perceived difficulty (as evidenced through an increase in perception of effort), could be perceived as resulting from a change in personal resources, therefore causing a decrease in self-efficacy. Importantly, whereas Sides, Chow, and Tenenbaum (2017) previously demonstrated a negative relationship between perceived task difficulty and self-efficacy, participants in the study were aware that the objective difficulty of the task had changed. How changes in perceived task difficulty (when the objective difficulty is believed to be the same) may influence self-efficacy remains unclear. A task difficulty manipulation, therefore, could be a suitable methodology for gaining an increased understanding of the malleability of self-efficacy beliefs. Additionally, it could also prove a valid experimental method for altering attributions in experienced individuals.

The use of an experimental method also aligns with the current thesis's use of a mixed-methods approach. In Chapter 2, qualitative inquiry was used to gain an understanding of endurance athletes experiences regarding the formation of their self-efficacy. The use of an experimental methodology in the current chapter would help advance these previous findings and provide further evidence for an aspect of reality which can not be identified solely through qualitative methods (i.e., causal mechanisms for change; Fletcher, 2017).

Based on the points presented so far, the current study attempts to address the third aim of the thesis regarding the malleability of self-efficacy beliefs by examining the effects of a task difficulty manipulation on self-efficacy and post-performance attributions in experienced individuals. Specifically, it was hypothesised that.

1. Self-efficacy would be significantly lower in the manipulation condition.



2. Post-performance attributions of controllability and stability would be significantly lower in the manipulation condition.
3. The change in perceived effort between the conditions would be negatively correlated with the change in self-efficacy between the conditions.

## **Method**

To address the research questions a single-blind, within-subject, repeated-measures, counterbalanced design was used. The design had two conditions; normal difficulty (ND; 1% incline) and increased difficulty (ID; 2% incline).

### **Participants**

Participants were twelve male (age =  $38.5 \pm 12.2$  years, height =  $177.5 \pm 7.6$ cm, weight =  $68.9 \pm 6.5$ kg, maximum oxygen uptake [ $\dot{V}O_{2\max}$ ] =  $59.3 \pm 5.7$  ml·kg<sup>-1</sup> ·min<sup>-1</sup>) and six female (age =  $42.8 \pm 11.6$  years, height =  $169.2 \pm 4.4$ cm, weight =  $60.2 \pm 6.8$ kg,  $\dot{V}O_{2\max}$  =  $52.0 \pm 2.6$  ml·kg<sup>-1</sup> ·min<sup>-1</sup>) runners recruited from local running clubs. Participants had been engaging in competitive running for  $15.1 \pm 10.5$  years, were training  $10.2 \pm 3.7$  hours a week, and were healthy and free of injury. All participants had completed at least three 5km races in the prior 6 months. Five kilometre personal best (PB) during this time was  $19:53 \pm 2:16$  minutes for men, and  $22:36 \pm 3:09$  for women. An a priori statistical power analysis calculated that 16 participants would be necessary to detect a medium effect size (Cohen's  $F = 0.25$ ) with an  $\alpha$  error probability of .05 and 90% power, assuming a correlation of 0.6 among repeated measures (based on comparable data from other studies; Wagstaff, 2014).

Following University Ethics Committee approval, participants, none of whom had prior knowledge of the nature of the study, were recruited from local running clubs. Participants were informed that the study was an investigation of psychological factors relating to running performance.

## Measures

**Positive and negative affect scale (PANAS).** Positive and negative affect were measured using the PANAS (Watson, Clark, & Tellegen, 1988). The PANAS is comprised of ten positive affect items (e.g., excited) and ten negative affect items (e.g., distressed). Responders rate the extent to which they are feeling each item at the present moment on a five-point scale, ranging from 1 (Very slightly or not at all) to 5 (Extremely).

**Self-efficacy.** Task self-efficacy was assessed with a 6-item measure of non-hierarchical self-efficacy scored on an 11-point scale (0, no confidence at all to 100, complete confidence). The scale was developed in line with recommendations by Bandura (2006) and focused on skills and behaviours related to the 5km time trial such as: pacing, controlling emotions and thoughts, pushing physically, managing pain and discomfort, and managing feelings of exertion. Pooled data from across the study revealed a satisfactory scale score reliability ( $\alpha = .78$ ). Performance self-efficacy was assessed through a hierarchical scale which consisted of a list of descending 5km times. Participants were asked to indicate their confidence in completing the 5km run in that time on an 11-point scale (0 - no confidence at all, 100 - complete confidence). The scale consisted of nine times, which were individualised for each participant. The first point represented 88% of their 5km PB, and then each point increased by 2% to a total of 104% of their 5km PB. To aid with ease of understanding and answering, times were rounded to the nearest multiple of five (e.g., a time of 21:32 became 21:30). Level of self-efficacy was calculated as the number of time points where a confidence rating was provided. Strength of self-efficacy was calculated as the sum of all confidence ratings (0-100) divided by the indicated levels of self-efficacy (Feltz et al.,

2008). Pooled data from across the study revealed acceptable internal reliability for the performance self-efficacy scale ( $\alpha = .81$ ).

**Ratings of perceived exertion (RPE).** In-task perception of effort was measured with the 6-20 RPE Scale (Borg, 1998). Participants were given instructions which included a definition of perception of effort (“how effortful, heavy, and strenuous the exercise feels”, Marcora, 2010), an explanation of the nature and use of the scale, definitions of scale anchors, and a statement that there are no right and wrong answers. Participants practised using the scale during the familiarisation time trial.

**Subjective performance satisfaction.** Subjective performance satisfaction was assessed through a seven-point Likert scale (1 – Not satisfied at all, 7 – completely satisfied).

**Attributions.** Post-performance attributions were assessed using the Revised Causal Dimension Scale (rCDS-II; McAuley, Duncan, & Russell, 1992), a 12-item self-report scale consisting of four subscales: stability, personal control, external control, and locus of causality. Participants were asked to reflect on the probable reason(s) for their performance, and then rated their level of agreement with 12 bipolar adjective statements, from 1 (permanent) to 9 (temporary).

**Post study questionnaire.** To probe whether participants guessed the study’s aims and hypotheses, participants were asked to describe what they thought was the purpose of the study.

## **Procedure**

Each participant visited the experimental facility a total of four times. The four visits comprised of a familiarisation and maximum incremental testing on visit one, followed by three experimental visits which involved a six-minute preload run at a fixed speed, followed by a 5km time trial. The purpose of the six-minute preload run

was to provide participants with a comparison point for the increased difficulty condition. Following familiarisation participants were randomly allocated to either a ND-ID-ND (n = 9) or ND-ND-ID (n = 9) counterbalancing system. Data from each participant was collected individually during these visits. Each visit commenced at the same time of day  $\pm$  2 hours, in order to minimise any circadian variations (ACSM, 2013). A minimum of 48 hr was given to rest between conditions. All participants were given written instructions to maintain their current diet and exercise regimen for the duration of the study. The day before each visit participants were asked to drink 40mL of water per kilogram of body weight, sleep for at least 7 hours, refrain from the consumption of alcohol, and avoid any vigorous exercise. Participants were also instructed to avoid caffeine for at least 3 hours before testing (ACSM, 2013). At each visit to the laboratory, participants were asked to complete a pre-test checklist to ascertain if they had complied with the instructions, and to check for illness, injury or infection. Two digressions due to illness were reported, and these two participants were rescheduled for the following week. At the end of their fourth visit, participants were fully debriefed, including the true purpose of the study.

**Session One - familiarisation and incremental max testing.** After gaining written informed consent, the participant's height, weight, and resting blood pressure were measured. Participants completed questions relating to demographics, training and running event history.

Participants then completed an incremental exercise test to volitional exhaustion on a treadmill (Pulsar 3P; h/p/cosmos Sports and Medical, Nussdorf-Traunstein, Germany) with continuous measurement of respiratory gas exchange using a metabolic cart calibrated according to the manufacturers instruction before each test (Metalyzer 3B; Cortex Biophysik gmbH, Leipzig, Germany). Following a 5

min warm-up at a self-selected pace, participants began at an intensity based on their ability, with the intention of reaching volitional exhaustion within 10-12 minutes. Stages during the test lasted 2 minutes, with 2% increments in incline for each of the first 5 stages, followed by 1kph increments to volitional exhaustion. Heart rate was measured continuously by wireless telemetry (Polar RS400, Kempele, Finland).  $\dot{V}O_2\text{max}$  was determined as the highest value for a 30 second average. Mean data for all 18 participants indicated that volitional exhaustion was reached in  $10.32 \pm 2.12$  minutes.

After completion of the incremental testing, participants were allowed a fifteen minute recovery period. During this time, participants were familiarised with measures that would be used in the upcoming visits. First, and in line with recommendations by Bandura (2006), participants were familiarised with the non-hierarchical and hierarchical self-efficacy scales that would be used in the study. Participants were instructed to indicate their perceived capability of achieving a time or behaviour in that immediate moment, rather than what they might be able to do one day, or what they would like to be able to do. Participants were also instructed on the use of the Borg 6-20 RPE scale (Borg, 1998) which would be used during the 5km run.

Following the rest period and measure familiarisation, participants completed a familiarisation 5km run on the treadmill. Participants were told that all runs would occur at a 1% incline. Participants were instructed to use this 5km as a practice before the experimental visits, and to gain a familiarity with the controls, and treadmill running. Every 1km, participants were asked their RPE. Heart rate was measured continuously throughout. No verbal communication occurred between the participant and the experimenter, outside of the measures every 1km (McCormick et al., 2015). Participants were free to alter the speed of the treadmill during the time trial through

the use of a control panel which was located close to their right hand, and was freely accessible.

**Remaining sessions.** Upon arrival, participants completed the experimental instructions checklist and the Positive and Negative Affect Scale (PANAS). After completion, participants were allowed to carry out their own individual warm up. The duration of this warm up was recorded on the first experimental visit, and kept the same for subsequent visits.

Following the warmup, participants undertook a preload comprising six minutes of running at 90% of their 5km PB pace ( $13.8 \pm 1.4$  km/h). The purpose of this fixed six minutes was to provide participants with information pertaining to the perceived task difficulty of running at a speed similar to which they would in the time trial. This therefore would allow a comparison point for the manipulation visit. During this preload, heart rate was monitored continuously, and RPE was assessed in the final 30 seconds. At completion of the preload, participants were allowed a six minute break before completing the 5km time trial. The length of this break was recorded and maintained on subsequent visits. During this break participants were presented with both a task self-efficacy scale, and an individualised hierarchical performance self-efficacy scale for the upcoming 5km run. After completion of the scales, participants were instructed to complete the 5km run as quick as they could. Participants were free to adjust the speed through the use of a control panel. Heart rate was monitored continuously throughout, and RPE was recorded every 1km. After the completion of the 5km run, participants completed a second PANAS, indicated their subjective performance satisfaction, and then completed the Revised Causal Dimension Scale (rRCDS).

The increased difficulty (ID) condition (2% incline) was identical to the normal difficulty (ND) conditions (1% incline), except that during the preload, as the speed of the treadmill was increased, the incline of the treadmill was raised to 2% rather than 1%. This increase in incline was maintained throughout the preload and for the 5km run. Prior research has indicated that such an increase in incline can lead to an increase in oxygen consumption, therefore increasing the physical demand of the task (Jones & Doust, 1996). Although a 1% change in incline represents a relatively small change in task difficulty, this was important as it was hypothesised that too large a discrepancy would lead to participants believing the task had changed. In order to hide the change from participants, on the control panel of the treadmill the information relating to incline and heart rate were covered up by a piece of paper under the guise of being needed for another experimenters study. This piece of paper was present on all visits, as to not arise suspicion. At the end of the study participants were asked to disclose what they believed the true purpose of the study was.

### **Statistical Analyses**

Independent t-tests were conducted on all primary dependent variables (self-efficacy and attribution) and manipulation check variables (perceived exertion, heart rate, performance, affective responses, and subjective performance satisfaction) in order to assess order effects. Repeated Measures Analyses of Variance (RM-ANOVA) were conducted for each of the primary dependent variables (self-efficacy and attributions), and for the manipulation check variables (perceived exertion, heart rate, performance, affective responses, and subjective performance satisfaction). A three (condition) x five (distance covered; i.e., each kilometre) RM-ANOVA was conducted to investigate the effects of the task difficulty manipulation on heart rate, perceived exertion, and speed during the 5km time trial. In order to investigate the relationship

between changes in perception of effort during the preload, and changes in self-efficacy, change scores were calculated by averaging the two ND condition scores, and then subtracting this from the ID condition. If assumptions of sphericity were violated, the Greenhouse-Geisser correction was used to report analyses. Post-hoc analyses were conducted using a Bonferroni correction where significant F ratios were observed. Statistical significance was accepted as  $p \leq 0.05$  (two-tailed). Effect sizes for RM-ANOVA outcomes ( $\eta^2$ ) are reported in Table 5. Cohen's d (Cohen, 1992) effect sizes are reported where relevant. Cohen's (1992) guidelines of small ( $r = .10$ ), medium ( $r = .30$ ), and large ( $r = .50$ ) were used when interpreting correlations. All analyses were conducted using the Statistical Package for the Social Sciences (IBM Statistics 23.0; SPSS Inc., Chicago, IL).

## Results

Mean and standard deviation (SD) data for all dependent variables are presented in Table 5.

### Manipulation Checks

**Post study questionnaire.** Analysis of the post-study questionnaire revealed that no participants guessed the aims of the study. The majority of the participants believed the aim of the study was to investigate how emotions and performance beliefs may influence running performance.

**Order effects.** To check the data for order effects, independent samples t-tests compared participants undertaking the 2% incline followed by the 1% incline (i.e., ND-ID-ND) with those receiving the 2% incline after the 1% inclines (i.e., ND-ND-ID). All study variables were included, with no significant differences being observed for self-efficacy, performance, RPE, HR, or affect. Participants who received the 2% incline followed by the 1% incline reported significantly higher perceptions of



external locus of control,  $t(16) = 2.28$ ,  $p = .041$ ,  $d = .24$ . Given the lack of theoretical explanation for this finding it was considered a false positive and when viewed amid the other non-significant relationships it was interpreted from these data no order effects were present.

**Pre-test and post-test affect.** RM-ANOVAS revealed no significant effect of condition on pre-test positive ( $p = .911$ ), or negative affect ( $p = .501$ ). This indicates that participants did not experience differing affect prior to the experimental conditions, and thus, makes it unlikely that any difference in variables can be attributed to affect. A RM-ANOVA revealed a significant effect of condition on post time trial positive affect,  $F(2, 34) = 10.49$ ,  $p < .001$ ,  $\eta^2 = .22$ , and post time trial negative affect,  $F(2, 34) = 4.91$ ,  $p = .013$ ,  $\eta^2 = .22$ . Pairwise comparisons revealed that positive affect was significantly lower in the ID condition than the first ND condition ( $p = .009$ ,  $d = 0.86$ ) and second ND condition ( $p = .001$ ,  $d = 0.87$ ). Pairwise comparisons revealed no significant differences between the two ND conditions ( $p = .998$ ,  $d = 0.09$ ). Pairwise comparisons revealed that negative affect was significantly higher in the ID condition than the second ND condition ( $p = .003$ ,  $d = 1.08$ ), but not in the first ND condition ( $p = .699$ ,  $d = 0.34$ ). The pairwise comparison between the two ND conditions revealed no significant differences ( $p = .340$ ,  $d = 0.41$ ).

**Effect of manipulation on preload.** RM-ANOVAS revealed a significant effect of condition on preload RPE,  $F(2, 34) = 7.13$ ,  $p = .003$ ,  $\eta^2 = .29$ . No significant effect was found for preload HR,  $F(2, 34) = 2.89$ ,  $p = .069$ ,  $\eta^2 = .15$ . Pairwise comparisons revealed that preload RPE was significantly higher in the ID condition than the first ND condition ( $p = .035$ ,  $d = 0.52$ ) and the second ND condition ( $p = .002$ ,  $d = 0.63$ ). The pairwise comparison between the two ND

conditions revealed no significant difference ( $p = .779$ ,  $d = 0.31$ ). This indicates that the manipulation increased the perception of effort in the preload condition.

**Effect of manipulation on the 5km time trial.** The 3x5 RM-ANOVA revealed a significant main effect of distance covered on HR ( $p < .001$ ), RPE ( $p < .001$ ), and speed ( $p < .001$ ). As can be seen in Figure 1, HR, RPE, and speed all tended to increase across the 5km time trial. The 3x5 RM-ANOVA also revealed a significant main effect of condition on 5km time trial RPE ( $p = .023$ ) and speed ( $p < .001$ ). There was no significant effect of condition on 5km time trial HR ( $p = .741$ ). The 3x5 RM-ANOVA also revealed a significant interaction between distance covered and condition for HR,  $F(8, 136) = 2.44$ ,  $p = .017$ ,  $\eta^2 = .13$ , RPE,  $F(8, 136) = 2.75$ ,  $p = .008$ ,  $\eta^2 = .139$ , and speed,  $F(8, 136) = 4.77$ ,  $p < .001$ ,  $\eta^2 = .22$ . As can be seen in Figure 1B, follow up one-way ANOVAs revealed that RPE was significantly higher at the third km time point in the ID condition than in the second ND condition ( $p = .003$ ) but not the first ND condition ( $p = .250$ ). Additionally, as can be seen in Figure 1C, speed was significantly slower at the third, fourth, and fifth time points in the ID condition than the first ND condition ( $p = .006$ ,  $p = .021$ ,  $p = .019$ ) and second ND condition ( $p = .012$ ,  $p = .012$ ,  $p = .004$ ).

Figure 1. Mean  $\pm$  standard deviation ratings of heart rate (panel A), perceived exertion (RPE; panel B), and speed (panel C) values over time in the first normal difficulty, second normal difficulty, and increased difficulty conditions.

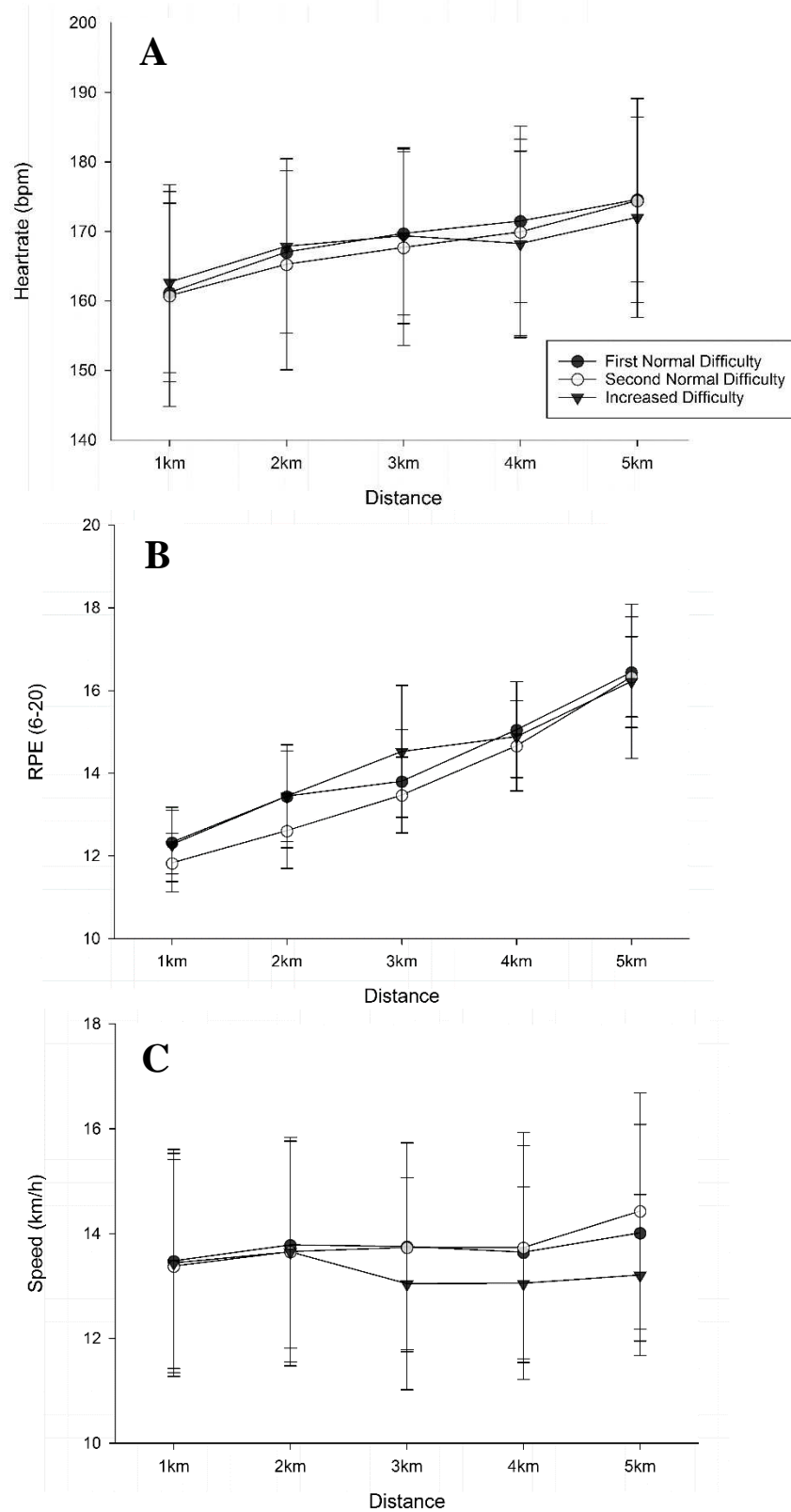


Table 5. Means, SD's, p-values and  $\eta^2$  for dependent variables

Measure	Condition						p	$\eta^2$
	First Normal Difficulty		Second Normal Difficulty		Increased Difficulty			
	M	SD	M	SD	M	SD		
Pre-PANAS Positive	37.50	6.15	37.22	4.20	37.72	4.65	.911	.01
Pre-PANAS Negative	13.61	2.45	12.94	2.46	13.05	2.79	.501	.04
Preload HR (bpm)	157	13	156	15	159	13	.069	.15
Preload RPE	12.39	0.91	12.17	0.62	12.89	0.75	.003	.29
Task Self-Efficacy	85.83	8.52	85.12	9.13	80.32	10.56	.007	.25
Performance Self-Efficacy (Level)	6.88	1.57	7.00	1.37	7.05	1.43	.880	.01
Performance Self-Efficacy (Strength)	74.82	11.65	73.52	9.11	68.22	10.25	.037	.19
Performance (seconds)	1339.22	220.93	1340.33	239.75	1389.50	217.55	<.001	.46
Subjective Performance Satisfaction	5.05	1.35	5.39	1.37	3.05	1.16	<.001	.60
Post-PANAS Positive	40.16	5.74	39.72	4.57	35.11	6.01	<.001	.38
Post-PANAS Negative	12.66	5.58	11.88	2.49	15.22	3.72	.013	.22
Locus of Control	20.00	3.35	21.38	3.46	19.83	3.79	.281	.07
External Control	9.89	5.04	8.22	5.54	10.50	3.84	.014	.22
Stability	11.66	5.11	10.77	4.65	7.50	4.64	.003	.29
Personal Control	23.38	2.19	22.17	3.05	19.38	5.86	.026	.22

Note. p-values and effect sizes ( $\eta^2$ ) based on RM-ANOVAs between conditions

A RM-ANOVA also revealed a significant effect of condition on 5km time trial performance,  $F(2, 34) = 14.58, p < .001, \eta^2 = .46$ . Pairwise comparisons revealed that performance was significantly slower in the ID condition than the first ND condition ( $p = .001, d = 0.51$ ) and the second ND condition ( $p = .003, d = 0.48$ ). No significant differences were detected between the two ND conditions ( $p = .999, d = 0.08$ ).

A RM-ANOVA revealed a significant effect of condition on subjective performance satisfaction,  $F(1.489, 25.31) = 25.64, p < .001, \eta^2 = .60$ . Follow up pairwise comparisons revealed that performance satisfaction was significantly lower in the ID condition than the first ND condition ( $p < .001, d = 1.45$ ) and the second ND condition ( $p < .001, d = 1.68$ ).

### **Effect of Manipulation on Primary Variables**

**Self-Efficacy.** RM-ANOVAS revealed a significant effect of condition on task self-efficacy,  $F(2, 34) = 5.79, p = .007, \eta^2 = .25$ , and performance self-efficacy strength  $F(1.45, 24.67) = 4.22, p = .037, \eta^2 = .19$ . There was no significant difference for performance self-efficacy level,  $F(2, 34) = 0.13, p = .853, \eta^2 = .01$ . Task self-efficacy was significantly lower in the ID condition than the first ND condition ( $p = .038, d = 0.35$ ) and the second ND condition ( $p = 0.22, d = 0.48$ ). Pairwise comparison between the two ND conditions revealed no significant change in task self-efficacy ( $p = .999, d = 0.09$ ).

Pairwise comparisons revealed that self-efficacy strength was significantly lower in the ID condition than the first ND condition ( $p = .033, d = 0.35$ ), and the second ND condition ( $p = .020, d = 0.51$ ). No differences for self-efficacy strength between the two ND conditions ( $p = .999, d = 0.08$ ) were detected.

**Attributions.** A RM-ANOVA revealed a significant effect of condition on attributional dimensions of stability,  $F(2, 34) = 7.18, p = .003, \eta^2 = .29$ , personal control,  $F(1.49, 26.61) = 4.85, p = .014, \eta^2 = .22$ , and external control,  $F(2, 34) = 4.83, p = .014, \eta^2 = .22$ . No significant effects were found for locus of control ( $p = .281$ ). Pairwise comparisons revealed that participants in the ID condition reported greater instability in their attributions than in the first ND condition ( $p = .010, d = 0.78$ ) and second ND condition ( $p = .009, d = 0.64$ ). No significant differences were detected between the two ND conditions ( $p = .988, d = 0.10$ ). Additionally, participants reported less perceptions of personal control in the ID condition than in the first ND condition ( $p = .047, d = 0.72$ ) but not in the second ND condition ( $p = .256, d = 0.34$ ). No significant differences were detected between the two ND conditions ( $p = .456, d = 0.12$ ). Participants also reported higher perceptions of external control in the ID condition compared to the second ND visit ( $p = .041, d = 0.62$ ), but not the first ND visit ( $p = .999, d = 0.18$ ). There was no significant difference between the two ND conditions ( $p = .126, d = 0.35$ ).

**Relationship between change in RPE and self-efficacy.** The correlational analysis revealed that change in RPE was significantly negatively correlated with change in self-efficacy strength,  $r(n = 18) = -.74, p < .001$ . There was no significant relationship between change in RPE and task self-efficacy,  $r(n = 18) = -.28, p = .261$ , and change in RPE and performance self-efficacy level  $r(n = 18) = .25, p = .317$ .

## Discussion

The current study examined the effects of a task difficulty manipulation on self-efficacy and performance attributions in experienced distance runners. Task self-efficacy and performance self-efficacy strength decreased after the task difficulty manipulation, but no changes were detected for performance self-efficacy level.

Regarding the causal explanations for performance, the manipulation condition resulted in decreased perceptions of personal control and stability and increases in perceptions of external control. A negative correlation was also detected between change in perception of effort and performance self-efficacy strength, although no statistically significant correlations were detected between the other types of self-efficacy. In summary, partial support was found for the hypotheses. These findings provide important insights into the malleability of self-efficacy beliefs and therefore help address the second aim of this thesis. Furthermore, evidence is provided for the previously identified interaction between past performance experiences and physiological states as identified in Chapter 2.

Both task self-efficacy and performance self-efficacy strength were significantly lowered following the preload in the ID condition. Perception of effort has been demonstrated to be an important source of self-efficacy for exercise in sedentary (McAuley & Blissmer, 2000; McAuley & Courneya, 1992) and elderly individuals (McAuley, Jerome, Marquez, Elavsky, & Blissmer, 2003), but the present study is the first study to link perception of effort to self-efficacy in endurance athletes. This finding also advances the previous findings of Chapter 2 through identifying a specific physical sensation (i.e., perception of effort) that endurance athletes are likely to use to gauge their progress towards a task. As perception of effort was higher than previously experienced during the preload, and as there was no explicit reason for this change in perception of effort, this may have resulted in individuals perceiving a personal resource to have changed, and thus resulted in a lowering of self-efficacy for the upcoming 5km time trial. This was in turn demonstrated by the negative relationship that was detected between change in perception of effort and change in performance self-efficacy strength. Task self-efficacy was also lower in the

manipulation condition, however unlike performance self-efficacy strength there was no correlation with change in perception of effort. This finding could be explained by small statistical power, an alternative, more theoretical explanation can be that task self-efficacy is informed by different sources of information. As mentioned in both Chapter 2 and Chapter 3, there exists considerable amounts of overlap between both types of self-efficacy and the sources. It may be that the current Chapter's focus on one specific aspect (i.e., perception of effort), meant that other important components were not measured which may have led to a change in task self-efficacy.

The attributions provided for performance play a crucial role in how these performances contribute to self-efficacy (Mitchell & Gist, 1992). As predicted by the hypothesis, perceptions of controllability and stability were lowered in the increased difficulty condition. In experienced individuals, such as those in this study, who possess a high level of self-efficacy, attributing poor performances to uncontrollable and unstable causes is hypothesised to act as a protective mechanism for both self-efficacy and self-esteem (Bandura, 1997; Kane et al., 1996). Such a finding also supports prior experimental research (Coffee & Rees 2008; Gernigon & Delloye, 2003), and helps demonstrate the potential validity of a task difficulty manipulation to alter attributions. Post-hoc comparisons, however, revealed that the changes in attributions were only statistically significant in comparison to one of the normal difficulty visits. A further reason for this lack of significance in post-hoc comparisons, could be due to the large amounts of intra-individual variability that exists for attributions (Weiner, 1986). The lack of significance may also be a result of the deception in the current study being a one-off experience, and that more repeat experience of poor performances may lead to a larger change in attributions.



Supporting these findings was the methodological rigor utilised in the current study. First, experienced athletes were recruited to the study and they were allowed a high level of familiarisation with the task. Although self-efficacy research which makes use of novices can be useful in examining the self-efficacy of learning, self-efficacy for performance is best examined where individuals have a strong understanding of the task demands and their own capabilities (Ericsson & Anders, 2006; Feltz et al., 2008). Second, the multidimensionality of self-efficacy beliefs was accounted for, using both hierarchical and non-hierarchical scales. Participants were familiarised with the scales, the scoring responses, and the performance times were personalised for everyone, all considered best practice in self-efficacy research (Bandura, 2006). Furthermore, as evidenced by the changes in subjective performance satisfaction and post-performance affect, the participants in the current study were motivated to, and cared about their performance, an important requirement for endurance performance research (McCormick et al., 2018).

Notwithstanding the strengths of the study presented, there are several limitations. First, although we detected a negative correlation between change in perception of effort and change in performance self-efficacy strength, this does not mean it was the only reason participants lowered their self-efficacy. Asking participants to provide a brief reason for giving the self-efficacy ratings that they did, could have helped provide further insight into why their self-efficacy was lower. Second, the laboratory setting of the study may have influenced the attributional process. Research has demonstrated that laboratory settings can have an influence on the attributions provided for performance in comparison to naturalistic settings (Van Raalte, 1994). Given, however, the need for laboratory settings to carry out the manipulation, this was deemed warranted. Third, because of the design of the study

it was not possible to examine if the lowering of self-efficacy by the change in task difficulty had an influence on performance, as both the preload and the time-trial were at a 2% incline. Additionally, as the main aim of the study was not to investigate the self-efficacy performance relationship, but instead examine the consequences of a change in task difficulty on self-efficacy and attributions, this does not pose a major limitation. A further limitation was the imbalance between male and female athletes. Prior self-efficacy research has indicated a potential gender effect for self-efficacy, with men typically reporting higher levels of self-efficacy (Feltz et al., 2008), and women being more susceptible to manipulations designed to lower self-efficacy (Feltz, 1988). Although no gender effect was detected in the current study this may have been due to a lack of statistical power. Additionally, alongside the measurements of task-specific self-efficacy, it may have also been beneficial to measure a domain-specific self-efficacy such as through the ESSES which was developed in Chapter 3. However, due to both Chapter 3 and the current Chapter being conducted concurrently it was not possible to include the ESSES as a measure.

The current study offers several directions for future researchers and applied practice. Future research could look to use a similar methodology as the one employed here and examine the effects that various interventions could have on attributions, self-efficacy, and performance. Future research could also examine if a dose-response effect (i.e., through an examination of differing levels of perceived task difficulty change) exists in relation to the task difficulty change and self-efficacy, and if sensations experienced during exercise such as perception of effort mediate this relationship. This could be achieved by increasing the scale of the task difficulty manipulation (e.g., using increased inclines on the treadmill, or an increased wattage on a cycle ergometer), and examine the effects of this on self-efficacy beliefs. Similar

changes in perceived task difficulty could be achieved through caffeine supplementation (which has been demonstrated to lower perception of effort; Ganio, Klau, Casa, & Armstrong, 2009), inducing hypoxia through altering the oxygen percentage in the atmosphere (which has been demonstrated to increase perception of effort; Shephard et al., 1992), or through inducing a state of mental fatigue (which has been demonstrated to increase perception of effort; Marcora, Staiano, & Manning, 2009). This variety of experimental manipulations would also allow an examination of positive changes in perceived difficulty, where a familiar task is experienced as being 'easier' (as evidenced through a decrease in perception of effort).

In terms of practical implications, the current study highlights how unexplained or unexpected changes in task difficulty may influence self-efficacy. This may act as a useful starting place for conducting intake interviews with endurance athletes, or for which to target interventions at. The use of psychological skills to attempt to mitigate the dissonance created when unexpected changes occur could be a critical aspect for interventions to target. Regarding coaches, based on the findings from the current study it may be beneficial to ensure that endurance athletes' training is structured so that they are able to develop an effective understanding of their body's response to various intensities. Importantly, however, it is likely to be beneficial to attempt to create discrepancies such as those experienced in the current study, using incline-training, pace changes, or reduced recovery time. The overall goal of such strategies is that endurance athletes should be aware of their likely physical reactions to such changes in difficulty, and as such potentially avoid the reductions in self-efficacy displayed in the current study. It may be necessary to ensure endurance athletes have strategies in place in case they experience unexpected and unexplained variations in perceived task difficulty. For example, during the warm up before an

important event, if an athlete begins to worry that their experienced level of perceived difficulty does not match their previous experiences, they could look to apply various psychological skills such as relaxation, imagery, and self-talk to ensure their self-efficacy is not affected (Lowther, Lane, & Lane, 2002; Sheard & Golby, 2006)

### **Conclusion**

The current study is the first to examine how a task difficulty manipulation may influence self-efficacy and attributions in experienced distance runners. These findings help demonstrate how variation in perceived task difficulty can influence self-efficacy in experienced individuals, and that a task difficulty manipulation can be used to successfully alter self-efficacy beliefs and attributions in experienced distance runners. These findings directly contribute to the third aim of the current thesis which was to gain an increased understanding on the malleability and dynamicity of self-efficacy beliefs in the endurance sport domain. A greater understanding of how self-efficacy beliefs are generated, altered, and maintained is critical to the development and delivery of interventions to aid endurance performance.

**Chapter 5: The effects of brief online web-based psychological interventions on endurance athletes in a naturalistic competitive setting**

## Abstract

**Objectives:** Psychological interventions have been demonstrated to be beneficial to endurance athletes. One psychological construct which could be targeted by these interventions is self-efficacy. Two interventions which have been previously used with endurance athletes, and have been associated with self-efficacy, are self-talk and implementation intentions. These two interventions represent brief, inexpensive, and accessible ways of providing psychological support to endurance athletes. To examine the effects of the two interventions on self-efficacy and performance, the current study examined the impact upon endurance athletes participating in real world competition.

**Method:** A randomised control trial design was employed in a naturalistic setting. Ninety-four endurance athletes (52 males) were randomised to one of three conditions (self-talk, implementation intentions, and control) prior to an upcoming endurance event. Measures of self-efficacy were collected pre and post-event, whereas goal attainment, performance satisfaction, coping, stress appraisals, and social validity of the interventions were collected post-event.

**Results:** Perceptions of stress controllability were significantly higher in the two intervention groups compared to the control group. Further ANOVAs revealed no significant effect of group on all outcome variables. High levels of perceived satisfaction and use of interventions during the event were reported in both intervention groups.

**Conclusions:** The current study is the first to examine how brief psychological interventions may influence self-efficacy, coping, performance, and subjective satisfaction in endurance athletes who are competing in naturalistic settings. Although these interventions only influenced perceptions of stress controllability, the interventions were deemed useful and suitable by the endurance athletes. The findings provide evidence for the use of the internet in helping to deliver psychological interventions to endurance athletes.

Psychological research in the sport and exercise domains has the potential to benefit a wide variety of individuals (Brown & Fletcher, 2017; Gill, Williams & Reifsteck, 2017). In the sport psychology literature these benefits have, arguably, largely focused on enhancing performance (i.e., improving competitive outcomes such as finishing times and positions), but there has also been calls for researchers to consider ways of enhancing the experience of those taking part in sport (Gill, Williams & Reifsteck, 2017). This enhancement of experience can relate to the emotional experience (e.g., through enhancing positive emotions such as joy and happiness), cognitions (e.g., irrational performance beliefs and concepts of self-worth), and through helping athletes cope and manage various demands and stressors that may impede their enjoyment and performance (Gill, Williams, & Reifsteck, 2017). Improving the experience of those taking part in sport could encourage continual engagement and participation, and this is important given the wide range of physical, mental, and social benefits that participating in sport can help provide (Wankel & Berger, 1990). One sporting population who could benefit from this psychological research are endurance athletes, who are broadly defined as people who participate and compete in endurance sports and events (McCormick, Anstiss, & Lavalley, 2018).

As discussed in the preceding chapters of this thesis, self-efficacy is likely to be an important factor in enhancing endurance performance. With information now known about the formation of these self-efficacy beliefs (Chapter 2), the measurement of these beliefs (Chapter 3), and their potential for malleability (Chapter 4), it is worthwhile to consider now how to enhance these beliefs through intervention.

### **Self-Efficacy Interventions**

There exists a variety of possible interventions to help enhance an athlete's self-efficacy (Short & Sullivan, 2009). One possible intervention is through the

development of an athlete's self-talk. Self-talk represents the word or phrases an athlete says to themselves (Hardy, 2007), and this self-talk can be used to reinforce an athletes' perceived capability (i.e., self-efficacy). In support of this, self-talk has been identified as commonly cited source of self-efficacy in athletes and endurance athletes (Feltz et al., 2008; Samson, 2014), and athletes' use of self-talk has also been associated with higher levels of self-efficacy (Hatzigeorgiadis et al., 2008). Additionally, self-talk was identified as a key source of self-efficacy in Chapter 2, with the endurance athletes in that study using self-talk to reinforce their self-efficacy during difficult periods of their events.

One self-talk intervention which has received a large amount of research attention in relation to endurance performance is motivational self-talk. Motivational self-talk focuses on reinforcing capability and desire through emotive statements such as "Come on you can do it!" or "You are crushing this" (Hardy, 2007). Motivational self-talk interventions have been demonstrated to lead to superior cycling performance in a variety of laboratory-based endurance tasks (Barwood et al, 2016; Blanchfield et al., 2014; Wallace et al., 2017), and therefore have a clear potential benefit for endurance athletes. Not all research examining motivational self-talk has revealed positive results however, with McCormick et al. (2018) finding that a motivational self-talk intervention delivered to ultra-runners, had no effect on performance in an ultra-marathon, and no effect on pre-event self-efficacy. Therefore, while there exists a rationale for motivational self-talk being a potential intervention for endurance athletes, further research is required, particularly in relation to self-efficacy.

Alongside the positive effects on endurance performance, a key benefit of the motivational self-talk interventions is their delivery method. These interventions are delivered using a workbook, which is designed to be relatively brief in terms of



completion (i.e., 30min-60min) and requires minimal interaction between the participant and the researcher. As such, this intervention does not require a large time investment from participants and is also low-cost. This is a benefit when considering non-elite endurance athletes, who often cite a lack of time as a major demand (McCormick et al., 2017) and also who may lack access to accredited professionals for interventions. ‘Brief’ psychological interventions, such as the use of a motivational self-talk workbook, could therefore be beneficial for a wide range of endurance athletes. Indeed, this use of ‘brief’ psychological interventions has received increased attention in other domains of psychology (Jamieson et al., 2017; Webb et al., 2010) but is still relatively unexplored in sport psychology.

A further brief psychological intervention which has been shown to be efficacious in academic, health, and educational contexts is implementation intentions (Achtziger, Gollwitzer, & Sheeran, 2008; Conner & Higgins, 2010). Implementation intentions are a form of goal related action planning, which are formulated through individuals identifying a potential challenge or difficulty they may face in pursuit of their goal, and then a solution for when this occurs. They are hypothesised to work as they encourage individuals to use a formulated action plan, which helps to prevent the use of ineffective or maladaptive plans (Adriaanse, Gollwitzer, De Ridder, de Wit, & Kroese, 2011; Gollwitzer, 1999). Like motivational self-talk, the use of implementation intentions has been associated with increased levels of self-efficacy (Webb et al., 2008; 2010). This increase in self-efficacy is hypothesised to occur as individuals perceive themselves as more capable of managing potential demands that may limit their performance. Implementation intentions could be an effective intervention at targeting the reduction in self-efficacy observed in Chapter 4, when there is a discrepancy between the expected and the experienced physical sensations.

Formulating if-then plans, in relation to these could be a way of helping inoculate endurance athletes against this reduction in self-efficacy.

There is also evidence to suggest that implementation intentions could be beneficial for endurance athletes, with Lane et al. (2016) demonstrating that the use of implementation intentions led to superior emotional control and increased levels of performance satisfaction in a sample of distance runners. Lane et al. (2016) hypothesised that the beneficial effects of the implementation intentions were a result of superior emotional regulation, and a more effective response to stressful events the athletes faced when performing. This in turn supports the previous idea of helping to enhance both performance but also the experience of endurance athletes. Motivational self-talk and implementation intentions could therefore be two possible interventions which could be used to enhance both the performance and experience of endurance athletes. In being able to understand the effectiveness of these interventions, two further factors must be considered. The first is what in context to examine these interventions (McCormick et al., 2018), and the second is the delivery method of these interventions (McCormick, Anstiss, & Lavalley, 2018).

### **Intervention Considerations**

A recent critical review by McCormick et al. (2018) highlighted that research conducted on psychological interventions and endurance performance has predominately made use of laboratory-based settings. Whereas such settings provide experimental control, endurance athletes do not perform in controlled environments, and the generalisation of these results to real-life competition is limited. To address this, McCormick et al. (2018) called for more studies to investigate psychological interventions at real-life endurance events (i.e., a naturalistic setting). Examining the effects of an intervention in a naturalistic endurance sport setting has two key

advantages. First, performance motivation of participants is likely to be more self-determined, and it is also likely that participants will have self-set goals for the competition (McCormick et al., 2018). This self-determined motivation and the possession of self-set goals can help result in greater effort in each of the experimental conditions. Second, in a naturalistic setting, endurance athletes are likely to encounter a variety of demands and stressors which are not encountered in laboratory settings (e.g., other competitors, weather, and logistical issues). These demands and stressors can result in a decrease in self-efficacy (Samson, 2014), and as such the use of a naturalistic setting provides stronger levels of ecological validity for the intervention.

After considering where to examine the intervention, it is equally important to consider how the intervention is delivered. A key aspect of psychological interventions is successful engagement with the target audience, and this chance of engagement is greatly increased when interventions are delivered in a preferable format (Greenspan & Feltz, 1989; Strachan, Marcotte, Giller, Brunet, & Schellenberg, 2017). In a recent study by McCormick, Anstiss, and Lavalley (2018) endurance athletes reported that one of the most preferred ways of receiving psychological guidance was via the internet. The internet has been demonstrated to be a successful delivery method for a variety of psychological interventions relating to behaviour change, mental health, and educational attainment (Gottlieb et al., 2017; Raghavendra, Newman, Grace, & Wood, 2013; Webb, Joseph, Yardley, & Michie, 2010), and could therefore be feasible for the current study. Implementation intention-based interventions have been successfully delivered online previously (i.e., Lane et al., 2016) and while there exists no research on motivational self-talk interventions delivered online, it is likely that the current workbook structure of these interventions could be adapted to be delivered online. The use of the internet in delivering the intervention could also help facilitate

the use of endurance athletes competing in real-world events, as a much larger pool of participants could be recruited who are participating in a variety of events.

### **The Current Study**

Based on the information presented so far, the current study attempted to address the third aim of the current thesis, by examining how brief psychological interventions (implementation intentions and self-talk) delivered online may impact endurance athletes competing in naturalistic settings, particularly in relation to their self-efficacy. There were three key aims of the research. First, in line with the desire to help enhance experience and performance, the first aim was to examine if receiving a brief intervention influenced self-referenced goal attainment and subjective performance satisfaction. Second, and in line with the desire to help enhance self-efficacy, the second aim of the current study was to examine if receiving a brief intervention influenced self-efficacy, coping behaviours, and stress appraisals. Last, and in line with the desire to provide endurance athletes with feasible and useful interventions, the third aim was to examine the endurance athlete's satisfaction and perceived usefulness of the interventions, and if there were any differences between the two interventions.

## **Methods**

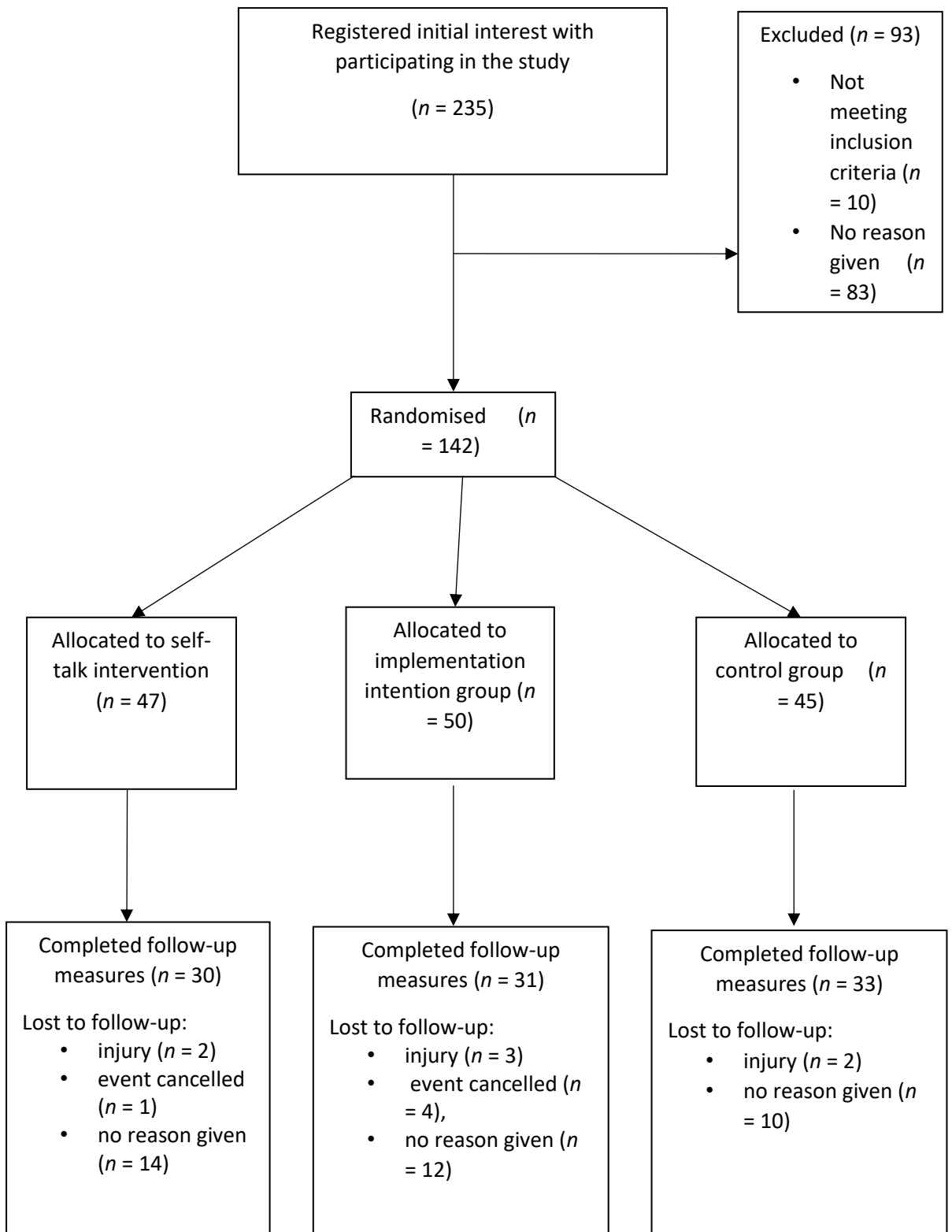
### **Design**

A randomised controlled experimental design was used to assess the effect of the brief psychological interventions in a naturalistic setting. Participants were randomly assigned to an intervention group (self-talk, implementation-intentions) or the control group by the Qualtrics randomisation software.

## **Participants**

Two hundred and thirty-five individuals originally registered their interest in the study, with 94 participants (52 males) ultimately completing the study (see Figure 2. for full details on participant completion and attrition). The mean age of these 94 participants was 40.05 years ( $SD = 10.57$ ), and they had been taking part and competing in their endurance sport for an average of 7.62 years ( $SD = 5.43$ ). Of the 94 participants, 67 were runners, 13 were rowers, 8 were triathletes, 4 were cyclists, and 2 were swimmers. In relation to previous exposure to psychology support for performance, most participants had not previously sought out prior psychological help and support ( $n = 58$ ). Twenty-five participants had sought psychological help and support in relation to books or online resources, and 11 had sought help from professional individuals (e.g., sport psychologists).

Figure 2. Participant attrition and completion rate for the online interventions



## **Procedure**

Ethical approval was granted by the Department ethics committee, and informed consent was obtained from all participants prior to data collection. Data were collected at three time points (baseline, intervention, follow up) using three online surveys which were hosted on the Qualtrics online survey platform. At baseline participants were able to register their interest in participating in the current study, by completing an online survey (Survey 1) which was distributed via emails to endurance sport clubs and posts to social media. Survey 1 provided participants with eligibility criteria, demographic questions, and asked them to indicate an event they were planning on competing in and the date of this event. Participants were also asked to report their goal for this event. Participant's emails were recorded at this point to allow contact for the other two time points of the study.

The intervention time point was three weeks before the participants reported event date, and they were emailed a link to Survey 2. In Survey 2, participants answered questions relating to their self-efficacy, and were randomised to one of the interventions or the control condition. If the survey was not completed, participants were sent a reminder email after five days, and again after ten days.

The follow up time point was two days after the participants reported event date, and they were emailed a link to Survey 3. Survey 3 consisted of questions relating to self-efficacy and several other outcome variables. If the survey was not completed, participants were sent a reminder email after five days, and again after ten days.

## **Measures**

**Self-efficacy.** Self-efficacy was measured 'Endurance Sport Self-Efficacy Scale' (ESSES) which was developed and validated in Chapter 3. The ESSES is an 11-item unidimensional scale which consists of items relating to pacing, controlling

thoughts and emotions, and managing exercise-induced sensations. Each item was rated on an eleven-point scale which ranged from 0 (No confidence at all) to 100 (Completely confident). The ESSES and its subscales have been demonstrated to possess satisfactory scale score reliability ( $\alpha = .88$ ), and this was replicated in the current study ( $\alpha = .85$ ).

**Coping.** Coping strategies were assessed using the Coping Inventory for Competitive Sport (CICS; Gaudreau & Blondin, 2002) in Survey 3. The CICS contains 10 subscales categorised into three second-order dimensions: task-oriented coping (mental imagery, thought control, effort expenditure, seeking support, logical analysis, and relaxation) distraction-oriented coping (mental distraction and distancing), and disengagement-oriented coping (venting of unpleasant emotions and resignation). The CICS has been previously used to assess coping strategies in a sample of marathon runners (Gaudreau, El Ali, & Marivain, 2005). The results of Gaudreau et al. (2005), however, suggested the removal of 10 items as they did not appear to be applicable to endurance athletes. To promote higher levels of content validity in the current study we opted to remove the problematic items identified by Gaudreau et al. (2005), and participants therefore completed a 28-item scale. Each item was rated on a 5-point Likert scale ranging from 1 (does not correspond at all) to 5 (corresponds very strongly). The CICS has previously reported acceptable scale score reliability ( $\alpha = .58$  — .94), and this was replicated in the current study ( $\alpha = .61$  — .92).

**Goal attainment and subjective performance satisfaction.** Participant's goal attainment was assessed via the question "Did you achieve your goal for this event?" and was responded to either yes or no. To assess performance satisfaction participants responded to the statement "How satisfied were you with your performance in this event/race/completion?" on a 7-point bipolar Likert scale ranging



from -3 (Extremely dissatisfied) to +3 (Extremely satisfied). We opted to use subjective performance satisfaction because of the high level of heterogeneity in the current sample (i.e., sport, event type, age, gender, experience). The use of subjective performance satisfaction has also been argued to allow participants to judge performance against their own standard, and as such, helps control for factors relating to course conditions, weather, and injury/illness which may otherwise impact upon performance (Lane et al., 2016).

**Stress appraisal.** To assess stress appraisals two items were adapted from Nicholls et al. (2009) which represented perceived intensity and controllability of the stress encountered during the event. Regarding perceived intensity participants were asked “How intense would you rate the stress that you encountered during your recent event?” and responded on a 7-point Likert scale ranging from 1 (Not intense at all) to 7 (Extremely intense). Regarding controllability, participants were asked “How much control did you perceive yourself to have over your stress during your recent event?” and responded on a 7-point Likert scale ranging from 1 (No control at all) to 7 (Complete control).

**Intervention checks.** Length of time spent on the intervention section was recorded using the Qualtrics time monitoring function and was taken to allow a comparison between the two interventions, and to explore the possible effects of time spent on intervention on further intervention checks.

To assess the use of the interventions during the event, participants in the intervention groups responded to three questions. The first question was “Generally speaking, to what extent did you remember the intervention?” and was responded to on a 10-point Likert scale ranging from 0 (Not at all) to 10 (Completely). The second question was “Generally speaking, to what extent did you use the intervention?” and

was responded to on a 10-point Likert scale ranging from 0 (Not at all) to 10 (All the time). The third question was “Generally speaking, to what extent were you comfortable using the intervention?” and was responded to on a 10-point Likert scale ranging from 0 (Not at all comfortable) to 10 (Completely comfortable).

**Social validity.** To assess their satisfaction with the intervention participants responded to three items. The first item was “How satisfied were you with the intervention you received?” and was responded to a 7-point bipolar Likert scale ranging from – 3 (Extremely dissatisfied) to + 3 (Extremely satisfied). The second item was “How useful did you find the intervention) and was responded to on a 7-point bipolar Likert scale ranging from – 3 (Extremely useless) to + 3 (Extremely useful). The last item was “Do you plan to keep using the intervention you received in the future), and was responded to on a 5-point bipolar Likert scale ranging from – 2 (Definitely not) to + 2 (definitely yes). Participants were also asked “Overall, are there any comments that you would like to make about the intervention you received?” and were provided with a textbox for qualitative responses. Social validation is used to determine satisfaction with an intervention (Page & Thelwell, 2013) and has been used in prior research on psychological intervention in endurance performance (McCormick et al., 2017).

### **Interventions**

Both interventions were delivered in Survey 2. The interventions were designed to be brief, and to be completed within approximately fifteen minutes. Participants were instructed to complete the intervention in one continuous sitting in a quiet place. It was also suggested to participants to make notes if they wish, but that they would also receive information about the intervention via email once they had completed it. Wording for each intervention was kept similar in order to minimise the

potential for expectancy effects (For full details of the interventions please Appendix S).

**Self-talk.** The self-talk intervention was largely adapted from previous research which has made use of self-talk workbooks to enhance endurance performance (Blanchfield et al., 2014; McCormick et al., 2017; Wallace et al., 2017). The first stage of the intervention consisted of providing participants with a background to what self-talk was and asked them to recall self-talk statements that they remembered having used in prior training or competition (Blanchfield et al., 2014). After listing these statements participants were then instructed to separate these self-talk statements into three categories: ‘Had a positive effect’, ‘Had a negative effect’, and ‘Had no effect’, using the click and drag function on Qualtrics.

After identifying and categorising their own prior self-talk statements participants were presented with a list of example motivational and instructional self-talk statements which were in the self-talk literature (Blanchfield et al., 2014; McCormick et al., 2017). With both this example list, and their own prior used self-talk statements, participants were then asked to identify four possible self-talk statements that they believed would be useful to them in their upcoming event. After identifying these four self-talk statements, participants were encouraged to practice and refine these self-talk statements in their training before their event. After the completion of Survey 2, participants were also emailed their self-talk statements via the Qualtrics automatic mailing system using a piped-text option.

**Implementation intentions.** The implementation intention was adapted from prior implementation-intention research in both behavioural change and performance related interventions (Lane et al., 2016; Verhoeven, Adriaanse, de Ridder, de Vet, & Fennis, 2013). Similarly to the self-talk intervention, participants were presented with

information as to what implementation intentions were, and how they may be used. They were given information on how implementation-intentions are formed (i.e., If X happens then I will do Y), and that they acted as a form of action planning. In order to provide the participants with an example of implementation intentions and how they may be formulated, participants were presented with a click and drag task where they were asked to identify possible strategies for two common problems “If I get home from work/school and feel like I have no energy to train:” and “If during training I start feeling like I want to stop”. The possible solutions were presented with the prefix “Then I will...” Both potential difficulties were deliberately chosen to be related to training, so as not to potentially influence participant’s decisions when formulating implementation intentions for their upcoming event.

After completing this click and drag task, participants were asked to consider four potential difficulties or challenges that they may encounter during their upcoming event. After entering these challenges or difficulties, participants were then asked to think of potential strategies for dealing with these difficulties or challenges. Participants were asked to consider strategies they had used previously, or that they had seen other endurance athlete’s use. Additionally, some examples strategies were provided which included: focusing on your breathing, encouraging yourself to relax, ensuring back up plans for nutrition/hydration. After formulating these implementation intentions, participants were encouraged to practice and refine these implementation-intentions in the build up to their event. After the completion of the survey, participants were also emailed their implementation-intentions via the Qualtrics automatic mailing system using a piped-text option.

**Control.** The control condition consisted of the following text:

‘You have been randomly allocated to the control condition. Control conditions are important as they allow us to work out the potential benefit of an intervention. We would like you to continue with your normal preparation and performance strategies. After you have completed the study, you will be provided with the other interventions we are trialling in this study.’

### **Data analysis**

Data were initially assessed for both univariate and multivariate normality using standard procedures (Tabachnick & Fidell, 2007). A group-by-time (3x2) mixed ANOVA was used to determine whether the intervention influenced self-efficacy. A Chi-square test was used to investigate differences between groups for goal attainment. A series of one-way ANOVAs were used to determine the effects of group on subjective performance satisfaction, coping, and stress appraisals. Independent samples t-tests were used to examine the effects of the interventions on intervention checks and social validity. As an exploratory analysis, correlational analysis was conducted between time spent on intervention during Survey 2, and scores on the intervention checks and social validity items. Partial eta squared ( $\eta^2$ ) effect sizes are presented for the ANOVAs (small, moderate, and large effect size anchors are 0.01, 0.06, and 0.14, respectively), and Cohen’s d effect sizes are presented for the independent t-tests (small, moderate, and large effect size anchors are 0.2, 0.4, 0.6, respectively). Qualitative data from Survey 3 relating to the intervention were analysed using inductive content analysis and organised into themes (Elo & Kyngäs, 2008).

## Results

Normality checks on all variables revealed that only intervention completion time violated assumptions of kurtosis and skewness (kurtosis = 8.43, skewness = 2.73). To address this violation, when conducting correlational analysis with intervention completion time, Spearman's rank correlation was used as it is suitable for non-parametric data. Means and standard deviations for each of the dependent variables are presented in Table 6.

### Goal Attainment and Performance Satisfaction

Goal attainment was similar in each of the groups, with 56% of participants achieving their performance goal in the self-talk group, 57% in the implementation intentions group, and 54% in the control group. The chi-square test revealed no significant effect of group on goal attainment,  $\chi(1) = 2.00, p = .157$ .

In each of the group's participants were generally satisfied with their performance in their recent event (out of 1-7, all medians = "6 – Moderately satisfied", self-talk Interquartile Range IRQ = 3-7, implementation intentions IQR = 5-7, control IQR = 5-7). There was no significant effect of group on performance satisfaction,  $F(2, 90) = 0.69, p = .695, \eta p^2 = .01$ .

Table 6. Means, SD's, p-values, and  $\eta^2$  for dependent variables.

Measure	Group						p	$\eta^2$
	Self-Talk		Implementation Intentions		Control			
	M	SD	M	SD	M	SD		
Pre-ESSES Score	68.88	10.54	72.23	10.69	71.38	10.22	.618	.01
Post- ESSES Score	72.72	13.72	74.58	9.19	69.37	12.90	.228	.03
Subjective Perf Satisfaction	5.20	2.09	5.57	1.67	5.18	2.14	.695	.01
Perceived Stress Intensity	5.60	1.59	4.96	1.54	5.03	1.51	.219	.03
Perceived Stress Controllability	5.33	1.06	5.66	1.02	4.82	1.53	.027	.08
CICS – Thought Control	3.62	0.75	3.54	0.79	3.53	0.83	.880	.00
CICS – Imagery	3.23	0.96	3.33	0.88	3.05	0.83	.428	.02
CICS- Relaxation	3.45	0.96	2.96	0.89	3.15	0.95	.110	.05
CICS – Effort	4.01	0.91	3.84	0.69	4.01	0.68	.481	.02
CICS – Logical Analysis	3.72	1.06	3.35	0.84	3.42	0.90	.282	.03
CICS – Venting	2.22	1.18	1.84	0.85	2.05	0.98	.353	.02
CICS – Distraction	2.47	0.83	2.21	0.81	2.56	0.90	.260	.03
CICS - Disengagement	2.11	1.13	2.00	1.06	2.42	1.27	.354	.02

Note. p values and effect sizes ( $\eta^2$ ) based on ANOVAs between groups.

### **Self-Efficacy and Coping**

There was an increase in self-efficacy between the two time-points for both the self-talk group (mean difference MD = 2.84, SD = 14.51) and implementation intentions group (MD = 1.91,  $p = 10.05$ ). Self-efficacy decreased between the two time-points in the control group (MD = -2.59, SD = 11.98). The effects of time,  $F(1, 91) = 0.46$ ,  $p = .500$ ,  $\eta^2 = .01$ , the effects of group,  $F(2, 91) = 0.87$ ,  $p = .423$ ,  $\eta^2 = .02$ , and the effects of the time group interaction,  $F(2, 91) = 1.79$ ,  $p = .173$ ,  $\eta^2 = .04$ , were not significant.

There was no significant effect of group on any of the CICS subscales ( $p$  values ranged from .880 to .110; see Table 6). This indicates that there was no effect of group on use of coping strategies during the participant's recent event.

### **Stress Appraisals**

There was no significant effect of group for perceptions of stress intensity,  $F(2, 90) = 1.54$ ,  $p = .219$ ,  $\eta^2 = .03$ . There was a significant effect of group for perceptions of stress controllability,  $F(2, 90) = 3.76$ ,  $p = .027$ ,  $\eta^2 = .08$ . Post-hoc analysis revealed that perceptions of stress controllability were lower in the control group compared to the implementation intentions group (MD = -0.85,  $p = .008$ ), but not in the self-talk group (MD = -0.52,  $p = .103$ ). Taken together, these results indicate that those in the implementation intentions group did not perceive the stress they encountered during their event as less intense, but instead as more controllable.

### **Intervention Checks and Social Validity**

As a primary manipulation check, there was no significant difference between the groups for time spent completing the intervention at time-point two,  $t(56) = 0.51$ ,  $p = .609$ , with both groups spending a similar amount of time on their respective



intervention (self-talk = 10m24s, implementation intentions = 11m48s). This provides support for the brief nature of the interventions.

In terms of the use of the intervention during their events, both groups reported similar levels of remembering to use the intervention (out of “1 –Not at all”, to “11 – Completely”, both medians = 8, self-talk IQR = 6-9.5, implementation intentions IQR = 6-9). The self-talk group reported slightly higher levels of using their intervention successfully during their event (out of “1 –Not at all”, to “11 – Completely”, self-talk median = 9, self-talk IQR = 6-10, implementation-intentions median = 7.5, implementation intentions IQR = 5-9), but this was not significant,  $t(57) = 1.26$ ,  $p = .212$ . Both groups also reported similar levels of comfortability using the intervention (out of “1 – Not at all comfortable”, to “11 – Completely comfortable”, self-talk median = 9.5, implementation intention median = 9, both IQRs = 8-11).

In terms of the social validity of the interventions, both interventions were viewed favourably in terms of satisfaction (out of -3 to + 3, both medians = “2 – Moderately satisfied”, self-talk IQR = 0-2, implementation intentions IQR = 1-2). Both interventions were also viewed as being useful for performance (out of -3 to +3, both medians = “2 – Moderately useful”, both IQRs = 1-2). Additionally, both groups reported they were likely to use their intervention in the future (out of -2 to +2, both medians = “1 – Probably yes”, self-talk IQR = 1-2, implementation IQR = 0-1).

A Kendall’s tau-b correlation also revealed a small positive correlation between time spent completing the intervention and intervention satisfaction, which was statistically significant ( $\tau_b = .23$ ,  $p = .024$ ).

### **Qualitative Responses**

The inductive content analysis of the qualitative responses resulted in the identification of three themes; “Intervention Delivery”, “Practice and Refinement”,

and “Performance Limiting Factors”. The theme of “Intervention Delivery” was centred on participants’ views of how the intervention was delivered, with several participants suggesting that the both the simplicity and structure of the interventions was helpful and useful. One participant remarked: ‘I liked that as a mental exercise, it was very simple to do. Didn't require a special environment, equipment, etc. so it was very accessible/practical’. Whereas the simplicity of the interventions was viewed as a strength by some, some participants viewed this as a potentially problematic with comments such as ‘Feels a bit fake’ and ‘*Didn't strike me as anything groundbreaking?*’

The theme of “Practice and Refinement” was centred on participants’ comments regarding the need for further practice with the interventions. Specifically, participants commented on the interventions being useful, but that as stress or anxiety grew, their ability to use the interventions decreased. One participant commented: ‘I need to practice using them in more race situations, as when I get nervous everything *seems to go out the window...*’. The theme of ‘Performance Limiting Factors’ focused on participants comments regarding other factors which influenced their performance during the event, which limited the effects of the psychological intervention. Participants discussed a variety of factors which influenced their performance, the two main factors were physical issues (e.g., injury, illness, fatigue) and non-sport related stressors (e.g., receiving bad news prior to the race).

## **Discussion**

The current study examined the effects of two web-based brief psychological interventions (implementation intentions and motivational self-talk) on endurance athletes competing in a naturalistic setting. The interventions had no effect on self-efficacy, and there were no differences between the groups regarding goal attainment,

subjective performance satisfaction, use of coping strategies, or perceived stress intensity. Participants in the implementation intentions group, however, reported higher levels of perceived stress controllability. Moreover, participants in the intervention groups were satisfied with their respective interventions, found them useful, and were planning to use them again in the future. Additionally, there were no differences between the two interventions regarding completion time and their usability during events, suggesting that the interventions are likely to be feasible and viable to implement with endurance athletes.

Goal attainment and performance satisfaction were similar across all three groups, with most participants achieving their performance goal and being satisfied with their performance. Although attempts were made to address the issue of confounding variables when examining performance in naturalistic setting through the use of subjective performance satisfaction, no effects of the interventions were detected. A key factor in this lack of a performance effect may relate to the experience and performance level of the participants. Participants were largely experienced, and as such would likely have developed their abilities and skills to perform at their own self-referenced level. This level of experience may have provided a high initial ‘floor’ effect for the intervention, and this may have limited the possibility for the interventions to influence self-efficacy (Short & Stewart, 2009). Furthermore, when implementation intentions have been associated with positive improvements in behaviour and performance, this has typically occurred in populations where individuals are not yet proficient at the desired behaviour (e.g., smoking cessation, exercise adherence, and alcohol consumption). These lack of performance effects are also in line with the result of McCormick et al. (2017), who found no effect of motivational self-talk on objective performance during an ultramarathon, and Lane et

al. (2016) who found no effect of implementation intentions on performance in runners. Nevertheless, sport is more than just performance, and both McCormick et al. (2017) and Lane et al. (2016) found beneficial effects of their respective interventions relating to experience (e.g., enhanced emotional control, increased levels of satisfaction). Enhancing the experience of sport performers has important implications regarding continued participation in the sport, particularly in amateur sub-elite athletes (Appleby & Dieffenbach, 2016), and this demonstrates a clear benefit of the current research.

Although self-efficacy did increase in the two intervention groups, this was not statistically significant, and when taken together with the self-efficacy in the control group decreasing, it is difficult to ascertain the true effects of the intervention. As self-efficacy beliefs are formed over time through repeated experience and exposure to a variety of sources of information (Gist & Mitchell, 1992), it is perhaps unlikely that the brief interventions used in this study would result in a change in self-efficacy, especially when considering the experience and proficiency level of the current participants. Additionally, self-efficacy beliefs are generally formed over time through repeated experience (e.g., the theme of cumulative experiences identified in Chapter 2) and exposure to a variety of information, so it is unlikely that a brief one-off intervention would result in changes in self-efficacy. Both brief interventions, however, could help raise self-efficacy if the athletes were able to use them to overcome potential challenges or difficulties they face (e.g., the sense of physiological discrepancy identified in Chapter 4). This could result in an increase in self-efficacy as it would provide them with demonstrations of their own ability in the face of adversity, a key source of self-efficacy (Bandura, 1997; Feltz et al. 2008).

Alongside self-efficacy the athletes' use of different coping strategies during their event were also examined. There were no differences between the groups regarding coping strategies, with all participants largely using problem-based coping. The finding that the athletes scored highest on problem-based coping supports is in support of other findings that show a similar coping profile in other endurance athletes (Gaudreau et al., 2005). Similarly, to both performance and self-efficacy, it is likely that due to the experience of the participants they had already developed preferred coping strategies, which would have limited the possible effects of the intervention. The use of problem-focused coping strategies is also in line with the high levels of self-efficacy reported. The possession of high levels of self-efficacy have been previously demonstrated to be associated with increased use of problem-focused coping (e.g., Chesney et al., 2006; Feltz et al., 2008), and this provides further evidence for a proposed mechanism of self-efficacy in influencing behaviour.

The only psychological variable which the interventions did influence was perceived stress controllability, although follow-up analyses revealed that this perception was only higher in the implementation intention group compared to the control group. As implementation intentions involve the identification of potential stressors and the formulation of strategies to deal with them, this appears a likely outcome of their use. Indeed, implementation intentions have been previously demonstrated to enhance perceived stress controllability in a variety of other domains (Webb & Sheeran, 2007). Enhancing perceived stress controllability has been demonstrated to be a desirable psychological outcome relating to endurance sport performance (Nicholls et al., 2009), and the current study provides initial evidence for the use of web-based implementation intentions to achieve this aim.

Despite the general lack of effects on goal attainment, performance satisfaction, and potential psychological mediators, participants were satisfied with the intervention received and found it useful. There were no significant differences between the use of implementation intentions and motivational self-talk during the event, and participants reported being generally favourable to using them in the future. An additional finding from the current study was the positive correlation between time spent completing the interventions, and the level of satisfaction with the interventions. Participants who spent longer completing the interventions initially may have learnt the intervention better, and in turn may have gained more from it during their event. Time spent engaging with self-directed interventions has been demonstrated to have positive impacts on subsequent intervention use and satisfaction (Geraghty, Wood, & Hyland, 2010), and the current research provides further evidence for this.

The findings in relation to social validity mirror the results of McCormick et al. (2017) where participants found the intervention useful, despite their being no effect on performance. When viewing these findings, it is beneficial to consider them in respect to the continuum that exists between efficacy and effectiveness of interventions (Singal et al., 2014). Studies focused on the efficacy of an intervention attempt to identify the effects of an intervention in perfect or ideal circumstances. In this instance, an efficacy-based intervention would have likely occurred in a laboratory-based setting, where greater control of compounding variables would be provided. Effectiveness based studies, instead examine the effects of an intervention in a real-world setting. As a result, they generally lack the strength of statistical relationships observed in efficacy trials, but arguably represent more of what these interventions can meaningfully achieve in real world settings.

While there exist several studies, which have demonstrated the efficacy of such brief interventions (e.g., self-talk; Blanchfield et al., 2014), this efficacy matters for little if it is not observed in a real-world setting. The current study therefore can be viewed as more of an effectiveness trial rather than an efficacy. What does this mean then regarding the results of the current study? If, participants found the interventions useful and were satisfied with them does this ‘override’ the lack of performance effects? The answer to this question will largely depend on an individual’s perspective regarding what the purpose of sport psychology interventions are (e.g., the enhancement of performance, the improvement of experience, or a combination of both).

### **Limitations and Future Research**

There were several limitations to the current research. First, the measure of self-efficacy utilised in the current study (the ESSES) may not have been suitable for detecting the changes in self-efficacy related to event performance. As discussed in Chapter 3, the ESSES represents a more general-domain focus, and it is therefore likely to be relatively stable. A potential solution to this would have been to assess more task-specific forms of self-efficacy alongside the ESSES such as self-efficacy for goal attainment (e.g., How confident are you that can you achieve your goal, surpass your goal) or self-efficacy for in-event skills (e.g., the hierarchical task self-efficacy scale used in Chapter 4). This, however, would have been problematic to implement due to the heterogeneity of participants events and goals.

Second, although participant’s intentions to use the interventions in the future were measured, there was no measurement of the interventions longitudinally. This limits our understanding of the potential lasting effects of the interventions, and this

has implications in terms of our ability to recommend them for use. Future research could address this concern by examining the effects of such brief interventions longitudinally, possibly through the use of brief questionnaires on a weekly basis or extending the length of time for follow up (e.g., examine use of the interventions across a number of events). This would help further demonstrate the benefits of such interventions, and would allow an understanding of the potential for ‘top-up’ interventions, or when to provide reminders regarding their use (e.g., through email or text messages) (Geraghty et al., 2010)

The third limitation of the current research relates to the study population. Although there was largely an equal gender split, and a suitable range of experience levels, in terms of endurance sport most athletes were runners. Although endurance sports have been demonstrated to possess a series of common demands and stressors (e.g., McCormick et al., 2016), each endurance sport is still likely to have its own series of unique demands and stressors (Taylor, 1995). It may be possible that certain brief interventions are more suitable to different endurance sports, and future research could look to address this through a more effective targeting of other endurance sports (e.g., triathlon and swimming).

A further limitation of the current study to consider is that no attempt was made to investigate individual’s prior use of psychological skills. Although participant’s previous use of sport psychology materials was examined, no questions pertaining to current use of self-talk or if-then plans were made. If an individual was already using self-talk in a structured and beneficial way (e.g., those participants interviewed in Chapter 2), a brief self-talk intervention would be unlikely to have an impact on self-efficacy or other outcome variables.



There are several other avenues which future research could also look to examine. First, it may be beneficial to examine interventions for self-efficacy at a more ideographic level. The use of single-person case studies would likely provide a richer insight into the development of self-efficacy-based interventions, and their impacts on various outcome measures (Barker et al., 2013). As discussed in both Chapter 2 and Chapter 4, the formation and alteration of self-efficacy is likely to be an idiographic occurrence. While general principles for this do exist (e.g., the discrepancy between the expected and the experienced physiological sensations), how individuals weigh specific information, and how this contributes to their self-efficacy is likely to be highly individualistic. The use of a single-person case study would allow this to be examined and could potentially provide further refinements to more large-scale intervention delivery such as used in the current study.

Second, brief interventions which aim to change an individual's perspective (e.g., arousal reappraisal, value affirmation) could also be examined. Such perspective changing interventions have also been demonstrated to have beneficial effects on complex behaviour and performance (e.g., Jamieson, Mendes, & Nock, 2013), and it would be worthwhile to see if such effects were replicated in the endurance performance domain. Second, whereas the current study made use of the internet to help deliver the interventions, future research could look to examine other technology such as smart phone applications. There is some initial evidence on the use of phone applications to deliver interventions in clinical and health related psychology, and this could also be a further feasible way of helping provide endurance athletes with psychological support (Howells, Ivtzan, & Eiroa-Orosa, 2016).

## **Conclusion**

The current study is among the first to examine the effects of brief web-based psychological interventions on endurance athletes competing in real life events. It makes a direct contribution to the third aim of the current thesis, by examining the effects of these interventions on self-efficacy using a pre-post design. Although the interventions had no effect on self-efficacy, they were well received by the athletes. The current study helps demonstrate the feasibility and viability of using brief web-based psychological interventions with endurance athletes and helps provide an initial starting point for further research to address psychological interventions targeted at self-efficacy for endurance athletes.

## **Chapter 6: General Discussion**

## Summary of Findings

The focus of this thesis was to gain an increased understanding on the formation, measurement, and malleability of self-efficacy within the endurance sport domain. By doing so, this thesis sets out to help advance our theoretical understanding of self-efficacy, and in turn help inform interventions designed to enhance self-efficacy. There were three aims. First, this thesis aimed to gain an increased understanding and awareness of the sources of self-efficacy that underpin self-efficacy in the endurance sport domain. Second, this thesis aimed to develop and validate a non-hierarchical self-efficacy scale for the endurance sport domain. Third, this thesis aimed to provide an increased understanding of dynamicity and malleability of self-efficacy beliefs.

The first aim of thesis was to gain an increased understanding of the sources that inform self-efficacy in the endurance sport domain. Although it has been demonstrated that endurance athletes draw on a variety of sources of self-efficacy (e.g., Samson, 2014) research these sources represent broad general categories, and no research has attempted to identify what specific information within these sources may contribute to self-efficacy. This aim was addressed in Chapter 2, where semi-structured interviews were carried out with experienced endurance athletes asking them about the sources of their self-efficacy. Through a deductive thematic analysis, five initial themes relating to the sources of self-efficacy were identified, and six sub-themes were identified within these themes. The athletes predominately drew on prior experiences in both training and performance to inform their self-efficacy, but what was also identified as being a key source was a sense of ‘physiological familiarity’, which was driven by a combination of both past experiences and physiological states. These findings identify key sources of self-efficacy in the endurance sport domain and

contribute to the reinforcement of several tenets of self-efficacy theory, namely the degree of overlap that exists between the sources.

The second aim of this thesis was to develop and validate a new non-hierarchical scale to measure self-efficacy in the endurance sport domain. This aim was addressed in Chapter 3 through three studies that were designed to develop and validate the ‘Endurance Sport Self-Efficacy Scale’ (ESSES). In Study A, an initial item pool for the scale was developed following a review of the literature. These items were subsequently examined by content validity by an expert panel. In Study B, the resultant 18 items from this examination were subjected to exploratory factor analyses. These analyses provided support for a unidimensional scale comprised of 11 items. These items related to behaviours and skills which must be carried out during endurance performance such as pacing, managing exercise-induced sensations, and controlling unwanted thoughts and emotions. Study B also provided initial evidence for the ESSES’s convergent validity, as it positively correlated with other similar validated scales. In Study C, using confirmatory factor analyses, further support was found for the 11-item structure. Study C provided further evidence for the ESSES’s convergent and concurrent validity, and the scalar invariance of the ESSES across endurance sports. The ESSES represents the first endurance sport self-efficacy scale, and is likely to be of use by researchers, applied practitioners, coaches, and athletes.

The third aim of this thesis was to gain an increased understanding of the dynamicity of self-efficacy beliefs. This aim was addressed in Chapter 4, where using an experimental laboratory study, the effects of an increase in perceived task difficulty on self-efficacy and attributions was examined. Although previous studies have demonstrated an inverse relationship between perceived task difficulty and self-efficacy (Sides, Chow, & Feltz, 2017), this was the first study to demonstrate this

relationship when participants were unaware of the task change in task difficulty. Specifically, in the increased difficulty condition, self-efficacy strength was lowered, and attributions for performance were more external and unstable. Interestingly, the level of self-efficacy was not affected by the task difficulty manipulation, suggesting that the different dimensions of self-efficacy may be influenced by different sources of information. The study also provided evidence that a task difficulty manipulation is a suitable methodology for altering self-efficacy and attributions in experienced athletes. This aim was also addressed in Chapter 5, where the effects of two brief web-based psychological interventions (implementation intentions and self-efficacy) on goal attainment, performance satisfaction, self-efficacy, and coping behaviours were examined in endurance athletes using a randomised-control trial. Although no effect was found for the interventions on any of the outcome measures except for perceived stress controllability, the interventions were well received by the participants and deemed to be useful. These findings help add to a growing body of research examining the effects of psychological interventions in real-world competitive settings (e.g., McCormick et al., 2017), and the use of the internet in delivering psychological interventions (Webb et al., 2010). This study helps provide clear directions for future research examining brief psychological interventions, and further highlights potential difficulties in altering self-efficacy beliefs in experienced individuals (i.e., floor effects).

Taken together these findings help advance our understanding of the formation, measurement, and malleability of self-efficacy in the endurance sport domain. Regarding formation, additional information is now known regarding the sources of self-efficacy, and how these sources may interact together. Regarding measurement, a new and validated scale for measuring endurance sport self-efficacy

beliefs has now been developed. Regarding the malleability of self-efficacy beliefs, the results of Chapter 4 reveal the need to consider task difficulty, perception of effort, and the dimensions of self-efficacy. Chapter 5 further adds to our understanding of malleability by demonstrating the potential use of brief web-based interventions to alter self-efficacy.

When considering the current thesis's research aims and contributions, it is also necessary to examine if these align with the research philosophy that underpinned it. The current thesis was approached from a critical realist perspective, and throughout it has adhered to the key tenets of critical realism. First, using a mixed-methods approach, the current thesis aligns itself with the critical realist view of there being differing levels of reality (Collier, 1994). These levels of reality, in turn, help represent the overall complexity of the self-efficacy construct. A key example of this use of mixed-methods, is the findings from both Chapter 2 and Chapter 4. The theme of physical familiarity was identified using qualitative inquiry in Chapter 2, and it was further confirmed using an experimental method in Chapter 4. Second, the current thesis aligned with the emphasis on holistic approaches found within critical realism (Fletcher, 2017). The breadth of the self-efficacy construct was examined throughout the thesis focusing on the formation, measurement, and malleability. While increased depth of understanding would have likely arisen from a more targeted perspective (e.g., four qualitative studies regarding the sources of self-efficacy.), such an approach would have likely limited the possible implications, as it would have failed to consider the other ways in which self-efficacy is represented and experienced by individuals. Overall, the current thesis aligned with a critical realist perspective, and this alignment helps reinforce the several theoretical and methodological implications that have arisen from the current thesis.

## **Theoretical & Methodological Implications**

Whereas self-efficacy is a widely studied construct in sport psychology (e.g., Feltz et al., 2008; Moritz et al., 2000), these studies have predominately focused on the self-efficacy – performance relationship. This focus is also apparent in the studies examining self-efficacy in endurance sport (e.g., Burke & Jin, 1996; Laguardia & Labbé, 1993; Martin & Gill, 1991; Miller, 1993). While the findings from these studies provide evidence for the hypothesised relationship between self-efficacy and performance as set out by Bandura, they do not necessarily help increase our theoretical understanding of the construct. Research directed at gaining an increased understanding of the self-efficacy construct and its conceptualisation has been more abundant in other domains of psychology (Gist & Mitchell, 1992; Pajares & Urdan, 2005; Williams & Rhodes, 2016), but has remained relatively limited in sport psychology. An increased theoretical understanding of the self-efficacy construct would help enhance the ability to design effective and theoretically sound interventions, and it could also provide further guidance to those working with endurance athletes such as coaches, trainers, and practitioners. As a result of the array of research methodologies employed in the current thesis, the current findings provide several theoretical and methodological implications in terms of self-efficacy. These implications relate to the measurement of self-efficacy, the dimensions of self-efficacy, and the distinction between proximal and distal sources of self-efficacy.

### **The Measurement of Self-Efficacy**

Throughout the thesis three approaches have been taken regarding the measurement of self-efficacy. In Chapter 3, this centred on the development and validation of a new endurance sport self-efficacy scale (the ESSES) which represents a domain-specific approach towards the measurement of self-efficacy. The ESSES



demonstrated good initial levels of factorial, convergent, concurrent, and criterion-related validity, and represents a key step forward in our ability to measure self-efficacy beliefs in the endurance sport domain. Alongside this domain-specific approach, in Chapter 4, situation-specific self-efficacy scales were used to examine the effects of a change in perceived task difficulty. This use of situation-specific scales allows for a more precise approach towards identifying the changes in self-efficacy (e.g., the decrease in strength of self-efficacy), and if the only measure of self-efficacy would have been the ESSES, it would have been unlikely for these changes to be detected. Additionally, in Chapter 4 both hierarchical and non-hierarchical self-efficacy scales were utilised.

These findings reinforce the proposal that there is no optimal level of measurement of self-efficacy beliefs, and that the key factor in determining how to measure them should be the research (Bandura, 2006; Maddux, 1995). A domain approach, such as through the ESSES, would be most suited to gaining a long term understanding of the antecedents and consequences of self-efficacy beliefs in endurance sport, and would be suited for cross-sectional or longitudinal observational studies. The situation specific approach towards the measurement of self-efficacy, in comparison, is best suited for gaining an understanding of how self-efficacy beliefs may change in response to proximal variables and is therefore more useful in experimental laboratory-based studies. To gain a holistic understanding of self-efficacy in the endurance performance domain, researchers must consider measuring self-efficacy in a number of ways, to ensure that both the breadth and the depth of these beliefs are captured. The use of multiple methods of measuring self-efficacy has been previously suggested in the educational (Pajares & Urdan, 2005) and behavioural change (Luszczynska, Tryburcy, & Schwarzer, 2007; Schwarzer & McAuley, 2016)

self-efficacy literature, but it is not overly apparent in the sport psychology literature (e.g., Feltz et al., 2008). At this point, however, it is necessary to consider if these different approaches towards the measurement of self-efficacy are still measuring the same underlying construct (i.e., are the beliefs we attempt to measure with situation specific scales the same as we measure with domain specific scales). This is important as if the scales were measuring a different construct, this would have implications regarding how much we could generalise the findings from each study and would also influence the direction future interventions would likely take (Marsh et al., 2018). There is, however, strong evidence in this thesis to support that even with the different measurement approaches the same construct is being measured. For instance, in Chapter 3 medium to large positive correlations were detected between the ESSES and other validated self-efficacy scales. This provides further evidence for these scales to be measuring a common construct. In the wider research literature, domain specific self-efficacy has also been demonstrated to positively correlate with situation-specific beliefs (Grether et al., 2018).

### **The Dimensions of Self-Efficacy**

The multidimensionality of self-efficacy (i.e., level, strength, and generality) has been well established within the self-efficacy literature (Bandura, 1997; Maddux, 1995). The current research makes a novel contribution in that it provides evidence for different potential antecedents of these dimensions. In Chapter 4, the level of self-efficacy was not altered by the change in perceived task difficulty, whereas the strength of self-efficacy was. This means that when endurance athletes encounter unexpected changes in task difficulty, although they may still believe themselves capable of still reaching the same level of performance (e.g., to complete their 10km race in forty five minutes), the certainty of this belief may be substantially lower. This

reduction in self-efficacy strength could impact performance if the athlete encounters further difficulties or obstacles during their performance, as the strength of self-efficacy is hypothesised to be associated with effort investment and perseverance (Bandura, 1997). This finding suggests that the dimensions of self-efficacy may be based on different sources, and this distinction between these two dimensions is particularly relevant given the unique demands of endurance performance. This distinction between these two dimensions of self-efficacy was initially discussed by Gist and Mitchell (1992), however there is a lack of studies which have directly examined this distinction in the self-efficacy literature.

As discussed in Chapter 1, due to the physiological demands of endurance performance, it is likely that the floor and ceiling of level of self-efficacy is largely determined by physiological parameters. While endurance athletes may not know what these parameters are exactly (e.g., they may not know at what speed or cadence they encounter their second lactate threshold), they instead are likely to gain an understanding of the level of performance they are capable of based on their own prior experiences and performances. These past experiences contributing to self-efficacy was also highlighted in Chapter 2, where the endurance athletes discussed the role of cumulative experiences in informing their self-efficacy. It may be that these experiences over time amass and provide athletes with a strong understanding of where their performance for an event is likely to occur (as evidenced by the theme of 'Cumulative Experiences' in Chapter 2). A runner who generally completes a marathon between 3h30m and 3h15m, is highly unlikely to ever feel that they are capable of running a marathon in 2h45m. Level of self-efficacy in experienced endurance athletes, therefore, is likely to be a relatively stable dimension, and that changes in level of self-efficacy for performance may only occur following a

culmination of experiences, whether they be successes or failures. Arguably, the stability of level of self-efficacy is also apparent in other experienced athletes across a range of sports and performances (Feltz et al., 2008). Nevertheless, there still exists a discrete difference when considering level of self-efficacy in fine-motor skill-based sports (e.g., golf, archery, or darts) compared to gross-motor skill sports such as endurance. A golfer, for example, through their past experiences is likely to know they can putt approximately seven out of ten putts from a distance of ten feet. In much the same way as an endurance athlete, this belief is unlikely to change without a consistent change in performance overtime. Where the differences lies, however, is that the golfer is capable of putting all ten, and indeed on a good day this may occur, because the basis for performance in this context is skill. Comparatively, an endurance athlete who consistently runs a marathon in 3hrs, even on a good day will not be able to complete it in 2h30min, as the basis for performance is largely driven by physiology. These physiological parameters therefore place a more 'stringent' ceiling on self-efficacy beliefs than may be observed in other sport or performance-based settings.

Strength of self-efficacy comparatively may be more influenced and driven by proximal, task specific factors. This further demonstrates the complexity and dynamicity of self-efficacy beliefs, a factor which is often overlooked in research (Gist & Mitchell, 1992). Evidence for the role of proximal sources, comes from Chapter 4, where a negative correlation between changes in perception of effort and self-efficacy strength was detected. As self-efficacy strength represents the perceived certainty of a belief, it appears logical that this sense may vary more readily based on proximal sources such as perceived fatigue or other physical sensations (e.g., exercise-induced pain, perception of effort, or discomfort). These proximal sources, however, do not always lead to an altering of self-efficacy strength. As outlined in Chapter 2, endurance

athletes are likely to engage in a process of appraisal when encountering exercise-induced sensations such as pain and exertion and attempt to identify if these are congruent with the expected sensations based on prior experiences. This interaction between distal past experiences and proximal current sensations will be discussed in greater depth in the next subsection.

When considering the changes in strength of self-efficacy demonstrated in Chapter 4, it is necessary to consider how these findings reconcile with previous suggestions that experienced athletes possess a ‘robust’ sense of self-efficacy which is unlikely to alter in the face of difficulty (Bandura, 1997; Feltz et al., 2008). Indeed, if such a small change in perceived task difficulty led to reductions in self-efficacy strength, what would this mean in terms of the variety of more powerful stressors and demands endurance athletes are likely to face when competing in the real world (McCormick et al., 2018)? In addressing this, in line with social-cognitive theory it is important to consider the environment in which the athletes performed in Chapter 4. As the athletes were performing in a carefully controlled laboratory setting, with minimal variation to other potential confounding variables (e.g., the weather, other athletes, the surface) they may have been more sensitive to detecting the change in perceived task difficulty, and this may therefore have had a larger impact on self-efficacy strength, than a similar manipulation would have in a more naturalistic setting. Another aspect to consider is that the way in which we conceptualise the dimensions of self-efficacy (i.e., through levels and strength) may not be how individuals view these beliefs for themselves. The act of separating these dimensions may be at odds with how endurance athletes view their perceived capability regarding tasks. Although other studies have demonstrated that individuals can distinguish between the level of self-efficacy and strength of self-efficacy for relatively simple

tasks (Bandura, 2006), exactly how this distinction between these dimensions may relate to complex behaviour such as endurance performance remains unclear.

In comparison to the level and strength of self-efficacy beliefs, the generality of self-efficacy beliefs has not been explicitly discussed throughout this thesis. This lack of focus on the generality of self-efficacy beliefs is also apparent in reviews of self-efficacy research in sport and exercise settings (Feltz et al., 2008), most likely due to the clear rationale for level and strength influencing performance and behaviour, whereas the rationale for investigating generality is relatively unclear. One aspect of the current thesis which could be seen as relating to the dimension of generality, was endurance athletes discussing their non-sport related experiences of overcoming adversity in Chapter 2. These experiences of overcoming adversity outside of the endurance sport domain, still provided the athletes with information pertaining to their capability to cope with and persevere with adversity. The ability for these experiences of adversity to contribute to self-efficacy across domains is in line with prior research examining general self-efficacy beliefs (Benight, Swift, Sanger, Smith, & Zeppelin, 1999; Chen et al., 2001). A further interesting avenue, and perhaps one for future researchers to consider is the generality of self-efficacy beliefs from endurance sport to other domains of life.

### **Proximal and Distal Sources of Self-Efficacy**

While the occurrence of proximal and distal sources of self-efficacy was noted by early self-efficacy theorists (e.g., Gist & Mitchell, 1992; Maddux, 1995), these sources have not received much explicit attention in the wider self-efficacy literature. This lack of attention is surprising given that the interaction between these proximal and distal sources could be a key factor in both the initial formation of self-efficacy beliefs, but also their alteration during performances or tasks (Maddux, 1995).

Furthermore, as discussed in the preceding subsection, proximal and distal sources may each contribute to different dimensions of self-efficacy beliefs.

The occurrence and interaction between proximal and distal sources were identified initially in Chapter 2, through the theme of ‘physiological familiarity’. This concept of physiological familiarity was based on a comparison between the current exercise-induced sensations (e.g., pain, exertion, and effort) an athlete was feeling (proximal sources) and the sensation they expected to be feeling based on their prior performance experiences (distal sources). As discussed by the athletes in Chapter 2, where a congruence was present (i.e., the exercise-induced sensations were what was to be expected) this did not alter self-efficacy, whereas an incongruence would likely lead to a decrease in their perceived capability. This finding was further supported experimentally in Chapter 4 through the observation of the decrease in self-efficacy strength in the manipulation condition. It was hypothesised that this decrease occurred due to the athletes detecting an incongruence between the experienced task difficulty (as indicated by their perception effort) and the expected task difficulty (based on their previous visits to the laboratory). This interaction between proximal and distal sources is particularly relevant to endurance sport because of both the length of time which endurance athletes are likely to perform for. This interaction is further complicated when considering temporal distortions of sensations such as exercise-induced pain (i.e., pain is remembered different based on the length of time following it), and this further demonstrates the complexity in this interaction (Babel, 2016).

Due to the length of the time in which endurance athletes perform for, there is an opportunity for self-efficacy beliefs to be altered during performance. This change in self-efficacy during performance, could be seen as being primarily driven through the interaction between proximal sources (e.g., exercise-induced sensations) and more

distal sources (e.g., previous experiences of the same race). Alongside this interaction, it is also likely that other proximal sources of information relating to other competitors (Williams et al., 2015) and perceived task progression (Halper & Vancouver, 2016) could also contribute towards changes in self-efficacy. As well as informing the changes in self-efficacy during performance, distal and proximal sources could also influence self-efficacy prior to performance. As discussed in the preceding sub-section it could be that distal sources of self-efficacy contribute more to the level of self-efficacy, whereas proximal sources contribute more towards the strength of self-efficacy. For example, although a cyclist may have had a recent string of good performances and successful training sessions (i.e., distal sources), they may feel lethargic and fatigued on the morning of an event (i.e., proximal sources). How then do these proximal and distal sources interact in order to inform self-efficacy for the upcoming event? Does the volume of prior experiences help mitigate more proximal sources, or are there potentially more idiosyncratic appraisals and judgements which occur? While several models have been put forth explaining how individuals may appraise information in the formation of their self-efficacy beliefs (e.g., Bandura, 2001; Gist and Mitchell, 1992), there still exists little experimental or qualitative research examining these processes. Nevertheless, the current thesis provides a clear theoretical implication that the interaction between these proximal and distal sources in part contributes to self-efficacy for endurance performance.

### **Limitations and Considerations**

Notwithstanding the strengths of the current thesis and the variety of research methodologies employed, there are several limitations which are apparent across studies. These limitations relate to how self-efficacy was conceptualised in the current



research, the samples used throughout, and the focus of the current thesis only on social-cognitive theory and self-efficacy.

### **The Conceptualisation of Self-Efficacy**

As discussed in Chapter 1, there exists several conceptualisations of self-efficacy within the literature (e.g., task, domain, and general; Bandura, 2006). While in the current thesis this issue was addressed through utilising both task and domain specific scales of self-efficacy, a further aspect of conceptualisation relates to the decision to focus on endurance sports as a whole, and not focus solely on the self-efficacy for one endurance sport, such as running. As well as potentially focusing on self-efficacy beliefs for specific disciplines of endurance sport (e.g., running, swimming, and cycling) it may have also been possible to focus on distances as well (e.g., ‘ultra’ distances). Such an approach focusing on either discipline or distance, may have resulted in the identification of further specific sources of self-efficacy in the case of Chapter 2, the inclusion of more specific behaviours and skills in Chapter 3, and a more targeted intervention in Chapter 5. This more specific and targeted approach may in turn have provided more actionable applied implications, as it would be clear as to what sport they were specifically in relation too. Such an approach is evident in the educational self-efficacy literature, where self-efficacy is often examined in relations to specific subjects (e.g., mathematics, chemistry, and writing) rather than general academic performance (Lent et al., 1992; Pajares, 1998; Usher & Pajares, 2005).

This argument for focusing on specific distances and durations, however, is centred on the idea that the differences between types of endurance sports are larger than the similarities. While there are of course differences between endurance sports in terms of the combination of physical, technical, and psychological factors which

will inform performance (Taylor, 1995), there is also evidence to suggest that endurance sports share a common series of psychological determinants and demands (Elferink-Gemser & Hettinga, 2017; McCormick et al., 2018; McCormick, Meijen, & Marcora, 2016). In this respect, the current thesis's focus on self-efficacy across endurance sports can be seen as being acceptable. Although at first this approach may appear to be at odds with the approach utilised in the educational self-efficacy literature, it is in fact consistent. The focus on specific academic subjects (e.g., mathematics versus writing) can be viewed as being similar to focusing on specific sports. Additionally, even when focusing on a specific subject (e.g., mathematics) there exists a multitude of components within that subject (e.g., algebra, geometry, calculus), and this is also similar to this thesis's focus on endurance sports and their multitude of components (e.g., cycling, running, swimming). Moreover, as there has been a lack of theoretical investigation of self-efficacy in the endurance sport context prior to this thesis, focusing on the endurance sport domain as a whole helps provide an effective starting place for future research, which could seek to examine self-efficacy in specific distances or durations. For instance, in a similar way that the coaching self-efficacy scale (Feltz et al., 1999) has been adapted to specifically on high school coaching (Myers et al., 2009), it could be that the ESSES is adapted to specifically focus on other disciplines such as running, triathlon, or rowing.

### **Sampling Issues**

There were several characteristics of the participants across the current thesis that may make the generalisation of these results difficult. First, in each of the chapters of this thesis the majority of participants were runners. Although care was taken to ensure that athletes from other endurance sports were included (excluding Chapter 4), there was still often a lack of participants from other endurance sports such as

swimming. Although this occurrence is potentially to be expected due to running being the most popular endurance sports in Europe (Scheerder, Breedveld, & Borgers, 2015), it still represents a limitation as it may be that self-efficacy construct in runners may be qualitatively or quantitatively different than in other endurance athletes. For instance, the more technical concerns associated with cycling (e.g., bike maintenance and repair), or the weather-related demands associated with open water swimming (e.g., waves, temperatures, visibility conditions), might lead to differences in the formation, stability, and malleability of self-efficacy beliefs. Conversely, it may be overly simplistic to attempt to label endurance athletes competing at sub-elite or recreational levels as ‘runners’ or ‘triathletes’. As identified by McCormick, Anstiss, & Lavalley (2018), sub-elite endurance athletes are likely to take part in a variety of endurance events and activities and attempting to categorise them based on their main sport may be problematic.

Throughout the thesis a decision was taken to focus on experienced competitive individuals. While this decision allowed an examination of already formed self-efficacy beliefs, it limits our ability to understand how these beliefs may be formed and altered in more novice athletes. This lack of understanding of how these beliefs are formed in novice athletes, limits our ability to provide theoretically informed interventions to help raise self-efficacy in these athletes, whose self-efficacy may be lower, or more at risk of decreasing in the face of setbacks (Feltz et al., 2008). Additionally, while the current thesis focused on the experience level of participants, it did not examine the competitive or performance level of participants (i.e., individuals competing at national, international, or professional levels). There may exist qualitative differences in the self-efficacy beliefs of more elite level athletes (Feltz et al., 2008), and it is likely there exists a series of demands which are not

encountered by more sub-elite athletes (e.g., selection for major events, chronic overtraining, and pressures associated with finances; Balague, 1999; Koivula, Hassmén, & Fallby, 2002). Elite level athletes are notoriously difficult to recruit for research, and as stated it is likely they face a series of demands that are not commonly faced by sub-elite or non-elite athletes. Research into the formation and alteration of self-efficacy in elite endurance athletes, therefore may have provided less useable and actionable information than was found in the current thesis. Nevertheless, future research examining self-efficacy beliefs in elite endurance athletes would prove beneficial.

### **Lack of Alternative Theoretical Constructs**

The current thesis was approached from Bandura's self-efficacy theory (Bandura, 1997) which resides within the broader remit of social-cognitive theory (Bandura, 2001). While this approach and focus on self-efficacy and social-cognitive theory provided a clear framework for the current thesis, it also meant that potentially other important theoretical constructs were not examined.

First, because of the focus on self-efficacy theory (Bandura, 1997), no focus was given to Vealey's sport-confidence model (Vealey, 1986; Vealey & Chase, 2008). As outlined in Chapter 1, while the sport confidence model demonstrates clear similarities with self-efficacy theory, it also possesses a series of unique components not explicitly discussed in self-efficacy theory (e.g., motivational climate, organisational factors). Examining the sport-confidence model alongside self-efficacy may have therefore provided a more holistic theoretical understanding of capability-based beliefs in the endurance sport domain. This argument, however, is limited by the fact there is no strong evidence suggesting that sport confidence can help further explain performance or behaviour than what is already possible using self-efficacy

(e.g., Moritz et al., 2000). Additionally, a key proposed strength of the sport-confidence model is that it represents an increased level of breadth compared to self-efficacy when considering perceived capability. This point, however, is countered by the decision to examine self-efficacy at the domain-level (i.e., the ESSES), which still allowed this breadth of capability to be considered and understood.

Second, while the current thesis only focused on self-efficacy, there exists a variety of constructs and beliefs within social-cognitive theory (Bandura, 2001). A key construct which was outlined in Chapter 1 was outcome expectancies. Outcome expectancies represents the perceived outcome from performing a behaviour, and several authors have argued that they may influence self-efficacy beliefs both directly and indirectly (Kirsch, 1985; 1992; Williams & Rhodes, 2014). The inclusion of outcome expectancies would have provided further evidence for the relation between these two constructs in social-cognitive theory, and it would have provided some initial baseline information regarding outcome expectancies in endurance athletes. For instance this may have related to whether their primary expectancies related to social comparisons, physical improvements, or self-achievement (Bandura, 1997). This information may have then helped inform experimental research where a manipulation of outcome expectancies could occur. Conversely, outcome expectancies are only hypothesised to directly influence self-efficacy in contexts where the individuals may lack motivation to engage in the behaviour (e.g., someone starting an exercise regime, or a snake phobic handling a snake; Bandura, 1992; Schwarzer & McAuley, 2014). Given the current thesis's focus on competitive experienced individuals, it could be assumed that motivation would unlikely to be a problem, which would in turn limit the potential importance of outcome expectancies. Nevertheless, the inclusion of outcome expectancies alongside measures of self-efficacy in future research would

provide a more theoretically holistic understanding of social-cognitive processes and mechanisms in endurance athletes (Williams & Rhodes, 2014).

### **Future Research**

Throughout this thesis several directions for future research have been presented. These have focused on further examination of the sources of self-efficacy (Chapter 2), further validation of the ESSES (Chapter 3), and further investigation of potential self-efficacy interventions (Chapter 4 and 5). Alongside these specific directions, there exists five general directions for future research which should be considered. First, research could to look further examine the self-efficacy – performance relationship at a within-persons level through using a combination of hierarchical performance scales, non-hierarchical scales (the ESSES), and qualitative methods. This assessment of self-efficacy longitudinally would help address the issues raised by Vancouver and colleagues in relation to the potential null effects of self-efficacy on performance (Halper & Vancouver, 2016; Sitzmann & Yeo, 2013). Alongside addressing the within-persons aspect of self-efficacy beliefs, such studies would also help provide additional information on how self-efficacy beliefs may form and develop in a variety of different populations who engage in endurance sport. For instance, examining the self-efficacy beliefs of a sample of novice runners (e.g., those who are engaging in a ‘Couch to 5km’ training plan) would help provide insight into the formation of new self-efficacy beliefs. Such a longitudinal approach would allow an examination of how pre-existing self-efficacy beliefs and experiences may contribute to domain-specific self-efficacy beliefs, but also how proximal sources of information such as training progression, peer support, and exercise induced sensations (e.g., pain and perception of effort) contribute to the development and formation of self-efficacy for endurance performance (Samson, 2014). Such findings

and information would help contribute to the design of interventions to help raise and ensure the robustness of self-efficacy in novice individuals, and this could have important implications in terms of adherence with the training program (McAuley & Courneya, 1992).

Moving away from a focus on more novice participants, research could also look to examine how self-efficacy beliefs may change during endurance performance. The majority of research on self-efficacy has focused on the measurement of self-efficacy beliefs prior to engagement with a task, but these beliefs are likely to also change during performances as well (Gist & Mitchell, 1992). The current thesis has helped provide evidence that these changes in self-efficacy may relate to a congruence between currently experienced sensations and expected sensations, and research could look to further examine these relationships. Experimental laboratory studies could investigate changes in self-efficacy during performance relating to exercise-induced sensations such as perception of effort or exercise-induced pain. For instance, utilising a similar methodology as adopted by Astorki and Mauger (2016), participants could cycle at a 'clamped' perceived effort of 16-17 on the Borg 6-20 scale. Participants could then be instructed to indicate their self-efficacy to maintain the current pace for a series of times, and the relationship between exercise-induced pain and self-efficacy could be examined through regression analysis. Alongside the investigation of these subjective exercise-induced sensations, the relationship between in performance self-efficacy and physiological parameters such as lactate thresholds, breathing frequency, rate of respiratory exchange, and cerebral oxygenation could also be examined. Understanding at which exercise intensities self-efficacy beliefs may decrease, or that self-efficacy is no longer an effective predictor of behaviour would provide further insight regarding the interaction between cognitions and physiology, but also would

help strengthen the ability for accurate and timed interventions. For instance, if it was discovered that self-efficacy strength to maintain a particular pace dipped significantly when reaching second lactate threshold, it could be a case of preparing strategies to buffer against this decrease in self-efficacy (e.g., the use of motivational self-talk). While self-efficacy beliefs would not overcome the reality of physiology, they could help influence just how long an endurance athlete is willing to maintain and endure their pace, and this has clear potential implications relating to performance.

Related to this examination of self-efficacy during endurance tasks, it is important to consider how exactly these self-efficacy beliefs are measured. While one recommendation could focus on more commonly used self-efficacy scales, there are other alternatives which could be considered. One option could be the use of 'ThinkAloud' protocols (Ericsson & Simon, 1993). These protocols encourage individuals to verbalise their cognitions and thoughts, and have been demonstrated to be suitable to use with endurance athletes, such as cyclists during a time-trial (Samson, Simpson, Kamphoff, & Langlier, 2017; Whitehead et al., 2017). If athletes were instructed to focus on their perceived capability to continue, this could provide interesting qualitative insight into how these beliefs may change. A further method could be through the use of a 'linear potentiometer'. A potentiometer would allow a continuous rating of self-efficacy to be measured across an exercise trial and could provide a more accurate presentation of the dynamism of self-efficacy beliefs. This would provide further information relating to the malleability of self-efficacy and would also allow an examination of the potential interaction between distal and proximal sources of self-efficacy. While both methodologies would require careful pilot testing and instructions to ensure that participant's responses are accurately reflecting perceived capability and no other related constructs, such findings would



prove valuable and further help advance our conceptual understanding of self-efficacy beliefs.

Related to these changes in self-efficacy during performance, is the concept of pacing. Pacing represents the goal-directed regulation of exercise intensity in which endurance athletes need to decide how and when to invest their energy (Smits et al., 2014). Endurance athletes must be conscious regarding maximising their performance, by understanding what speed or power output may be sustainable (Mauger, 2014). As pacing involves athletes making decisions regarding what is sustainable, this could be related to self-efficacy. A cyclist's perceived capability to create and maintain a certain speed or cadence, would likely inform their willingness to engage with this during the task. In line with social-cognitive theory, this relationship between pacing and self-efficacy would also involve the environment. For instance, the presence of other competitors and their pacing strategies has been demonstrated to lead to alterations in pacing behaviour (Corbett et al., 2012; Williams et al., 2015), and self-efficacy could be a potential mediator of these effects. As other competitors represent the source of vicarious influences, research could also examine how competitor characteristics may influence the effect on self-efficacy. This could relate to perceived competitive level of the competitor (e.g., Weinberg et al., 1979), demographical similarity (e.g., age, ethnicity, or gender), or even the perceived effort that the other competitor is working at (e.g., facial frowning, breathing frequency, 'tired' body language). The findings from such research would prove further insights into pacing decisions, and this could help inform performance in real-world competition as well. Alongside this focus on pacing decisions and self-efficacy during performance, this relationship could also be examined prior to races as a well. For example, research could examine if endurance athletes exhibit different pacing strategies or pacing profiles based on their domain-

specific self-efficacy (e.g., the ESSES), or how changes in situation-specific self-efficacy may also influence these pacing decisions.

As a more general comment on future research examining self-efficacy, the benefits of qualitative inquiry in this area can not be understated. As highlighted and discussed throughout this thesis, self-efficacy represents a complex and dynamic construct. While experimental studies can provide insight, attempting to generalise from these studies regarding such aspects as the formation and malleability is likely to be ineffective. This is because self-efficacy is formed and altered through an interaction between various sources of information. How these sources are weighted, interpreted and appraised is likely to be a highly idiographic process (Bandura, 1997). Qualitative studies examining this idiographic process, could help identify how some of these processes may occur. A clear example of these processes was the theme of physical familiarity identified within Chapter 2. Future qualitative research which attempts to identify further processes underpinning self-efficacy formation and alteration (e.g., processes for understanding when non-domain experiences may generalise) would be highly beneficial to our knowledge of self-efficacy both in the endurance sport domain but also more generally as well.

### **Applied Implications**

A key benefit of researching self-efficacy is that it is a malleable construct which has the potential to be shaped and changed through intervention (Bandura, 1997). This thesis primarily looked to inform this possibility of intervention through an investigation of the formation and alteration of these beliefs (Chapter 2 and 4) and the measurement of these beliefs (Chapter 3). Alongside these aspects, in Chapter 5 of this thesis the effects of two brief psychological interventions on self-efficacy were

also examined. Whereas the specific applied implications for each of the studies was discussed in their respective chapters, there exists three general applied implications from the current thesis.

Before examining these applied implications, it is worth clarifying the practicality of intervening to enhance self-efficacy for endurance athletes. When the self-efficacy construct was first theorised and developed by Bandura, it was in response to the behaviour of phobic individuals encountering their phobias (Bandura, 1977). As such, most of the initial work on self-efficacy focused on its formation and alteration in individuals where there was a lack of self-efficacy. While there are a number of endurance athletes whose self-efficacy is likely to be low, such as those competing in the sport for the first time, those transitioning to a new sport, or those who may be rehabilitating from injury, the majority of experienced athletes will have high levels of self-efficacy (Feltz et al., 2008). These existing high levels of self-efficacy mean that there is likely to be a strong ‘floor’ effect of self-efficacy-based interventions, and that rather than trying to simply raise self-efficacy for endurance performance in general, practitioners and coaches may consider other factors relating to the stability of these beliefs, and to best support the development of these beliefs longitudinally.

First, it is imperative that endurance athletes are encouraged to reflect upon their performances both in training and competition to help facilitate the development and formation of their self-efficacy. Experiences do not directly influence self-efficacy, instead this influence occurs following a process of appraisal and weighting (Gist & Mitchell, 1992). Based on the results of Chapter 2, this reflection could relate to both their performance (i.e., what they achieved and why this may have occurred), but also the sensations they felt during their performance (e.g., their perceived

exertion). This could help enhance the athlete's awareness of their cumulative experiences, and help increase the likelihood of accurate physiological appraisal. As discussed in Chapter 4, this physiological appraisal (i.e., perception of effort), can have potential impacts on self-efficacy strength. There is, therefore, a need to ensure that endurance athletes are capable of understanding the sensations they are experiencing, and how these match to the demands of the task. This process of self-reflection is an integral part of social-cognitive theory (Bandura, 2001), and taking a systematic approach to encouraging athletes to engage in this behaviour could lead to an enhancement of self-efficacy. This process of self-reflection on performance and behaviour has been demonstrated to lead to superior self-regulation and increases in self-efficacy in the educational domain (Zimmerman, 2000), and there is clear potential for these benefits to also be actualised in the endurance sport domain. Practitioners and coaches could help probe athletes with questions pertaining to their capability, such as why they may have felt incapable at certain points, or why at times they may have maintained this capability. This facilitated self-reflection could allow the athletes to gain a better understanding of their own self-efficacy beliefs, help provide an individual level of awareness of what might contribute to them and can promote increased stability of self-efficacy. Additionally, while competitive endurance athletes are likely to keep record of their training (e.g., using web-based monitoring such as Strava), it may also be beneficial to keep a record of how they felt during these trainings. These measurements of feelings could be in relation to perception of effort, exercise-induced pain, or just a more general sense of how their body felt during the session. Keeping records of such variations would allow endurance athletes the opportunity to reflect more thoroughly on their training

progression, and these could lead to the enhancement of self-efficacy as it would help provide further examples of their own capabilities.

While this facilitated process of self-reflection may help with the formation of self-efficacy beliefs, it may still be likely that practitioners and coaches may need to address specific decreases in self-efficacy. At this point, it is crucial to ensure that possible interventions are targeted at both the correct self-efficacy belief but also the correct dimension. For instance, using the ESSES it may be revealed that although an athlete reports generally high self-efficacy, they report low self-efficacy in relation to coping. To address this, it would be most beneficial for interventions to be targeted at this specific aspect, and such a micro-analytical approach towards self-efficacy is in line with Bandura's recommendations for self-efficacy interventions (Bandura, 1977; 1997). Furthermore, while the use of the ESSES in identifying 'lower' levels of self-efficacy could be beneficial, it must be reinforced that further examination should likely come from interviews and discussions with the endurance athlete. The reasons why a self-efficacy belief may be lower is likely to be multi-faceted, and it is important for both practitioners and coaches to be aware of such complexity.

Alongside this targeting of specific self-efficacy beliefs, it would also be beneficial for practitioners and coaches to consider the dimension of self-efficacy to be addressed. As discussed elsewhere in this chapter, the level of self-efficacy for endurance performance is likely to be heavily influenced by an individual's physical fitness and associated parameters (Joyner & Coyle, 2008). It therefore may be more beneficial for practitioners and coaches to consider how to enhance the strength of self-efficacy beliefs and following the recommendations of Bandura to provide athletes with a robust sense of self-efficacy that is unlikely to waver in the face of adversity (Bandura, 1997). This aim could be achieved through the athlete practicing

various psychological techniques which may help maintain self-efficacy strength such as motivational self-talk (e.g., you can do it!) or imagery (e.g., imagining themselves continuing forward despite the current sensation). While these skills may have already been taught or used by the athlete in a more general sense, it may be that a more deliberate focus on self-efficacy could be used to ensure that the athlete is able to use these skills to maintain their strength of self-efficacy during challenging or difficult situations.

### **Conclusion**

The focus of this thesis was to gain an increased understanding of the self-efficacy construct within the endurance sport domain. There were three main research aims. First, this thesis aimed to gain an increased understanding of the sources of self-efficacy in the endurance sport domain. This aim was achieved by conducting a series of semi-structured interviews with endurance athletes about the sources of their belief (Chapter 2). Second, this thesis aimed to develop and validate a new self-efficacy for the endurance sport domain. This aim was achieved through the development and validation of the 'Endurance Sport Self-Efficacy Scale (Chapter 3). Third, this thesis aimed to gain an increased understanding of the malleability of self-efficacy beliefs. This aim was achieved through an experimental laboratory study (Chapter 4) which demonstrated the effects of a change in perceived task difficulty on self-efficacy. This aim was also addressed through a randomised control trial of two brief psychological interventions (Chapter 5). Although no effect of the interventions on self-efficacy were detected, the study helps provide evidence for the feasibility and use of brief web-based interventions with endurance athletes.

Overall, the findings of this thesis help reinforce and advance several key tenets of self-efficacy and social-cognitive theory and help advance our understanding of self-efficacy in the endurance sport domain. It provides the first proposed model of the sources of self-efficacy for endurance performance (Chapter 2), the first non-hierarchical measure of endurance self-efficacy (the ESSES; Chapter 3) and advances our understanding on the malleability of self-efficacy from both an experimental and interventional perspective (Chapters 4 and 5). From a theoretical perspective, the current thesis helps raise awareness in relation to the conceptualisation of self-efficacy, the measurement of these beliefs, and the multidimensional nature of these beliefs. These theoretical implications in turn, provide several clear directions for future research on self-efficacy and endurance performance. Alongside these theoretical and research-based implications, the current findings also help provide several applied implications for those who may be interested in enhancing self-efficacy in endurance athletes or those engaging in endurance sport.

This thesis began with a focus on how the idea that our beliefs shape our actions and behaviour is arguably present across centuries, cultures, and continents. As a result of this existence, it may appear that self-efficacy is a ‘common sense’ construct within psychology. Indeed, when we consider endurance sports it is perhaps unlikely that anyone would disagree with the idea that belief in oneself is necessary to complete a marathon! While self-efficacy may therefore appear common sense, this does not mean it is a simple construct. On the contrary, the current thesis helps demonstrate the complexity and depth of the self-efficacy construct in perhaps one of the most challenging and unique domains of human functioning, endurance sports. It is in this domain, where self-efficacy does not solely extend to one what believes they are capable of achieving, but more so to what one believes they are capable of

withstanding, of overcoming, and ultimately, enduring. An understanding of what informs this capability, this resolute belief of being able to endure, has the potential to better endurance athletes and non-athletes alike.



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## **Chapter 8: Appendices**

## **Appendix A: Information Sheet and Informed Consent Form for Study 1 (Chapter 2)**

### **Information Sheet For Participants**

#### **INVESTIGATING PERFORMANCE BELIEFS IN ENDURANCE ATHLETES**

##### **INFORMATION SHEET FOR PARTICIPANTS**

Thank you for showing an interest in this project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate we thank you. If you decide not to take part there will be no disadvantage to you of any kind and we thank you for considering our request.

##### **What is the aim of the project?**

We are interested in assessing what influences an endurance athlete's belief in their own abilities. Currently there is only limited research investigating these factors. By gaining a greater understanding of these factors, this may help improve psychological interventions designed to aid performance

##### **What types of participants are needed?**

In order for you to be able to participate in this project you need to be at least 18 years old, have been competing in an endurance sport for at least five years, to have completed at least two competitive events, races or competitions over the previous year, and to be currently training at least three times week.

##### **What will participants be asked to do?**

Should you agree to take part in this project you will be asked to engage in an interview with the lead researcher. This interview will explore your beliefs as an endurance athlete. For example in this study, you may be asked to discuss the importance of how you have performed previously, or the influence of the people around you.

This interview can occur through a variety of means. Face to face interviews will take place at the University of Kent Medway Campus (ME4 4AG). Additionally, there is the option for this interview to take place through the use of Skype or through a telephone call. It is believed that this interview will last no longer than 45 minutes. An example of a question that may be asked during the interview could be "to what extent do you think your emotions influence your belief in yourself?"

##### **Can participants change their mind and withdraw from the project?**

You may withdraw from participation in the project at any time and without any disadvantage to yourself of any kind.

For a month after the interview session may request your data to be destroyed, and for your responses and answers omitted from the transcript.

##### **What data or information will be collected and what use will be made of it?**

During the interview, an audio recording device will be used to record the discussion. This will lead to the generation of a transcript which will then be emailed to you to



check for accuracy and/or remarks. Prior to analysis, all identifiable information (names) will be removed from the transcript and all participants will receive a pseudonym to ensure confidentiality. Anonymised direct quotes from this transcript may be later used in publication, but these quotes will be in no way linked to an individual. This transcript may be used for future research purposes.

**What if participants have any questions?**

If you would like to receive feedback regarding the results or have any questions about the project, either now or in the future, please feel free to contact:

Researcher Information:

Paul Anstiss – [pa298@kent.ac.uk](mailto:pa298@kent.ac.uk)

Supervisor Information:

Carla Meijen - [C.Meijen@kent.ac.uk](mailto:C.Meijen@kent.ac.uk)

Department Information:

School of Sport and Exercise Sciences - +44 (0)1634 888858

**Title of project: Performance Beliefs in Endurance Athletes**

**Name of investigator: Paul Anstiss**

**Please initial box**

1. I confirm that I have read and understand the information contained on the accompanying Participant Information Sheet for the above study. I have had the opportunity to consider the information, to ask questions and I have had these answered satisfactorily.
  
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. Paul Anstiss can be contacted by email (pa298@kent.ac.uk)
  
3. I am aware that the interview is audio recorded for the purpose of analysing the content of our discussions and I am happy to proceed.
  
4. I understand that my responses will be anonymised before analysis (I will be given a false name and identifying information will be removed). I give permission for members of the research team to have access to my anonymised responses.
  
5. I am aware that the researcher intends to publish the results from this research study and that anonymised direct quotes will be included in the publication. I am aware that this publication will not include identifying information.
  
6. I understand that anonymised audio files, or word processed transcriptions, of the interview may also be disclosed to a research journal to prove that the research findings are genuine.
  
7. I agree to take part in the above research project.

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Name of participant

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Date

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Signature

## **Appendix B: Interview Guide for Semi-Structured Interviews (Chapter 2)**

- Introduction & Rapport Building
  - Introduce self, outline the role of the project, ask them if they have any questions before starting the interview
  - Demographic questions: How old are you? What is your gender? What is your primary endurance sport? How long have you been competing in it? How often do you train per week?
  - Why did you decide to take up your particular endurance sport in the first instance?
  - Why do you continue to compete/take part in your endurance sport?
  - What do you enjoy most about competing/taking part in your endurance sport?
  - What do you enjoy least?
- Self-efficacy
  - I'd now like you to think about your confidence in your own abilities as an endurance athlete. What I mean by this is your belief in yourself to reach your goals or perform at a high level. If I gave you a scale of 0 – which represented no confidence at all, to 100 – which represented complete supreme confidence, where would you rate yourself on this scale?
  - What would you say is the primary reason for the score that you gave? I.e., why did you give the number that you did?
- Probing Follow Up Questions

- To what extent do you think your past experiences contribute to the rating you gave?
- Are there any particular times or experiences that you think may have contributed to your score?
- How has this belief developed over time?
- How does how you feel physically feel contribute towards the rating that you just gave?
- Are there any particular physical feelings that can cause your belief and confidence to change?
- Are there any people who have influenced your confidence rating?
- Has anyone ever said anything that influenced the belief in yourself?
- Are there any individuals outside of your endurance sport who have contributed to your confidence rating and the belief in yourself?
- Do your emotions contribute to your belief in yourself?
- How do you feel emotionally before an important event, does this influence your beliefs in yourself?
- Is there anything else we haven't discussed that you think contributed to the score that you gave?
- What would need to occur for your confidence rating to increase?
- Conclusion
  - Thank you for your help today, from what we have discussed it appears that..... (RECAP the key points of what they have said). Is this accurate?
  - Is there anything else you would like to discuss?
  - Do you have any questions for me about the research or the project?

## Appendix C: Theme Concept Cards (Chapter 2)

### Past Performance Experiences

#### Cumulative Experiences (12 participants – 248 references):

This theme encompasses the idea that self-efficacy beliefs have developed over time, based on small incremental successes. Although athletes might refer to particular turning points (especially related to overcoming difficulties and come backs) - most link their current self-efficacy beliefs back to a gradual build up.

This might involve slow increases in distances covered or time completed. This theme also most likely links in with the physiological adaptations observed from training, where we are likely to see incremental changes following consistent training rather than massive dramatic one off changes.

#### Selected Quotes:

*“I think its gradually increased over time - as I've increased the distance... so I've done 10 mile runs and 10k runs, and then you're thinking well I'll do a half-marathon and I think with each race you gain more confidence.”*

*“No, what I have done is that I have gradually increased the mileage I have done, ahem, literally the first big swim I done, was across (REDACTED), about 7 K, 7 miles and then built up every year. I didn't jump in immediately and say I was going to swim the channel or I am going to swim round (REDACTED) which I did last year, which is 44 miles. I incrementally increased year upon year.*

*“Ok the thing is I have done 26 marathons for example and finished them in respectable times. Within 3'30 which are respectable times, they are not elite standard, they are just not, but the thing is I have never failed”*

*“I think for that confidence to increase is just a matter of time, and just a matter of competing more at half iron man distance or stepping up to full iron man distance. I think it is a matter.. just a matter of time. The sheer number of races.”*

**Challenge and Adversity (11 sources, 19 references):**

This theme refers to the athlete’s experience of having overcome difficult events in the past. Although their self-efficacy beliefs have received a large impact from cumulative successes, they also think back to events or training sessions which have proved difficult and strenuous. As suggested by Bandura, successes which occur when faced with difficulty are more beneficial than those which come easy. This theme may also encompass coping self-efficacy, where athletes possess the belief that if they have been capable of overcoming and coping with difficulties in prior races they will continue this moving forward.

**Selected Quotes:**

*“I did it and I started feeling pain after about 12 k but I was saying I was half way let's try. And I finished my first half marathon in terrible pain and I was like I had a bigger injury because of that. But I lost the respect to that distance because I know I can run it even injured and I can finish”*

*“So I think in triathlon you can draw on, races that have been hard or times that you have struggled - and knowing that you have overcome them and managed to finish it, or do better than you think anyway - so I think those experiences definitely, definitely are really important.”*

*“Knowing that I won't give up really... I've run 7 marathons now and I know that even if it takes me 5 hours I'll finish, even though you know that's a long way outside my PB... (laughing) so I've got no issues with confidence...”*

*“That was my first channel swim and I did it with very little food and drink. So you know, If I could do it with that what is stopping me now?”*

*“I was an athlete as a kid, so there’s some of that that’s given me that confidence as well. You know I know how to push through these things ... You know softball and basketball aren’t quite triathlon, but you still have confidence in your athletic ability. Say even though it’s not from endurance sport per sé, knowing that you can push through difficulties, issues and negative aspects from softball and basketball, that’s what’s helped.”*

### **Physiological States**

#### **Physiological Awareness (12 sources, 25 references) :**

This theme attempts to incorporate the ideas of athletes feeling comfortable with their physiological state. This can focus on their perception of their physiological state while training or competition, and typically focuses on listening/paying attention to 'signals'. What is important is that all athletes accept sensations of fatigue, pain and exertion - what is important is that they are congruent to where they are currently. High levels of discomfort or exertion will lead to corresponding changes in pacing or performance. This discussion of physiological awareness primarily occurs through self-talk - with athletes discussing what they are feeling, and linking it to past performances and experiences. This signals can be exercise induced sensations, sensations such as cramps and more general senses (potentially linked with mood and affective states???).

#### **Selected Quotes:**

*“I’m constantly telling myself where I need to be and how my pace is doing - okay... pull back or keep pushing a bit. So, I am constantly adjusting... my body to be in the right place for the terrain for any race... so there is a lot of talking to yourself...”*

*“So, where you find yourself comfortably riding, is something that I take quite a bit of confidence in. So, if I’m sort of confidently riding and well within perception of effort that I know is manageable, and I’m quite near the front, that gives me a lot of confidence. But if I’m further towards the back and .. I look behind me and there’s only a few people, and I try to go up to the front and that perception of effort goes up and I have to drop back. That’s not great for confidence. “*

*“I can continue to keep myself positive and I know that for example after about 8 hours the biceps of my arms get really sore and I know that after 9 hours I would have swum through it. So when I get to that point, I say to myself you can just keep going you know this is going to go, and you just keep doing it.”*

*“I’m kind of very, very aware of feelings within my own body - in terms of what feels right and what feels wrong. What feels bad and what feels good.. I do know if that I get to 1k or 2k in a 5k race, and I feel like I’m running through treacle already it’s probably not going to be a good result”*

*“I will talk to myself about how I feel from a physical exertion standpoint.. like you know, I did a training run on Sunday uhm, and a lot of the conversation was you know, reminding myself that I felt calm, that I felt comfortable. Because it was a lot.. it was an 18 miler, with 14 at race pace so I was talking to myself “This 14 feels comfortable, just keep it there keep it there keep it there..” and.. That was the majority of the internal conversation”*

### **Social/Verbal Persuasions**

#### **Social Support (12 sources, 19 references):**

This theme attempts to capture the essence of verbal encouragement and ability confirmation from other individuals. At times this can be other competitors, training partners, coaches or crowds. There does not seem to be a single uniting factor across where individuals draw their reinforcement from. However, where the athlete perceives the verbal deliverer as having high



levels of expertise (coach, training partner, other competitor) they appear to be more willing to take this on as confirmation of their own abilities.

**Selected Quotes:**

*“About 5 miles later I ran into my family and I actually stopped on my bike and they could see my face start to turn and they were like.. They said nothing else except keep going, everyone else in the crowd was screaming at me to keep going. They know... they didnt know everything, they didn't know how I was feeling but they certainly knew something wasn't right and all they do is say keep going keep going”*

*“People say something to you.. I had a race the other week. I put an attack made the rest hard and when I came back, I rode sort of back past one of my teammates and he said ‘that was a bloody good squeeze’. You know.. because, he .. I made him suffer, so he just sort of gave me that bit of... and that kind of made me think ‘oh maybe I’m going really well today’. So that sort of boosted that confidence.”*

*“And.. the next we did it .. I don't know if it was 25 or 20 minutes.. whatever it was.. the next time we went training they said .. and I said ‘no I can't do it’ and they said ‘yes you can’ .. so I did and when it was all done I ran 8'10s or something stupid and now I'm like ooh I can do it. So you know. That's how my coach works on trying to show me. You do have the ability, but you talk yourself down. So that's kind of how they try to lift me is by showing me that I can do it.”*

*“Yeah definitely... yeah I've got a few close friends in the club and when my head was dropping when I was trying to do an awful lot of miles... it was feeling really really like hard work for Comrades, then.. You know they were really helpful with a lot of the stuff they were staying... and when you respect them and what they do... it's good sometimes to hear people you really respect for their abilities kind of... really giving*

you encouragement and motivation and saying that you're inspirational and that kind of thing - *that really helps.*”

*“Having the girl I train with and my coach telling me that I'm the fittest I've ever been, that “It's your day - Go and do it, and show us what you can do”. And when you know that someone of that ability is saying that to you - then you know that you can do it... and it kind of gives you the belief that you can do it”*

**Self-Talk (10 references, 18 references):**

Self-Talk is a theme underlying the words and phrases that athletes say to themselves in order to aid their own belief. This can be done for instructional reasons such as knowing when to push and when not too (linked with past performance experiences) but can also be done when discussing their physiological state (linked with physiological awareness). Self-talk also appears important for reassuring self-efficacy beliefs when encountering difficulties (pain, exertion, unexpected events).

**Selected Quotes:**

*“Well I've really focused on those things and I've just kept telling myself that, and you have to realise that you've put in the effort, the blood sweat and tears that... you're physically capable of doing it - something hurts you just kinda need to suck it up and keep going”*

*“There always is that sort of the conflict in your own mind between sort of.. you know.. when the race is hard, you try to tell yourself, it's going to get easier, or I can push through this, I've gone harder, I've gone harder”*

*“OK, so I, ahem, I talk to myself. I talk I have the self talk. Do self talk. So I talk to myself and say that I talk myself through the process and if I know when.... what to do when I am talking to myself to get the outcomes. It is very important about listening to yourself. There are, its,*

ahem, it is kind of like I did the Manchester marathon a few weeks ago and I knew, I got to a point where I knew I said to myself "you can do this" "Push now" "go now" And I knew to talk to myself and you kind of get yourself into a groove and kinda get yourself focused and it is about *you can do this. It invariably is positive, invariably positive .*"

*"Again it's very much situational based. If for example .. if for example I'm swimming where technique .. my swimming is my weakest discipline so I'm particularly in open water I consider myself very inexperienced as an open water swimmer so I will be trying to give myself motivation, remind myself of the technique, remind myself of the bigger picture rather than actually allowing the self doubt, the negativity to creep in. Whereas something like cycling I've got a much better understanding of what my cycling abilities are and what my limits are. Again, under those circumstances I talk to myself much less. But when I do.. it's more around.. yeah. This is a really quick ride. Or things are going well. And then.. somebody was running where, again, I consider myself new to endurance running, it will be more.. yeah keep it up, keep going. You just need to work through this next little bit and then going to the home straight or just watch the next mile marker .. the next couple of mile markers go past. Just so to help.. the legs turning over, keep the body going."*

## **Emotional States**

### **Doubt and worries (9 sources, 15 references):**

This primarily focuses on athletes feeling worries and concerns, which may detract from their confidence in their own abilities. Often these are doubts which are outside of their own control (mechanical, weather, injuries) but are still present for lowering self-efficacy beliefs. Also discussed within are whether or not the athletes perceive the anxiety to be harmful to their confidence, most see it is as a normal occurrence, with some also suggesting that anxiety is required to ensure appropriate training and nutrition.

### **Selected Quotes:**

*“Historically ever since I raced for about a week before, if anyone mentions the race I get a horrific stomach, butterflies everything... and the night before you stay awake and you play the race out in your mind and how you want it to go, and you can't sleep - and then on the morning I'm fine”*

*“Oh yes, yeah, but that is where the 85 comes from in my view you need to have that bit of doubt, that bit of doubt you see keeps you on edge, keeps you sharp, it keeps you just at the sweet spot, that you know for example in a full marathon you know you have got to prep. You know what you have got to take on, you know you got to fuel properly, you know you have got to do all your things that prepare. Being cavalier about it leads to too many things that could go wrong”*

*“I think there's a little natural anxiety regardless right. What happens on my bike, how am I going to overcome that? Mechanical things, or whatever? Those three things.. I don't really think that really hinders you, I think they're natural thoughts going into those big races and that .. honestly, that probably does pump me up a little bit. “*

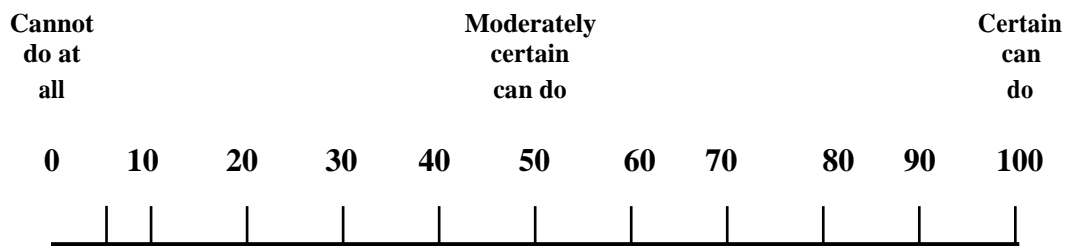
*“It's inexperience right, I haven't biked 180 Km ever, which is the bike portion of the race, and it gets me a bit worried sometimes. Running a marathon as well like it is just sort of, running a marathon is like this huge social thing whatever, it is a bit worrying....”*

*“Yeah.. it probably does actually, it probably does... because I guess the nerves come up.. well I don't know.. maybe it's a bit chicken and egg.. I don't know which comes first. I don't know the nerves impact the confidence - or actually its the lack of confidence that actually generates the nerves. So I think it's probably that way round.. so you know I don't know if I can actually achieve this - so this then starts to build the nervous feeling.. because then I start to get worried that I'm not going to achieve what I want too.. It's probably that bit that comes first actually that then builds the nerves.”*

**Appendix D: Initial 18-item ESSES & final 11-item ESSES (Chapter 3)**

**Endurance Sport Self-Efficacy Scale (ESSES)**

Below you will find a list of actions and skills that are important for endurance performance. When you are taking part in your endurance sport, how confident are you that can do the following things. In each case please rate your degree of confidence from 0 (cannot do at all) to 100 (completely certain can do).

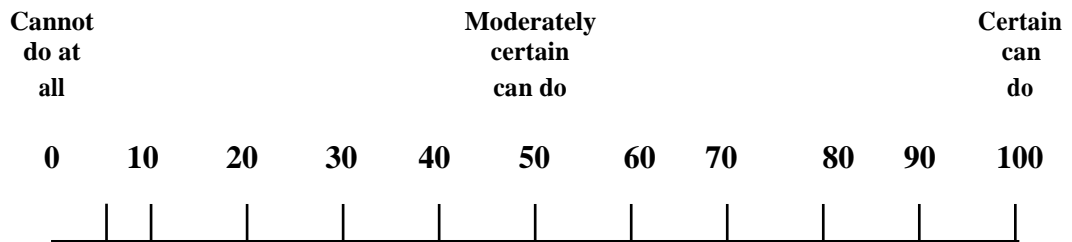


**My confidence in my ability to:**

1. Manage non-injury related pain \_\_\_\_\_
2. Ensure appropriate technique and form \_\_\_\_\_
3. Manage my emotions before events \_\_\_\_\_
4. Manage my emotions during events \_\_\_\_\_
5. Manage injury related pain \_\_\_\_\_
6. Take on appropriate nutrition during events \_\_\_\_\_
7. Take on appropriate hydration during events \_\_\_\_\_
8. Manage my thoughts before events \_\_\_\_\_
9. Manage my thoughts during events \_\_\_\_\_
10. Achieve my goals \_\_\_\_\_
11. Manage and deal with unexpected events \_\_\_\_\_
12. Prepare mentally for demanding events \_\_\_\_\_
13. Pace myself appropriately \_\_\_\_\_
14. Manage and deal with unexpected weather conditions \_\_\_\_\_
15. Maintain my concentration \_\_\_\_\_
16. Prepare physically for demanding events \_\_\_\_\_
17. Perform well in challenging events \_\_\_\_\_
18. Deal with feelings of effort and exertion \_\_\_\_\_

### Endurance Sport Self-Efficacy Scale (ESSES)

Below you will find a list of actions and skills that are important for endurance performance. When you are taking part in your endurance sport, how confident are you that can do the following things. In each case please rate your degree of confidence from 0 (cannot do at all) to 100 (completely certain can do).



#### My confidence in my ability to:

1. Manage non-injury related pain \_\_\_\_\_
2. Ensure appropriate technique and form \_\_\_\_\_
3. Manage my emotions during events \_\_\_\_\_
4. Manage injury related pain \_\_\_\_\_
5. Manage my thoughts during events \_\_\_\_\_
6. Manage and deal with unexpected events \_\_\_\_\_
7. Pace myself appropriately \_\_\_\_\_
8. Manage and deal with unexpected weather \_\_\_\_\_
9. Maintain my concentration \_\_\_\_\_
10. Perform well in challenging events \_\_\_\_\_
11. Deal with feelings of effort and exertion \_\_\_\_\_

## Appendix E: First Online Survey (Chapter 3)

# Self-Belief in Endurance Athletes

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## Page 1: Information & Informed Consent

The following study is designed to examine beliefs about performance in endurance athletes. This study is being conducted by Paul Anstiss, a PhD student at the University of Kent. This study has been approved by the School of Sport and Exercise Sciences (SSES) Research Ethics Committee.

In order to take part in this survey it is important that you meet the following criteria:

- You are currently in training for an upcoming endurance event within the next 12 months.
- You have previously completed at least 2 endurance events
- You are currently training at least 2 times a week
- You are at least 18 years of age

In this study you will be asked to complete a survey about your beliefs in your own performance. To start you will be asked demographical and endurance sport background related questions. You will then be asked questions relating in your beliefs to cope with difficulties in everyday life. You will then be asked questions about your performance beliefs in relation to your endurance sport.

The online survey should take approximately 15-20 minutes to complete. All of your responses will be anonymous. At no time will your name be requested or recorded during your participation. Upon completing the survey, participants will be given the opportunity to leave their email in regards to receiving further information about the results of the study and/or future research participation opportunities. Should you choose to select these options, your contact information will be stored separate from your survey responses.

Your participation in this study is entirely voluntary. You are free to withdraw your participation at any time during the study without penalty. This study entails no risks beyond those routinely encountered in daily life, nor does it provide any direct benefits to individual participants. However, you may learn more about yourself from participating in this study.

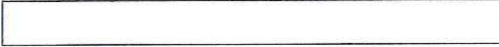
Your responses to the survey will be encrypted and stored securely and safely on the Bristol Online Survey (BOS) website. The BOS is a commonly used survey tool used by over 300

organisations and approximately 130 higher education institutes across the UK. Results of this project may be published, but any data included will in no way be linked to any specific participant. You are most welcome to request a copy of the summary of the results of the project should you wish.

If you have any questions concerning this survey, the results, or your participation in this research please feel free to contact Paul Anstiss (pa298 @ kent.ac.uk) or their supervisor Carla Meijen (c.meijen @ kent.ac.uk). (Please remove the space between the @ and the rest of the address when attempting to email.)

I acknowledge that I have been informed of, and understand the nature and purpose of this study, and I freely consent to participate. I acknowledge that I am at least 18 years of age.

**Click on the “I agree” button below to indicate that you have read this form and understand the information above. By clicking on the “I agree” button, you are providing an online signature for your consent to participate in the study.**





## Page 2: Participant Information

What is your age?

Please enter a whole number (integer).  
The number should be 18 or greater.

What is your gender?

- Male
- Female
- Other
- Prefer Not To Say

What endurance sports/activities do you currently compete in? (if you compete in multiple please select all that apply)

Please select at least 1 answer(s).

- Running
- Swimming
- Cycling
- Triathlon
- Ironman
- Skiing
- Race-walking
- Rowing
- Canoeing
- Other

If you selected Other, please specify:

What is your 'primary' endurance sport/activity?

- Running
- Swimming
- Cycling
- Triathlon
- Ironman
- Skiing
- Race-walking
- Rowing
- Canoeing
- Other

If you selected Other, please specify:

How many years have you been taking part in competitions / races?

What is your main competitive distance(s)?

What is your personal best (PB) for this distance within the last year?

On average, how many hours per week do you spend training?

Please enter a number.

On average, how much distance do you cover per week? (please specify either km or miles)

Which of the below best describes the level and/or standard of competitions that you currently enter?

- Local
- University
- Regional
- National
- International
- Other

If you selected Other, please specify:

What is the highest level or standard that you have competed at? (for all sports not just endurance)

- Local
- University
- Regional
- National
- International
- Other

If you selected Other, please specify:

## Page 3: General Measures

This next section asks questions on how you deal with difficulties and situations in your everyday life. It is not specific to your endurance sport.




















Please rate the following items in terms of your agreement

	1 - Not at all true	2 - Hardly true	3 - Moderately true	4 - Exactly true
I can always manage to solve difficult problems if I try hard enough.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If someone opposes me, I can find the means and ways to get what I want.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is easy for me to stick to my aims and accomplish my goals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am confident that I could deal efficiently with unexpected events.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thanks to my resourcefulness, I know how to handle unforeseen situations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can solve most problems if I invest the necessary effort.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can remain calm when facing difficulties because I can rely on my coping abilities.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I am confronted with a problem, I can usually find several solutions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I am in trouble, I can usually think of a solution.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can usually handle whatever comes my way.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

When things aren't going well for you, or when you're having problems, how confident are you that you can do the following things. Please rate your confidence by recording a number

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from 0 (cannot do at all) to 100 (completely certain can do).

Keep from getting sad and upset	Please select 
Talk positively to yourself	Please select 
Sort out what can be changed, and what cannot be changed	Please select 
Get emotional support from friends and family	Please select 
Find solutions to your most difficult problems	Please select 
Break an upsetting problem down into smaller parts	Please select 
Leave options open when things get stressful	Please select 
Make a plan of action and follow it when confronted with a problem	Please select 
Develop new hobbies or recreations.	Please select 
Take your mind off unpleasant thoughts	Please select 
Look for something good in a negative situation	Please select 
Keep from feeling sad	Please select 
See things from the other person's point of view during a heated argument	Please select 
Try other solutions to your problems if your first solutions don't work	Please select 
Stop yourself from being upset by unpleasant thoughts	Please select 
Make new friends	Please select 
Get friends to help you with the things you need	Please select 
Do something positive for yourself when you are feeling discouraged	Please select 
Make unpleasant thoughts go away	Please select 

Think about one part of the problem at a time	Please select <input type="button" value="v"/>
Visualize a pleasant activity or place	Please select <input type="button" value="v"/>
Keep yourself from feeling lonely	Please select <input type="button" value="v"/>
Pray or meditate	Please select <input type="button" value="v"/>
This is an awareness test. Please select the answer 0 - cannot do at all	Please select <input type="button" value="v"/>
Get emotional support from community organizations or resources	Please select <input type="button" value="v"/>
Stand your ground and fight for what you want	Please select <input type="button" value="v"/>
Resist the impulse to act hastily when under pressure	Please select <input type="button" value="v"/>

## Page 4: Endurance Sport Experiences and Beliefs

This next section focuses on your experiences and beliefs in your endurance sport.

The following are statements that athletes have used to describe their experiences. Please read each statement carefully, and then recall as accurately as possible how often you experience the same thing. There are no right or wrong answers. Do not spend too much time on any one statement.

	0 - Almost never	1 - Sometimes	2 - Often	3 - Almost always
On a daily or weekly basis, I set very specific goals for myself that guide what I do.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I get the most out of my talent and skill.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When a coach or my peers tells me how to correct a mistake I've made, I tend to take it personally and feel upset.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I'm taking part in my endurance sport, I can focus my attention and block out distractions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I remain positive and enthusiastic during competition, no matter how badly things are going.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tend to perform better under pressure because I think more clearly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I worry quite a bit about what others think of my performance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tend to do lots of planning about how to reach my goals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel confident that I will perform well.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When a coach or peer criticizes me, I become upset rather than feel helped.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>




It is easy for me to keep distracting thoughts from interfering with something I am watching or listening to.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I put a lot of pressure on myself by worrying about how I will perform.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I set my own performance goals for each training.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't have to be pushed to train or compete hard; I give 100%.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If a coach criticizes or yells at me, I correct the mistake without getting upset about it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I handle unexpected situations in my sport very well.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When things are going badly, I tell myself to keep calm, and this works for me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The more pressure there is during an event, the more I enjoy it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
While competing, I worry about making mistakes or failing to come through.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have my own race plan worked out in my head long before the event begins.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I feel myself getting too tense, I can quickly relax my body and calm myself.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To me, pressure situations are challenges that I welcome.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think about and imagine what will happen if I fail or screw up.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I maintain emotional control regardless of how things are going for me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is easy for me to direct my attention and focus on a thing.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I fail to reach my goals, it makes me try even harder.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I improve my skills by listening carefully to advice and instruction from coaches and peers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I make fewer mistakes when the pressure is on because I concentrate better.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



















Below you will find a list of actions and skills that are important for endurance performance. When you are taking part in your endurance sport, how confident are you that you can do the following things. In each case please rate your degree of confidence from 0 (cannot do at all) to 100 (completely certain can do).

Manage non-injury related pain	Please select <input type="button" value="v"/>
Ensure appropriate technique and form	Please select <input type="button" value="v"/>
Manage my emotions before events	Please select <input type="button" value="v"/>
Manage my emotions during events	Please select <input type="button" value="v"/>
Manage injury related pain	Please select <input type="button" value="v"/>
Take on appropriate nutrition during events	Please select <input type="button" value="v"/>
Take on appropriate hydration during events	Please select <input type="button" value="v"/>
Manage my thoughts before events	Please select <input type="button" value="v"/>
Manage my thoughts during events	Please select <input type="button" value="v"/>
Achieve my goals	Please select <input type="button" value="v"/>
Manage and deal with unexpected events	Please select <input type="button" value="v"/>
Prepare mentally for demanding events	Please select <input type="button" value="v"/>
Pace myself appropriately	Please select <input type="button" value="v"/>
Manage and deal with unexpected weather conditions	Please select <input type="button" value="v"/>
Maintain my concentration	Please select <input type="button" value="v"/>
Prepare physically for demanding events	Please select <input type="button" value="v"/>

Perform well in challenging events	Please select 
Deal with feelings of effort and exertion	Please select 

## Page 5: Barriers to Training

Below you'll find a list of situations that can interfere with training for an endurance sport. On each of the items, please indicate the degree to which you are confident that you can continue training despite these situations. Please rate your confidence by recording a number from 0 (cannot do at all) to 100 (completely certain can do).

When I am feeling tired	Please select 
When I am feeling pressure from school/work	Please select 
During bad weather	Please select 
After recovering from an injury that prevented me from training	Please select 
When experiencing personal problems	Please select 
When I am feeling sad	Please select 
When I am feeling anxious	Please select 
After recovering from an illness that prevented me from training	Please select 
When I feel physical discomfort from training	Please select 
After a vacation	Please select 
When I have too much work to do for school/work	Please select 
When visitors are in town	Please select 
When there are other interesting things to do	Please select 
If I don't reach my performance goals	Please select 
Without support from my family/friends	Please select 
During a vacation	Please select 
When I have other time commitments	Please select 
During/ after experiencing family problems	Please select 

## Page 6: Endurance Sport Experiences

Using the scale listed below, please indicate your level of agreement with the following statements

	1 - Strongly disagree	2	3	4	5 - Strongly agree
I tell myself that I am good at my sport and can achieve my goals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoy participating in my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have overcome challenges in my endurance sport through hard work and training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am in good physical shape	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have improved my abilities and skills by watching professional endurance athletes, who are similar to me in some way, perform well.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Even though I have not always performed well, I have always finished my previous events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My coach or other endurance athletes have told me that my training has improved my performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have had positive experiences competing in my endurance sport in the past	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Training and competing in my endurance sport makes me feel upset	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have met or exceed other people's expectations of what they thought I should be able to achieve in my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My family or friends have told me that my training has improved my performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have seen the benefits of my training reflected in how my body looks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I have consistently reached my goals in my events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have improved my abilities and skills by watching non- professional endurance athletes, who are similar to me in some way, perform well.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My coach or other endurance athletes have told me that I am good at my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Even when I train hard I perform poorly in events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When thinking about taking part in my endurance sport I feel excited	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My family or friends have told me that I am good at my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I watch others take part in endurance events, and believe if they can do it so can I	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I visualise and imagine myself doing well in my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have positive memories of most, or all, of my past endurance events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am often able to feel physically powerful and strong	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I compare my abilities to those of others who compete at a similar level to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When thinking about taking part in my endurance sport I feel anxious or nervous	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can feel in my body that I possess a good level of physical fitness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Page 7: End

Thank you very much for taking part in this ongoing research project.

We do not anticipate any issues arising from your participation in this study, but if you would like further information on dealing with stress and emotions you may find it useful to visit the following website - <http://www.nhs.uk/livewell/mentalhealth/Pages/Mentalhealthhome.aspx>

If you would like to receive further information, or for signposting to relevant professionals please contact Paul Anstiss at [pa298@kent.ac.uk](mailto:pa298@kent.ac.uk)

If you would like to receive details about the findings of the study please leave your email in the box below.

If you would like to be contacted about future research opportunities, such as intervention studies, please leave your email in the box below. (Please note we are based in Medway, Kent , ME4 4AG)

Please leave your email below if you wish to be contacted with the details/findings of this study

Please enter a valid email address.

Please leave your email below if you would like to be contacted about future research opportunities

Please enter a valid email address.

## Appendix F: Second Online Survey (Chapter 3)

# Self-Belief in Marathon Runners

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## Page 1: Information & Informed Consent

The following study is designed to examine beliefs about performance in endurance athletes. This study is being conducted by Saratha Kugendran, an undergraduate student at the University of Kent, alongside Paul Anstiss, a PhD student at the University of Kent. This study has been approved by the School of Sport and Exercise Sciences (SSES) Research Ethics Committee.

In order to take part in this survey it is important that you meet the following criteria:

- You are currently in training for an upcoming marathon event within the next 12 months.
- You have previously completed at least 2 marathons in the last five years OR this will be your first marathon.
- You are at least 18 years of age

In this study you will be asked to complete a survey about your beliefs in your own performance. To start you will be asked demographical and endurance sport background related questions. You will then be asked questions relating in your beliefs to cope with difficulties in everyday life. You will then be asked questions about your performance beliefs in relation to the marathon event you are planning to take part in.

The online survey should take approximately 10-15 minutes to complete. All of your responses will be anonymous. At no time will your name be requested or recorded during your participation. Upon completing the survey, participants will be given the opportunity to leave their email in regards to receiving further information about the results of the study and/or future research participation opportunities. Should you choose to select these options, your contact information will be stored separate from your survey responses.

Your participation in this study is entirely voluntary. You are free to withdraw your participation at any time during the study without penalty. This study entails no risks beyond those routinely encountered in daily life, nor does it provide any direct benefits to individual participants. However, you may learn more about yourself from participating in this study.

Your responses to the survey will be encrypted and stored securely and safely on the Bristol



Online Survey (BOS) website. The BOS is a commonly used survey tool used by over 300 organisations and approximately 130 higher education institutes across the UK. Results of this project may be published, but any data included will in no way be linked to any specific participant. You are most welcome to request a copy of the summary of the results of the project should you wish.

If you have any questions concerning this survey, the results, or your participation in this research please feel free to contact Saratha Kugendran (spk26 @ kent.ac.uk) or their supervisor Carla Meijen (c.meijen @ kent.ac.uk). (Please remove the space between the @ and the rest of the address when attempting to email.)

I acknowledge that I have been informed of, and understand the nature and purpose of this study, and I freely consent to participate. I acknowledge that I am at least 18 years of age.

**Click on the "I agree" button below to indicate that you have read this form and understand the information above. By clicking on the "I agree" button, you are providing an online signature for your consent to participate in the study.**

## Page 2: Participant Information

What is your age?

Please enter a whole number (integer).

The number should be 18 or greater.

What is your gender?

- Male
- Female
- Other
- Prefer Not To Say

How many marathons have you completed?

Please choose the entry category that best applies to the level you have ran at or are going to run at in the upcoming marathon.

Please select at least 1 answer(s).

- |  |   |   |
|--|---|---|
| <input type="checkbox"/> Ballot entry          | <input type="checkbox"/> Charity entry  | <input type="checkbox"/> Good for Age   |
| <input type="checkbox"/> Championship entry    | <input type="checkbox"/> Overseas entry | <input type="checkbox"/> Lottery system |
| <input type="checkbox"/> Qualifying time entry | <input type="checkbox"/> Other          |   |

If you selected Other, please specify:

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If you have a goal for this event, what is it? (For example a time or finishing place)

On a scale of 0 (no confidence at all) to 100 (completely confident) How confident are you that you can reach this goal?

Why did you choose the number that you did? Please feel free to go into as much detail as you want
















On a scale of 0 (no confidence at all) to 100 (completely confident) How confident are you that you can surpass this goal in your upcoming event? (for example if your goal was to run a marathon in 3 hours and 30 minutes, how confident are you that you could do this in a faster time).



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## Page 3: Endurance Sport Experiences and Beliefs

This next section focuses on your beliefs in relation to running.

Below you will find a list of actions and skills that are important for endurance performance. When you are taking part in your endurance sport, how confident are you that can do the following things. In each case please rate your degree of confidence from 0 (cannot do at all) to 100 (completely certain can do).

Manage non-injury related pain	Please select 
Ensure appropriate technique and form	Please select 
Manage my emotions before events	Please select 
Manage my emotions during events	Please select 
Manage injury related pain	Please select 
Take on appropriate nutrition during events	Please select 
Take on appropriate hydration during events	Please select 
Manage my thoughts before events	Please select 
Manage my thoughts during events	Please select 
Achieve my goals	Please select 
Manage and deal with unexpected events	Please select 
Prepare mentally for demanding events	Please select 
Pace myself appropriately	Please select 
Manage and deal with unexpected weather conditions	Please select 
Maintain my concentration	Please select 
Prepare physically for demanding events	Please select 

Perform well in challenging events	Please select 
Deal with feelings of effort and exertion	Please select 

## Page 4: Endurance Sport Experiences

Using the scale listed below, please indicate your level of agreement with the following statements

	1 - Strongly disagree	2	3	4	5 - Strongly agree
I tell myself that I am good at my sport and can achieve my goals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoy participating in my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have overcome challenges in my endurance sport through hard work and training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am in good physical shape	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have improved my abilities and skills by watching professional endurance athletes, who are similar to me in some way, perform well.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Even though I have not always performed well, I have always finished my previous events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My coach or other endurance athletes have told me that my training has improved my performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have had positive experiences competing in my endurance sport in the past	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Training and competing in my endurance sport makes me feel upset	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have met or exceed other people's expectations of what they thought I should be able to achieve in my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My family or friends have told me that my training has improved my performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have seen the benefits of my training reflected in how my body looks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I have consistently reached my goals in my events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have improved my abilities and skills by watching non- professional endurance athletes, who are similar to me in some way, perform well.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My coach or other endurance athletes have told me that I am good at my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Even when I train hard I perform poorly in events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When thinking about taking part in my endurance sport I feel excited	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My family or friends have told me that I am good at my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I watch others take part in endurance events, and believe if they can do it so can I	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I visualise and imagine myself doing well in my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have positive memories of most, or all, of my past endurance events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I compare my abilities to those of others who compete at a similar level to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When thinking about taking part in my endurance sport I feel anxious or nervous	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can feel in my body that I possess a good level of physical fitness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Page 5: End

Thank you very much for taking part in this ongoing research project.

We do not anticipate any issues arising from your participation in this study, but if you would like further information on dealing with stress and emotions you may find it useful to visit the following website - <http://www.nhs.uk/livewell/mentalhealth/Pages/Mentalhealthhome.aspx>

If you would like to receive further information, or for signposting to relevant professionals please contact Saratha Kugendran at [spk26@kent.ac.uk](mailto:spk26@kent.ac.uk)

If you would like to receive details about the findings of the study please leave your email in the box below.

If you would like to be contacted about future research opportunities, such as intervention studies, please leave your email in the box below. (Please note we are based in Medway, Kent , ME4 4AG)

Please leave your email below if you wish to be contacted with the details/findings of this study

Please enter a valid email address.

Please leave your email below if you would like to be contacted about future research opportunities

Please enter a valid email address.



## Appendix G: Third Online Survey (Chapter 3)

# Self-Belief in Endurance Athletes V.2

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## Page 1: Information & Informed Consent

The following study is designed to examine performance beliefs in endurance athletes. This study is being conducted by Paul Anstiss, a PhD researcher at the University of Kent. This study has been approved by the School of Sport and Exercise Sciences (SSES) Research Ethics Committee.

In order to take part in this survey it is important that you meet the following criteria:

- You are currently taking part in an endurance sport
- You are at least 18 years of age
- You are not currently injured

In this study you will be asked to complete a survey about your beliefs in your own performance. To start you will be asked some demographical questions as well as questions relating to your endurance sport experience and training. Next you will be asked questions relating to your belief in your own abilities. You will then be asked to rate how several statements apply to you.

The online survey should take approximately 10-15 minutes to complete. All of your responses will be anonymous. At no time will your name be requested or recorded during your participation. Upon completing the survey, participants will be given the opportunity to leave their email in regards to receiving further information about the results of the study and/or future research participation opportunities. Should you choose to select these options, your contact information will be stored separate from your survey responses.

Your participation in this study is entirely voluntary. You are free to withdraw your participation at any time during the study without penalty. This study entails no risks beyond those routinely encountered in daily life, nor does it provide any direct benefits to individual participants. However, you may learn more about yourself from participating in this study.

Your responses to the survey will be encrypted and stored securely and safely on the Bristol Online Survey (BOS) website. The BOS is a commonly used survey tool used by over 300 organisations and approximately 130 higher education institutes across the UK. Results of

this project may be published, but any data included will in no way be linked to any specific participant. You are most welcome to request a copy of the summary of the results of the project should you wish.

If you have any questions concerning this survey, the results, or your participation in this research please feel free to contact Paul Anstiss (pa298 @ kent.ac.uk) or their supervisor Carla Meijen (c.meijen @ kent.ac.uk). (Please remove the space between the @ and the rest of the address when attempting to email.)

I acknowledge that I have been informed of, and understand the nature and purpose of this study, and I freely consent to participate. I acknowledge that I am at least 18 years of age.

**Click on the “I agree” button below to indicate that you have read this form and understand the information above. By clicking on the “I agree” button, you are providing an online signature for your consent to participate in the study.**

## Page 2: Participant Information

What is your age?

Please enter a whole number (integer).

The number should be 18 or greater.

What is your gender?

- Male
- Female
- Other
- Prefer Not To Say

What is your height? Please answer in either centimeters (e.g., 185cm) or feet and inches (e.g. 6 foot, 1").

How much do you weigh? Please answer in either kilograms (e.g. 70 kg), pounds (e.g. 150 lb) or stone and pounds (e.g. 10 stone, 6 pounds). Note: There are 14 pounds in one stone.

What endurance sports/activities do you currently compete in? (if you compete in multiple

please select all that apply)

Please select at least 1 answer(s).

- Running
- Swimming
- Cycling
- Triathlon
- Ironman
- Skiing
- Race-walking
- Rowing
- Canoeing
- Other

If you selected Other, please specify:

What is your 'primary' endurance sport/activity?

Please select no more than 1 answer(s).

- Running
- Swimming
- Cycling
- Triathlon
- Ironman
- Skiing
- Race-walking
- Rowing

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Canoeing

Other

If you selected Other, please specify:

How many years have you been taking part in your endurance sport?

How many years have you been taking part competitively in your sport? (e.g. races, events, competitions)

If applicable, what is your main competitive distance(s)?

What is your personal best (pb) for this distance within the last year?

On average, how many hours per week do you exercise?

Please enter a number.

How long have you been consistently (no more than 2 months without exercise) been exercising? Please answer in years.

Please indicate in general, the level at which you carry out your training and exercise regimen. 9 corresponds to "very light" exercise. For a healthy person, it is like walking slowly at his or her own pace for some minutes. 13 on the scale is "somewhat hard" exercise, but it still feels OK to continue. 17 "very hard" is very strenuous. A healthy person can still go on, but he or she really has to push him- or herself. It feels very heavy, and the person is very tired. 19 on the scale is an extremely strenuous exercise level. For most people this is the most strenuous exercise they have ever experienced.



















Which of the below best describes the level or standard of competitions that you currently enter?

- Local
- University
- Regional
- National
- International
- Other

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## Page 3: Performance Beliefs

Below you will find a list of actions and skills that are important for endurance performance. When you are taking part in your endurance sport, how confident are you that you can do the following things. In each case please rate your degree of confidence from 0 (cannot do at all) to 100 (completely certain you can do).

Manage non-injury related pain	Please select 
Ensure appropriate technique and form	Please select 
Manage my emotions before events	Please select 
Manage my emotions during events	Please select 
Manage injury related pain	Please select 
Take on appropriate nutrition during events	Please select 
Take on appropriate hydration during events	Please select 
Manage my thoughts before events	Please select 
Manage my thoughts during events	Please select 
Achieve my goals	Please select 
Manage and deal with unexpected events	Please select 
Prepare mentally for demanding events	Please select 
Pace myself appropriately	Please select 
Manage and deal with unexpected weather conditions	Please select 
Maintain my concentration	Please select 
Prepare physically for demanding events	Please select 
Perform well in challenging events	Please select 
Deal with feelings of effort and exertion	Please select 

## Page 4: Endurance Sport Experiences

Using the scale listed below, please indicate your level of agreement with the following statements

	1 - Not at all true	2	3	4 - Somewhat true	5	6	7- Completely true
When taking part in my endurance sport I have a good idea of how my body should be feeling and when	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My family or friends have told me that they believe in me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My family or friends have told me that I am good at my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tell myself that I am good at my sport and can achieve my goals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have improved my abilities and skills by watching professional endurance athletes, who are similar to me in some way, perform well.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have seen my performance ability improve gradually over time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have seen the benefits of my training reflected in how my body looks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



When things become difficult during training or competition I am able to talk myself through it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often imagine myself overcoming difficulties in my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I visualise and imagine myself doing well in my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am in good physical shape	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am at a good weight for my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Even when things have been difficult, I have still managed to perform well in my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often feel 'psyched' up before events or competitions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have improved my abilities and skills by watching non-professional endurance athletes, who are similar to me in some way, perform well.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My coach or other endurance athletes have told me that they believe in me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Through my training and competing I have been able to push the limits of my performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Using the scale listed below, please indicate your level of agreement with the following statements

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	1 - Not at all true	2	3	4 - Somewhat true	5	6	7 - Completely true
I have overcome challenges in my endurance sport through hard work and training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
After taking part in my endurance sport I am usually in a positive mood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I think about competing or taking part in my endurance sport I feel nervous	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My coach or other endurance athletes have told me that I am good at my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am often able to feel physically strong when taking part in my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have consistently reached my goals in my endurance sport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I watch others perform well in my endurance sport, and believe if they can do it so can I	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Through my training I have seen my performance improve	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My family or friends have told me that my training has improved my performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I think about competing or taking part in my endurance sport I feel excited	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I have seen others cope with difficulties in their endurance sports, and believe if they can do it so can I	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My coach or other endurance athletes have told me that my training has improved my performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My physique has improved as a result of my training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can feel in my body that I possess a good level of physical fitness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Page 5: End

Thank you very much for taking part in this ongoing research project.

We do not anticipate any issues arising from your participation in this study, but if you would like further information on dealing with stress and emotions you may find it useful to visit the following website - <http://www.nhs.uk/livewell/mentalhealth/Pages/Mentalhealthhome.aspx>

If you would like to receive further information, or for signposting to relevant professionals please contact Paul Anstiss at [pa298@kent.ac.uk](mailto:pa298@kent.ac.uk)

If you would like to receive details about the findings of the study please leave your email in the box below.

If you would like to be contacted about future research opportunities, such as intervention studies, please leave your email in the box below.

Please leave your email below if you wish to be contacted with the details/findings of this study

Please enter a valid email address.

Please leave your email below if you would like to be contacted about future research opportunities

Please enter a valid email address.

## **Appendix H: Information Sheet and Consent Form for Lab Study (Chapter 4)**

### **INVESTIGATING THE EFFECTS OF SELF-BELIEF ON ENDURANCE PERFORMANCE**

#### **INFORMATION SHEET FOR PARTICIPANTS**

Thank you for showing an interest in this project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate we thank you. If you decide not to take part there will be no disadvantage to you of any kind and we thank you for considering our request.

This study has been approved by the School of Sport and Exercise Sciences (SSES) Research Ethics Committee.

#### **What is the aim of the project?**

We are interested in examining the role of self-belief in endurance performance. Although there is some research to suggest that our beliefs in relation to how well we will do can affect our performance, we still do not know enough to help us enhance performance. It is hoped that with the knowledge gained from this study, we can begin to design psychological interventions to help aid endurance performance.

#### **What types of participants are needed?**

In order for you to be able to participate in this project you need to be 18-55, free of any chronic illnesses or injury which may prevent you from taking part in this study.

We are looking for individuals who are: currently engaging in distance running at least twice a week and have completed at least three distance events (5km+) in the last year.

#### **What will participants be asked to do?**

Should you agree to take part in this project you will be asked to visit the University of Kent Sport Science Laboratory (ME4 4AG, Medway Building) on four separate occasions spread across approximately two-three weeks. You will be asked to comply with certain instructions during this study and for the 24 hours prior to each of your visits.

For the 24 hours prior to each of your visits you will be asked to: sleep for at least 7 hours and avoid alcohol.

Additionally, throughout the study you will be asked to maintain your current training program and diet.

The first visit should take approximately 90 minutes, and the second, third and fourth visits should each take no longer than 60 minutes. At least 24 hours will

be required between visits. The total time investment (excluding travel) is expected to be between 5-6 hours spread across 2-3 weeks.

During your first visit, we will ask you to sign a consent form and a health questionnaire. We will then take measures of your resting heart rate and blood pressure. Once these are done you will be asked to complete questionnaires in relation to beliefs you may have about yourself. We will also weigh and measure you. You will then complete something called a Vo2 max test which will last approximately 15 minutes. This test will allow us to measure your maximal oxygen uptake, which provides a good indicator of your aerobic fitness. We will require you to wear a facemask during this fitness test so that we can take measurements of your expired air. The facemask covers your nose and mouth, but it is not uncomfortable and it will not impede your breathing. This running test starts at a low intensity and gets progressively harder until you cannot continue. Following this test you will be allowed to warm down, and then asked to relax until you feel rested. You will then be asked to warm up again and complete a 5km run on the treadmill as quick as you can.

For visit two, three and four you will be asked to come in and complete a 5km run on the treadmill as quickly as you can. On these visits, prior to your 5km run you will be asked to complete something called a 'preload'. This 'preload' will consist of you running at a predicted 5km pace (based off your performance history and physiological data) and will last for 6 minutes. Following this preload you will then be asked some questions about how you think you will perform in the upcoming run. You will then be asked to the run 5km as quick as you can. At the end of your fourth visit, we will also ask you several questions in relation to how you found taking part in this study.

### **Are there any benefits involved in taking part?**

We will tell you your measured  $\dot{V}O_2\text{max}$ , which is a measure of your aerobic fitness. You will also receive some information on psychological skills and strategies on improving performance from the main researcher. Additionally, if you wish you can leave your contact details with the researcher, who can provide you with a copy of the overall research findings, which will be written up in a report.

### **Are there any risks involved in taking part?**

During the incremental test and 5km runs, you will experience uncomfortable exercise sensations that are typical for high intensity exercise. You are, however, likely to be familiar with these sensations from your own experiences with exercising regularly. During or after these tests, you may experience light-headedness, fainting, discomfort, muscle soreness, nausea and in very rare cases, a cardiac event. These risks, however, are the same during your own regular exercise. For those without underlying heart disease, the risk of a cardiac event is extremely low.

Nevertheless, you will be asked to complete a health questionnaire and we will also measure your resting heartrate and blood pressure, prior to the start to assess your suitability and to further reduce the risk. At all times during the study, you will be closely supervised by a researcher (who is first aid trained) and a person trained in first aid will always be on site. There is a small chance of picking up an injury (e.g., a muscle pull or strain) and you may also suffer some muscles aches and soreness in the days after testing. These are typical consequences of training. To further reduce the risk of injury, you will have the chance to warm up before the exercise and warm down afterwards too.

### **Can participants change their mind and withdraw from the project?**

You may withdraw from participation in the project at any time and without any disadvantage to yourself of any kind. If you decide to withdraw prior to completion of the study, your data will be destroyed and it will not be included in the analysis.

### **What data or information will be collected and what use will be made of it?**

We will be collecting several types of data throughout this study such as physiological (your  $\dot{V}O_{2max}$  and heart rate during your 5km runs), psychological (your completed questionnaires) and your performance data (how fast it took you to run the 5km). All data will be stored securely on password protected spreadsheets. Additionally, your completed paper questionnaires will be kept in a locked cabinet in a PhD office in the Medway Building. Your individual results and performance cannot be identified in any of these reports.

Anonymised data may be shared with a research journal to prove that our data is genuine.

### **What if participants have any questions?**

If you would like to receive feedback regarding the results or have any questions about the project, either now or in the future, please feel free to contact:

Researcher Information:

Paul Anstiss – [pa298@kent.ac.uk](mailto:pa298@kent.ac.uk)

Supervisor Information:

Carla Meijen - [C.Meijen@kent.ac.uk](mailto:C.Meijen@kent.ac.uk)

Department Information:

School of Sport and Exercise Sciences - +44 (0)1634 888858

## Consent Form

Participant code:

**Title of project:** An investigation of the effects of self-belief on endurance performance.

**Name of investigator:** Paul Anstiss

Please initial box

8. I confirm that I have read and understand the information contained on the accompanying *Participant Information Sheet (dated 24/10/16)* for the above study. I have had the opportunity to consider the information, to ask questions and I have had these answered satisfactorily.

9. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. Paul Anstiss can be contacted by email ([pa298@kent.ac.uk](mailto:pa298@kent.ac.uk))

10. I understand that all of my data (such as questionnaire responses, or task performance) will be anonymised by assigning me a code before analysis. I give permission for members of the research team to have access to my anonymised data.

11. I am aware that the researchers intend to publish the results from this study. I am aware that only group data will be published.

12. I understand that anonymised group data may be disclosed to a research journal to prove that the research findings are genuine.

13. I agree to take part in the above research project.

---

Name of participant

Date

Signature



## **Appendix I: Pre-Visit Instructions and Checklist (Chapter 4)**

### **PRE-VISIT INSTRUCTION SHEET**

Thank you for agreeing to take part in this study. Here are some instructions we hope you will follow as accurately as possible in preparation for your three testing sessions.

Throughout your involvement in the study:

- Please maintain your current exercise regime.
- Please maintain your current diet.

Within 24 hours of a laboratory visit:

- Avoid heavy / strenuous exercise.
- Sleep for at least 7 hours.
- Do not consume alcohol.
- Please attend each laboratory visit well hydrated. To do this, please drink 40 ml of water for each kg of body weight during the 24 hours preceding a visit. For your weight, this would be \_\_\_\_\_ ml of water.

Within 3 hours of a laboratory visit:

- Avoid caffeine (e.g., tea, coffee, Coca Cola, energy drinks / tablets).

Attending the laboratory:

- Please wear similar clothing (i.e., shoes) for each laboratory visit.
- Report if you have taken any medication or had any acute illness, injury, or infection.

INSTRUCTION SHEET CHECKLIST

**Participant ID:**  
**Date:**

**Visit:**

Have you taken any form of medication today? **YES/NO**

Do you have any form of illness or infection? **YES/NO**

Do you have an injury? **YES/NO**

Within the last 24 hours:

Have you avoided heavy/ strenuous exercise? **YES/NO**

Have you slept for 7 hours or longer? **YES/NO**

Have you consumed alcohol? **YES/NO**

Have you consumed the recommended intake of water? **YES/NO**

Within the last 3 hours:

Have you consumed any caffeine? **YES/NO**

## Appendix J: Health Questionnaire (Chapter 4)

### HEALTH QUESTIONNAIRE



Name.....

Date of Birth..... Age.....

Please answer these questions truthfully and completely. The sole purpose of this questionnaire is to ensure that you are in a fit and healthy state to complete the exercise test.

ANY INFORMATION CONTAINED HEREIN WILL BE TREATED AS CONFIDENTIAL.

#### SECTION 1: GENERAL HEALTH QUESTIONS

Please read the 8 questions below carefully and answer each one honestly: check YES or NO.

	YES	NO
1. Has your doctor ever said that you have a heart condition or high blood pressure?	<input type="checkbox"/>	<input type="checkbox"/>
2. Do you feel pain in your chest at rest, during your daily activities of living, or when you do physical activity?	<input type="checkbox"/>	<input type="checkbox"/>
3. Do you lose balance because of dizziness or have you lost consciousness in the last 12 months? (Please answer NO if your dizziness was associated with over-breathing including vigorous exercise).	<input type="checkbox"/>	<input type="checkbox"/>
4. Have you ever been diagnosed with another chronic medical condition (other than heart disease or high blood pressure)?	<input type="checkbox"/>	<input type="checkbox"/>

If yes, please list condition(s) here:

5. Are you currently taking prescribed medications for a chronic medical condition?

If yes, please list condition(s) and medications here:

6. Do you currently have (or have you had within the past 12 months) a bone, joint or soft tissue (muscle, ligament, or tendon) problem that could be made worse by becoming more physically active? Please answer NO if you had a problem in the past but it *does not limit your ability* to be physically active.

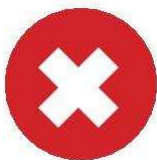
If yes, please list condition(s) here:

7. Has your doctor ever said that you should only do medically supervised physical activity?
8. Are you, or is there any chance you could be, pregnant?

If you answered NO to all of the questions above, you are cleared to take part in the exercise test



Go to SECTION 3 to sign the form. You do not need to complete section 2.



If you answered YES to one or more of the questions in Section 1 - PLEASE GO TO SECTION 2.

## Section 2: CHRONIC MEDICAL CONDITIONS

Please read the questions below carefully and answer each one honestly: check YES or NO.

	YES	NO
<p><b>1. Do you have arthritis, osteoporosis, or back problems?</b></p> <p>If YES answer questions 1a-1c. If NO go to Question 2.</p>	<input type="checkbox"/>	<input type="checkbox"/>
1a. Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking any medications or other treatments).	<input type="checkbox"/>	<input type="checkbox"/>
1b. Do you have joint problems causing pain, a recent fracture or fracture caused by osteoporosis or cancer, displaced vertebrae (e.g., spondylolisthesis), and/or spondyloysis/pars defect (a crack in the bony ring on the back of the spinal column)?	<input type="checkbox"/>	<input type="checkbox"/>
1c. Have you had steroid injections or taken steroid tablets regularly for more than 3 months?	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>2. Do you have cancer of any kind?</b></p> <p>If YES answer questions 2a-2b. If NO, go to Question 3.</p>	<input type="checkbox"/>	<input type="checkbox"/>
2a. Does your cancer diagnosis include any of the following types: lung/bronchogenic, multiple myeloma (cancer of plasma cells), head and neck?	<input type="checkbox"/>	<input type="checkbox"/>
2b. Are you currently receiving cancer therapy (such as chemotherapy or radiotherapy)?	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>3. Do you have heart disease or cardiovascular disease? This includes coronary artery disease, high blood pressure, heart failure, diagnosed abnormality or heart rhythm.</b></p> <p>If YES answer questions 3a-3e. If NO go to Question 4.</p>	<input type="checkbox"/>	<input type="checkbox"/>
3a. Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking any medications or other treatments).	<input type="checkbox"/>	<input type="checkbox"/>
3b. Do you have an irregular heartbeat that requires medical management? (e.g., atrial fibrillation, premature ventricular contraction)	<input type="checkbox"/>	<input type="checkbox"/>
3c. Do you have chronic heart failure?	<input type="checkbox"/>	<input type="checkbox"/>

- 3d. Do you have a resting blood pressure equal to or greater than 160/90mmHg with or without medication? Answer YES if you do not know your resting blood pressure.
- 3e. Do you have diagnosed coronary artery (cardiovascular) disease and have not participated in regular physical activity in the last 2 months?

	YES	NO
<p><b>4. Do you have any metabolic conditions? This includes Type 1 Diabetes, Type 2 Diabetes and Pre-Diabetes.</b> If YES answer questions 4a-4c. If NO, go to Question 5.</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p>4a. Is your blood sugar often above 13mmol/L? (Answer YES if you are not sure).</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p>4b. Do you have any signs or symptoms of diabetes complications such as heart or vascular disease and/or complications affecting your eyes, kidneys, OR the sensation in your toes and feet?</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p>4c. Do you have other metabolic conditions (such as thyroid disorders, current pregnancy related diabetes, chronic kidney disease, or liver problems)?</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>5. Do you have any mental health problems or learning difficulties?</b> This includes Alzheimer's, dementia, depression, anxiety disorder, eating disorder, psychotic disorder, intellectual disability and down syndrome.</p> <p>If YES answer questions 5a-5b. If NO go to Question 6.</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p>5a. Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking any medications or other treatments).</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p>5b. Do you also have back problems affecting nerves or muscles?</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>6. Do you have a respiratory disease?</b> This includes chronic obstructive pulmonary disease, asthma, pulmonary high blood pressure.</p> <p>If YES answer questions 6a-6d. If NO, go to Question 7.</p>	<input type="checkbox"/>	<input type="checkbox"/>

- 6a. Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking any medications or other treatments).  YES  NO
- 6b. Has your doctor ever said you blood oxygen level is low at rest or during exercise and/or that you require supplemental oxygen therapy?  YES  NO
- 6c. If asthmatic, do you currently have symptoms of chest tightness, wheezing, laboured breathing, consistent cough (more than 2 days/week), or have you used your rescue medication more than twice in the last week?  YES  NO
- 6d. Has your doctor ever said you have high blood pressure in the blood vessels of your lungs?  YES  NO
- 7. Do you have a spinal cord injury?** This includes tetraplegia and paraplegia.  YES  NO
- If YES answer questions 7a-7c. If NO, go to Question 8.
- 7a. Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking any medications or other treatments).  YES  NO
- 7b. Do you commonly exhibit low resting blood pressure significant enough to cause dizziness, light-headedness, and/or fainting?  YES  NO
- 7c. Has your physician indicated that you exhibit sudden bouts of high blood pressure (known as autonomic dysreflexia)?  YES  NO

	YES	NO
<b>8. Have you had a stroke?</b> This includes transient ischemic attack (TIA) or cerebrovascular event. <input type="checkbox"/> YES <input type="checkbox"/> NO	<input type="checkbox"/>	<input type="checkbox"/>
If YES answer questions 8a-8c. If NO go to Question 9.		
8a. Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking any medications or other treatments). <input type="checkbox"/> YES <input type="checkbox"/> NO	<input type="checkbox"/>	<input type="checkbox"/>
8b. Do you have any impairment in walking or mobility? <input type="checkbox"/> YES <input type="checkbox"/> NO	<input type="checkbox"/>	<input type="checkbox"/>
8c. Have you experienced a stroke or impairment in nerves or muscles in the past 6 months? <input type="checkbox"/> YES <input type="checkbox"/> NO	<input type="checkbox"/>	<input type="checkbox"/>
<b>9. Do you have any other medical condition which is not listed above or do you have two or more medical conditions?</b> <input type="checkbox"/> YES <input type="checkbox"/> NO	<input type="checkbox"/>	<input type="checkbox"/>
If you have other medical conditions, answer questions 9a-9c. If NO go to Question 10.		

- 9a. Have you experienced a blackout, fainted, or lost consciousness as a result of a head injury within the last 12 months OR have you had a diagnosed concussion within the last 12 months?
- 9b. Do you have a medical condition that is not listed (such as epilepsy, neurological conditions, and kidney problems)?
- 9c. Do you currently live with two or more medical conditions?
- Please list your medical condition(s) and any related medications here:

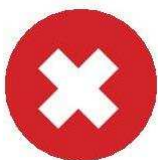
10. Have you had a viral infection in the last 2 weeks (cough, cold, sore throat, etc.)? If YES please provide details below:

11. Is there any other reason why you cannot take part in this exercise test? If YES please provide details below:

Please see below for recommendations for your current medical condition and sign this document:



If you answered NO to all of the follow-up questions about your medical condition, you are cleared to take part in the exercise test.



If you answered YES to one or more of the follow-up questions about your medical condition it is strongly advised that you should seek further advice from a medical professional before taking part in the exercise test.

### SECTION 3: DECLARATION



Please read and sign the declaration below:

*I, the undersigned, have read, understood and completed this questionnaire to the best of my knowledge.*

NAME: .....

SIGNATURE: .....DATE: .....

**Appendix K: Baseline Demographic and Performance Questionnaire (Chapter 4)**

**Participant Code:**

**Date:**

Please answer the below questions as accurately as you can. Please provide an estimate if you cannot answer a question with specific details. If you do not wish to answer a question, please leave it blank. Information that you provide shall be treated as confidential, as detailed in the Research Study Information Sheet.

**Age:**

**Gender:** M / F / Other

**Nationality:**

**How many years have you been involved in running, including recreational (non-competitive) involvement?**

.....  
.....

**On average, how many hours do you train each week?**

.....  
.....

**Approximately how many weeks do you train each year?**

.....  
.....

**How many years have you been taking part in running competitions / races?**

.....  
.....

**What is your main competitive distance (this can be a single distance or a range of distances):**

.....  
.....

**How many years have you been competing at your main competitive distance(s)?**

.....  
.....

**What is your personal best time in your main competitive distance(s) within the last 12 months? Please provide the approximate distance, performance time, and date.**

.....  
.....

**What is your personal best time in a 5km race in last 12 months? Please provide the approximate performance time, and date.**

.....  
.....

**How many times have you competed in 5km running competitions over the previous 12 months?**

2-5                  6-10                  11-15                  16-20                  21 or more

**How many times have you competed in running competitions (any distances) over the previous 12 months?**

2-5                  6-10                  11-15                  16-20                  21 or more

**Please tell us more about your previous races where you were motivated to perform well over the last 12 months. Please complete at least two of the below. The more you provide, the more the help this will be.**

When?: .....-.....-..... .....	Distance: .....	Finishing Time:
When?: .....-.....-..... .....	Distance: .....	Finishing Time:
When?: .....-.....-..... .....	Distance: .....	Finishing Time:
When?: .....-.....-..... .....	Distance: .....	Finishing Time:
When?: .....-.....-..... .....	Distance: .....	Finishing Time:
When?: .....-.....-..... .....	Distance: .....	Finishing Time:
When?: .....-.....-..... .....	Distance: .....	Finishing Time:
When?: .....-.....-..... .....	Distance: .....	Finishing Time:

**Could you estimate how many times you have competed in running races (any distances) in total?**

- 2-5
- 6-10
- 11-20
- 21-50
- 51-100
- 101 or more

**Which of the below best describes the level or standard of competitions that you currently enter?**

- Local    University    Regional    National    International    Other
- (please state)
- .....

**What is the highest level or standard that you have competed at?**

Local University  
(please state)

Regional

National

International

Other

.....

## **Appendix L: RPE Instructions (Chapter 4)**

We want you to rate how effortful, heavy, and strenuous the exercise feels to you.

We call this perceived effort or perceived exertion. Perceived effort depends mainly on how hard you have to drive your legs and how heavy your breathing is. It does NOT depend on muscle pain (i.e., the aching and burning sensation in your leg or arm muscles). Look at the scale below. We want you to use this scale from 6 to 20, where 6 means “no exertion at all” and 20 means “maximal exertion”.

6 No exertion at all

7 Extremely light

8

9 Very light

10

11 Light

12

13 Somewhat hard

14

15 Hard (heavy)

16

17 Very hard

18

19 Extremely hard

20 Maximal exertion

To help you choose a number that corresponds to how you feel within this range, consider the following:

- 9 Very light. As for a healthy person taking a short walk at his or her own pace.
- 13 Somewhat hard. It still feels OK to continue.
- 15 It is hard and tiring, but continuing is not terribly difficult.
- 17 Very hard. It is very strenuous. You can still go on, but you really have to push yourself and you are very tired.
- 19 An extremely strenuous level. For most people this is the most strenuous exercise they have ever experienced.

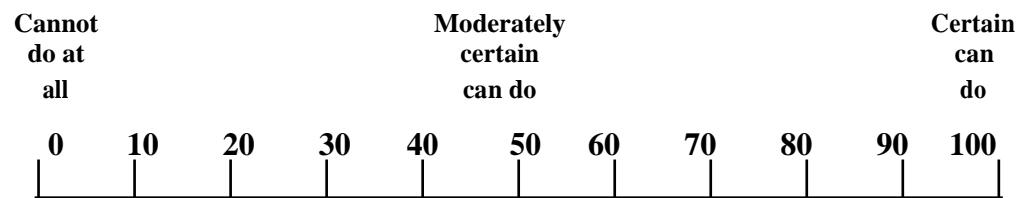
When rating your perceived effort, start with a verbal expression and then choose a number. If your perception of effort is light, rate 10, 11, or 12; if it is very hard, rate 16, 17, or 18, and so on. You can use even numbers or odd numbers. You could also select a half number.

### Appendix M: Example Participant Hierarchical Self-Efficacy Scale (Chapter 4)

Your time on your 1<sup>st</sup> visit was:

Your time on your 2<sup>nd</sup> visit was:

**Instructions:** How confident are you that you can complete the 5k in the following times. For each of the following times, write a number from 0-100 using the scale below.



- 1. 25:50 \_\_\_\_\_
- 2. 25:25 \_\_\_\_\_
- 3. 25:00 \_\_\_\_\_
- 4. 24:35 \_\_\_\_\_
- 5. 24:10 \_\_\_\_\_
- 6. 23:45 \_\_\_\_\_
- 7. 23:20 \_\_\_\_\_
- 8. 22:55 \_\_\_\_\_
- 9. 22:30 \_\_\_\_\_





## Appendix O: PANAS Questionnaire (Chapter 4)

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way right now, that is, at the present moment:

1	2	3	4	5
very slightly or	a little	moderately	quite a bit	extremely
not at all				

\_\_\_\_\_ interested

\_\_\_\_\_ irritable

\_\_\_\_\_ distressed

\_\_\_\_\_ alert

\_\_\_\_\_ excited

\_\_\_\_\_ ashamed

\_\_\_\_\_ upset

\_\_\_\_\_ inspired

\_\_\_\_\_ strong

\_\_\_\_\_ nervous

\_\_\_\_\_ guilty

\_\_\_\_\_ determined

\_\_\_\_\_ scared

\_\_\_\_\_ attentive

\_\_\_\_\_ hostile

\_\_\_\_\_ jittery

\_\_\_\_\_ enthusiastic

\_\_\_\_\_ active

\_\_\_\_\_ proud

\_\_\_\_\_ afraid

## Appendix P: Revised Causal Dimension Scale (Chapter 4)

You completed the 5km in:

How satisfied were you with this performance? Please circle a response below:

1	2	3	4	5	6	7
Not satisfied at all			Somewhat satisfied			Completely satisfied

**What do you believe was the main cause of your performance on this task?**

**Instructions:** Think about the reason or reasons you have written above. The items below concern your impressions or opinions of this cause or causes of your performance. Circle one number for each of the following questions.

Is this cause(s) something:

<b>That reflects an aspect of yourself situation</b>	9 8 7 6 5 4 3 2 1	<b>reflects an aspect of the situation</b>
<b>Manageable by you</b>	9 8 7 6 5 4 3 2 1	<b>not manageable by you</b>
<b>Permanent</b>	9 8 7 6 5 4 3 2 1	<b>temporary</b>
<b>You can regulate</b>	9 8 7 6 5 4 3 2 1	<b>you cannot regulate</b>
<b>Over which others have control control</b>	9 8 7 6 5 4 3 2 1	<b>over which others have no control</b>
<b>Inside of you</b>	9 8 7 6 5 4 3 2 1	<b>outside of you</b>
<b>Stable over time</b>	9 8 7 6 5 4 3 2 1	<b>variable over time</b>
<b>Under the power of other people others</b>	9 8 7 6 5 4 3 2 1	<b>not under the power of others</b>
<b>Something about you</b>	9 8 7 6 5 4 3 2 1	<b>something about others</b>
<b>Over which you have power power</b>	9 8 7 6 5 4 3 2 1	<b>over which you have no power</b>
<b>Unchangeable</b>	9 8 7 6 5 4 3 2 1	<b>changeable</b>
<b>Other people can regulate regulate</b>	9 8 7 6 5 4 3 2 1	<b>other people cannot regulate</b>

## **Appendix Q: End of Study Deception Check (Chapter 4)**

**INSTRUCTIONS:** Considering all three performances, why do you believe you performed the way that you did?

For example if you performed similarly on all visits why do you believe this occurred? Or if your performance improved/worsened as testing went on why do you believe this occurred?

**Time on Visit 1:**

**Time on Visit 2:**

**Time on Visit 3:**

**INSTRUCTIONS:** To the best of your knowledge, what do you believe was the main aim of the study that you just took part in?

## Appendix R: Baseline Questionnaire (Chapter 5)

7/17/2018

Qualtrics Survey Software

### Default Question Block

#### Information Sheet & Informed Consent

The following study is designed to investigate the effects of a brief online mental skills intervention on the performance of endurance athletes. This study is being conducted by Paul Anstiss and Ian Farr, two PhD students at the University of Kent. This study has been approved by the School of Sport and Exercise Sciences (SSES) Research Ethics Committee.

#### Who are we looking for?

In order to take part in this survey it is important that you meet the following criteria:

- You are at least 18 years of age
- You are fluent in English
- You are currently training at least twice a week in your endurance sport
- You have an upcoming race, event, or competition within the next 2 months and you have a specific goal for this event.

#### What constitutes a race, event or competition?

A race, event, or competition can cover a wide variety of experiences. What we are looking for is a situation in which you are motivated to perform well and you have a specific goal of what you would like to achieve. This could be a mass participation type event (such as a marathon, triathlon or an audax) or a solo event. If you are unsure if your event, competition, or race is suitable please feel free to contact the lead researcher Paul Anstiss (pa298@kent.ac.uk) to confirm.

#### Why are we carrying out this research?

Research has suggested that mental skills interventions can help improve endurance performance, however the majority of this research only ever occurs in laboratory settings. We are interested in examining if a brief mental skills intervention that is delivered online can play a role in real world competitive settings.

#### What will I be asked to do?

If you decide to take part we will ask you to register your interest at the end of this form. You will be asked to provide some details about you (e.g. your age, gender, endurance sport), the name of the event, competition, or race that you are taking part in, the date that this will occur, and a contact email address.

Two weeks before this event we will email you a link to a questionnaire which contains some questions about your perceptions of your endurance performance. After completing these questions you will be randomised to one of our interventions or to the control group. The interventions themselves are designed to be brief and should take you no longer than 10-15 minutes to complete. We will give you instructions on what to do with these interventions and how you may use them in your upcoming event, competition, or race. If you are in the control condition you will not receive an intervention, and you will be asked to prepare and take part in your event, competition, or race as you normally would. Control conditions are important as they allow us to work out the potential positive effects of an intervention. If you are in the control condition you will receive information on the other interventions at the end of the study.

Two to three days after your event you will receive a follow up email containing a link to a final questionnaire. This will ask you questions on how you performed in your event, your experiences of stress and coping during the event, and how you found the intervention (if applicable). This follow up survey will take approximately 10 minutes to complete.

#### Do I have to take part in this study?

<https://kentpsych.eu.qualtrics.com/WRQualtricsControlPanel/Ajax.php?action=GetSurveyPrintPreview>

1/4

Your participation in this study is entirely voluntary. You are free to withdraw your participation at any time during the study without penalty. At the end of the study your personal email which we have collected for contacting you will be deleted. This study entails no risks beyond those routinely encountered in daily life.

Your responses to the survey will be encrypted and stored securely and safely on the Qualtrics website. Qualtrics is a commonly used survey tool used by over 300 organisations and approximately 130 higher education institutes across the UK. Results of this project may be published, but any data included will in no way be linked to any specific participant. Your individual results cannot be identified in any of these reports. You are welcome to request a copy of the summary of the results of the project should you wish, and there is an opportunity to leave your contact details at the end of the study.

If you have any questions concerning this study, the results, or your participation in this research please feel free to contact the lead researcher: Paul Anstiss (pa298@kent.ac.uk), the assistant researcher: Ian Farr (if55@kent.ac.uk) or their supervisor: Dr Carla Meijen (carla.meijen@stmarys.ac.uk).

**\*Click on the "I agree" button below to indicate that you have read this form and understand the information above. By clicking on the "I agree" button, you are providing an online signature for your consent to participate in the study.**

I agree

What is your gender?

- Male
- Female
- Other
- Prefer not to say

What is your age?

What is your primary endurance sport?

- Running
- Cycling
- Swimming
- Triathlon (Including Ironman)
- Rowing
- Racewalking
- Canoeing
- Cross-country Skiing
- Other (Please specify)

Other:

How long have you been taking part in your endurance sport? (Please indicate to the closest year)

How many hours a week do you train for your endurance sport? Please provide a rounded number

Have you had any prior experience with the use of psychological interventions to aid your endurance performance?

Please choose the answer that best fits with your previous experience

- Yes - I have sought help from professional qualified individuals (e.g. Sport Psychologists)
- Yes - I have sought information from books, websites or other similar sources
- Yes - Other
- No

Please detail your experience of your use of psychological interventions:

What is the name of the event that you are competing/taking part in?

When will this event take place? Please provide a date: (DD/MM/YYYY)

What is the duration and/or distance of your event?

What is your goal for the event? (e.g. a finishing time, a place, a distance to cover)

Thank you for registering your interest in the current study. Two weeks before the event date you have inputted on the previous page, you will receive an email containing a link to the next aspect of this study, which will contain information about the possible intervention.

**In order to ensure you receive this information please enter a contact email below, which you will use for the rest of the study.**

To ensure that follow up emails do not end up in your spam box, please add: paul.anstiss@gmail.com and pa298@kent.ac.uk to your contact list.



## Appendix S: Intervention Questionnaire (Chapter 5)

7/17/2018

Qualtrics Survey Software

### Default Question Block

#### Online Mental Skills Intervention for Endurance Performance

Thank you for your continued engagement in this study. The form you are about to complete will randomly allocate you to an intervention, or to the control condition.

For the intervention conditions, we expect these to take approximately 10-15 minutes to complete. We suggest that you complete these in one sitting in a quiet location where you will be able to concentrate.

Information about the interventions will be emailed to you after the completion of this questionnaire, however, you may wish to still write down notes for yourself throughout.

If you have any questions on this, or anything else to do with the study please contact Paul Anstiss at [pa298@kent.ac.uk](mailto:pa298@kent.ac.uk).

To allow us to follow your involvement in this study, please enter the email you previously provided below:

When you first indicated your interest in this study you were asked to provide a goal for an upcoming event.

Do you still have the same goal for this event?

- Yes  
 No

What has your goal changed too?

This next section looks to gain an understanding of your beliefs as an endurance athlete. Please take your time filling these questions out, and remember that there are no wrong or right answers.

Below you will find a list of actions and skills that are important for endurance performance. When you are taking part in your endurance sport, how confident are you that you can do the following things. In each case please rate your degree of confidence from 0 (cannot do at all) to 100 (completely certain can do).

	0 - No confidence at all	10	20	30	40	50 - Moderately confident	60	70	80	90	100 - Completely confident
Manage non-injury related pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ensure appropriate technique and form	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	0 - No confidence at all	10	20	30	40	50 - Moderately confident	60	70	80	90	100 - Completely confident
Manage my emotions before events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manage my emotions during events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manage injury related pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Take on appropriate nutrition during events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	0 - No confidence at all	10	20	30	40	50 - Moderately confident	60	70	80	90	100 - Completely confident
Take on appropriate hydration during events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manage my thoughts before events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manage my thoughts during events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Achieve my goals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manage and deal with unexpected events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prepare mentally for demanding events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	0 - No confidence at all	10	20	30	40	50 - Moderately confident	60	70	80	90	100 - Completely confident
Pace myself appropriately	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manage and deal with unexpected weather conditions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maintain my concentration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prepare physically for demanding events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Perform well in challenging events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Implementation Intentions**

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When taking part in your endurance sport it is likely that you experience a variety of challenging or difficult situations and sensations.

These can be related to what you are feeling physically (pain, tiredness), mentally (boredom, frustration) or may be related to something that has happened (a competitor has gone past you in a race).

The list of factors which can affect us in endurance sports is almost limitless, but what can help counter-act these, is having a response in place for when this occurs. This is a psychological process called implementation intentions. Implementation intentions are a form of if-then planning.

Implementation intentions are not "Plan B's", instead they are a form of action planning. It involves you identifying difficult or challenging aspects of performance, and then providing a solution for them. The idea behind this, is that when you encounter these challenges and/or difficulties when performing, you do not need to spend time thinking about how you will deal with it, as you already have a plan.

Research has shown that implementation intentions can help improve our emotions, coping and behavior in a variety of tasks.

Below you will find some some example implementation intentions. We have provided you with two "If's" which are commonly experienced by endurance athletes when training. We would like you to identify the potential "Then" that you would use.

Items	If I get home from work/school and feel like I have no energy to train:
Then I will immediately get changed into my training clothes	
Then I will remind myself of my specific mantra or motto	
Then I will remind myself that other competitors are likely training right now	
Then I will start counting back from 100 in my head	
Then I will focus on my technique and breathing	
	If during training I start feeling like I want to stop

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We would now like you to think of at least 3 difficulties that you may encounter during your upcoming event. This may be related to something you would experience during the event (e.g. pain, discomfort, boredom, worry) or before the event (e.g. feelings of anxiety, worry about letting people down). What is important is that these represent difficult and challenging aspects to you.

Difficulty:

Difficulty:

Difficulty:

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Now that you have identified potential difficulties, we would like you attempt to think up some strategies which may help you with these. You may wish to think of strategies that you have used previously, or that you have seen other endurance athletes use.

For example you may wish to consider:

- Specific words or phrases that you can repeat to yourself
- Creating a specific image in your head
- Focusing on your breathing
- Encouraging yourself to relax
- Ensuring back up plans for nutrition/hydration

What is important, is that you choose a 'then' plan that you believe will be effective for you.

The difficulties you reported on the previous page are presented below. In the text-box we would like you to attempt to right out a if-then plan for yourself - using the structure ""If (difficulty), then I will (strategy)".

You can also provide more than one strategy for each difficulty if you wish.

`\${q://QID20/ChoiceTextEntryValue/1}`

`\${q://QID20/ChoiceTextEntryValue/2}`

`\${q://QID20/ChoiceTextEntryValue/3}`

Now that you have chosen these three if-then plans, it is important that you practice using them. By practicing these in training or saying them out loud at various times of the day, it becomes more automatic and natural.

Over the next three weeks, we would like you to attempt to use your if-then plans in any upcoming training sessions. Additionally, we would like you to try and say your if-then plans out loud to yourself at least once a day.

**Self-Talk****These page timer metrics will not be displayed to the recipient.**First Click: *0 seconds*Last Click: *0 seconds*Page Submit: *0 seconds*Click Count: *0 clicks*

When you are taking part in your endurance sport, it is common to repeat certain words or phrases to yourself silently (in your head) or out loud. These words and phrases are called "self-talk" statements.

Many athletes are unaware of the content of their thoughts, but this "internal dialogue" can influence how you feel and how you perform. Some self-talk statements have been found to improve endurance performance, whereas other self-talk statements may have a negative effect on endurance performance. This next section will help you to identify constructive self-talk statements that you can practice in training and use in your upcoming event.

We would now like you to recall some self-talk statements you have may have said to yourself during a previous training session, or a previous event.

For example, these may have been something that you said to yourself to help counteract the pain or fatigue you were feeling, or when a competitor went past you.

Do not feel that you must write a self-talk statement for each box, simply list as many as you can remember.

Self-Talk Statement 1:

Self-Talk Statement 2:

Self-Talk Statement 3:

Self-Talk Statement 4:

Self-Talk Statement 5:

Self-Talk Statement 6:

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Some self-talk statements have a positive effect on how you feel, whereas others have no effect or even a negative effect. Use the drag options to indicate the effect each statement had on how you felt.

With the statements you have previously listed, please consider if these had a positive, negative, or no effect on how you felt.

Items	Positive (+)
<code>#{q://QID43/ChoiceTextEntryValue/1}</code>	<div style="border: 1px solid black; width: 100%; height: 100%;"></div>
<code>#{q://QID43/ChoiceTextEntryValue/2}</code>	
<code>#{q://QID43/ChoiceTextEntryValue/3}</code>	
<code>#{q://QID43/ChoiceTextEntryValue/4}</code>	
<code>#{q://QID43/ChoiceTextEntryValue/5}</code>	
<code>#{q://QID43/ChoiceTextEntryValue/6}</code>	
	Negative (-)

No effect
-----------

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Click Count: *0 clicks*

We would now like you to think of four self-talk statements that you think would be most beneficial during your upcoming event.

You may wish to consider the statements that you have used previously, and we also have a list of statements that other endurance athletes have used as well below. What is most important is that you pick statements which you believe will be effective for yourself.

**Example Self-Talk Statements**

- Feeling good
- Light and easy
- Push it
- Keep going, be strong
- Drive forward
- Smash this!
- Keep pushing
- Time to go to work
- You're going to dominate
- Pain is temporary
- You're in the best shape of your life
- Fast and powerful

Self-Talk Statement 1:

Self-Talk Statement 2:

Self-Talk Statement 3:

Self-Talk Statement 4:

Now that you have chosen these four statements, it is important that you practise using them. Self-talk is a skill that is developed through practice, like a physical skill. By practicing self-talk in training or at various times of the day, it becomes more automatic and natural.

Over the next three weeks, we would like you to practise your statements at least twice a day. You could say the statements silently in your head or you could say them out loud. To help you make the most of these statements, there are three things to remember:

1. Remind yourself of your four chosen statements twice a day when thinking about your upcoming event, or another time when they might be helpful (e.g. training).
2. During your event, use your statements whenever you think they might be helpful. We suggest using your statements often.
3. During difficult or challenging periods of your event, it may be likely that you will use unhelpful self-talk statements that encourage you to "give up" and put in less effort. You can use a countering technique to keep going. Every time you hear yourself repeating a negative statement, you should recognize it and respond with a motivational statement. For example, if you said to yourself, "This hurts, I want to give up", at the halfway point of a task, you could respond with the phrase, "Come on, I can do this!". This is a technique that endurance athletes have used successfully in the past.

### Control

You have been randomly allocated to the control condition. Control conditions are important as they allow us to work out the potential benefit of an intervention.

We would like you to continue with your normal preparation and performance strategies. After you have completed the study, you will be provided with the other interventions we are trialing in this study.

### Block 4

Thank you for your engagement so far in the study. You will be contacted again approximately 3-4 days after the indicated date of your event.

If you received an intervention, we encourage you to attempt to practice these during training over the coming weeks. The information you provided is also presented below.

\${q://QID21/ChoiceTextEntryValue/1}  
 \${q://QID21/ChoiceTextEntryValue/2}  
 \${q://QID21/ChoiceTextEntryValue/3}

\${q://QID30/ChoiceTextEntryValue/1}  
 \${q://QID30/ChoiceTextEntryValue/2}  
 \${q://QID30/ChoiceTextEntryValue/3}  
 \${q://QID30/ChoiceTextEntryValue/4}

Follow up emails will include reminder information on them.

We wish you the best of luck for your event.

If you have any questions please get in contact with the lead researcher Paul Anstiss (pa298@kent.ac.uk)

## Appendix T: Post-Event Questionnaire (Chapter 5)

7/17/2018

Qualtrics Survey Software

### Default Question Block

#### Online Mental Skills Intervention for Endurance Performance

Thank you for continuing to take part in this study.

The questionnaire you will fill out today will take approximately 10 minutes to complete, and will focus on your experience of the intervention you received, and your experiences during your recent event/race/or competition.

To allow us to follow your involvement in this study, please enter the email you previously provided below:

What was the event/race/competition that you took part in?

What was your goal for this event?

Did you achieve your goal?

- Yes  
 No

How satisfied were you with your performance in this event/race/competition?

- Extremely dissatisfied    Moderately dissatisfied    Slightly dissatisfied    Neither satisfied nor dissatisfied    Slightly satisfied    Moderately satisfied    Extremely satisfied
- 

Did you receive an intervention?

- Yes I was in an intervention condition  
 No I was in the control group

### Social Validation

How satisfied were you with the intervention you received?

- Extremely dissatisfied    Moderately dissatisfied    Slightly dissatisfied    Neither satisfied nor dissatisfied    Slightly satisfied    Moderately satisfied    Extremely satisfied
- 

How useful did you find the intervention?

- Extremely useless    Moderately useless    Slightly useless    Neither useful nor useless    Slightly useful    Moderately useful    Extremely useful
-



Do you plan to keep using the intervention you received in the future?

- Definitely not
- Probably not
- Might or might not
- Probably yes
- Definitely yes

Overall, are there any comments that you would like to make about the intervention you received?

**Block 3**

Which intervention did you receive?

- Self-Talk
- If-then plans (Implementation Intentions)

Generally speaking, to what extent did you **remember** to use the self-talk statements?

- |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 0 - Not at all        | 1                     | 2                     | 3                     | 4                     | 5 - Somewhat          | 6                     | 7                     | 8                     | 9                     | 10 - Completely       |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Generally speaking, to what extent were you able to **use** the self-talk statements?

- |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 0 - Not at all        | 1                     | 2                     | 3                     | 4                     | 5 - Somewhat          | 6                     | 7                     | 8                     | 9                     | 10 - Completely       |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Generally speaking, to what extent were you **comfortable** using self-talk statements?

- |                            |                       |                       |                       |                       |                          |                       |                       |                       |                       |                             |
|----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|--------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------------|
| 0 - Not at all comfortable | 1                     | 2                     | 3                     | 4                     | 5 - Somewhat comfortable | 6                     | 7                     | 8                     | 9                     | 10 - Completely comfortable |
| <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>       |

Generally speaking, to what extent did you **remember** to use the if-then plans?

- |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 0 - Not at all        | 1                     | 2                     | 3                     | 4                     | 5 - Somewhat          | 6                     | 7                     | 8                     | 9                     | 10 - Completely       |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Generally speaking, to what extent did you **use** the if-then plans?

- |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 0 - Not at all        | 1                     | 2                     | 3                     | 4                     | 5 - Sometimes         | 6                     | 7                     | 8                     | 9                     | 10 - All the time     |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Generally speaking, to what extent were you **comfortable** using the if-then plans?

- |                            |                       |                       |                       |                       |                          |                       |                       |                       |                       |                             |
|----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|--------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------------|
| 0 - Not at all comfortable | 1                     | 2                     | 3                     | 4                     | 5 - Somewhat comfortable | 6                     | 7                     | 8                     | 9                     | 10 - Completely comfortable |
| <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>       |

**Likert Scales**

How intense would you rate the stress that you encountered during your recent event?

1 - Not intense at all	2	3	4 - Somewhat intense	5	6	7 - Extremely intense
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How well did you believe you managed the stress that you encountered during this event?

1 - Not well at all	2	3	4 - Somewhat well	5	6	7 - Extremely well
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How much control did you perceive yourself to have over your stress during this event?

1 - No control at all	2	3	4 - Some control	5	6	7 - Complete control
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Each question represents things that athletes can do or think about when taking part in endurance sport. For each question you must indicate the extent to which it corresponds to what you did immediately before and during your recent event.

	1- Not at all	2	3 - Moderately	4	5- Very much so
I visualised that I was in total control of the situation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I used swear words loudly or in my head in order to expel anger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I committed myself by giving a consistent effort	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I occupied my mind in order to think about other things than the competition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tried to relax my body	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I lost all hope of attaining my goal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I mentally rehearsed the execution of my movements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I got angry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	1- Not at all	2	3 - Moderately	4	5- Very much so
I retreated to a place where it was easy to think	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I gave a relentless effort	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I thought about another hobby in order not to think about the competition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tried to get rid of my doubts by thinking positively	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tried to reduce the tension in my muscles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I let myself feel hopeless and discouraged	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I visualised myself doing a good performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I expressed my discontent	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	1- Not at all	2	3 - Moderately	4	5- Very much so

	1- Not at all	2	3 - Moderately	4	5- Very much so
I gave my best effort	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I replaced my negative thoughts with positive ones	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I did some relaxation exercises	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I thought about possible solutions to manage situations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I wished that the competition would end immediately	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I visualised my all time best performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I expressed my frustrations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I searched for calmness and quietness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	1- Not at all	2	3 - Moderately	4	5- Very much so
I tried not to think about my mistakes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I relaxed my muscles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I analysed the demands of the competition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I stopped believing in my ability to attain my goal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I thought about my family or friends to distract myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Each question represents things that athletes can do or think about when taking part in endurance sport. For each question you must indicate the extent to which it corresponds to what you did immediately before and during your recent event.

	1- Not at all	2	3 - Moderately	4	5- Very much so
I visualised that I was in total control of the situation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I used swear words loudly or in my head in order to expel anger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I committed myself by giving a consistent effort	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I occupied my mind in order to think about other things than the competition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tried to relax my body	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I lost all hope of attaining my goal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I mentally rehearsed the execution of my movements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I got angry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	1- Not at all	2	3 - Moderately	4	5- Very much so
I retreated to a place where it was easy to think	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I gave a relentless effort	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I thought about another hobby in order not to think about the competition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tried to get rid of my doubts by thinking positively	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	1- Not at all	2	3 - Moderately	4	5- Very much so
I tried to reduce the tension in my muscles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I let myself feel hopeless and discouraged	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I visualised myself doing a good performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I expressed my discontent	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	1- Not at all	2	3 - Moderately	4	5- Very much so
I gave my best effort	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I replaced my negative thoughts with positive ones	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I did some relaxation exercises	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I thought about possible solutions to manage situations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I wished that the competition would end immediately	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I visualised my all time best performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I expressed my frustrations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I searched for calmness and quietness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	1- Not at all	2	3 - Moderately	4	5- Very much so
I tried not to think about my mistakes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I relaxed my muscles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I analysed the demands of the competition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I stopped believing in my ability to attain my goal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I thought about my family or friends to distract myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Below you will find a list of actions and skills that are important for endurance performance. When you are taking part in your endurance sport, how confident are you that can do the following things. In each case please rate your degree of confidence from 0 (cannot do at all) to 100 (completely certain can do).

	0 - Not confident at all	10	20	30	40	50 - Moderately confident	60	70	80	90	100 - Completely confident
Managenon-injury related pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ensure appropriate technique and form	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manage my emotions before events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manage my emotions during events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manage injury related pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Take on appropriate nutrition during events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Take on appropriate hydration during events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	0 - Not confident at all	10	20	30	40	50 - Moderately confident	60	70	80	90	100 - Completely confident
Manage my thoughts before events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manage my thoughts during events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Achieve my goals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manage and deal with unexpected events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prepare mentally for demanding events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pace myself appropriately	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manage and deal with unexpected weather conditions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maintain my concentration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prepare physically for demanding events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Perform well in challenging events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Deal with feelings of effort and exertion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thank you for your time, and for taking part in this study. From these findings we hope to develop more effective brief mental skills interventions to aid endurance performance.

If you would like to receive information on the interventions used during this study, please select the 'yes' box below.

I would like to receive information on the interventions used in this study

Yes

If you would like to receive information on the findings of the study, please leave your contact email below: