# Cardiff School of Sport

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<td><strong>Title and Abstract (5%)</strong></td>
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Title to include: A concise indication of the research question/problem. Abstract to include: A concise summary of the empirical study undertaken. |
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To include: outline of context (theoretical/conceptual/applied) for the question; analysis of findings of previous related research including gaps in the literature and relevant contributions; logical flow to, and clear presentation of the research problem/question; an indication of any research expectations, (i.e., hypotheses if applicable). |
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## CONTENTS

<table>
<thead>
<tr>
<th>SECTION</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td></td>
</tr>
<tr>
<td>CHAPTER ONE:</td>
<td>1</td>
</tr>
<tr>
<td>1.0 Introduction</td>
<td>1</td>
</tr>
<tr>
<td>CHAPTER TWO:</td>
<td>2</td>
</tr>
</tbody>
</table>

### 2.0 Review of Literature

2.1 Competitive Anxiety ................................................................. 2
   - 2.1.1 State and Trait Anxiety ................................................... 2
   - 2.1.2 Multidimensional Anxiety ................................................. 2
   - 2.1.3 Competitive Anxiety Definition ....................................... 3
2.2 State Anxiety and Performance ................................................. 3
   - 2.2.1 Relationships .................................................................. 3
     - 2.2.1.1 Arousal-based Approaches ........................................... 3
     - 2.2.1.2 Multidimensional Anxiety Theory .................................. 4
     - 2.2.1.3 Catastrophe model of Anxiety and performance .................. 4
   - 2.2.2 Mechanisms ..................................................................... 6
     - 2.2.2.1 Directional Perspective, Perceived Control and Individual Differences ................................................................. 6
     - 2.2.2.2 Conscious Processing Hypothesis ................................... 8
     - 2.2.2.3 Processing Efficiency Theory ......................................... 8
     - 2.2.2.4 Conscious Processing Hypothesis Vs Processing Efficiency theory .............................................................................. 9
     - 2.2.2.5 Processing Efficiency Measurements .............................. 10
       - 2.2.2.5.1 Gaze Behaviour, visual attention and aiming tasks ................... 11
       - 2.2.2.5.2 The Gaze-Attention Relationship ............................... 12
       - 2.2.2.5.3 The Quiet Eye ......................................................... 12
       - 2.2.2.5.4 The Quiet Eye and Competitive Anxiety ......................... 13
   - 2.2.6 Attentional Control Theory ................................................. 13
2.3 Rationale and Purpose ............................................................... 14
CHAPTER THREE: ................................................................. 16

3.0 Methodology ........................................................................ 16
  3.1 Research Design ................................................................. 16
  3.2 Participants ......................................................................... 16
  3.3 Anxiety Measurement ............................................................ 16
  3.4 Procedure ........................................................................... 17
    3.4.1 Low Threat Condition .................................................... 17
    3.4.2 High Threat Condition ................................................... 17
    3.4.3 In game condition ............................................................ 18
  3.5 Interview Process ............................................................... 18
  3.6 Data Collection ..................................................................... 18
    3.6.1 Pilot Study ...................................................................... 19
    3.6.2 Main Interviews .............................................................. 19
  3.7 Data Analysis ....................................................................... 19

CHAPTER FOUR: ..................................................................... 21

4.0 Results ................................................................................. 21
  4.1 Introduction ........................................................................ 21
  4.2 Anxiety and Performance as a function of a Low Threat Condition ................................................. 21
    4.2.1 Low threat anxiety and performance scores ................................................................. 21
    4.2.2 Low threat condition: Explanations for anxiety and performance .................................... 22
      4.2.2.1 Causes and Direction of Anxiety ............................................................................. 22
      4.2.2.2 Coping Mechanisms and Perceptions ..................................................................... 22
      4.2.2.3 Perceived Control ................................................................................................. 23
      4.2.2.4 Gaze Behaviour ................................................................................................. 23
  4.3 Anxiety and Performance as a function of a high threat condition .................................................... 25
    4.3.1 High Threat Anxiety and Performance Scores ................................................................ 25
    4.3.2 High Threat Condition: Explanations for anxiety and performance .................................... 25
      4.3.2.1 Causes and direction of Anxiety ............................................................................. 26
      4.3.2.3 Perceived Control ................................................................................................. 27
      4.3.2.4 Gaze Behaviour ................................................................................................. 27
  4.4 Anxiety and Performance as a function of an in-game condition ....................................................... 29
    4.4.1 In-game Anxiety and Performance Scores ......................................................................... 29
    4.4.2 In-game condition: Explanations for anxiety and performance .............................................. 29
      4.4.2.1 Causes and direction of anxiety ............................................................................. 30
ABSTRACT

Objective: The purpose of the study was to qualitatively examine the anxiety effects on free-throw performance through a multi-method approach.

Design and Methods: Four experienced male basketball players were interviewed alongside video footage of their free throw performances in a low-threat, high-threat and in-game condition. Semi structured interviews were used to collect in-depth explanations of participants anxiety, coping mechanisms, control perceptions and gaze behaviour during each condition.

Results and Conclusion: The key findings of the study show possible support for both attentional and directional explanations to performance impairments under elevated levels of anxiety. The study also found that participants used pre-shot routines, controlled breathing and self-talk during elevated levels of anxiety. Specifically, participants described focus enhancing qualities from using pre-shot routine, relaxing qualities from controlled breathing and self-confidence enhancements when using self-talk.
CHAPTER ONE

1.0 Introduction

In the field of sport psychology, the relationship between anxiety and performance has been a popular topic of research (Jones, 1995; Hanton, Mellalieu and Thomas, 2008; Vealey, 1990). Within this research, there has been a range of approaches that attempt to explain why performance can become significantly impaired under high levels of anxiety.

In sport, the distinction between failure and success could be determined by an athlete’s ability to perform visually aided tasks in these high pressured environments. For example, the free throw that could win the National Basketball Association (NBA) playoffs or the deciding penalty kick that could win the International Federation of Association Football (FIFA) world cup final. Considering this, sport psychologists have attempted to analyse the effects of which cognitive factors, such as competitive anxiety, play on visually aided tasks (e.g., Vickers, 2007; Wilson, 2008). However the mechanisms used to explain the anxiety-performance relationship remain unclear (Jannelle, 2002; Wilson, 2012). This study will therefore use a qualitative approach in an attempt to add further depth and understanding to current research, as well as new insights in into the anxiety-performance relationship.
CHAPTER TWO

2.0 Review of literature

The following chapter will review the available anxiety literature and the current mechanisms proposed to explain anxiety’s relationships with performance. The chapter will start with an insight into the evolution of our understanding of competitive anxiety to provide the reader with context. Subsequently, the chapter will analyse the various models that describe competitive anxiety and the mechanisms used to explain its relationship with performance, identifying possible avenues that require further research.

2.1 Competitive Anxiety

2.2 State and Trait Anxiety

Cartell (1966) introduced a distinction between state and trait anxiety, which was then elaborated by Spielburger (1966). Spielburger (1966) described state anxiety as a transitional emotional state of undesirable feelings of anxiety that fluctuate over time with varying intensities. This fluctuation of anxiety was said to correspond with the perceived threat of each occasion. In contrast, trait anxiety was described as a stable characteristic tendency to experience frequent state anxiety.

2.3 Multidimensional Anxiety

More recent research suggests a multidimensional viewpoint of anxiety, formed from two components; cognitive anxiety (worry) and somatic (physical) anxiety (Fazey & Hardy, 1988; Martens, Vealey & Burton, 1990). To cultivate the multidimensional anxiety approach into sport psychology, Martens, Burton, Vealey, Bump and Smith (1990) produced the competitive state anxiety inventory-2 (CSAI-2). The CSAI-2 measured the strength of both cognitive and somatic anxiety, as well as self-confidence. Trait versions of the CSAI-2 were also introduced; the competitive trait anxiety inventory-2 (CTAI-2) and the Sports Anxiety Scale (SAS; Smith, Smoll and Schutz, 1990).
2.4 Competitive Anxiety Definition

Hardy, Mullen and Jones (1996) noted how researchers have frequently failed to differentiate terms such as stress, anxiety, arousal and activation. The multidimensional anxiety approach recognised anxiety as experiences of negative cognitions and/or negative perceptions of one’s physiological state (Hanton, Neil and Mellalieu, 2011). In medical research, Dornelas (2008) accepted the difficulty in generating operational definitions of anxiety, due to the common use of the term ‘stress’ being used to describe a broad area of issue, including anxiety. This review will therefore use a definition of competitive anxiety offered by Hanton, et al (2011) which relates to the broader concept of competition stress. Hanton, et al (2011) defined competition anxiety as, “a specific negative emotional response occurring when a performer appraises competitive stressors as uncertain threats. This response may include such symptoms as worry along with a heightened perception of physiological arousal” (pg., 91). The advantages of using such a definition are that it recognises anxiety to be an emotional response to stressful situations.

2.5 State anxiety and performance

This section will start off by looking at the various models that describe the relationships between anxiety and performance; this will then be followed by the different theories (mechanisms) that explain why anxiety may influence performance.

2.6 Relationships

To describe the relationship between anxiety and performance, this section will give insight into the early arousal approaches used, followed by the Multiple Anxiety Theory (MAT) perspective and finally an interactive approach.

2.6.1 Arousal based approaches

The two main approaches to the arousal based link with anxiety were Yerkes and Dodson’s (1908) inverted-U hypothesis and Spence’s (1958) drive theory. The inverted-U hypothesis (also known as the Yerkes-Dodson law) hypothesises that increased arousal will benefit performance up to a specific optimal point; past this point continued levels of
arousal will be debilitative to performance. However, optimal levels of arousal may vary between task complexities. For instance, a highly complex task was said to benefit from lower levels of arousal, where as a task low in complexity could benefit from high levels of arousal. Spence’s (1958) drive theory hypothesised that enhanced performance is dependent on the combined influence of arousal and task execution, in that performance will increase simultaneously with arousal levels as long as the performance incorporates the correct task execution response. Graydon (2002) acknowledged how these arousal based concepts could be an outcome of the misguided views of arousal and anxiety being interrelated. The recognition of anxiety and arousal being unconnected, as well as the simplistic nature of these approaches resulted in the verdict that these arousal based approaches were insufficient in describing the anxiety-performance relationship (Mellalieu, Hanton and Fletcher, 2006).

2.6.2 Multidimensional Anxiety Theory

The Multidimensional Anxiety Theory (MAT; Martens, Burton and Vealey, 1990) describes specific relationships between different components of competitive anxiety (i.e., cognitive anxiety, somatic anxiety and self-confidence) and performance. The relationship between performance and cognitive anxiety is seen as negatively linear, where performance decreases as cognitive anxiety increases. The relationship between performance and somatic anxiety is seen as an inverted-U, where performance increases as somatic anxiety increases, up to a certain peak; beyond this peak the effects are reversed and performance decreases as somatic anxiety increases. Self-confidence is said to share a positive linear relationship with performance where increased levels of self-confidence are accompanied with increased levels of performance. The multidimensional anxiety theory has received limited support from researchers (e.g. Burton, 1988; Hammermeister and Burton, 1995; Krane, Williams and Feltz, 1992). Hanton et al (2011) note how the multidimensional Anxiety Theory fails to appreciate the positive effects of cognitive anxiety as well as the interactive relationship between the different components of competitive anxiety, in relation to performance, offering an explanation to MAT’s limited support.

2.6.3 Catastrophe model of anxiety and performance

Given the lack of support, MAT not considering the interactive anxiety effects and that anxiety could be beneficial for performance, Frazer and Hardy (1988) and Hardy (1990)
used Rene Thom’s (1975) catastrophe model and developed a cusp catastrophe model of anxiety and performance. Instead of analysing the effects of competitive anxiety components per se, the cusp catastrophe model attempted to examine the interactions of such competitive anxiety components. The Cusp catastrophe model describes that cognitive anxiety impacts performance and also anticipates the effects of physiological arousal. The model hypothesises that cognitive anxiety increases have positive effects on performance when accompanied with low levels of physiological arousal and negative effects on performance when physiological arousal levels are high, as well as an inverted-U relationship between performance and anxiety when cognitive anxiety levels are low. When high levels of cognitive anxiety are shared with high levels of physiological arousal, the model predicts a performance increase up to a critical point. Beyond the critical point a further increase in physiological arousal will lead to a sudden ‘performance catastrophe’ or sudden drop in performance which can only be countered by significant decreases in physiological arousal.

The catastrophe model has received partial support (e.g. Hardy and Parfitt, 1991; Hardy, Woodman and Carrington, 2004). However such support only confirmed certain aspects of the catastrophe model, a possible explanation to this could be found in the methodologies, such as Hardy and Parfitt (1991) physical exertion measurement being the asymmetry factor instead of physical arousal (Hanton et al., 2011). Hardy, Beattie and Woodman (2007) also criticised how the catastrophe model only considered cognitive state anxiety and physiological arousal with regards to performance. Due to the limitations and partial support received for the cusp catastrophe model, authors studied the effect of extra dimensions on the relationship between anxiety and performance (Fazey and Hardy, 1988; Hardy and Parfitt, 1991), suggesting a five dimensional higher-order butterfly catastrophe model. This model included two additional dimensions; a bias dimension and a butterfly dimension (Zeeman, 1976). The bias dimension moderates the interaction between cognitive anxiety and physiological arousal by swinging the cusp to the left or right of the front edge. The butterfly dimension acts as a third stable behaviour surface between the lower and upper surfaces of the cusp catastrophe model, implying that when a sudden drop in performance is present the performer could decrease cognitive anxiety levels to advance performance to moderate levels (Fazey and Hardy, 1988; Hanton et al., 2011). Hardy (1990) proposed that self-confidence would function as the as the mediating bias dimension, therefore suggesting that heightened levels of self-confidence could enable performers to allow higher levels of physiological arousal before performance reductions occurred. Hardy et al. (2004) study supported the notion of self-confidence
acting as a moderating dimension, finding that when performers experienced high levels of self-confidence, cognitive anxiety was seen to be more beneficial to performance when physiological arousal was high, as opposed to low. However, Hanton et al. (2011) noted a requirement for further studies looking into the utility of the higher-order model in relation to its effects with performance.

2.7 Mechanisms

This section will give insight into the various theories (mechanisms) that attempt to explain why anxiety might influence performance, covering the directional perspective, the conscious processing hypothesis, the processing efficiency theory and finally the attentional control theory. Within this, an insight into gaze behaviour and visual attention will be given as measurements of processing efficiency.

2.7.1 Directional perspective, perceived control and individual differences

Cognitive anxiety has often been deemed debilitating in relation to performance. For instance, Martens et al. (1990) predicted a negative linear relationship between cognitive anxiety and performance. The CSAI-2 measurement scale also overlooked the directional perspective by only measuring performer’s anxiety intensity levels. The view that the anxiety-performance relationship could be explained by anxiety intensity levels per se received criticism from Jones (1991), who suggested a combination of factors that might explain anxiety. Jones and Swain (1992) proposed how individuals might interpret specific anxiety intensities as positive or negative in relation to performance. Kowalski (2000) acknowledged the detrimental effects anxiety can elicit on behaviour and cognitive function, however suggested the adaptive nature of anxiety and highlighted the possible performance enhancing qualities anxiety could offer if experienced in moderation. Hanton, Neil and Mellalieu (2011) also state how the responses involved in anxiety may be better understood if consideration is given to the interpretation of an individual’s anxiety symptoms, for example whether the individual perceives them to be facilitative or debilitating. Jones and Swains (1992) inclusion of a directional scale in the CSAI-2 required participants to rate the intensity of their anxiety symptoms as facilitative and debilitative in relation to performance. Since the directional scale, studies have acknowledged the importance of determining differences between anxiety symptoms’ intensity and direction. For example, Hardy, Parfitt and Pates (1994) suggested
physiological arousal can alter performance indirectly depending on the individual’s perception of their psychological symptoms. For instance, an athlete could perceive high levels of somatic anxiety, such as an accelerated heart rate, as a sign that they are ready to perform which could potentially lead to a positive performance. On the other hand, an athlete may perceive the accelerated heart rate as a sign of insufficient preparation which might lead to a decrease in performance. This indicates how athletes may perceive their competitive anxiety symptoms in different directions (facilitative or debilitative to performance).

Theorists have attempted to understand the concept of anxiety direction, for instance, Jones’ (1995) control model attempts to explain the facilitative and debilitative interpretations of anxiety. The main hypothesis of Jones’ control model is that the ability to which a performer can control a stressor defines their interpretation of anxiety, of which the stressor presented. From this, facilitative interpretations of anxiety are said to be influenced by perceived acquisitions of control over a situation and goal attainment. In contrast, debilitative interpretations of anxiety are said to be influenced by a perceived absence of control over a situation and goal attainment. The hypothesis of Jones’ (1995) control model has received support from several studies (Hanton and Connaughton, 2002; Jones and Hanton, 1996; Ntoumanis and Jones, 1998). With regards to Jones’ (1995) control model, Hanton et al. (2008) emphasised the importance of which personal and situational factors control perceptions. A broad amount of research has investigated performer’s perceptions of anxiety symptoms as a combined function of individual difference variables, such as; hardiness (Hanton, O’Brien and Mellalieu, 2003), trait anxiety (Hanton, Mellalieu and Hall, 2002), psychological skills (Fletcher and Hanton, 2001), coping strategies (Ntoumanis and Biddle, 1998), competitive experience (Hanton and Jones, 1999) and the nature of the sport (Hanton, Jones and Mullen, 2000). Generally, these studies support the importance of differentiating between the direction and intensity symptoms involved with competitive anxiety. A major individual difference variable that has repeatedly shown differentiations between facilitative and debilitative anxiety interpretations is that of skill level (Hanton et al., 2008). Directionality research found anxiety direction to vary between athletes skill levels, with higher skilled athletes generally having more facilitative interpretations of pre-competition anxiety towards good performances than athletes with lower skill levels (e.g., Jones, Hanton and Swain, 1994; Jones and Swain, 1992; Jones, Swain and Hardy, 1993). Jones, Hanton and Swains’ (1994) study compared female gymnasts’ performances and found that the good performance group reported cognitive anxiety as more facilitating and less debilitating to
performance in relation to the poor performance group, although no differences were recorded in somatic anxiety. Studies have also used a qualitative approach to investigate why elite athletes perceive their anxiety symptoms facilitative and show higher levels of self-confidence (Hanton and Jones, 1999; Hanton, Mellalieu and Hall, 2004). These studies found that elite performers used combined psychological skills (e.g. self-talk and imagery) in order to justify occurring thoughts and feelings prior to competition, enabling them to maintain facilitative perceptions of anxiety and higher levels of self confidence.

2.7.2 Conscious Processing Hypothesis

Masters (1992) developed the conscious processing hypothesis (CPH) as a possible explanation to anxiety induced performance reductions. The hypothesis suggests that when high levels of anxiety are present the automatic task control processes used by advanced performers are disrupted and subsequently, in an attempt to regain control of their performance, performers adopt novice characteristics experienced in the early stages of learning (Masters, 1992; Gucciardi and Dimmock, 2008). The disruptions to the automatic task control processes are said to be a product of performers trying to attain task success by the inclusion of explicit knowledge (conscious rules), that the performer is aware of and able to verbalise in the working memory (Masters, 1992; Mullen and Hardy, 2010). Masters (1992) provided initial support for the CPH, Masters’ study found that golfers who were tested in an anxiety induced setting experienced performance reductions when using explicit knowledge in a golf putting task. Further support for the CPH was also provided by Hardy, Mullen and Jones (1996). Despite the support for CPH, Mullen and Hardy (2000) acknowledged alternative attentional explanations for the performance reductions linked with conscious processing. The attentional alternative explanation suggests performance reductions, linked with cognitive anxiety and conscious processing, could be a result of an overloaded attentional capacity (Processing efficiency theory; Eysenck and Calvo, 1992).

2.7.3 Processing Efficiency Theory

Processing efficiency theory (PET; Eysenck and Calvo, 1992) hypothesises that cognitive anxiety, or more specifically worry, plays two major roles in performance. The first being; cognitive anxiety interrupts or challenges the processing behaviours as well as the storage capacity of the working memory, this in turn limits the ability to provide maximal resources
to the task being carried out. The second role is that; worry serves as a motivational function for the individual, leading to the use of extra resources (e.g.) increased effort levels in an attempt to compensate for any performance reductions and maintain performance in high anxiety settings (Wilson, 2012). However, the inclusion of extra resources, such as extra effort, ultimately reduces the processing efficiency and is dependent on how the individual perceives their own ability. To elaborate, an individual will only use extra resources if they believe their performance is lower than their performance expectations. PET also states that when an individual’s perceptions of their own ability are inferior to what is required to complete the task, the investment of extra resources is unlikely (Eysenck, 1982). Eysenck (1992) emphasises the distinction between processing efficiency and performance effectiveness in relation to PET; performance effectiveness relates to the task execution or quality, where as processing efficiency refers to the relationship between performance effectiveness and the invested effort or processing resources. A primary prediction of PET postulates that the debilitative effects of anxiety are higher in processing efficiency as opposed to performance effectiveness, this is because the reduced processing resources caused by worry can be partially or fully compensated by the inclusion of extra resources, such as increased effort (Calvo, 1985). There has been a wealth of literature providing support for the predictions of PET in mainstream cognitive psychology (e.g., Eysenck, 1996; Eysenck, Payne, and Derakshan, 2005; Eysenck, Derakshan, Santos, and Calvo, 2007), however initial research that used the predictions of PET in sport was limited (Janelle, 2002). In recent years, studies measuring processing efficiency in various sports have increased; including, Golf Putting (Wilson et al, 2007), simulated archery (Behan and Wilson, 2008), field hockey (Wilson and Smith, 2007), climbing (Nieuwenhuys, Pijpers, Oudejans, and Bakker, 2008) and racing stimulations (Murray and Janelle, 2007). The findings of such studies came with complications, for instance, Wilson et al (2007) provided support for the predictions of PET as well as the predictions of CPH, creating difficulties in distinguishing between the two explanations of anxiety impairment.

2.7.4 CPH/PET Debate

Studies have attempted to determine between the attentional (PET; Eysenck and Calvo, 1992) and conscious processing (CPH; Masters, 1992) explanations to performance reductions in anxiety induced conditions (Mullen, Hardy and Tattersall, 2005; Wilson, Smith and Holmes, 2007). Wilson et al (2007) used a golf task in low and high anxiety
conditions and found that despite increased effort levels were present in high anxiety settings, the data showed performance did not decline significantly, this interaction effect between effort and performance supports attentional predictions of anxiety-induced performance reductions (e.g. processing efficiency theory; Eysenck and Calvo, 1992), however such findings were uncertain. The only definitive support for the attentional explanation was provided by Mullen et al. (2005) study which required golfers to put in high and low anxiety settings using three conditions; single task, task-relevant shadowing and task-irrelevant tone counting. The finding of the study showed performance reductions in both the task relevant shadowing and task irrelevant counting conditions when combined with heightened anxiety, supporting the attentional explanation viewpoint on anxiety related performance reductions. Gucciardi and Dimmock (2008) attempted to address the issues involved in Mullen’s earlier, unequivocal studies in a golf putting task, the task required golfers to use either three explicit cues or three task-irrelevant cues when putting in both a high and low anxiety setting. The study found that, in an anxiety induced setting, golfers who used the explicit cues during their putting tasks experienced performance reductions (Hardy and Mullen, 2010) giving support to the CPH as opposed to an attentional explanation. These varied views left an inconclusive answer to the CPH versus attentional effect debate in relation to performance impairments.

2.8 Processing Efficiency Measurements

The measurements used to index processing efficiency have varied in anxiety literature, with authors using; subjective mental effort (Williams et al., 2007), secondary task measurements (Murray and Janelle, 2003), psychophysical measures; heart rate variability (Wilson et al., 2007); cognitive papillary response (Wilson et al, 2006); Event related potentials (Murray and Janelle, 2007), processing time (Wilson et al., 2007) and in-event tests (Wilson and Smith, 2007), (for a more in-depth review of these measurements see Wilson (2008)). Research measuring anxiety through in-event measurements has been limited (e.g. Smith, Bellamy, Collins and Newell, 2001; Wilson and Smith, 2007), although research has used a range of manipulations in an attempt to replicate in-event scenarios to a lab based environment (Beehan and Wilson, 2008; Wilson and Vine, 2009; Wood and Wilson, 2010), Wilson (2008) acknowledges the difficulties in translating lab based findings to real life scenarios. Woodman and Hardy (2003) have also considered the advantages of both methods with regards to the internal control achieved through lab based studies and the realistic nature of in-event measurements. Most recently, gaze behaviour has been
used to measure the predictions of PET; such methods provide a more specific understanding to how visual attentional control is influenced by anxiety (Wilson, 2008).

2.8.1 Gaze Behaviour, Visual Attention and Aiming Tasks

The way in which gaze is conducted has been referred to as ‘gaze behaviour’ (Vickers and Adolphe, 1997). In the field of cognitive psychology, gaze behaviour (within motor actions) has been a popular topic (Land et al., 1999; Land and Mayhoe, 2001; Land, 2009). Land et al. (1999) found a relationship between eye movements and motor actions/responses. Studies have also shown that the execution of aiming tasks can be influenced through gaze behaviour (Elliot et al., 1998; Binsted et al., 2001). One focus of gaze behaviour in sport has been the ‘gaze control’ of sports performers when undertaking aiming tasks. McPhersan and Vickers (2004) described gaze control as a combined movement process of the head and eyes used to provide information on performance. In the initial stages of gaze control studies, emphasis was given to the execution of near aiming tasks (e.g. Abrams, 1994; Keele and Posner, 1968). In more recent years, gaze control research has directed its attention towards far aiming tasks that use closed skills such as; archery, rifle shooting, the penalty kick in football and the free throw in basketball (e.g. Harle and Vickers, 2001; Oudejans, Koedijher, Bleijendaal and Baker, 2005 and Vickers, 1997) and also far aiming tasks that involved open skills (Vickers and Adolphe, 1997).

Janelle (2002) acknowledged another area of focus within sporting performance called visual attention. Visual attention refers to the cognitive process of selectively focusing on specific stimuli in an area, with disregard to any irrelevant stimuli (Corbetta and Schulman, 2002). In sport, performers must be able to determine the best sources of information from an environment, guide their attention to the appropriate stimuli and draw meaning from these sources both effectively and efficiently (Mann, Williams, Ward and Janelle, 2007; Williams, Davids, and Williams, 1999). Morgan (1996) suggested the role of visual attention was to determine ‘targets’ (task relevant stimuli) from distracters (task irrelevant stimuli). Corbetta and Schulman (2002) describe one model of attention which suggests that two isolated neural systems control how a stimulus is processed from day to day. One system is associated with preparing and applying a goal directed or ‘top down’ selection of stimuli and action responses. This system is directed by the expectations, current goals and knowledge of a task. In contrast, the other system is disengaged from top-down selection. Instead, this system is utilised to detect relevant stimuli; especially when the stimuli is of significance or unexpected.
2.8.2 The Gaze-Attention Relationship

In gaze related research, a significant theoretical consideration has been whether or not the measurement of where a person looks (their gaze) is related to the direction of their actual attention. Within this research, cognitive neuroscience researchers generally support the notion of using gaze measurements to equate to visual attention (Corbetta, 1998; Ship, 2004). Shinoda, Hayhoe and Shrivastava (2001) accept that when gaze changes the activation of covert and subsequently overt attention is required. This suggests the difficulty of changing gaze, without subsequently switching attention. Wilson (2012) emphasised the significant presence of this gaze-attention relationship in visually aided tasks. With progressions in eye tracking technology (the advancement of mobile and lightweight head mounted eye trackers) gaze behaviour can be analysed in a more natural setting (Land, 2006). This technology has enabled the analysis of planning and control (in relation to eye movements) to be taken out of the laboratory setting and into more natural environments, such as; driving (Wilson, Stephenson, Chattington, and Marple-Horvat, 2007), surgery (Wilson, McGrath, Vine, Brewer, Defriend and Masters, 2010) and far aiming tasks (Beehan and Wilson, 2008; Wilson and Vine, 2009; Wood and Wilson, 2010). In sporting tasks, expert performers have demonstrated the use of more efficient gaze strategies in comparison to novices, giving more focus to task-relevant stimuli (Mann et al, 2007), indicating the importance of optimal gaze strategies in relation to sporting success.

2.8.3 The ‘Quiet Eye’

In sport, the ‘quiet eye’ (QE; Vickers, 1996) uses the relationship between spatial and temporal gaze fixations and motor actions to measure the efficacy of visual attention. Vickers (2007) defined the QE as the, “final fixation directed to an appropriate target before the execution of essential phases of motor actions” and acknowledged its utility as an optimal measurement of visual attention in visually guided tasks. The significance of QE fixations has been emphasised in sporting literature, including the free throw in basketball (Vickers, 1996). The notion of QE fixation being a distinction of excellent performance has developed in aiming tasks. The timing of the duration and initiation of QE periods has been suggested to give indication of greater skill levels and precision in aiming tasks, showing longer, earlier periods of QE fixations to be associated with optimal performance (Vickers et al., 2000). Williams et al (2002) explained how longer QE periods
can provide performers with more time for the cognitive programming and processing of appropriate information needed for productive aiming in visual aiming task.

### 2.8.4 The Quiet Eye and Competitive Anxiety

In recent years, research has shown that visual attention, in particular QE periods, can be damaged under increased levels of anxiety (Behan and Wilson, 2008; Wilson and Vine, 2009; Wood and Wilson, 2010), supporting the predictions of PET; that anxiety effects processing efficiency. Behan and Wilson’s (2008) study examined individuals control over their gaze behaviour in far aiming tasks by measuring the individuals QE durations during the execution of a simulated archery task in anxiety manipulated conditions. The study found that in a manipulated anxiety condition, individuals QE fixations reduced in duration, suggesting the detrimental effects anxiety has on gaze behaviour and subsequently performance. Although the central predictions of PET (anxiety being adverse to processing efficiency) have been supported through QE measurements, limitations regarding the utility of PET have been proposed; in that it lacks precision and explanatory ability (Wilson, 2008). In an attempt to understand the performance impairments created by attentional control disruptions, Eysenck, Derakshan, Santos and Calvo (2007) formulated the attentional control theory.

### 2.8.5 Attentional Control Theory

Attentional Control Theory (ACT; Eysenck et al., 2007) extends the framework of PET while keeping the main prediction that anxiety negatively impacts the central executive of working memory by reducing its processing efficiency. The framework provided by ACT attempts to explain the components that construct the cognitive performance of the perceptual motor tasks in a pressured environment. This progression therefore aids in the understanding of performance reductions set off by attentional control disruptions. ACT uses the fundamental acceptance that the regulation of attention is achieved through Corbetta and Shulman’s (2002) two attentional systems; a goal directed or ‘top down’ attentional system and a stimulus-driven or ‘bottom-up’ attentional system. The top-down system is influenced by knowledge, current goals and expectations as opposed to the bottom-up system which responds to threatening and intrusive stimuli. Eysenck et al (2007) theorise that anxiety disrupts the balance between these two systems, increasing the dominance of the stimulus (bottom-up) attentional system. In summary, ACT
hypothesises that anxiety reduces attentional control by increasing the disposal of attention to task irrelevant and/or threatening internal (e.g. worry) and external (e.g. crowd pressure) stimuli. The predictions of ACT in motor task performance and threatening situations has been supported by various studies in sport (e.g. Beehan and Wilson, 2008; Wilson et al., 2009). Wilson et al. (2009) study investigated attentional control in football penalty kicks and found that in high anxiety settings footballers gazed at the goalkeeper significantly longer and earlier in contrast to low anxiety settings, with these attentional changes subsequently impairing shot placement. These findings coincide with ACT’s predictions that anxious performers have an attentional tendency towards threatening stimuli, caused by an imbalance between the top down and bottom up control systems (Eysenck et al., 2007).

2.9 Rationale and Purpose

This chapter has provided an insight into the understanding of competitive anxiety, covering the various models that have attempted to describe anxiety and the mechanisms which seek to explain competitive anxiety in a sporting context. Specifically this review has focused on the directional, conscious processing, processing efficiency and attentional control explanations of the anxiety-performance relationship, including measurements of visual attention in relation to processing efficiency. From these mechanisms, research has offered various explanations to the anxiety performance relationship; although the explanations these mechanisms provide remain indefinite (Janelle, 2002; Wilson, 2012). Indeed, such mechanisms have looked at anxiety, processing efficiency and performance mainly though an experimental mean, but haven’t, to the best of the author’s knowledge, considered an explanatory, qualitative perspective. Within this literature authors have also tried to distinguish between these mechanisms, nonetheless Wilson and Smith (2007) concluded that further research was needed to identify which mechanism provides the best explanation to the effects of the anxiety-performance relationship. Finally research measuring anxiety through in-event measurements has been limited (e.g. Smith, Bellamy, Collins and Newell, 2001; Wilson and Smith, 2007), possibly providing a gap in the research to gain an understanding of performers anxiety-performance relationship in a real game setting.

Consequently the purpose of this study was to explore the anxiety-performance relationship and the mechanisms proposed through qualitative means, using semi-structured interviews to find out why anxiety might impair performance through an
explanatory perspective, specifically the study will investigate: participant’s anxiety interpretations, coping mechanisms, perceived control and gaze behaviour. Such an approach has received support from researchers (in order to advance current literature as well as add depth and understanding (Neil, Mellalieu and Hanton, 2009). The study will also consider any support given for the proposed mechanisms presented in the anxiety literature, as well as using in-event measurements of anxiety.
CHAPTER THREE

3.0 Methodology

3.1 Research Design

The study examined the anxiety effects on performance through a multi-method approach that used simulated competitions, video recall and a qualitative approach to gain an increased understanding of the anxiety-performance relationship. This multi-method approach was used to identify performance differences between anxiety levels, using repeated semi-structured interviews to compare participant’s experiences in each condition.

3.2 Participants

Five experienced male university basketball players between the ages of 20-22 years (mean = 21, SD = 0.71) volunteered to participate in the study. The participants had a mean playing experience of 7.2 years. To qualify for selection, participants were required to have two years or more playing experience and had either represented an equivalent English Basketball League (EBL) division three side or higher or represented their region or county. This was used in line with previous studies that used experienced performers to explore the anxiety-performance relationship (e.g. Hanton, Mellalieu and Hall, 2004; Mullen and Hardy, 2010; Oliveria, Oudejans and Beek, 2008). Written consent was provided by all participants and ethics approval was gained prior to testing.

3.3 Anxiety Measurement

Due to the revised multidimensional view of trait and state anxiety the CSAI-2 (Martens et al., 1990) was introduced and has been the main facilitator of quantitative anxiety measurements since. The CSAI-2 measures the state subscales of; cognitive anxiety, somatic anxiety and self-confidence with regards to the subscales intensity, direction and frequency. This study used the brief version of the CSAI-2 to assess anxiety, the immediate anxiety measurement scale (IAMS; Thomas, Hanton and Jones, 2002). Thomas et al. (2002) concluded that the IAMS was accurate to the CSAI-2 (Martens et al., 1990) for measuring participant’s anxiety levels and direction. The advantages of using the
IAMS scale are that it measures the immediate anxiety levels, making it an appropriate measurement of anxiety in a sporting task, as well as having the ability to relate to previous research that used the CSAI-2 (Beehan and Wilson, 2008; Wilson and Vine, 2009; Wood and Wilson, 2010). The IAMS measures cognitive anxiety, somatic anxiety and self confidence using a 7-point Likert scale which ranges between not at all (1) and extremely (7) for intensity and very negative (-3) and very positive (+3) for direction. Thomas et al. (2002) provided support for the validity and reliability of this measure and it has previously been used in similar studies (e.g. Moore, Vine, Wilson and Freeman, 2012).

3.4 Procedure

The study required participants to take free throws in three conditions; low threat, high threat and in-game. The following section will describe the procedures in each of these conditions. The manipulations used were designed to induce low levels of anxiety in the low-threat condition and high levels of anxiety in the high-threat condition. Similar approaches were used to manipulate anxiety levels in previous anxiety research (e.g. Wilson et al., 2009) and found to be successful in inducing the required anxiety levels.

3.4.1 Low-threat condition

Prior to low-threat condition, participants were advised to take 20 free throws to warm up and become familiar with the surroundings. Participants were then required to take a two minute recess and then instructed to take 10 free throws, with emphasis given that the results recorded for this condition were for testing purposes only and would not be counted, shared or compared to other participants. Before taking the 10 free throws, participants were required to fill out the IAMS to assess their anxiety current levels anxiety.

3.4.2 High-threat condition

Prior to high-threat condition, participants were advised to take 20 free throws to warm up and become familiar with the surroundings. Participants were then required to take a two minute recess and then given the condition briefing. Participants were briefed that they were about to take 10 free throws and that their free throw scores would be counted, compared and shared with other participants; with the highest scoring individual being awarded £30. There was also a line-up and small crowd used to replicate a game-like
setting. Following the briefing, participants were required to fill out the IAMS to assess their current levels of anxiety and then asked to perform the 10 free throws. The manipulations

3.4.3 In-game condition

The in-game threat condition recorded the participant’s free throw performances in a real game, with no manipulation approaches being presented to the participants. This approach offers a more realistic measurement of the anxiety-performance relationship (Woodman and Hardy, 2003) as opposed to a laboratory based setting which some researchers suggest to be insufficient in providing equivalent levels of ego threat as real life, high pressured sport settings. (William, Vickers and Rodrigues, 2002; Wilson, Smith, Chattington, Ford and Marple-Horvat, 2006).

3.5 Interview Process

Anxiety literature provided a framework for each participants interview guide, giving insight to appropriate themes within the anxiety-performance relationship. The study used an open ended, semi structured interview technique (Patton, 2002), this technique was considered suitable to facilitate the exploration of arising themes and produce better explanation and understanding (Gratton and Jones, 2010). The interview guide was developed to draw out an in depth explanation of anxiety in relation to free throw performance. A similar study was used to investigate the types of self talk used by batsman in cricket (Miles and Neil, 2013). The main anxiety themes focused on in the interview guide were; anxiety direction, perceived control, coping mechanisms, processing efficiency and attentional control (for the complete interview guide, see appendix 7).

3.5.1 Data Collection

To help gain accurate recollections of the free throw performances, video footage of individual free throw performances was gathered to use along the side of interviews. This approach has gained validation in previous studies in providing more meaningful recollections (Smith and Harwood, 2002). With participant’s approval, footage of each free throw performance in all three anxiety conditions was recorded directly behind the basket and in line with the participant. For the in-game threat condition footage, the complete
match was recorded and footage was edited post game to include the appropriate clips of free throw performances to use in interviews.

3.5.2 Pilot Study

A pilot study was carried out with the authors peer in order to test the interview guide’s structure, gain interview experience and filter the questions (Kvale, 2009). This allowed the author to reflect and process the interview guide, gaining insight to possible responses that could occur and experience in drawing out in-depth descriptions. The interview guide was subsequently tailored and developed in preparation for the main interviews. Specifically, the interview guide was shortened to keep the participant engaged throughout the interview, as the author found that a drawing out questions seemed to generate less elaborate responses. Originally the author planned to conduct the interviews in a public place, but through the process of the pilot study learnt that more personalised responses were gained in a closed setting. From the pilot study, the author also realised their inexperience in conducting interviews, this allowed the author to practice the interview process with peers and improve his communication skills within the interview setting.

3.5.3 Main interviews

The main interviews were administered within 24 hours of the associated video footage. This approach was used to minimise the delay between performance and the interview, in an attempt to reduce any issues with recollections and association with other free throw performances in matches or training separate to the study. The interviews were conducted by the author with each participant in a closed setting to provide comfort for the participant, video footage of the related free throw performance was also provided during the interview to enhance the participants recollections. The interview guide was followed during the interview, although the flow of the conversation was made as natural as possible to help determine provocations and elaborations (e.g., Miles and Neil, 2013).

3.7 Data analysis

All interviews were transcribed verbatim and to enhance the trustworthiness, the study adopted four criteria developed by Lincoln and Guba (1985) to determine the trustworthiness of qualitative research; credibility, transferability, dependability and
conceivability. Conceivability was improved using a ‘member checking’ process (as in Miles and Neil, 2013), this required the interview transcripts to be sent separately to each individual participant to verify the accuracy of the transcript interpretations in accordance to how the participant recalled the interview. After the ‘member checking process’ was confirmed by participants, the author then read over the transcripts for each interview (as in Miles and Neil, 2013) to gain and enhanced understanding of the participants recollections (Corbin and Straus, 2008). For transferability, detailed illustrations of the information gathered are recorded in the results section so that others can determine their own verdict on the generalisability of the study’s findings. Finally, dependability and conformability were gained by keeping detailed records of the data.
CHAPTER FOUR

4.0 Results

4.1 Introduction

The following chapter will provide a description of the main findings from the study, focusing on the anxiety and performance scores reported in each anxiety condition as well as the explanations for anxiety and performance from participants in each anxiety condition. The following themes have emerged from the explanations for anxiety and performance; causes and interpretations of anxiety, coping mechanisms and perceptions, perceived control and gaze behaviour. These themes will be the main focus points when illustrating the explanations of anxiety and performance.

4.2 Anxiety and performance as a function of a low threat condition

4.2.1 Low threat anxiety and performance scores

Table 4.2.1 represents the anxiety and performance scores across the low threat condition for each participant. The cognitive anxiety (CA) and somatic anxiety (SA) scores were equivalently low between all participants in the low threat condition, with the exception of participant C who recorded a SA score of three. Participants A, B and D all recorded facilitative interpretations of their CA. The way SA was interpreted varied, with a range of negative one to positive two. Self confidence (SC) was moderate to high across all participants, ranging between four and six with facilitative scores ranging between one and three. All participants’ free throws were successful in the low threat condition.

Table 4.2.1 Participants’ low-threat anxiety and performance scores

<table>
<thead>
<tr>
<th>Participant</th>
<th>CA</th>
<th>CAD</th>
<th>SA</th>
<th>SAD</th>
<th>SC</th>
<th>SCD</th>
<th>FTP</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2</td>
<td>+1</td>
<td>2</td>
<td>-1</td>
<td>6</td>
<td>+3</td>
<td>S</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>+2</td>
<td>S</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>+1</td>
<td>3</td>
<td>+2</td>
<td>5</td>
<td>+1</td>
<td>S</td>
</tr>
<tr>
<td>D</td>
<td>2</td>
<td>+2</td>
<td>2</td>
<td>+1</td>
<td>4</td>
<td>+1</td>
<td>S</td>
</tr>
</tbody>
</table>
4.2.2 Low threat condition: Explanations for anxiety and performance

Table 4.2.2 gives an insight into the experiences each participant described in the low threat anxiety condition. From the table, four themes have been identified; causes and direction of anxiety, coping mechanisms, perceived control and gaze behaviour. The following section will further illustrate these themes with participants’ responses to provide a more in-depth insight into the explanations for anxiety and performance.

4.2.2.1 Causes and direction of anxiety

Generally, participants felt there was no need to be anxious in the low threat condition. For example, participant C described how there, “Was no pressure to do well”. Similarly, participant A stated how he, “didn’t feel there was any reason to be anxious”. A stressor that was identified in the low threat condition was the environment, for instance, participant D described how he, “felt a bit uncomfortable in the setting”. Due to the lack of anxiety being presented, some participants felt their interpretations anxiety were irrelevant. For instance, Participant A stated, “I don’t think there was enough anxiety to really affect my performance”. Participant C described how the anxiety he experienced helped his performance, stating, “I think it was good to be a bit anxious, it motivated me to concentrate more”. In contrast participant D showed a debilitating interpretation of their anxiety stating how it, “had potential to make me over think”.

4.2.2.2 Coping mechanisms and perceptions

Most participants identified using a coping mechanism when experiencing anxiety. The use of a pre-shot routine was identified by participants A and D, with both participants finding their pre-shot routines to aid performance. Specifically, the use of the pre-shot routine in the low anxiety condition was shown to be comforting, for example, participant A explained how his pre-shot routine, “makes me feel comfortable and helps prevent any negative thought or distractions”. Participant B described how he tried to increase his focus when anxious, stating, “I tried to focus on the rim”. He then explained how the use of increased focus affected his performance in that it, “calms me down, and gives me something to focus on to avoid any negative thoughts”. Participant C was the only
exception to using a coping mechanism, stating how it, “wasn’t needed” because the anxiety, “wasn’t really enough to try and manage”.

4.2.2.3 Perceived Control

Most participants felt in control over their free throw because of the skill level, for instance, participant A stated that he, “felt in control as it was down to me if I scored or not, I’ve shot plenty of free throws so I knew I was capable of scoring”. Participants B and C shared similar experiences, for example, participant B stated, “I know I can score free throws” and participant C describing how performance was, “down to my technique”. Participant D was the only exception in the group, showing lower levels of perceived control. Participant D described how he, “felt less in control than normal” because he, “had missed a few shots in the warm up”.

4.2.2.4 Gaze behaviour

All participants described how their gaze was focused on the basketball and the rim during the free throw. For example, participant A stated how he, “started off focusing on the ball, and then at the rim for the whole shot”. Participants shared similar explanations to why they started off focusing on the ball. For instance participant A stated how focusing on the ball allowed him to, “a good feel of the ball” and participant B stated how it helped him get his hand in to a, “good position to take the shot.”.
## Table 4.2.2 Participants low-threat anxiety and performance explanations

<table>
<thead>
<tr>
<th>Participant</th>
<th>Anxiety Causes</th>
<th>Coping Mechanisms</th>
<th>Perception of Coping</th>
<th>Perceived Control</th>
<th>Focus of Attention</th>
<th>Anxiety Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>N/A</td>
<td>Pre-shot routine</td>
<td>Made them feel comfortable</td>
<td>In control and capable of scoring</td>
<td>Basketball and rim</td>
<td>Mixed</td>
</tr>
<tr>
<td>B</td>
<td>Slightly concerned with poor performance</td>
<td>Focused on the rim</td>
<td>Helped to block out negative thoughts</td>
<td>In control, confident in ability</td>
<td>Basketball and rim</td>
<td>Irrelevant (low levels of anxiety)</td>
</tr>
<tr>
<td>C</td>
<td>Slightly anxious about missing</td>
<td>N/A</td>
<td>N/A</td>
<td>In control, confident he was going to score</td>
<td>Basketball and rim</td>
<td>Facilitative</td>
</tr>
<tr>
<td>D</td>
<td>Environment and previous performance</td>
<td>Pre-shot Routine</td>
<td>Helped them focus</td>
<td>Not in control, low confidence in scoring</td>
<td>Basketball and rim</td>
<td>Facilitative if dealt with</td>
</tr>
</tbody>
</table>
4.3 Anxiety and performance as a function of a high threat condition

4.3.1 High threat anxiety and performance scores

Table 4.3.1 represents the anxiety and performance scores across the high threat condition for each participant. The CA scores were moderate to high, ranging between three and five. Participants A and B recorded facilitative interpretations of their CA whereas participants C and D recorded debilitative interpretations of their CA. SA scores recorded were low to high, ranging between two and five. The direction of SA varied in the high threat condition, ranging from a negative value of three to a positive value of one. SC was also mixed with participants A and B recording high levels of six whereas participants C and D recorded moderate to low levels of three. SC was generally perceived as facilitative with scores ranging from zero to a positive value of three. The free throw attempts were mostly successful with participants A, B and D all scoring, however participant C’s attempt was unsuccessful in this high threat condition.

Table 4.3.1 Participants’ high-threat anxiety and performance scores

<table>
<thead>
<tr>
<th>Participant</th>
<th>CA</th>
<th>CAD</th>
<th>SA</th>
<th>SAD</th>
<th>SC</th>
<th>SCD</th>
<th>FTP</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3</td>
<td>+2</td>
<td>2</td>
<td>-1</td>
<td>6</td>
<td>+2</td>
<td>S</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>+1</td>
<td>4</td>
<td>+1</td>
<td>6</td>
<td>+3</td>
<td>S</td>
</tr>
<tr>
<td>C</td>
<td>5</td>
<td>-3</td>
<td>5</td>
<td>-3</td>
<td>3</td>
<td>0</td>
<td>U</td>
</tr>
<tr>
<td>D</td>
<td>5</td>
<td>-1</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>+2</td>
<td>S</td>
</tr>
</tbody>
</table>

4.3.2 High threat condition: Explanations for anxiety and performance

Table 4.3.2 gives an insight into the experiences each participant described in the high threat anxiety condition. From the table, four themes have been identified; causes and direction of anxiety, coping mechanisms, perceived control and gaze behaviour. The following section will further illustrate these themes with participants’ responses to provide a more in-depth insight into the explanations for anxiety and performance.
4.3.2.1 Causes and Direction of Anxiety

The causes of anxiety varied between participants in the high threat condition, some shared similarities but each had their own individual characteristics. Participants C and D felt anxious about losing to their opponents, for instance, participant C described how he wanted to, “beat other players” and was, “a bit anxious about failing to do so”. Both participants C and D interpreted their anxiety as debilitative towards performance, with participant C finding it to be, “distracting” and participant D explaining how the anxiety might have made him, “over think the shot”. Participants A and B both described how they were concerned about their performance, for example, participant A stated how he was worried about, “Missing the free throw and losing out on the money”. In contrast to participants C and D, Participants A and B both interpreted their anxiety as facilitative to performance. For instance, participant A stated how his anxiety signifies how, “important it is” and participant B explained how his anxiety, “motivated” him to, “focus more”.

4.3.2.2 Coping Mechanisms and Perceptions

The participants used a variety of techniques to attempt to cope with the anxiety. Participants A and D both used a pre-shot routine to cope with their anxiety, although their perceptions on how this affected their performance varied. Participant D found the pre-shot routine to have a calming effect on his anxiety, however was disappointed with its overall effectiveness, “it calmed my anxiety slightly, but wasn’t as effective as I’d hoped”. In contrast, participant A stated how the pre-shot routine provided him with a comfortable environment and prevented him from becoming distracted, “It put me in a comfortable environment and allowed me to block out and negative thoughts”. Participant C explained how they increased their focus when experiencing anxiety, “I just tried to focus on the task and ignore everything else” and found that this technique reduced his anxiety levels, “I felt less anxious” although felt he didn’t use the coping mechanism efficiently, “I should have done more”. Similar to Participant C, Participant B increased his focus when experiencing anxiety, however also included deep breathing and found this combination to calm him down and reduce anxiety levels, “I was trying to take deep breaths and keep my eye on the rim”, “It helped to reduce my anxiety levels a bit and calmed me down so I was prepared for the shot”.
4.3.2.3 Perceived Control

Most participants showed perceived levels of control over their free throw outcome in the high threat condition. Participant A, B and D all described high levels of control as a result of their ability to score. For instance, Participant D stated, “I felt in control as I knew I had the ability to score” and Participant A explained how he, “felt in control” and was, “confident in his technique”. In contrast, Participant C felt that he lacked control over his free and explained that this might be a result of his previous performance, “I was not really in control, and I felt as if I was unlikely to score because of how I was shooting”.

4.3.2.4 Gaze Behaviour

Most participants in the high threat condition reported how their gaze was drawn to task-irrelevant stimuli during the free throw process, with the exception of participant B who reported only task relevant gazes, “I just looked at the rim and tried to keep my focus away from anything else”. Participants C and D described how they focused on the ball and rim during the free throw, but were also drawn to other players and around the court at times, for example, participant D stated, “my main focus was on the ball and then on the ring, however in between I was looking at other players and just around the court in general”. Participant A showed similarities to participants C and D but described how he was drawn to spectators as opposed to players and around the court, “I looked at the spectators, but after that I looked at the ball and then the rim”. When asked why he focused on the rim participant A explained how it distracted him from other stimuli, “the more I concentrate on the rim the less I think about other stuff”.

Table 4.3.2 Participants high-threat anxiety and performance explanations

<table>
<thead>
<tr>
<th>Participant</th>
<th>Anxiety Causes</th>
<th>Coping Mechanisms</th>
<th>Perception of Coping</th>
<th>Perceived Control</th>
<th>Focus of Attention</th>
<th>Anxiety Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Worried about losing out on the prize</td>
<td>Pre-shot routine</td>
<td>Worked well-distracts irrelevant thoughts</td>
<td>In control, confident in technique</td>
<td>Crowd, Basketball and rim/</td>
<td>Facilitative, signifies importance</td>
</tr>
<tr>
<td>B</td>
<td>Worried about missing the shot</td>
<td>Imagery, controlled breathing and increased focus</td>
<td>Reduced anxiety helped to relax</td>
<td>In control, with slight doubt</td>
<td>The rim</td>
<td>Facilitative but can be debilitative and result in over thinking</td>
</tr>
<tr>
<td>C</td>
<td>Worried about losing out on the prize, and conscious about being recorded.</td>
<td>Extra effort on focusing</td>
<td>Reduced anxiety</td>
<td>Not in control, didn’t feel confident in scoring.</td>
<td>Ball, around the court and the rim</td>
<td>Debilitative and distracting</td>
</tr>
<tr>
<td>D</td>
<td>Worried about other competitors and losing out on the reward</td>
<td>Pre shot routine and deep breathing</td>
<td>Partially calmed anxiety levels.</td>
<td>Decreased control from previous miss</td>
<td>Players, around the court, Ball and Rim</td>
<td>Debilitative, could lead to over thinking</td>
</tr>
</tbody>
</table>
4.4 Anxiety and performance as a function of an in-game condition

4.4.1 In-game anxiety and performance scores

Table 4.3.1 represents the anxiety and performance scores across the In-game condition for each participant. CA scores were equivalent between participants, with all participants recording a score of four. The perceptions of cognitive anxiety varied, with participants A and B finding their CA to be facilitative towards their performance. In contrast, Participant D found their cognitive anxiety to be debilitative with a score of negative one. SA scores were moderate with participants B and D recording a score of four and participant A recording a score of three. The participants perceptions of SA varied with participant A recording a facilitative score of negative one, participant B recording a neutral score of zero and participant D recording a debilitative score of negative two. SC scores were moderate to high in the in-game condition with scores ranging between four and six. The perception of the self-confidence experienced was facilitative with all participants recording positive scores, ranging between positive two and positive three.

Table 4.4.1 Participants’ in-game anxiety and performance scores

<table>
<thead>
<tr>
<th>Participant</th>
<th>CA</th>
<th>CAD</th>
<th>SA</th>
<th>SAD</th>
<th>SC</th>
<th>SCD</th>
<th>FTP</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4</td>
<td>+1</td>
<td>3</td>
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<td>+3</td>
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</table>

4.4.2 In-game condition: Explanations for anxiety and performance

Table 4.4.2 gives an insight into the experiences each participant described in the in-game anxiety condition. From the table, four themes have been identified; causes and direction of anxiety, coping mechanisms, perceived control and gaze behaviour. The following section will further illustrate these themes with participants’ responses to provide a more in-depth insight into the explanations for anxiety and performance.
4.4.2.1 Causes and Direction of anxiety

Participants described a range of anxiety causes in the in-game condition, including; game pressure, spectators and performance. Participant A described how he felt inclined to score for the benefit of the team, “We were losing so I felt like I needed to score, I didn’t want to let the team down” and interpreted his anxiety to be facilitative to his performance, in that it improved his focus and effort levels, “made me focus more and put more effort into the shot”. Participant B described how he was anxious about the crowd, “I could hear the crowd trying to put me off” however felt that this pressure from the crowd was facilitative to his performance and increased his desire to perform well, “it made me want to score more, to shut them up”. Participant D described how he was anxious about his current performance levels being insufficient, “I hadn’t been playing that well so I wanted to score to make up for it” however found this anxiety to be distracting, “I feel as if I was putting too much pressure on myself, causing me to over think and complicate the shot”.

4.4.2.2 Coping mechanisms

All participants tried to cope with their anxiety using a variation of techniques, Participant A used self-talk in an attempt to control his anxiety, “I took a few dribbles before the shot and told myself to score” and found this approach effective in increasing confidence, “telling myself to score made me feel more confident”. Participant B used a combination of controlled breathing and self talk, “I took a few deep breaths to calm myself down and kept telling myself to focus” as a result he stated how he felt more relaxed, focused and confident in scoring, “I think the deep breathing helped to keep me relaxed, which allowed me to focus more on the shot. The self-talk helped me feel more in control and confident in scoring”. Participant D described how he tried to maintain his focus on the rim and used imagery, “by trying to focus just on the rim and picturing the ball going in”, however, despite describing an increase in confidence, stated that he could have been more productive, “It helped me concentrate but I could have focused more”.

4.4.2.3 Perceived control

Participants A and B stated that they were in control of the free throw as well as having high levels of self-confidence, for example, participant B explained, “I felt in complete control, I hadn’t missed a free throw all game so I was confident in my ability to score”. In
contrast, participant D showed low levels of perceived control due to a lack of confidence in his ability to score, “I wasn’t shooting well...it affected my confidence, making me question my ability to score”.

4.4.2.4 Gaze behaviour

The majority of participants described how they were drawn to task-irrelevant stimuli during the in-game condition. For instance, Participant A stated how he was drawn to the environment during the free throw, “I was looking around the court and basket before the shot” and participant D stated how he was drawn to both teammates and opponents, “I was looking at my teammates before the shot, then at the opponents”. The only participant to describe task-relevant gazes throughout the free throw was participant B who reported looking at only the ball and rim, “just at the ball until I was ready to shoot, then at the rim” in an attempt to avoid distraction, “I didn’t want to look anywhere that would distract me”.
Table 4.4.2 Participants In-game anxiety and performance explanations for anxiety

<table>
<thead>
<tr>
<th>Participant</th>
<th>Anxiety Causes</th>
<th>Coping Mechanisms</th>
<th>Perception of Coping</th>
<th>Perceived Control</th>
<th>Focus of Attention</th>
<th>Anxiety Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Game pressure</td>
<td>Imagery and self-talk</td>
<td>Reinforced confidence</td>
<td>In control, confident in ability to score</td>
<td>Around the court, ball and rim</td>
<td>Facilitative, improved effort</td>
</tr>
<tr>
<td>B</td>
<td>Crowd</td>
<td>Self-talk and deep breathing</td>
<td>Improved confidence</td>
<td>In control, confident in scoring</td>
<td>Ball and rim</td>
<td>Facilitative but can be debilitative and result in over thinking</td>
</tr>
<tr>
<td>C</td>
<td>/</td>
<td>/</td>
<td>/</td>
<td>/</td>
<td>/</td>
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<tr>
<td>D</td>
<td>Personal and team performance</td>
<td>Focusing on the rim, imagery</td>
<td>Slightly effective, lacked effort</td>
<td>Not in control, low confidence in scoring</td>
<td>Other players, ball and rim</td>
<td>Debilitative, caused over thinking</td>
</tr>
</tbody>
</table>
CHAPTER FIVE

5.0 Discussion

5.1 Introduction

The purpose of the study was to explore the anxiety-performance relationship in a low threat, high threat and In-game setting. The following chapter will illustrate the key findings from the study, discussing any similarities, or differences with existing anxiety research. It will also identify the strengths, limitations and possible future research directions from the study as well as practical applications drawn from the findings.

5.2 Main Findings

The study revealed a persuasive argument for the attention based explanation of anxiety induced performance impairments. Specifically, some participants in the high threat condition described how they focused on external stimuli such as ‘other players’ and ‘around the court’ during their free throw, whereas in the low threat condition only described focusing on ‘the rim’ or ‘the ball’. This could suggest some participants were drawn to task irrelevant stimuli when experiencing elevated levels of anxiety associated with higher levels of threat. These distractions of focusing on irrelevant stimuli when experiencing high levels of anxiety support the predictions of PET (Eysenck and Calvo, 1992) and more recently ACT (Eysenck et al., 2007). ACT postulates that anxiety reduces attentional control by increasing the disposal of attention to task irrelevant and/or threatening internal (e.g. worry) and external (e.g. crowd pressure) stimuli. These findings share similarities with quantitative studies that have produced support for the predictions of ACT in performance impairments in sport (Beehan and Wilson, 2008; Wilson et al., 2009). For instance, in Wilson et al. (2009) study the author’s found that experienced footballers directed their gaze at the goalkeeper earlier and for longer durations when experiencing anxiety, resulting in a negative effect on shot placement. These findings could explain how an athlete’s performance in visually aided tasks is dependent on their ability to focus on a target efficiently, similar to the suggestions made by Wulf (2007), that the performance of motor tasks can be significantly influenced by an individual's focus of attention. However, the current study also found that although possible reductions in attentional control were
observed, performance failure was not necessarily a resulting factor. This further supports
the theoretical predictions of ACT and its predecessor (PET), in that the impact of anxiety
is possibly more prominent on processing efficiency than performance effectiveness. To
elaborate, ACT theorises that individuals experiencing heightened anxiety often use
compensatory strategies, such as increased effort, in an attempt to maintain performance
effectiveness in a reduced processing efficiency setting (Eyesenck and Darakshan, 2011).

Research that tested the hypothesis of ACT in a lab based setting found that performance
was likely to be impaired when an individual’s Quiet Eye (QE: Vickers, 2007) period is
disrupted significantly. This might suggest the participants in the present study maintained
QE periods for a sufficient amount of time, despite initial processing efficiency being
interrupted. One explanation for this could be that the strategies used by participants
compensated for the processing efficiency disruptions and were used to cope with anxiety.
Indeed, the present study highlighted the strategies participants used in each anxiety
setting and found the main strategies associated with higher levels of competitive anxiety
were the use of a pre-shot routine, controlled breathing and self-talk. Specifically,
participants described their perceptions of these strategies and revealed each had
different effects and ways of reducing anxiety levels. In this study, the pre shot routine
emerged as a possible focus enhancing technique, a finding that shares similarities with
research that has considered the experiences of pre-shot routines among professional
golfers (Yancey, Czech, Joyner, Zwald and Gentner, 2011). In Yancey et al. (2011) study
the authors proposed that pre-shot routines kept the golfers minds focused and occupied,
blocking out any irrelevant thoughts which might interfere with performance. This might
suggest that pre-shot routines, in the current study, enhanced focus by protecting the
performer from any performance impairing stimuli, such as task-irrelevant thoughts. Due to
the individualised nature of pre-shot routines, it’s worth noting that individual’s pre-shot
routines did not share the exact same characteristics, however each shared similar
content.

The use of controlled breathing was revealed to have relaxing effects on participants,
helping them to ‘calm down’ and act as a distraction from any task-irrelevant stimuli.
Peden (2009) identified similar utilizations of deep breathing, describing its use as a simple
and basic method of relaxation, as well as its qualities in reducing anxiety (Peden, 2007).
This might suggest that participants in the present study were able to distract themselves
away from task irrelevant stimuli by reducing their anxiety through controlled breathing. A
theme that emerged from self-talk was its utility to increase confidence. The increases in
confidence through self-talk also emerged through a recent study that focused on the use
of self-talk in cricket batting performances (Miles and Neil, 2013). One finding from Miles and Neil’s (2013) study was the use of self-talk as a motivational method to increase confidence as well as concentration through decreasing anxiety. This might explain why some participants using self-talk in the current study were able to avoid task-irrelevant stimuli under elevated levels of anxiety, by decreasing anxiety through self-talk and subsequently increasing concentration to keep their gaze fixated on task-relevant stimuli.

Interestingly, the study also found a possible link between interpretations of anxiety and performance. To elaborate, facilitative interpretations of anxiety were often accompanied with perceived levels of control over the free throw outcome, with some participants describing how high levels of control were influenced by confidence in their ability, as well as facilitative interpretations of anxiety helping to enhance focus on the shot. These illustrations show similarities to the hypothesis of Jones’ (1995) control model, which explains how a performer’s ability to control a stressor determines the interpretation of anxiety, of which the stressor presented. To expand, perceived acquisitions of control over a situation are said to influence a facilitative interpretation of anxiety. In most cases in the present study, the presence of a facilitative interpretation of anxiety was accompanied with a successful performance; this is consistent with the findings of previous research linking successful performances with facilitative interpretations of anxiety (Butt, Weinburg and Horn, 2003; Swain and Jones, 1996; Neil, Wilson, Mellalieu, Hanton and Taylor, 2012). The study also revealed that almost every facilitative perception of anxiety was accompanied with a high recorded level of self-confidence. This might suggest that individual’s facilitative anxiety perceptions are mediated by high levels of self-confidence, similar to the findings of previous research that has linked self-confidence with anxiety direction (Mellalieu, Neil and Hanton, 2006; Neil et al., 2012). In Mellalieu et al. (2006) study, the authors examined whether self-confidence had a mediating effect on the anxiety intensity-direction relationship and found that self-confidence mediated the relationship between performers worry symptoms and subsequent directional interpretations. Therefore, a possible explanation to the findings of the present study might be that the participant’s high levels of self-confidence enabled them to adjust the meaning of negative symptoms into positive cognitions that facilitated performance.

To summarise, the main findings of the present study pose a strong argument for the predictions of both a directional and attentional explanation of the anxiety-performance relationship. The study also highlighted the participant’s use of pre-shot routines, controlled breathing and self-talk in conditions of elevated anxiety. To elaborate,
participants showed the benefits of such routines in their ability to enhance focus, relax and increase confidence, however further research would be warranted to determine whether the findings of the current study are common across other performance experiences, different situations and other sports. The current findings also suggest there could be multiple mechanisms that appear to explain performance reductions under high levels of anxiety.

5.3 Strengths, Limitations and Future Research

The current study was the first, to the best of the author's knowledge, to examine anxiety effects on performance through a multi-method approach that used simulated competitions, video recall and qualitative approaches. Previous studies investigating the anxiety-performance have mainly considered the anxiety-performance experiences from a simulated anxiety setting (e.g. Beehan and Wilson, 2008; Wilson et al., 2009), failing to offer the performer the opportunity to reflect and recall on actual performance to enhance the performer-environment accuracy. The approach of measuring participant’s actual performance was also used in Miles and Neil (2013) study, investigating the use of self-talk on cricket batsmen’s performance. The theory of ecological dynamics supports the notion of analysing the performer-environment relationship, as opposed to the performer or environment per se, to better understand behaviour (Araujo and Davids, 2011). To elaborate, the dynamic nature of the sporting environment, where the timescales of environmental change and decisional and action processes are similar, complicate the accommodation of behavioural calculations in a fixed setting (Balague, Hristovski and Vazquez, 2008), suggesting a higher ecological value in analysing actual performance as opposed to a fixed induced environment. The main strength of this study, therefore, is found in the design which enabled a more enhanced reflection of participant’s anxiety during performance. From this approach the study gained a more ecological explanation to the anxiety-performance relationship and mechanisms as well as the strategies used in heightened levels of anxiety. Despite this contribution to knowledge, there are a number of limitations within the study that have implications for further research. For instance, the present study used four participants in each of the anxiety conditions measuring a single trial for each condition, limiting the transferability of results. The study also attempted to ensure that interview responses were related to the relevant performances, however there remains some possibility that performer’s recollections were associated with a different performance. Opportunity therefore emerges for future research to administer a similar
study that uses a greater amount of participants, performances and trials to find out whether or not the findings of the current study can be applied to a larger population and are consistent to multiple performances. In addition, the in-event performance analysed in the current study only received moderate to high anxiety recordings from participants, this could be due to the associated performance not imposing maximal levels of pressure on the performer. Future research should therefore also consider the importance of the game and the specific performances within it, possibly analysing highly competitive games and performances such as cup finals or game dependant performances such as the closing minute free throws from which the performer needs to score to prevent a loss. These methods might impose higher levels of anxiety on performers to better understand the effects of anxiety on performance.

A further strength of the current study could be found in the qualitative approach to the attentional explanations of the anxiety-performance relationship. Studies to date, have only considered quantitative designs to assess performers attentional gaze behaviours (e.g. Beehan and Wilson, 2008; Wilson et al., 2009), focusing on how anxiety might impair performance as opposed to why it does from a performers perspective. Indeed, qualitative approaches, such as the one adopted in the present study, have been suggested to further explanation and understanding of the performer's behaviours (Gratton and Jones, 2010). From this, the current study has gained insight into the different strategies used to cope with anxiety and how these might influence gaze behaviour or attentional control. Nevertheless, such measurements of gaze behaviour and attention are limited within this study due to their subjective nature, in that they rely on the individual’s interpretation. Future research should therefore consider combining this qualitative approach with quantitative objective measures of gaze behaviour; this could be achieved through the measurement of the quiet eye period (QE) (see Vickers, 1996, 2007), which has been used as an objective measure of attentional control in visually guided tasks (Wilson et al., 2009).

5.4 Practical Implications

The findings from this study provide several possible avenues for applied implications that might interest athletes, coaches and sport psychologists, including attentional distractions and distraction techniques. The study found that participants might be drawn to task irrelevant stimuli under increased levels of anxiety, in line with the predictions of PET and ACT. Interventions that provide advice and counsel athletes, coaches and sport
psychologists on how these task-irrelevant distractions could be best handled might be advantageous in decreasing the impact that these distractions have on performance. The use of controlled breathing and a pre-shot routine identified in the current study showed possible signs of reducing such distractions through relaxation and enhancing focus, although further research would be required before recommendations could be given to athletes, coaches or sports psychologists. Two training strategies that might be of further interest include QE training and training with anxiety. QE training guides performers to focus on their optimal visual cues to increase performance accuracy, providing the performer with more preparation to handle pressure. The content of QE training is much dependant on the sport being played, with most research being present in golf putting, basketball free throws and shotgun shooting (Wilson, 2012). Specifically performers taking basketball free throws should be first presented with their current gaze on video which should be then used for comparison between an elite free throw performer’s gaze. Subsequently performers are then coached to shoot free throws using the quiet-eye coaching points (see Vickers, 2007). Several studies support the utilisation of QE training to deal with processing reductions from anxiety, these include; QE training for novices in basketball free throw shooting (Vine and Wilson, 2011) and golf putting (Vine and Wilson, 2010) as well as QE training in experienced performers (Causer, Holmes and Williams, 2011b). A recent study analysed the effects of QE training in protecting low-handicapped golfers from the pressure of competition (Vine, Moore and Wilson, 2011), the study compared two groups; one group receiving individual QE training and the other receiving only individual gaze feedback. The study found that the QE trained group performed significantly better than their competitors.

An alternative approach to dealing with processing efficiency reductions from increased anxiety has identified by several researchers who found that training with anxiety can result in improved performances in subsequent pressured situations (Nieuwenhuys and Oudejans, 2010; Oudejans, 2008; Oudejans and Nieuwenhuys, 2009; Oudejans and Pipers, 2009, 2010). In Oudejans and Pipers (2009) study, performers practised basketball free throw shooting in an induced anxiety condition and a condition without induced anxiety. The study found that the performers who practised in an induced anxiety setting no longer experienced performance impairment when performing in a pressurized transfer test, with the opposite applying to the performers who practiced without induced anxiety, even though both groups maintained high levels of recorded anxiety in the pressurized test. The authors concluded that these findings were possible due to the performers being
able to acclimatize to the processing efficiency reductions, allowing them to maintain optimal attentional control even when anxious. Coaches should therefore consider the implementation of training with anxiety in their training sessions.
CHAPTER SIX

6.0 Conclusion

The findings of the current study show possible support for the attentional predictions of PET and ACT as well as support for the predictions of Jones (1995) control model. This highlights that performance impairments under elevated levels of anxiety could be down to multiple explanations and mechanisms, suggesting that explanations provided for performance reductions should view multiple approaches and consider how they interact with one another to enhance the understanding of the performance-anxiety relationship. The study also found that, during elevated levels of anxiety, performers used specific strategies to cope with increased pressure; the main strategies identified in the current study were pre-shot routines, controlled breathing and self-talk. Specifically, performers found focus enhancing qualities from using a pre-shot routine, relaxing qualities in controlled breathing and self-confidence enhancing properties in self-talk, although further research is warranted to assess whether these findings can be applied to a larger population and are consistent to multiple performances.
CHAPTER SEVEN

7.0 References


Gucciardi, D.F


Vealey, and D. Burton (Eds.), Competitive anxiety in sport (pp.117-213). Champaign, IL: Human Kinetics.


Yerkes, R. M. & Dodson, J. D. (1908). The Relation of Strength of Stimulus to Rapidity of Habit-Formation. Journal of Comparative Neurology and Psychology, 18, 459-482.

APPENDICES

Appendix 1:

Table 4.2.1 Participants’ low-threat anxiety and performance scores

<table>
<thead>
<tr>
<th>Participant</th>
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### Appendix 2:

**Table 4.2.2 Participants low-threat explanations for performance and anxiety**

<table>
<thead>
<tr>
<th>Participant</th>
<th>Anxiety Causes</th>
<th>Coping Mechanisms</th>
<th>Perception of Coping</th>
<th>Perceived Control</th>
<th>Focus of Attention</th>
<th>Anxiety Direction</th>
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<tbody>
<tr>
<td>A</td>
<td>N/A</td>
<td>Pre-shot routine</td>
<td>Made them feel comfortable</td>
<td>In control and capable of scoring</td>
<td>Basketball and rim</td>
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<td>B</td>
<td>Slightly concerned with poor performance</td>
<td>Focused on the rim</td>
<td>Helped to block out negative thoughts</td>
<td>In control, confident in ability</td>
<td>Basketball and rim</td>
<td>Irrelevant (low levels of anxiety)</td>
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<td>C</td>
<td>Slightly anxious about missing</td>
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<td>N/A</td>
<td>In control, confident he was going to score</td>
<td>Basketball and rim</td>
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<td>D</td>
<td>Environment and previous performance</td>
<td>Pre-shot Routine</td>
<td>Helped them focus</td>
<td>Not in control, low confidence in scoring</td>
<td>Basketball and rim</td>
<td>Facilitative if dealt with</td>
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Appendix 3:

Table 4.3.1 Participants’ high-threat anxiety and performance scores

<table>
<thead>
<tr>
<th>Participant</th>
<th>CA</th>
<th>CAD</th>
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Appendix 4:

Table 4.3.2 Participants high-threat explanations for anxiety and performance

<table>
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<tr>
<th>Participant</th>
<th>Anxiety Causes</th>
<th>Coping Mechanisms</th>
<th>Perception of Coping</th>
<th>Perceived Control</th>
<th>Focus of Attention</th>
<th>Anxiety Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Worried about losing out on the prize</td>
<td>Pre-shot routine</td>
<td>Worked well-</td>
<td>In control,</td>
<td>Crowd, Basketball and rim/</td>
<td>Facilitative, signifies importance</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>distract-</td>
<td>confident in technique</td>
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<td></td>
<td></td>
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<td>irrelevant thoughts</td>
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<tr>
<td>B</td>
<td>Worried about missing the shot</td>
<td>Imagery, Controlled breathing and increased focus</td>
<td>Reduced anxiety helped to relax</td>
<td>In control, with slight doubt</td>
<td>The rim</td>
<td>Facilitative but can be debilitative and result in over thinking</td>
</tr>
<tr>
<td>C</td>
<td>Worried about losing out on the prize, and conscious about being recorded</td>
<td>Extra effort on focusing</td>
<td>Reduced anxiety</td>
<td>Not in control, didn’t feel confident in scoring</td>
<td>Ball, around the court and the rim</td>
<td>Debilitative and distracting</td>
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<tr>
<td>D</td>
<td>Worried about other competitors and losing out on the reward</td>
<td>Pre shot routine and deep breathing</td>
<td>Partially calmed anxiety levels</td>
<td>Decreased control from previous miss</td>
<td>Players, around the court, Ball and Rim</td>
<td>Debilitative, could lead to over thinking</td>
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</table>
## Appendix 5:

### Table 4.4.1 Participants’ in-game anxiety and performance scores

<table>
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## Appendix 6:

### Table 4.4.2 Participants In-game explanations for performance and anxiety scores

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<th>Perception of Coping</th>
<th>Perceived Control</th>
<th>Focus of Attention</th>
<th>Anxiety Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Game pressure</td>
<td>Imagery and self-talk</td>
<td>Reinforced confidence</td>
<td>In control, confident in ability to score</td>
<td>Around the court, ball and rim</td>
<td>Facilitative, improved effort</td>
</tr>
<tr>
<td>B</td>
<td>Crowd</td>
<td>Self-talk and deep breathing</td>
<td>Improved confidence</td>
<td>In control, confident in scoring</td>
<td>Ball and rim</td>
<td>Facilitative but can be debilitative and result in over thinking</td>
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<td>Personal and team performance</td>
<td>Focusing on the rim, imagery</td>
<td>Slightly effective, lacked effort</td>
<td>Not in control, low confidence in scoring</td>
<td>Other players, ball and rim</td>
<td>Debilitative, caused over thinking</td>
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Appendix 7:

INTERVIEW GUIDE

How would you describe your anxiety before the free throw?

What were you anxious about?

How did you perceive the anxiety?

Did you attempt to manage the anxiety you were experiencing?

How?

How was this effective in helping your performance?

Describe any thoughts you experienced before and during the free throw?

To what extent did you feel in control of the free throw outcome?

Why was that?

Where were you focusing your attention throughout the free throw? From the moment you step up to the line all the way through to the shot outcome.

And why did you focus on these points?
Appendix 8:

Ethical Approval Letter

Date: 01/10/2013

To: Nathan Archer

Project reference number: 13/11/07U

Your project was recommended for approval by myself as supervisor and formally approved at the Cardiff School of Sport Research Ethics Committee meeting during the 2013/14 Academic Year.

Yours sincerely

Dr. Rich Neil

[Signature]

Supervisor