Psychological mechanisms underpinning severe performance loss in sport : Applying theory to practice.

CHELL, Benjamin J.

Published version

CHELL, Benjamin J. (2005). Psychological mechanisms underpinning severe performance loss in sport : Applying theory to practice. Doctoral, Sheffield Hallam University (United Kingdom)..

PSYCHOLOGICAL MECHANISMS UNDERPINNING SEVERE PERFORMANCE LOSS IN SPORT: APPLYING THEORY TO PRACTICE

Benjamin James Chell

A thesis submitted in partial fulfilment of the requirements of

Sheffield Hallam University

for the degree of Doctor of Philosophy

May 2005

I dedicate this thesis to my Dad, Geoff Chell, for
his love, friendship and inspiration,
which will remain within
me forever.

"God gave us memories so that we might have roses in December"
(James Barrie).

ABSTRACT

This thesis provided a detailed examination of severe performance loss in competitive sport. Baumeister's (1984) model of choking under pressure and Masters, Polman and Hammond's (1993) model of skill failure under pressure have largely predicted the direction of the current research associated with this phenomenon. Both models control for dispositional and situational factors. The research underpinning these theories has produced equivocal findings. Furthermore, mechanisms associated with these models have been derived from limited research, lacking empirical or qualitative grounding in sport. The primary aims of this thesis were to identify psychological mechanisms that underpin severe performance loss, examine how the dominant mechanisms within the problem interact and establish coping strategies to counteract this phenomenon. Three research designs were used across this thesis. The first study adopted an inductive qualitative design. Studies two, three and four adopted a group-based design. The final study adopted a single-subject reversal design. The final two studies also used qualitative interview techniques. Study one investigated from the athlete's perspective, psychological mechanisms that underpin severe performance loss in sport. Inductive techniques produced five main themes that described athletes' experiences: stress, anxiety, self-consciousness, conscious processing and automaticity disruption. Athletes followed a similar sequence of events outlined by Masters' (1992) conscious processing hypothesis and reported dispositional characteristics consistent with Masters et al.'s (1993) model of skill failure under pressure. The contentions of Baumeister (1984) were not supported. Masters et al. (1993) constructed the Reinvestment Scale which they claimed to be a predictor of performance loss under stress. Study two investigated the predictive power of the Reinvestment Scale in skilled soccer players executing a gross dynamic motor task under stress. Results indicated that high reinvesters were more susceptible to performance loss under stress than low reinvesters, which provided support for the predictive power of the Reinvestment Scale. Study three investigated the effect of holistic and process learning methods and reinvestment on the performance of an adapted basketball free-throw task under stress. Results indicated that minimising the acquisition of explicit task knowledge in high reinvesters using holistic style learning performance loss, precipitated by conscious processing could be prevented when under stress. These findings have practical implications for rule-based orthodox coaching strategies used in sport. Study four investigated whether or not the use of different attentional foci could prevent performance loss in skilled golfers, high in reinvestment when they performed a putting task under stress. Results indicated that loading heavily on working memory (e.g. random letter generation focus) desensitised high reinvesters to stress. Thus, conscious processing of explicit task knowledge was prevented and automaticity promoted, which enabled consistent performance under stress. The final study investigated the influence of a two-phase putting intervention strategy on skilled golfers high in reinvestment. The intervention strategy successfully counteracted conscious processing by loading on working memory to prevent access to explicit knowledge during putting execution, whilst still enabling critical environmental information to be processed prior to putting execution via the use of external imagery. Interview data indicated that all participants would feel confident in using the putting intervention during competition. It is the author's belief that, although unanswered questions remain, this research programme has enriched the conceptual and practical understanding of severe performance loss in competitive sport for researchers, practitioners and coaches. Future research should investigate the relationship between personality and environmental factors on learning styles and skilled performance to establish a richer understanding of this phenomenon. Research also needs to examine the efficacy of psychological intervention strategies used to counteract severe performance loss in a variety of sports and ecologically valid competitive environments.

ACKNOWLEDGEMENTS

The constant guidance and support I have encountered not only during this research programme but throughout my life has been extraordinary. Without the generosity of certain people this journey would have neither started nor ended. My deepest appreciation goes out to those individuals on whose shoulders I stand. First, I would like to thank Professor Ian Maynard for not only his expert support and guidance throughout this thesis, but also for giving me the opportunity to realise my ambition and become a Sport Psychologist.

I would like to express a special thanks to Dr. Mark Bawden whose support, encouragement and belief in me has been immense. Thank you also to Mark for 'showing me the way' as an undergrad., 'giving me a leg-up' as a postgrad., and 'picking me up when I fell' as a human being throughout the last ten years. Above all thank you to Mark for his friendship and shared vitality in following the 'Way of the Peaceful Warrior'.

I would like to extend my gratitude to Dr. Owen Thomas for his advice and guidance and Professor Edward Winter for his phenomenal attention to detail. Thank you also to Dr. Jan Graydon for her belief in me and for giving me the opportunity to start this journey in the first place, and to Dr. Tim Holder for his tireless encouragement to continue the journey even when the path began to subside. I would like to extend my appreciation to all the participants that were involved in this research programme, without them this thesis would not have been possible.

I would like to express my thanks to Ian Knights not only for his counsel and encouragement, but also for his belief in me, which sparked my awakening and enabled me to face my fears and return back to education. Thanks to Steve Peters whose enlightening support triggered 'a moment of clarity' that enabled me to start to 'see myself in me'. Thanks to Gill Bradley whose friendship and empathy over the past two years has been tireless. Thanks also to John Rennie whose selflessness and kind heart has touched my life in more ways than he will ever know; his vitality for life continually reminds me of the difference that can be made to the world by helping others. I would like to extend my appreciation to 'the boys' for their lifelong friendship. In particular I would like to say a special thanks to my oldest friend Andy Marcer whose remarkable ability to 'suck the marrow out of life' continues to inspire me – 'bezzle on'!

I would like to thank my family, whose unrelenting support and belief has made me the person I am today; for this I am truly grateful. I would like to express a special thank you to Mum for her unconditional love, patience and support throughout my life and for teaching me always to be tenacious. Thank you to Ken for his words of wisdom and his extraordinary capacity to make me smile no matter what the circumstance. Thanks also to Adam who constantly provides me with gravity and reminds me about the important things in life'; a true envoy for the human spirit – 'ride on'! Finally, I would like to express a heartfelt thank you to Kate whose love and zest for life has illuminated my world.

PEER REVIEWED MATERIAL FROM THIS THESIS

Publications:

Chell, B.J., Graydon, J.K., Crowley, P.L. & Child, M. (2003). Manipulated stress and dispositional reinvestment in a wall-volley task: An investigation into controlled processing. Perceptual & Motor Skills, 97 435-448.

Chell, B.J., Holder, T., Graydon, J.K. Greenlees, I.A. (under review). Dispositional Reinvestment, Stress and Learning Style in Motor Skill Acquisition. Submitted to Research Quarterly - Oct. 2004.

Chell, B.J., Holder, T., Graydon, J.K. Greenlees, I.A. (under review). Antecedents and Consequences of Severe Performance Loss in Competitive Sport: The Athletes' Perspective. Submitted to Journal of Sport & Exercise Psychology - Dec. 2004.

Chell, B.J., Maynard, I.M., Bawden, M.A.K., & Thomas, O.T (under review). Dispositional Reinvestment, Stress and Focus of Attention in Skilled Golfers. Submitted to Journal of Sport & Exercise Science - Feb. 2005.

Chell, B.J., Maynard, I.M., Thomas, O.T., & Bawden, M.A.K. (under review). Dispositional Reinvestment, Stress and Skilled Golfers: A Psychological Putting Intervention. Submitted to Journal of Applied Sport Psychology - March. 2005.

Conference Presentations :

Chell, B.J., Holder, T., Graydon, J.K. (2002). Manipulated stress and dispositional reinvestment in a wall-volley task: An investigation into controlled processing. British Association of Sport and Exercise Science Annual Conference. July 2002.

Chell, B.J., Holder, T., Graydon, J.K. (2003). An investigation into psychological mechanisms underpinning severe performance loss in competitive athletes: A qualitative perspective. British Association of Sport and Exercise Science Annual Conference. September 2003.

Chell, B.J., Holder, T., Graydon, J.K. (2003). The effect of holistic and process learning, dispositional reinvestment and manipulated stress on a basketball free-throw task. British Association of Sport and Exercise Science Annual Conference. September 2003.

Chell, B.J., Maynard, I.M., Bawden, M.A.K., & Thomas, O.T (under review). Dispositional Reinvestment, Stress and Focus of Attention in Skilled Golfers. Submitted to British Association of Sport and Exercise Science Annual Conference. March 2005.

Chell, B.J., Maynard, I.M., Thomas, O.T., & Bawden, M.A.K. (under review). Dispositional Reinvestment, Stress and Skilled Golfers: A Psychological Putting Intervention. Submitted to British Association of Sport and Exercise Science Annual Conference. March. 2005.

CONTENT

ABSTRACT **III**

CHAPTER I **1**

1.0. INTRODUCTION 2

CHAPTER II **8**

2.0. REVIEW OF LITERATURE 9

2.1. Clarification of terms 10

2.2. Arousal and severe performance loss in competitive sport 13

2.3. Anxiety and severe performance loss in competitive sport 17

2.4. Attentional mechanisms influential in severe performance loss in competitive sport 23

2.41. Distraction theories 24

2.42. Self-awareness, self-consciousness andself-attention 28

2.5. The influence of skill acquisition, focus of attention and deautomatization upon severe performance loss incompetitive sport 32

2.51. Conscious versus automatic processing systems 33

2.52. Explicit knowledge suppression during learning and skilled performance 35

2.53. Focus of attention during skillacquisition and performance 48

2.6. Dispositional factors and severe performance loss in competitive sport 58

2.7. Summary and aims of research 69

CHAPTER III **71**

3.0. STUDY 1. ANTECEDENTS AND CONSEQUENCES OF SEVERE PERFORMANCE LOSS IN COMPETITIVE SPORT: THE ATHLETES' PERSPECTIVE

3.1. Introduction 72

3.2. Method 74

3.3. Results and Discussion 77

3.4. General Discussion 101

CHAPTER IV **108**

4.0. STUDY 2. DISPOSITIONAL REINVESTMENT AND STRESS IN SKILLED SOCCER PLAYERS

4.1. Introduction 109

4.2. Method 112

4.3. Results 117

4.4. Discussion 122

CHAPTER V **127**

5.0. STUDY 3. DISPOSITIONAL REINVESTMENT, STRESS AND LEARNING STYLE IN BASKETBALL SKILL ACQUISITION

5.1. Introduction 128

5.2. Method 131

5.3. Results 136

5.4. Discussion 145

CHAPTER VI **153**

6.0. STUDY 4. DISPOSITIONAL REINVESTMENT, STRESS AND FOCUS OF ATTENTION IN SKILLED GOLFERS

6.1. Introduction 154

6.2. Method 158

6.3. Results 165

6.4. Discussion 176

CHAPTER VII **183**

7. 0. STUDY 5. DISPOSITIONAL REINVESTMENT AND STRESS IN SKILL GOLFERS: A PSYCHOLOGICAL PUTTING INTERVENTION

7.1. Introduction 184

7.2. Method 186

7.3. Results 194

7.4. Discussion 209

CHAPTER VIII **214**

8.0. SUMMARY, DISCUSSION AND CONCLUSIONS

8.1. Introduction 215

8.2. Summary 215

8.3. Discussion 221

6.4. Practical Implications 226

8.5. Strengths of the Research Programme 229

8.6. Limitations of the Research Programme 230

8.7. Recommendation for Future Research 231

8.8. Conclusions 235

REFERENCES 236

APPENDICES **1**

1. Flow diagram of thesis 2
2. Informed Consent for Study 1 4
3. A Survey on Individual Sporting Experiences 6
4. Interview Guide for Study 1 8
5. Transcribed Interview 10
6. The Reinvestment Scale 23
7. The Modified Anxiety Rating Scale (ARS) 25
8. The Modified Competitive State Anxiety Inventory-2 (CSAI-2) 27
9. The Mental Effort Scale 29
10. The Movement Imagery Questionnaire - Revised (MIQ-R) 31
11. Condition Criteria - Study 4 34
12. Competition Brief - Study 4 36
13. Social Validation Interview Guide - Study 4 38
14. Intervention Brief - Study 5 40
15. Competition Brief (Phase 1 & 2) - Study 5 44
16. Social Validation Interview Guide / Questionnaire - Study 5 47
17. Statistical Analysis for Study 2 50
18. Statistical Analysis for Study 3 59
19. Statistical Analysis for Study 4 70

LIST OF FIGURES

Figure	Title	Page No.
2.1.	The Inverted-U Hypothesis	14
2.2.	Catastrophe model of anxiety, physiological arousal and performance	22
2.3.	A Schematic of the conscious processing hypothesis	36
2.4.	A Schematic of the choking under pressure model	60
2.5.	A Schematic of the skill failure under pressure model	65
3.1	Factors influencing the occurrence of severe performance loss	79
3.2	Experiences during severe performance loss	84
3.3	Consequences of skill disruption occurring	98
3.4	Personality characteristics	99
3.5	Type of competition	100
3.6	A Schematic of severe performance loss in competitive sport	102
4.1	The wall-volley soccer format	114
4.2	Performance Scores for the High and Low Reinvestment Groups in each Experimental Condition. Values are Means (M)	121
5.1.	The Adapted Basketball Free-Throw Task	132
5.2.	The experimental format	134
5.3	Learning curves for each of the high and low reinvestment Groups, in each learning subgroup	138
5.4.	Means and standard deviations for the test scores for the low and high reinvestment groups in each learning sub-group in each stress condition	144
6.1.	The adapted golf putting task	159
6.2.	Putting Scores in the Baseline Measure and ThreeExperimental Conditions. Values are Means (M)	168
7.1.	Putting scores for each participant	200

LIST OF TABLES

Table	Title	Page No.
4.1.	Means and standard deviations for the anxiety rating scale intensity scores for the high and low reinvestment groups in each experimental condition	118
4.2.	Means and standard deviations for the anxiety rating scale direction scores for the high and low reinvestment groups in each experimental condition	119
5.1	Means and standard deviations for the anxiety rating scale intensity scores for the low and high reinvestment groups in each learning sub-group for each stress condition	140
5.2	Means and standard deviations for the anxiety rating scale direction scores for the low and high reinvestment groups in each learning sub-group for each stress condition	142
6. 1.	Means and standard deviations for the CSAI-2 intensity and direction scores for the baseline measure and 3 experimental conditions	166
6.2.	Means and standard deviations for the mental effort baseline measure and 3 experimental conditions	170
6.3.	Means and standard deviations (secs.) for time-on-task baseline measure and the 3 experimental conditions	171
7.1.	Scores for the Reinvestment Scale and Movement Imagery Questionnaire - Revised	195
7.2.	Modified CSAI-2 intensity scores for somatic anxiety, cognitive anxiety and self-confidence	196
7.3.	Modified CSAI-2 direction scores for somatic anxiety, cognitive anxiety and self-confidence	197
7.4.	Means and standard deviations for the golf-putting scores at each experimental phase of the study	201

7.5. Means and standard deviations for the mental effort scores at each experimental phase of the study 203
7.6. Time-on-task (secs.) for the first ten putts, for each set of 50 trials at each experimental phase of the study 204
7.7. Score for questions 1, 3, 7, 8 and 9 of the social validation data for the treatment condition 206

GLOSSARY

Severe Performance Loss in Competitive Sport	A sudden and substantial deterioration of a well-learnt motor skill under stress.
Conscious Processing	Consciously rehearsing explicit task knowledge associated with early stages of learning under stress.
Automaticity	An implicitly regulated processing system unconstrained by conscious control.
Choking Under Pressure	The occurrence of inferior performance despite an individual striving and situational demands for superior performance.
Reinvestment	A dispositional tendency to experience conscious processing and automaticity disruption under stress.
Self-consciousness	A dispositional tendency to experience self-awareness in social situations.
Anxiety	The emotional impact or cognitive dimension of arousal.
Pressure	Any factor or combination of factors that increases the importance of performing well.
Stress	A substantial imbalance between environmental demands and response capacity, under conditions where failure to meet the demands has important consequences.
Explicit (Process) Learning	Acquiring a skill through a specific set of rules that are one is aware of and therefore can articulate.
Implicit learning	Acquiring a skill through a specific set of rules that one is not aware of and therefore can not articulate.
Holistic Learning	Acquiring a skill as a whole with little or no awareness of rules associated with that skill.

CHAPTER I

1.0. INTRODUCTION

The world of sport hosts many famous examples where athletes occasionally have experienced a sudden and severe loss in performance during competition. One has only to reflect on the semi-final of the 1990 football World Cup finals when both Chris Waddle and Stuart Pearce missed important penalty kicks against Germany or Jana Novotna's extraordinary loss to Steffi Graf in the 1993 Wimbledon tennis final. A more recent example of this phenomenon is Jean Vandervalde's missed opportunity to win The Open Golf Championship in 1999 at Carnoustie after experiencing an unprecedented triple bogy on the final hole. Paradoxically, on these occasions it would appear that motivation and the importance to perform well were at a premium, yet performance suddenly dropped well below what would normally be anticipated. A clear understanding of this phenomenon eludes applied sport psychologists and researchers alike owing perhaps to the complex and individual nature of such a phenomenon.

Severe performance loss in competitive sport can be characterised by a sudden and substantial deterioration of performance under stress. As a result of the complexity of such an experience several theories probably have a part to play in explaining this performance deterioration (e.g. choking under pressure (Baumeister, 1984); catastrophe theory (Hardy, 1990); conscious processing hypothesis (Masters, 1992); skill failure under pressure (Masters, Polman & Hammond, 1993)). These theories provide different perspectives in attempting to explain performance loss phenomenon. For these reasons, throughout the programme of research this phenomenon will be referred to as severe performance loss in competitive sport as opposed to other terminology used in the literature such as choking or skill failure. It was the author's belief that this would avoid any confusion about the thrust of the thesis. In addition, it was believed that by initially adopting a broad approach to this phenomenon the value of different theoretical perspectives could be adequately explored.

Current research has highlighted pressure and stress as fundamental antecedents associated with decrements in motor performance (Baumeister, 1984; Hardy, Mullen & Jones, 1996; Masters, 1992; Masters et al., 1993; Mullen & Hardy, 2000). Pressure increases the demands of performing well; stress is the process involving one's appraisal of whether or not those demands can be successfully met (Lazarus, 1966, 1982, 2000; Lazarus &

Folkman, 1984). In the context of sport it has been suggested that stress might or might not place strain on the individual, it is one's appraisal or perceived ability to cope with the situation (i.e. stressor) that is central to the process (Jones, 1990). The purported mechanisms through which such stress affects motor performance are wide ranging and depend on the theoretical position adopted. Some researchers have suggested that large deteriorations in performance can occur due to the effects of anxiety (Fazey & Hardy, 1988; Masters et al., 1993) and arousal (Easterbrook, 1959) that emerge from stress. These researchers argued that the combination of high cognitive anxiety and physiological arousal would have catastrophic effects on skill execution. Some purported effects of experiencing arousal and anxiety are that they can cause either a distraction or a self-focused attention. Distraction occurs when an individual is preoccupied by task-irrelevant information (e.g. worry) and fails to attend to task-relevant cues (Eysenck, 1979). Alternatively, performance decrements occur when self-focused attention interferes with the automatic execution of a motor skill (Baumeister, 1984; Masters, 1992).

Substantial support has been provided for the stress-self-focus relationship. For example, Masters (1992) proposed the conscious processing hypothesis, which stated that heightened state anxiety precipitated by stress can direct attention to the process by which a well-leamed skill is executed. Deikman (1969) refers to this as deautomatization; performance decreases because conscious attention interferes with the automatic regulation of the skill sequence. These arguments have led to suggestions that such attentional shifts are influenced by the method through which the skill was learnt (Masters, 1992). Motor skills have been proposed, initially, to be learned explicitly through conscious processing (Anderson, 1982; Fitts & Posner, 1967). Over time, with practise, motor skills are then thought to become implicit through automatic processing. It is therefore hypothesised by some authors that stress results in a regression to early learning phase strategies (Fuchs, 1962) and results in a movement characterised by inefficient co-ordination patterns and a freezing of the degrees of freedom within the movement sequence (Bernstein, 1967). Hence the movements lose effectiveness, which leads to large deteriorations of performance.

The phenomenon under investigation in this study has sometimes been labelled as choking and describes an athlete when he/she experiences a severe loss in performance during a critical moment in competition (Baumeister & Showers, 1986). This suggests that the timing of the deterioration in performance is linked to specific characteristics of the situation such as the competition environment and the moment by moment status of that performance and targets set. Baumeister (1984) proposed a model of choking, which hypothesised that arousal, created by pressure, heightens self-consciousness, which directs attention to the movement characteristics of a skill sequence. An anxious attempt is then made to consciously control the movement to ensure the correct execution of the skill. This disrupts automaticity and impairs performance because explicit knowledge is no longer available to the conscious attention to successfully guide the execution of a well-learned skill.

To test the choking model Baumeister (1984) conducted a series of experiments. The outcome was that it is easier for highly self-conscious individuals to cope with pressure because they are used to performing whilst feeling self-conscious, in contrast to low self-conscious individuals who are not so accustomed to this process (Baumeister, 1984). This suggests that the role of dispositional characteristics in a performer’s personality might have an explanatory role in large performance decrements. Further to this Masters et al. (1993) regard the primary mechanism by which skill regression occurs as reinvestment of controlled processing. They described this occurrence as having a greater or lesser disposition to rehearse explicit task knowledge, particularly when under stress.

Clearly, a definitive explanation in terms of mechanisms that underpin the experiences of such athletes as Chris Waddle, Jana Novotna and Jean Vandervalde has yet to be established. There a four central criticisms emanating from the literature that require investigation: first, psychological mechanisms associated with models claiming to explain severe performance loss (e.g. Baumeister, 1984; Masters, 1992; Masters et al., 1993) have been derived from limited research, possessing no empirical or qualitative grounding in sport. Current research has not identified the athlete’s perspective on psychological mechanisms that might underpin severe performance loss in competitive performers. Second, there are conflicting elements between such models both from theoretical and research perspectives. Third, dispositional factors and learning methods have independently emerged as key mechanisms that underpin severe performance loss. Nevertheless, the combined effects of such mechanisms have not been investigated. Finally, intervention strategies have yet to be developed to help promote automaticity and prevent severe performance loss in competitive sport. These limitations in the literature will form the basis for this programme of research.

Purpose of the Thesis

The central purpose of this thesis was to investigate psychological mechanisms that underpin severe performance loss in competitive sport. Moreover, one intention was to make the transition from theory into practice and provide psychological intervention strategies that practitioners could use to help performers counteract this phenomenon. Subsidiary aims of this thesis were to establish psychological mechanisms that underpin severe performance loss (Studies 1 & 2), examine how dominant mechanisms of the problem interact (Studies 3 & 4) and establish coping strategies to counteract the severe performance loss phenomenon (Study 5). A time line of this thesis is presented in Appendix 1.

Structure and Main Findings of the Thesis

The thesis comprises seven further chapters that address the central research aims. The structure of this thesis is as follows:

Chapter 2 provides a critical overview of a broad range of theories and research that could explain severe performance loss in competitive sport.

Chapter 3 examines psychological characteristics derived from the perceptions and interpretations of competitive athletes that have experienced first-hand, performance loss in a variety of sports. To date, previous research has exclusively used quantitative, outcome-based measures to examine performance loss in competitive sport without a qualitatively derived understanding. The main purpose of the study was to explore the value of available theories used in the literature to explain severe performance loss in relation to the perceptions of athletes who have experienced such a phenomenon. The study also provides a basis for testing specific psychological mechanisms in the subsequent investigations.

Chapter 4 investigates the effects of dispositional reinvestment (Masters et al., 1993) and stress on experienced soccer players using a gross, dynamic motor task. The main purpose of the study was to assess whether or not those players who scored high on the Reinvestment Scale would be more susceptible to severe performance loss of a gross dynamic motor skill, precipitated by conscious processing and automaticity disruption under high stress.

Chapter 5 examines the effects of learning methods and reinvestment under stress. The main purpose of the study was to assess if limiting explicit knowledge during skill acquisition could prevent conscious processing and so promote implicit regulation of performance in individuals predisposed to conscious processing (high reinvesters) under high stress.

Chapter 6 investigates the effects of attentional foci (internal, external and articulatory suppression) on experienced golfers high in reinvestment under stress. The main purpose of the study was to assess whether the manipulation of attentional focus or loading on working memory could prevent conscious processing and promote automaticity in experienced golfers high in reinvestment. Another aim of this study was to provide information to develop psychological intervention strategies that golfers could use to prevent severe performance loss during competition in the future.

Chapter 7 examines the effects of a two-phase psychological putting intervention on experienced golfers, high in reinvestment, in an ecologically-valid environment under stress. The purpose of the study was to assess whether the putting intervention could help experienced golfers, high in reinvestment, to maintain performance by preventing conscious processing and promoting automaticity under high stress.

Chapter 8 summarises the overall findings of the research programme and discusses theoretical implications. The chapter also provides an outline of practical implications as well as strengths and limitations that emanate from the findings. The chapter concludes by identifying areas of future research and clarifying the overall conclusions of the thesis.

CHAPTER II

2.0. REVIEW OF LITERATURE

Sport comprises many athletes that have experienced, under pressure, a marked loss in their performance. However, definitive understandings of the mechanisms that underpin these experiences continue to elude sports psychologists and researchers. Deleterious performance effects are scattered across a wide range of topics in the academic literature. Hence, explanations for these phenomena have been made through the most readily available theory (Baumeister, 1986). An area that has received much attention in sport psychology literature is the influence of stress and pressure upon performance (Hardy, Jones, & Gould, 1996). Current sports performers are required to compete under intense pressure, which often elicits high psychological stress. It is therefore no surprise that researchers have tried to identify the antecedents of stress, whilst attempting to develop strategies to help performers cope with this phenomenon (Scanlan, Stein & Ravizza, 1991). Explanations of the stress - athletic performance relationship have been provided through a string of theoretical models. Nonetheless, the relationship between stress and the disruption to automatic skills (or deautomatization; Deikman, 1969) has received comparatively little attention in the academic literature and, hence, is not that well understood. This is perhaps owing to the individual nature and complexity of such a phenomenon.

The initial section of this review of literature will clarify issues surrounding the use of terminology and concepts associated with performance pressure, psychological stress, arousal, activation and anxiety in sport. This is followed by an overview and critique of both unidimensional and multidimensional arousal and competitive anxiety theories associated with severe performance loss. The next section of the review provides an overview and critique of theory and research on the influence of attention mechanisms on severe performance loss. Also incorporated into this section is an overview and critique of the theory and research relating to the influence of skill acquisition upon severe performance loss. The final section provides an overview and critique of theory and research relating to the influence of dispositional factors upon severe performance loss. The main focus of the review forms a synopsis of the nature of the aforementioned cognitive mechanisms and compares how they interact with each other in relation to severe performance loss. The review concludes by summarising areas of future study within the domain of severe performance loss in competitive sport. This provided the rationale for the programme of research undertaken within this thesis.

2.1. PERFORMANCE PRESSURE, PSYCHOLOGICAL STRESS, AROUSAL, ACTIVATION AND ANXIETY - CLARIFICATION OF TERMS

An integral part of competing in sport, particularly at elite level, is the capability to cope with high levels of pressure, stress, arousal and anxiety (Jones & Hardy, 1990). A problem within the literature has been the imprecise use of terminology. This has led to such constructs being used interchangeably in previous research. Therefore, the aim of this review section is to remedy this problem by presenting a series of clear definitions that outline and distinguish these constructs.

Current research has highlighted pressure and stress as being fundamental antecedents of decrements in motor performance (Baumeister, 1984; Hardy, Mullen & Jones, 1996, Masters, 1992; Masters et ah, 1993; Mullen & Hardy, 2000).
These constructs, often used interchangeable in the literature, are not synonymous and possess distinct differences. Pressure has been defined as

> "any factor or combination of factors that increases the importance of performing well on a particular occasion" (Baumeister, 1984, p.610).

Baumeister and Showers (1986) highlight five main antecedents of pressure in sport. These are contingency of reward or punishments on level of performance, an evaluative audience, comparative coactors (e.g. competition), the relevance of performance in relation to the 'ego', and finally, having only one chance to be successful. Baumeister and Showers (1986) argued that an individual must be aware of the incentive(s) of pressure for performance to be influenced. They also argued that more than one factor might elicit pressure in certain circumstances and thus, speculated the effects on performance would be additive.

General psychology has suggested that stress should be characterised as a process (Lazarus, 1966; 1982; 2000; Lazarus & Folkman, 1984). Stress has been defined as

> "a relationship between the person and the environment that is appraised by the person as relevant to his or her well-being and in which the person's resources are taxed or exceeded" (Folkman & Lazarus, 1985, p.152).

In short, pressure increases the demands of performing well, whilst stress is one's appraisal as to whether those demands can be successfully met or not. Current researchers within sport have acknowledged the main principles of Lazarus and colleague's definition (e.g. Hardy, Jones & Gould, 1996; Jones, 1990). For examples, Jones (1990) proposed that stress in sport was a state in which some demand is placed on the individual, who then is required to react in some way to overcome the situation. Therefore, it has been suggested that stress might or might not place strain on the individual, it is one's appraisal or perceived ability to cope with the situation (i.e. the stressor) that is central to the process. Apprehension and doubt relating to an athlete's perceived ability to cope with a stressful situation is likely to be reflected in heightened levels of anxiety (Hardy, Mullen & Jones, 1996).

Anxiety can be defined as

> "a negative emotional state with feelings of nervousness, worry and apprehension associated with the activation or arousal of the body" (Levitt, 1980, p. 182).

Anxiety has become commonly accepted as a negative emotional response that can be experienced as cognitive reactions, such as worry and distraction or as bodily arousal (cf. Raffety, Smith & Ptacek, 1997).

Arousal[1] has been defined as

> "the extent of release of potential energy, stored in the tissue of the organism, as this is shown in activity or response". (Duffy, 1962, p.179).

Arousal was hypothesised to indicate an Inverted-U type performance relationship with moderate levels being associated to optimal performance (Broadhurst, 1975). More recently researchers have questioned the simplistic explanation of unidimensional theorisation of arousal (e.g. Hardy, Jones & Gould, 1996; Hockey & Hamilton, 1983; Lacey, 1967; Neiss, 1988; Pribram & McGuinness, 1975). Lacey (1967) proposed that arousal comprises three separate components; cognitive (electocortical activity measured via EEG), physiological (activity measured via skin conductance and heart rate) and behavioural (overt activity) components. Arousal and activation are often used interchangeably in the literature. Therefore, Pribram and McGuiness (1975; cf. Hardy Jones, & Gould, 1996) called for researchers to make a distinction between the two constructs. Arousal refers to an unprepared response to some new or unexpected form of stimulus presented to the system, involving cognitive and physiological activity. In comparison, activation refers to a prepared response to an anticipated input into the system involving cognitive and physiological activity (Pribram & McGuinness, 1975).

In summary, research within stress and anxiety has been limited by the incongruent terminology used to define pressure, stress, arousal, activation and anxiety (Hardy, Jones & Gould, 1996; Woodman & Hardy, 2001). Clearly these constructs are inter-related. Nevertheless, differentiation between these constructs remains essential for understanding. Thus, for the remainder of this thesis reference will be made to each construct in accordance with the previously denoted definitions.

[1] An in-depth review of undimensional and multidimensional arousal and anxiety theories are provided in sections 2.2 and 2.3, respectively.

For almost a century researchers have sought to explain the arousal-performance relationship. Until recently, research has attempted to resolve the anxiety-performance relationship through arousal based theories. The following section provides a brief outline and critique of two main arousal-performance explanations; Inverted-U theory and Drive theory. This is followed by an outline of multidimensional theory, a more contemporary explanation of the arousal-performance relationship. Throughout this section a series of theoretical issues will be discussed relating to the role of arousal upon severe performance loss in competitive sport.

From a theoretical perspective, Inverted-U theory was the first documented model proposed to explain the arousal-performance relationship. Inverted-U theory was initially proposed by Yerkes and Dodson (1908) to explain the habit strength formulation of mice at different levels of punishment stimulus frequency. More recently, this theory has been used to explain the relationship between arousal and sports performance. Inverted-U theory proposed that arousal has a curvilinear relationship with performance. It was hypothesised that increases in arousal up to a certain 'optimal' level would result in performance gains. In comparison, it was proposed that increases or decreases in arousal above or below the optimal point would result in performance decrements, proportionate to the changes in arousal levels (see Figure 2.1). Hence, the Inverted-U theory has received much criticism from several perspectives (Hardy, 1990; Lacey, 1967; Landers & Boutcher, 1986). Initially, criticism was directed towards the lack of theory to underpin the Invert-U hypothesis. The hypothesis provides no explanation as to how arousal affects performance or why performance is impaired when levels are less than optimal (Eysenck, 1985). Further criticism came from catastrophe models[2] which suggest slight arousal reduction is unlikely to reinstate optimal performance levels (Hardy, 1990). Finally, Lacey (1967) found evidence to suggest that arousal was not undimensional, but rather a multidimensional construct comprising three elements. Individuals that experience severe performance deterioration in sport report a large and dramatic loss to performance, rather than a gradual decrease in performance. Hence, the Inverted-U theory is unlikely to be able to explain the occurrence of severe performance loss in competitive sport.

[2] A review of catastrophe theory is provided in section 2.3.

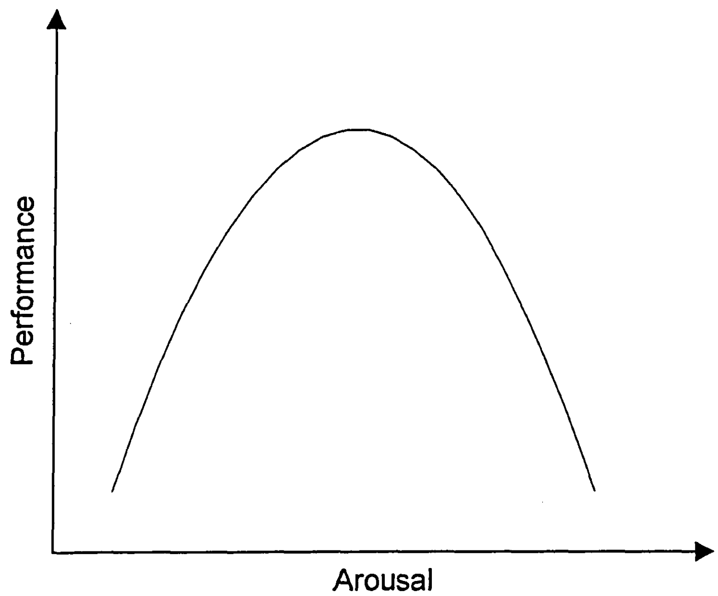


Figure 2.1. The Inverted-U Hypothesis (Yerkes & Dodson, 1908)

Drive theory, initially proposed by Hull (1943) and later modified by Spence and Spence (1966) hypothesised that drive and habit strength were predictors of performance. Drive is considered synonymous with arousal. Habit strength is associated with the dominance of the correct or incorrect response. In contrast to Inverted-U theory, Drive theory proposed that the arousal-performance relationship was linear - Performance (P) = Habit (H) x Drive (D). Habit represented the standard of skill that the individual had obtained and drive was the level of arousal that they were experiencing. Thus, in the early stages of learning where a skill had not reached automaticity, the habit (dominant response) would not be the correct response. Hence, as arousal increases so the quality of the performance would deteriorate because the skill was not well learned. Later in the learning process, where the skill has been well learned the dominant response will be the correct one. For individuals at this stage of skill development increases in arousal should produce a higher quality performance.

Drive theory also takes into account 'incentive value'. This aspect of the theory suggests that performance will only increase if the performer desires to perform the task. Hence, if an individual's 'incentive value' is low then performance improvements will not occur. Drive theory has been criticised on two main counts; first the theory is too simplistic to explain behaviour in a sporting context. Second, it is very difficult to determine the habit hierarchy of correct and incorrect responses (Fisher, 1976). Such limitations have made it problematic to test the theory in motor behaviour contexts. Hence, Drive theory has been rejected as an accurate predictor of the effects of arousal on motor performance (Martens, 1971; Neiss, 1988). Individuals who experience severe performance loss in competitive sport are generally considered to possess well learned, automatic skills (Masters, 1992). According to Drive theory high levels of arousal should help to produce the dominant response and facilitate performance. Baumeister (1984) identified high levels of arousal to be detrimental to executing a well learned skill, which is inconsistent with the predictions of Drive theory. Therefore, it is unlikely that Drive theory is able to explain the occurrence of severe performance loss in competitive sport.

More recently, researchers have taken a multidimensional approach to arousal (Hockey & Hamilton, 1983; Jones & Hardy, 1989; Lacey, 1967). Pribram and McGuiness (1975) proposed three interactive neural systems that influenced the arousal-performance relationship; these were arousal, activation, and cognitive effort. Arousal refers to an unprepared response to some new form of stimulus presented to the system, involving cognitive and physiological activity. Activation refers to a prepared response to an anticipated situation involving cognitive and physiological activity. Cognitive effort is responsible for co-ordination between the arousal and activation systems and is deemed to be an attentional measure associated with maintaining or increasing efficiency.

Deuchamps (1988) proposed three inter-related dimensions of arousal; energetical, emotional, and computational (cognitive). Deuchamps (1988) asserted that specific stressors would predict which dimension is most aroused, which is then given priority (via the central nervous system) at the expense of the other dimensions. For example, if the stressor is physical the energetical dimension will be given priority in terms of arousal; if the stressor is anxiety then the emotional dimension will be most aroused at the expense of the other dimensions. Presumably, although Deuchamps (1988) does not comment on this, resources are taken up by negative emotions, which might leave insufficient arousal for the other two dimensions to operate efficiently. Hence, the execution of a motor skill might be impeded. Thus, Deuchamps' (1988) theory could offer an explanation as to why individuals experience severe performance loss in sport. However, this theory has not been rigorously tested in relation to motor performance due to the complexities of measuring such a construct.

Neiss (1988) conceptualised arousal as a patterning of different physiological parameters rather than a unidimensional quantitative state. Hockey and Hamilton (1983) argued that the appropriateness of this pattern (Neiss, 1988) in relation to the task being undertaken can affect performance efficiency. If the present physiological arousal pattern is inappropriate a decrement in performance will ensue (Neiss, 1988). In a specific task being undertaken activation states of some subsystems will be inevitably higher than in others. Hardy, Jones and Gould (1996) explained the potential differences in activation subsystems using the example of golf putting. They suggested that when this task is executed brain wave activity may be high, but local muscle activity in the forearms may be low. These activation states are task specific as different tasks utilise different subsystems. A degree of preparation is also required to create the appropriate activation state prior to performance (Hardy, Jones, & Gould, 1996).

Hockey and Hamilton (1983) suggested that by using different strategies to induce stress (e.g. auditory noise, monetary reward, and sleep deprivation) different activation states could be elicited. However, processes of some operations would be facilitated whereas others would be impaired. Hockey and Hamilton (1983) highlighted the importance of identifying specific subsystems relating to arousal that support performance. In addition, they called for research to investigate different constructs that induce stress and their impact on different cognitive variables (e.g. vigilance, selective attention, working memory capacity, short and long-term recall, and speed of information transfer).

Clearly, Hockey and Hamilton (1983) consider arousal to be a multidimensional state and thus reject unidimensional theories relating to this construct. However, a criticism of multidimensional arousal theorists is they do not quantify the required dimensions of arousal needed to activate the different subsystems in order to elicit optimal performance. Finally, a multidimensional approach to arousal suggests generic interventions used to suppress physiological arousal (e.g. applied relaxation techniques) in athletes are inappropriate, as they collectively reduce both the positive and negative aspects of arousal in relation to performance (Burton, 1990). Arousal, if treated as a multidimensional construct could offer an explanation as to why severe performance loss occurs. However, a greater understanding of the required dimensions of arousal that activate performance is needed before a fuller explanation of the relationship between multi-dimensional arousal and severe performance loss can be established.

2.3. ANXIETY AND SEVERE PERFORMANCE LOSS IN COMPETITIVE SPORT

Anxiety and its effects on athletic performance have received a considerable amount of attention in the sport psychology literature. The majority of the literature relating to severe performance loss in competitive sport has been associated with some form of anxiety (e.g. Baumeister, 1984, Bright & Freedman, 1998; Hardy, Mullen, & Jones, 1996, Masters, 1992; Masters et al. 1993; Mullen & Hardy, 2000). The following section provides a brief outline and critique of anxiety theory and research. This includes a description of the components and measures of anxiety, followed by a series of explanations relating to the anxiety-performance relationship. Throughout this section a series of theoretical issues will be discussed relating to the role of anxiety and severe performance loss in competitive sport.

Early research by Spielberger (1966) proposed two types of anxiety that are situational specific, defined as state anxiety and that which is a personality disposition, defined as trait anxiety. State anxiety was defined as

> "subjective, consciously perceived feelings of tension and apprehension associated with the arousal of the autonomic nervous system." (p.17)

In comparison, trait anxiety was defined as

> "a motive or acquired behavioural disposition that predisposes an individual to perceive a wide range of objectively non-dangerous circumstances as threatening and respond to these with state anxiety reactions disproportionate in intensity to the magnitude of the objective danger." (p.17)

In short, individuals high in trait anxiety interpret more situations as threatening and thus, respond with greater levels of state anxiety. In general psychology Davidson and Schwartz (1976) began to recognise anxiety as a multidimensional response including a cognitive and somatic component. When defining the components, cognitive anxiety was suggested to reflect "...the cognitive elements of anxiety, such as negative expectations and cognitive concerns about oneself, the situation at hand, and potential consequences." (Morris, Davis, & Hutchings, 1981; p.541). Whereas somatic anxiety was defined as "...ones perception of the physiological-affective elements of the anxiety experience, that is, indications of autonomic arousal and unpleasant feelings states such as nervousness and tension." (Morris et al., 1981). From a sports perspective, Hardy, Jones and Gould (1996) defined cognitive anxiety as 'concerns about performing well, and the consequence of failing to do so'. In comparison, somatic anxiety was defined as 'the physiological response to psychological stress' (p. 69).

Liebert and Morris (1967) proposed that the two sub-components of anxiety have different effects on performance. Similarly, from a sporting perspective, Burton (1988) contended that somatic and cognitive anxiety influence performance in different ways. Cognitive anxiety was hypothesised to exhibit a negative linear relationship with performance. Hence, the greater the levels of cognitive anxiety, the greater the performance decrement. In comparison, somatic anxiety was suggested to display a quadratic or Inverted-U relationship with performance. Hence, moderate levels of somatic anxiety would produce optimal performance. However, changes in somatic anxiety levels (e.g. increase or decrease) would elicit a proportionate performance decrement (Burton 1988; Martens, Burton, Vealey, Bump, & Smith, 1990). In the case of cognitive anxiety, the proposed performance relationship was based on Wine's (1971) theory of attentional disruption where worried athletes were suggested to become preoccupied with their own self-evaluation rather than direct attention to the task in hand (i.e. performance; Martens et al., 1990). The rationale for the hypothesised relationship between somatic anxiety and performance is less clear, although it appears to be an extension of the proposed Inverted-U relationship between arousal and performance (cf. Woodman & Hardy, 2001). Additionally, Martens et al. (1990) cited Weinberg's (1978) research surrounding the effects of increase muscular tension on performance deterioration as a possible mechanism accounting for the relationship.

Much of the early research used either the state version of the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Luschane, 1970) or the Competitive State Anxiety Inventory (CSAI; Martens, Burton, Rivkin, & Simon, 1980) to calculate competitive anxiety intensity. The STAI was developed as a non-sport specific measure of anxiety and was criticised because of the need for instruments to be situation specific and sensitive to the characteristics of the measurement environment (Mandler & Sarason, 1952). In response, Martens et al. (1980) developed the sport specific CSAI, suggested to be a more sensitive scale for use within sporting environments.

Although the developments outlined above aided understanding, the conceptualisation of anxiety was still somewhat limited owing to the inventories used to calculate competitive anxiety intensity being unidimensional. The stimulus for the use of multidimensional anxiety in sport psychology was initiated through the development of the Competitive State Anxiety Inventory-2 (CSAI-2; Martens et al., 1990) as a development of Martens et al.'s (1980) original (unidimensional) CSAI scale. Martens et al. (1990) integrated the definitions of Morris et al. (1981) with state cognitive anxiety suggested to be "...most commonly manifested in negative expectations about performance and thus negative self-evaluation, both of which precipitate worry, distributing visual images or both." (p. 120). In comparison, state somatic anxiety was referred to as "...the physiological and affective elements of the anxiety experience that develop directly from autonomic arousal. Somatic A-state is reflected in such responses as rapid heart rate, shortness of breath, clammy hands, butterflies in the stomach, and tense muscles." (p. 121).

During the original validation of the CSAI-2 self-confidence also emerged as a separate construct of competitive anxiety (Martens et al., 1990). During the exploratory factor analysis procedures adopted by Martens et al., (1990) cognitive anxiety effectively split into two factors; a positively labelled factor subsequently termed self-confidence, and a negatively worded set described by the term cognitive anxiety. Martens et al. (1990) suggested that the two constructs represented opposite ends of a continuum, with state self-confidence indicative of an absence of cognitive anxiety, and conversely state anxiety representing a lack of state self-confidence. For this reason, self-confidence became a component of multidimensional arousal theory.

More recently Jones (1991, 1995) criticised the 'intensity' (i.e., levels) alone approach to the measurement and conceptualisation of competitive anxiety suggesting the need to consider the direction dimension of the response (i.e., the interpretation of symptom intensity as either facilitative or debilitative towards performance). Jones (1995) contended that areas such as educational psychology have long regarded the positive consequences of anxiety and identified the need to distinguish between positive and negative components of the stress relationship. To examine the efficacy of directional perceptions within competitive anxiety, Jones and Swain (1992) modified the CSAI-2 adding a debilitative-facilitative continuum to each item. Specifically, performers were asked to rate whether they interpreted the intensity of pre-competitive anxiety symptoms as facilitative (i.e., positive) or debilitative (i.e., negative) towards future performance. Empirically research using the modified CSAI-2 has been successful in identifying several individual differences variables over and above approaches simply viewing anxiety as an intensity-based construct. Studies have revealed a consistent pattern of findings in their comparisons between elite versus non-elite performers (Jones, Hanton, & Swain, 1994; Jones & Swain, 1995), good versus bad performance (Jones, Swain, & Hardy, 1994), high versus low competitive individuals (Jones & Swain, 1992), and positive versus negative goal expectancy groups (Jones & Hanton, 1996). However, no research has examined the directional interpretation of anxiety in relation to severe performance loss in competitive sport. Consequently, it is not clear what impact directional interpretation of anxiety might have on such a phenomenon.

Multidimensional anxiety theory has undoubtedly developed an improved understanding of the anxiety-performance relationship (Martens et al., 1990). However, research assessing the relationship between the components of anxiety and performance has tended to produce equivocal findings (Burton, 1998). A limitation of multidimensional anxiety theory is that it only describes the independent effects of somatic and cognitive anxiety, it does not account for the interactive nature of the two constructs upon performance (Hardy, Jones & Gould, 1996). In an attempt to clarify the interactive effects of the two anxiety sub-components the cusp catastrophe model (see Figure 2.2) was proposed (Fazey & Hardy, 1988; cf. Hardy, 1990; Hardy, Jones, & Gould, 1996). This model hypothesises that the cognitive sub-component of anxiety determined the effects of physiological arousal on performance, which was termed a splitting function. The catastrophe model indicated that if cognitive anxiety is low, physiological arousal has a relatively small and systematic effect on performance, similar to Inverted-U theory. However, if cognitive anxiety is high then the effects of physiological arousal on performance will be large and catastrophic. A substantial reduction in cognitive anxiety is required if performance is to be reinstated. Fazey and Hardy (1988) argue that under such circumstances even reinstating intermediate levels of performance are unlikely.

More recently, Hardy (1990) proposed the catastrophe butterfly model; a higher order theme paradigm. This was to remedy criticisms of catastrophe theory, which did not account for self-confidence or the directional interpretation (facilitative or debilitative) of anxiety. This five-dimensional model proposed that self-confidence increases the probability that individuals will be able to sustain performance even when experiencing high levels of cognitive and physiological arousal. This model could offer a more

Performance

I

p Yi^s\o\o^ caX
OViS^

c °gnitive
Anxiety

Figure 2.2. Catastrophe Model of Anxiety, Physiological Arousal and Performance (Hardy, 1990)

complete explanation of the anxiety-performance relationship. Nevertheless, research to support this paradigm has not been forthcoming.

Only limited support has been provided for catastrophe theory largely because of the difficulties in testing such a complex model. Athletes that have experienced severe performance loss have associated high levels of anxiety with a sudden and dramatic decrease in performance (LeUnes & Nation, 1996). Therefore, catastrophe theory might explain why performers, on occasions, experience this phenomenon. However, this model does not provide an explanation as to how skills breakdown or how anxiety influences the mechanics of automatic skill execution. Further, this model does not take into account dispositional factors (Baumeister, 1984; Masters et al., 1993), or the influence of using different processing systems (e.g. automatic versus conscious) to execute automatic skills (Hardy, Mullen, & Jones, 1996; Masters, 1992), which have been proposed to influence this phenomenon. Hence, catastrophe theory is unlikely to explain fully the complex nature of severe performance loss in competitive sport.

2.4. ATTENTIONAL MECHANISMS INFLUENTIAL IN SEVERE PERFORMANCE LOSS IN COMPETITIVE SPORT

As established in the preceding two sections of this review it is clear that both arousal and anxiety can influence decrements in sports performance. However, the models used to explain both the arousal- and anxiety-performance relationships are limited. Hence, it would appear that such models alone are unable to provide a complete explanation as to how and why automatic skills breakdown. Much of the literature that has examined the disruption to automatic skills, associated with arousal and anxiety, has also identified changes in attentional focus to be pivotal in this occurrence (e.g. Baumeister, 1984, Bright & Freedman, 1998; Hardy, Mullen, & Jones, 1996; Masters, 1992; Masters et al. 1993; Mullen & Hardy, 2000).

A dichotomy has emerged in the literature. This has produced two alternative mechanisms to explain the processes underpinning decrements in motor performance through an interference or change in attentional processes, often associated with arousal (Easterbrook, 1959) and anxiety (Masters et al., 1993). The first of these mechanisms occurs when an individual is distracted by task irrelevant information (e.g. worry) and fails to attend to task relevant cues (Eysenck, 1979; Kahneman 1973; Morris & Liebert, 1969; Sarason, 1972; Spencer & Spencer, 1966; Wine, 1971). The second mechanism occurs when self-attention interferes with the automatic execution of a motor skill (Baumeister, 1984; Liebling & Shaver, 1973; Masters, 1992; Masters et al., 1993). Throughout this section a series of theoretical issues will be discussed pertaining to the relationship between attention-arousal and attention-anxiety, and how these constructs might influence severe performance loss in competitive sport. This section begins with an overview and critique of distraction theories. This is followed by an overview and critique of self-awareness, self-consciousness and self-attention theories.

2.41. Distraction theories

Duval and Wickland (1972) proposed that distraction might be evoked in one of two ways. Firstly, an attempt to process a large amount of information will leave insufficient capacity to attend to task relevant cues. Secondly, if a normal amount of information is processed, but attention shifts to focus on task irrelevant cues insufficient resources will be available to process relevant information. Either way a decrement in performance will ensue.

Easterbrook's (1959) cue utilisation theory proposed that attention and arousal have a curvilinear relationship with performance, similar to Inverted-U theory (Yerkes & Dodson, 1908). This theory hypothesised that as arousal increases to a moderate level, attention narrows, which only allows task relevant cues to be processed. However, if arousal continues to increase attention continues to narrow causing task relevant information to be missed, which in turn leads to performance impairment. Easterbrook (1959) argued that low arousal levels can lead to processing large amounts of information. This can cause information overload, which might explain the occurrence of severe performance loss in competitive sport. However, pressure is not usually associated with low levels of arousal. Rather, pressure is usually associated with high arousal levels (Baumeister, 1984). Hence, this phenomenon is more likely to be explained through the omission of task relevant information, owing to high arousal levels (Baumeister, 1984).

Kahneman (1973) described arousal as a functional resource (neurotransmitters) in the brain available for processing information. As arousal increases so to does the amount of functional resources available for processing information. The amount of resources required to execute a task depends on the complexity of that task. If there are insufficient resources available to execute a skill then a decrement in performance will ensue. Furthermore, if sufficient resources are available to execute a skill, but some resources are allocated to task irrelevant information then a decrease in performance will also ensue. Kahneman (1973) also highlighted cognitive effort to be an influential factor. Kahneman (1973) proposed that when only limited resources are available (low arousal levels) or not all resources are allocated to the task, cognitive effort can prevent decrements in performance provided the task is simple and does not involve extensive information processing. However, the unidimensional arousal theories used to explain attentional distraction are unlikely to fully explain the occurrence of severe performance loss owing to the limitations highlighted in Section 2.2.

One type of distraction that has been suggested to affect the processing of task relevant information is worry. Wine (1971) investigated the distraction of worry precipitated by the effects of test anxiety. Wine (1971) found that highly anxious individuals directed attention to task irrelevant negative thoughts (e.g. worry). Consequently, such individuals were unable to engage in the cognitive processing required for successful completion of the test (Wine, 1971; cf. Eysenck, 1979; Morris & Liebert, 1969; Sarason, 1972; Spencer & Spencer, 1966).

An influential factor in Eysenck and Calvo's (1992) processing efficiency theory is worry (e.g. self-preoccupation / evaluation apprehension), which is thought to deplete processing and storage resources in working memory. Specifically, this theory attempts to explain the interactive function of state anxiety, trait anxiety and situational threat or stress on performance. Processing efficiency theory is based on Baddeley's (1986) multi-dimensional working memory model. This model of working memory comprises at least three primary components (Baddeley & Hitch, 1974; Logie, 1995, 1999). The core of the system is the central executive, which has limited capacity to process information. This component regulates, retrieves, processes and stores information (Baddeley, 1992). The phonological loop and visuo-spacial sketch-pad are the two subsidiary systems, also limited in capacity, and work on behalf of the central executive.

The phonological loop co-ordinates the retention and manipulation of verbal information. The visuo-spacial sketch-pad co-ordinates the visual and spatial material required for processing and short term retention (Baddeley, 1992).

Eysenck and Calvo (1992) proposed that the control system, which mediates the effects of anxiety on performance, initiates the response to poor performance in two ways. Firstly, by dealing directly with worry to reduce it, available capacity in working memory can be increased. Secondly, deleterious effects of worry on performance can be eradicated by recruiting additional resources, through increased effort on the task. According to processing efficiency theory highly anxious individuals tend to allocate additional resources to the task in hand more frequently than low anxious individuals for several different reasons. Firstly, worry can increase motivation and thus, improve performance which reduces worry. Secondly, highly anxious individuals are more likely to acknowledge a mismatch between expected and actual performance, as they tend to allocate more resources to worry and task irrelevant cues, which leads to performance impairment. Thirdly, highly anxious individuals are more sensitive to failure feedback. This makes salient any discrepancy between expectation and outcome, which increases motivation to task performance. Finally, highly anxious individuals tend to set unrealistically high standards, which elicit a greater chance of a discrepancy occurring between expectances and outcome.

Eysenck and Calvo (1992) made a distinction between performance effectiveness and processing efficiency. Performance effectiveness is associated with the quality of performance. Processing efficiency is the relationship between performance effectiveness and the investment of processing resources (e.g. effort). According to Masters et al. (1993) athletes who experience skill failure under pressure[3] consciously reinvest processing resources in the movement characteristics of the task, which disrupts automaticity and impairs performance. Therefore, conscious processing reduces processing efficiency (by allocating resources to task irrelevant self-focused cues), which reduces performance effectiveness. The extent to which performance effectiveness is reduced is presumably exacerbated by those irrelevant cues being associated with the explicit rules of the task, which are thought to disrupt automaticity and lead to skill failure under pressure (Masters, 1992; Masters et al., 1993). Woodman

3 A review of skill failure under pressure is provided in 2.6

and Hardy (2001) have made links between the conscious processing hypothesis[4] (Masters, 1992) and processing efficiency theory (Eysenck & Calvo, 1992). Woodman and Hardy (2001) suggest that dramatic decrements in performance under stress can be produced in one of two ways; effort withdrawal or effort-induced lapses into conscious processing. Hence, processing efficiency provides a theoretical framework by which conscious processing can take place.

Carver and Scheier (1988) also attempted to explain the effects of anxiety on human behaviour (see also Carver, Blaney, & Scheier, 1979; Carver, Peterson, Follansbee, & Scheier, 1983; Carver & Scheier, 1981, 1984). Their model proposed that individuals develop reference points which are mediated by short and long term goals, standards and intentions. From these reference points individuals attempt to monitor their actions. Any discrepancies between the actually and desired task outcome are monitored by a regulatory feedback control system (Carver & Scheier, 1988).

From a control-process perspective human behaviour can be distracted by anxiety, which disrupts performance. Carver and Scheier (1988) described anxiety as a conflicting variable in the regulatory mechanism. Conflict could arise when behaving in the direction of one reference point, which offsets the balance of another reference point (e.g. physical safety, acceptance from other people, personal comfort; Rogers, 1980). In addition, the nervous system uses anxiety by means of information, which takes up space in working memory (Hamilton, 1983) and can interrupt specific actions (Simon, 1967).

Carver and Scheier (1988) argued that anxiety could have an energising and focusing or conversely a disrupting and negative effect on behaviour. The diverse effects of anxiety are contingent upon favourable versus unfavourable expectancies of achieving the intended outcome goal(s). For example, for an individual who perceives a high likelihood of success to complete a task (favourable expectancy) anxiety will increase effort and thus self-focused attention will facilitate perseverance. Conversely, for an individual who perceives a low likelihood of success to complete a task (unfavourable expectancy) anxiety will decrease effort and thus self-focused attention will lead to disengagement (discontinue) from the task. More subtly, an individual may disengage

4 A review of the conscious processing hypothesis is provided in 2.52.

from the effort required to execute the task rather than disengaging from the task itself. Masters (1992) stated that skill breakdown under pressure is common in those highly motivated to succeed. Baumeister and Showers (1986) argued that choking can not occur without pressure. Consequently, if an athlete effectively disengages from a situation involving pressure by withdrawing effort from the task, any performance decrement that ensues is clearly not a result of stress induced skill disruption. In addition, individuals who perceive a high likelihood of success will focus on the task, which from a control-process perspective suggests that

> "one cannot be task focused without being simultaneously focused on an aspect of the self." (Carver & Scheier, 1988, p. 132)

Conversely, self-focused attention in individuals who perceive a low likelihood of success will be directed towards negative cognitions such as self-doubt and worry in addition to their failure to proceed towards their intended outcome goal (Carver & Scheier, 1988).

2.42. Self-awareness. Self-consciousness and Self-Attention

An alternative mechanism derived from the attentional literature that claims to explain the occurrence of severe performance loss in competitive sport are theories of self-awareness. Self-awareness theories propose that attention is directed to oneself, and essentially, towards the movement characteristics of a task, which can disrupt and impair performance (Baumeister, 1984). However, before discussing these theories it is important to draw attention to the link that exists between theories of distraction and self-awareness. Task irrelevant worries associated with distraction theories can also manifest themselves in the form of self-evaluation. Consequently, self-awareness can be a form of distraction, which can monopolise attentional resources, detract from processing task relevant information and lead to performance impairment (Leibling & Shaver, 1973).

This section begins by clarifying terminology and concepts associated with self-awareness, self-consciousness and self-focus. A series of theoretical issues are then discussed relating to the role of these constructs upon severe performance loss in competitive sport.

Philosophers and psychologists alike have investigated the nature of the self, the role of self-consciousness and self-awareness in an attempt to understand such constructs and their influence on human behaviour (Carver & Scheier, 1978). These constructs are often used interchangeably in the literature. However, they are not synonymous and thus, require clarification. Self-consciousness has been defined as

> "a dispositional tendency to experience self-awareness in social situations." (Christensen, 1982, p. 177)

In comparison, self-awareness has been defined as

> "a state in which the subject's attention is directed towards the self, and there will be a comparison of the self with standards of correctness." (Innes & Young, 1975, p. 36)

Self-awareness has been advocated by psychoanalysts and Rogerian therapists suggesting that getting in touch with oneself by attending to and understanding one's inner thoughts and feelings is both a tool and a goal. Individuals possessing greater self-awareness will conform in accordance with normal behavioural standards (e.g. society) more so than those who are less self-aware (Duval & Wicklund, 1973; Scheier, Fenigstein, & Buss, 1974). A theory of self-awareness, proposed by Duval and Wickland (1972), suggested that attention can be directed inwardly (e.g. to the self) or outwardly (e.g. to the environment). A person high in self-awareness can become more conscious of their feelings, presence and attributes when performing. The standards and correctness by which behaviour is evaluated is heightened when an individual is self-aware. Hence, if there is a mismatch between behaviour and standard then a negative affect will ensue (Duval & Wickland, 1972). Greater attempts will be made by a self-aware individual to remedy this mismatch than when they are not self-aware. Thus, the theory proposes that performance should improve in self-aware individuals. This does not support the contention of Carver and Scheier (1881) who suggested that self-awareness can detract away from processing task relevant information, otherwise required for successful performance. Nevertheless, low self-consciousness has been found to be detrimental to performance of a well learned motor skill under pressure owing to conscious attempts to control ones movements (Baumeister, 1984). There have been numerous connections made between self-awareness and a person's self-consciousness. Fenigstein, Scheier, and Buss (1975) proposed that self-attention was a element of dispositional self-consciousness.

Fenigstein et al., (1975) proposed that certain individuals are predisposed to self-consciousness. Hence, they constructed the Dispositional Self-Consciousness Scale to assess individual differences within this construct. The validation of the scale revealed that self-consciousness comprises three subscales; private, public and social anxiety. The private self-consciousness subscale measure an individual's self-focus, that is the mulling over of specific aspects of oneself. High scores on this scale were indicative of feelings, thought and mood awareness. The public self-consciousness subscale measures an individual's awareness and concerns of being a social entity. The final subscale was social anxiety. This refers to individual reactions when being evaluated by others. Research by Carver and Scheier (1978) used the Self-Consciousness Scale to assess aspects of self-awareness. Carver and Scheier (1978) attempted to increase self-awareness by manipulating the environment whilst conducting a sentence completion task. They found that having to perform in front of an audience or mirror, heightened self-attention. They also reported the private subscale of the Dispositional Self-Consciousness Scale did measure self-attention. More recently, research conducted using the Dispositional Self-Consciousness Scale (Fenigstein et al., 1975) found it to be a successful predictor of choking under pressure[5] (Baumeister, 1984).

The terms nervousness and self-consciousness, although not synonymous, are believed to be associated with the same stimulus conditions (e.g. audience evaluation; Wegner & Giuliano, 1980). Research has been directed towards self-consciousness as a construct that heightens arousal levels. However the findings are equivocal (Gibbons, Carver, Scheier, & Hormuth, 1979; Gur & Sackeim, 1979; Paulus, Annis & Riser, 1978). In antithesis, Wegner and Giuliano (1980) hypothesised that it is arousal that heightens self-consciousness. Wegner and Giuliano (1980) examined the two constructs and found that heightened arousal does increase attention to the self. Their findings support

[5] A review of choking under pressure is provided in section 2.6.

Baumeister (1984) who also found that heightened arousal was responsible for directing attention to oneself, which led to conscious control of movement and subsequent performance impairment.

Simon (1967) proposed fear as a construct that can interrupt and impede a specific behaviour. Pressure inducing situations such as competition demand optimal performance (Baumeister & Showers, 1986). However, an athlete in such a situation might not perceive they are capable of meeting those demands. Hence, stress through a sense of apprehension and fear of failure might ensue. Fear of failure can impair performance and in extreme cases can preclude success to such an extent that it renders an athlete dysfunctional (LeUnes & Nation, 1996). Pam Shriver, when talking about her performance anxieties stated

> "I'm scared when I play tennis. I fear failure at every comer, and until I rid myself of that attitude, I know I will never attain my goal, of winning a Wimbledon or U.S. Open." (Cited in LeUnes & Nation, 1996. p. 112)

Carver and Scheier (1981) contended that rising fear commands attention, which can make people stop what they are doing and consider for a moment whether they are capable of meeting the demands of the task. Scheier, Carver, and Gibbons (1979) examined the effects of dispositional private self-consciousness (Fenigstein et al., 1975) and manipulated fear. Scheier et al. (1979) found that heightened fear directs attention to the self, which in turn disrupts behaviour. Carver and Scheier (1981) proposed that as fear is heightened an individual's subjective awareness of that fear would become greater. However, interruption of certain behaviour is dependent upon the amount of anxiety that the person is experiencing at this time. If anxiety is relatively low then behaviour is unlikely to be effected. Conversely, if anxiety is relatively high then frequent interruption to behaviour is inevitable. This supports the contention of the skill failure under pressure (precipitated by conscious processing) literature as this phenomenon has been associated with both automaticity disruption and high levels of state anxiety (Hardy, Mullen & Jones, 1996; Masters, 1992; Masters et al. 1993; Mullen & Hardy, 2000).

In an attempt to remedy the dichotomy in the literature Lewis and Linder (1997) conducted an investigation to explore distraction and self-focus theories used to explain breakdown in performance under pressure. Participants were required to complete the Dispositional Self-Consciousness Scale (Fenigstein et al., 1975) prior to the study. A golf putting task was learned in either a 'self-awareness non-adapted' (no manipulation), or a 'self-awareness adapted' (using a video camera, and evaluation techniques during practice) treatment group. Performance was then assessed in conditions of low (no distraction) or high (increased cognitive load - counting backwards from 100 in twos) distraction under different conditions of stress (e.g. reward contingency). Lewis and Linder (1997) found that participants who were acclimatised to self-awareness during skill acquisition experienced less of a breakdown under pressure than those not acclimatised. In addition, they found that adding a distraction task (e.g. number generation) during the pressure phase did not have an additive effect on skill breakdown. Lewis and Linder (1997) concluded that skill breakdown under pressure is mediated by self-focus rather than distraction, which support the findings of Baumeister (1984). Findings from the Dispositional Self-Consciousness Scale were equivocal. Hence, support for Baumeister's (1984) contention that dispositional self-consciousness (Fenigstein et al., 1975) is a predictor of performance under pressure was not forthcoming.

2.5. THE INFLUENCE OF SKILL ACQUISITION, FOCUS OF ATTENTION AND DEAUTOMATIZATION UPON SEVERE PERFORMANCE LOSS IN COMPETITIVE SPORT

In the academic literature increasing attention has been directed towards specific learning processes in the belief that skill breakdown under stress is anchored in the stages of motor leaning (Masters, 1992). Specifically, attention has been directed towards the phenomena of 'implicit' versus 'explicit' (Hardy et al, 1996; Masters, 1992; Maxwell, Masters & Eves, 2000) and 'internal' versus 'external' (Wulf, HoB & Prinz, 1998; Wulf, Lauterbach & Toole, 1999; Wulf, McNevin, Fuchs, Ritter & Toole, 2000) modes of skill acquisition and their effectiveness on learning and performance. Both implicit and external modes of learning have been found to promote automaticity, particularly under stress. In comparison, both explicit and internal modes of learning have been found to disrupt automaticity, particularly under stress. Throughout this section a series of theoretical issues will be discussed relating to the acquisition and control of motor skills and how these factors might influence severe performance loss in competitive sport. This section begins with an overview and critique of information processing systems in relation to skill progression. This is followed by an overview and critique of leaning methods used to minimise the accumulation and prevent the processing of explicit task knowledge during learning and skilled performance, tested under different conditions of stress. This section ends with an overview and critique of the relationship between learning and focus of attention upon skill effectiveness.

2.51. Conscious Versus Automatic Processing Systems

Well learned motor skills are believed to comprise automatic procedures and are considered an integral part of performance (Chase & Simon, 1973). Motor skills have been proposed, initially, to develop explicitly through conscious processing (Anderson, 1982; Fitts & Posner, 1967). Hence, early stages of learning are characterised by verbalisable, inconsistent, effortful and slow performance (Anderson, 1982; Fitts & Posner, 1967). Over time, with practice, motor skills are thought to become implicit through automatic processing (automaticity). This stage is characterised by non-verbalisable (unavailable to conscious awareness) (Carr, McCauley, Sperber, & Parmalee, 1982; Marcel, 1983), stereotypic (McLeod, McLaughlin, & Nimmo-Smith, 1985; Naveh-Benjamin & Jonides, 1984), effortless (Logan, 1978; 1979; Schneider & Shiffrin, 1977), and fast (Neely, 1977; Posner, & Snyder, 1975) performance.

Conscious processing has been defined as

> "a temporary sequence of nodes activated under control of, and through attention by the subject. Because active attention by the subject is required, only one such sequence at a time may be controlled without interference, unless two sequences each require such a slow sequence of activations that they can be serially interwoven" (Schneider & Shiffrin, 1977. p. 2).

In comparison, automatic processing has been defined as

> "the activation of a sequence of nodes with the following properties: (a) The sequence of nodes (nearly) always becomes active in response to a particular input configuration, where the inputs may be externally or internally generated and include the general situational context, (b) The sequence is activated automatically without the necessity of active control or attention by the subject" (Schneider & Shiffrin, 1977, p. 2).

Automatic processing has been differentiated from conscious processing by three main characteristics: Firstly, automatic processing must occur without intention; secondly, it should not involve any conscious awareness; and thirdly, it should not interfere with any other cognitive activity that is currently being undertaken (Fitts & Posner, 1967). Automatic processing is not subject to attentional limitations, which would explain why this mechanism is fast, effortless and effective in executing motor skills. Hence, automaticity is uncontrollable as it does not require attentional capacity. Thus, any process that does not require conscious attention can not be controlled by the use of allocating resources to that process (Posner & Synder, 1975). This adds further support to the contention that trying consciously to control normally automatic, implicit processing by explicit utilisation, disrupts automaticity and impairs performance (Hardy, Mullen & Jones, 1996; Masters, 1992; Maxwell, Masters & Eves, 2000).

Anderson (1982) proposed two systems that govern the progression of skilled performance; declarative and procedural. According to Anderson (1982), skill progresses from declarative to procedural. In the declarative stage performance is slow and not fluent as explicit, verbal knowledge dominates the control of movement. In the procedural stage performance is fluent as it is no longer governed by verbal knowledge; the skill is regulated implicitly and run automatically with little conscious control. Salmoni (1989) contented that motor skills are governed by the procedural system. Thus, knowledge of a skill should be developed through performing rather than by explicit instruction. Such an instructional based strategy of learning places high demands on the declarative system, owing to the copious amounts of rule based information to be processed (Salmoni, 1989). However, this contention is not consistent with general coaching principles today. The use of rule-based instructions is still widely used by coaches, particularly during early stages of learning, which can interfere with implicit regulation even after a skill has become well learned.

2.52. Explicit Knowledge Suppression during Learning and Skilled Performance

Developing one's skill to an automatic level of functioning is what sports performers generally aspire to achieve because of its fluidity and efficiency. Without the development of automatic processing many fast ball sports could not be performed at such a high level due to temporal demands, which leave little time for information processing. Recent research has reported that performers could inadvertently switch from using automatic to conscious processing systems, particularly under stress. To explain this phenomenon Masters (1992) proposed the conscious processing hypothesis (see Figure 2.3). This hypothesis stated that heightened state anxiety, precipitated by stress can direct attention to the process in which a skill is executed. Owing to the importance of the correct execution of the task, performance is consciously guided by use of explicit task knowledge associated with early stages of learning (reinvestment). This ironically, disrupts automaticity, and impairs the performance of a well learned skill. Recent research has reported that, under stress, performers could inadvertently switch from using automatic to conscious processing systems to ensue correct skill execution (Crews, 2001). Such an attempt to focus conscious attention on explicit task rules, associated with the early stages of learning, is thought to disrupt the automatic flow of a well learned skill and impair performance (Hardy, Mullen & Jones, 1996; Masters et al., 1992).

Masters (1992) proposed that conscious processing in automatic skills might also explain 'dartitis' or the feared 'yips'". The 'yips' has been defined as a long-term motor disorder that affects finely controlled motor skills by causing involuntary movement during execution (McDaniel, Cummings & Shain, 1989). Some researchers believe the 'yips' to be a physiological-based problem (Foster, 1977; McDaniel et al., 1989), whereas other researchers consider the disorder to be caused by psychological factors (Bawden & Maynard, 2001). However, limited research has been unable to conclusively ascertain how and why the 'yips' occur (Moody, 1993; Sachdev, 1992;

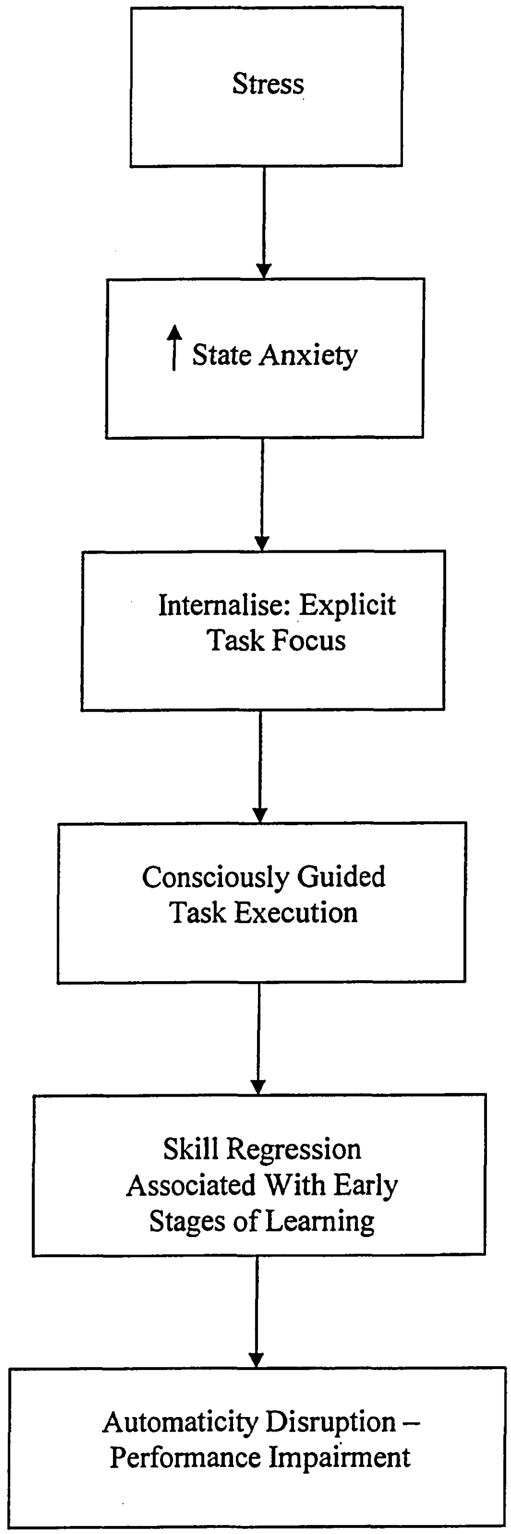


Figure 2.3. A Schematic of the Conscious Processing Hypothesis (Masters, 1992)

Smith et al., 2000; White, 1993). Nevertheless, the purpose of this programme of research was to investigate temporary forms of severe performance loss not long-term motor disorders. For this reason, the 'yips' was considered outside the scope of this programme of research and therefore was not investigated in this thesis.

Deikman (1969) refers to conscious control on a typically automatic skill sequence as deautomatization. This conceptualisation suggests that by reinvesting in actions governed by conscious attention automaticity will be undone. Wertz (1986) argued that automaticity breaks down because the mind is not aware of the movement on more than a surface level when the body performs the action. Research by Keele (1973) on experienced pianists, and Langer and Imber (1979) on experienced typists reported that conscious control of their finger movements produced a decrement in performance. Hefferline, Keenan, and Harford (1959) demonstrated that by increasing the consciousness of the behavioural process (e.g. a muscle response) operant conditioning could be undermined. Psychotherapists use similar techniques to help individuals with psychological disorders by making unconscious material conscious. This helps to eradicate neurotic effects which have become instinctive. Thus suggesting increased consciousness makes things less lawful and less predictable (Baumeister, 1984).

Langer and Imber (1979) suggested that over-learning (e.g. automaticity) a skill could be detrimental to performance. They hypothesised that when an individual is led to question his / her ability to perform a skill (e.g. stress), explicit task components are required to help guide performance. However, once a skill has been over-learned it becomes mindless. Consequently, such skills become inaccessible to consciousness and thus, re-correction of how to perform is no longer possible. Langer and Imber (1979) and Masters (1992) concur in the theorisation that attempting to consciously control a movement can result in the breakdown of automatic skills. However, their explanations as to why this is detrimental to performance are conflicting. Langer and Imber (1979) proposed that conscious skill control is harmful to performance owing to an absence of explicit knowledge. In antithesis, Masters (1992) proposed that it is the availability and processing of explicit knowledge that impairs the execution of an over-learned skill[6].

6 It is important to note that Langer and Imber (1979) used a cognitive task, which was neither sport specific nor required any motor co-ordination.

This contention is supported by the amount of rules reported by participants relating to the task in Masters' (1992) study.

Theoretical explanations for skill deautomatization include the Progression-Regression hypothesis (Fitts, Bahrick, Noble & Briggs, 1961). This hypothesis proposed that as a skill becomes well learned (automaticity), the high order strategies used to control that skill become more complex. More recently, the regression aspect of this theory has been used to explain the breakdown of automatic motor skills (Lee & Swinnen, 1993). Under stress, the higher order control strategies that guide automatic performance can become disrupted. This is a consequence of an individual adopting the use of control strategies, associated with early stages of learning, to execute the skill. Thus, causing a regression back to a more basic level of skill processing (e.g. conscious processing) which offers support to Masters' (1992) conscious processing hypothesis.

Baddeley and Woodhead (1982) postulated that a decrement in performance would ensue if specific components of an automatic skill were focused upon. Similarly, Klatzky (1984) reported that performance awareness impairs the execution of a skilled act. The martial artist Bruce Lee suggested that consciousness of self is the greatest hindrance to the proper execution of all skills. Moreover, he asserted that knowledge and skill are meant to be forgotten so that an individual may be poised, enabling them to strike at the right moment (cited in Thomas, 1997). Prinz (1997) suggested that when speaking we do not focus on the spatiotemporal patterns of movement required to produce the desired sounds. Instead, our action plans are related to the audible effects, which appear to effectively guide the motor system to produce the desired outcome. Kerr's (1973) simplified analogy of this conceptualisation suggested that consciously thinking about an automatic skill could have unpredictable consequences, for example,

> "if you think too deeply about the leg movement involved in walking down a flight of stairs, you may well finish up in a heap at the bottom of those stairs", (p. 62)

Roger and Nesshoever (1987) suggested that reducing explicit task knowledge means less potential information to rehearse and thus less distraction when performing. Further, research has highlighted that a skill can be effectively learned without the need for explicit 'declarative encoding' of knowledge (Brooks, 1978; Hayes & Broadbent, 1988; Reber, 1967). Hayes and Broadbent (1988) argued that knowledge of a particular task can be developed through implicit or explicit processes (see also Berry & Broadbent, 1987; Reber, 1989; Reber & Allen, 1978). Explicit knowledge comprises

> "factors and rules of which we are specifically aware and therefore able to articulate" (Masters, 1992, p. 343).

In comparison, implicit knowledge comprises

> "that which we 'know' yet are not aware of and thus cannot articulate" (Masters, 1992, p. 343).

Over the last decade increasing attention in the literature has been devoted to the phenomenon of implicit and explicit learning. Research on implicit learning has typically used cognitive tasks such as artificial grammers (Reber, 1967; Reber & Allen, 1978), complex computer systems (Berry & Broadbent, 1984; Broadbent & Aston, 1978) or serial reaction time tasks (Nissen & Bullemer, 1987). Several factors have been identified which distinguish implicit and explicit processes. The primary indictor of implicit held knowledge is a lack of explicit knowledge despite improved performance (Berry & Broadbent, 1984). Another indicator is that implicit processes are more resistant to psychological stress, disorders and dysfunctions than explicit processes (Abrams & Reber, 1988; Reber, 1993; Schacter, 1987). A further indicator is that implicit processes are more durable and less likely to erode over time (Allen & Reber, 1980) and are relatively independent of IQ and age (Light & Singh, 1987; Reber, 1993). In antithesis, explicit processes and memory tend to erode with age and are correlated with IQ (Light & Singh, 1987; Reber, 1993).

Despite the increasing interest in implicit learning, the research on implicit motor learning is sparse (Maxwell, Masters, & Eves, 2000). One study that has examined the learning and performance effects of this phenomenon is Masters (1992). He proposed that by learning a motor skill implicitly (without the knowledge of rules) explicit task knowledge is kept to a minimum (see also Masters, 2000 for review). Consequently, an individual is less able to rehearse consciously the rules of the skill, particularly under conditions of heightened state anxiety, than if they had learned the skill explicitly (with the knowledge of rules). Thus, implicit learners are less likely to experience a disruption to automaticity or a decrement in performance because the explicit knowledge of the skill is relatively inaccessible to conscious attention.

Masters (1992) conducted a study in which participants were required to leam a golf putting task either explicitly or implicitly in a low stress environment. The explicit learning group received specific instructions on how to putt. The implicit learning group was given no instructions on how to putt, but was required to carry out Baddeley's (1966) randomised letter generation task to occupy working memory. This was to prevent participants from generating their own explicit rules relating to the task. Participants were then required to perform the putting task under manipulated conditions of stress (evaluation apprehension and financial incentive). The implicit learning group was not required to perform the secondary task when executing the putting task under stress.

Masters (1992) found that the implicit learners performed significantly better under stress than explicit learners did. Results also indicated that implicit learners continued to improve regardless of stress. Masters (1992) argued that skills learned implicitly are more robust under stress and are less susceptible to skill breakdown, than skills learned explicitly. Masters concluded that this was owing to implicit learners having limited rule-based knowledge available to the conscious to rehearse under stress. Be that as it may, according to Hodge and Franks (2002), focusing on a single explicit aspect of movement dynamics can still disrupt automated control systems (see also Wulf, McNevin & Shea, 2001; Wulf, Shea, & Park, 2001).

Hardy, Mullen and Jones (1996) criticised Masters' work (1992) by suggesting that the implicit learning group only used the secondary task during the learning phase and not during the stress phase of the experiment. Therefore, Hardy, Mullen and Jones (1996) argued that the implicit learning group continued to improve under stress because the skill was made easier by omitting the secondary task load in the putting only group. This indicated that the release from the secondary task load was responsible for the increased performance of Masters' (1992) putting-only group.

Hardy, Mullen and Jones (1996) replicated and extended the work of Masters (1992). In addition to a putting-only group they included an implicit learning group that was required to perform a putting task under secondary task load during both the learning phase and stress phase of the experiment. The results indicated that both implicit learning groups continued to improve regardless of stress; whereas the explicit learning group did not. The results supported Masters' (1992) research. Hardy, Mullen, and Jones (1996) concluded that skills learned implicitly are more robust under stress, than skills learned explicitly. Hardy et al. (1996) also suggested that individuals who learn implicitly are less likely to experience skill failure under pressure, than individuals who leam explicitly.

However, using a dual task paradigm has affected the way in which Masters' (1992) and Hardy, Mullen, and Jones's (1996) results have been interpreted. The explicit learning group demonstrated no significant decrease in performance under stress; data indicated that the learning curve of this group reached a plateau whereas, the implicit group carried on improving. For this reason, it could be that the implicit learning groups progressed at a slower rate because the dual task made the overall skill more complex. Perhaps the participants in the implicit learning groups had not yet reached their plateau, therefore, continued to improve regardless of stress. Implicit learning using a secondary task has been found to suppress the progression of learning even after the completion of 3000 putting trials, owing to greater demands being placed on working memory (Maxwell et al., 2000).

Baddeley and Wilson (1994) contended that implicit learners are unable to leam from or correct errors. Consequently, this learning style is unable to prevent individuals from repeating the same errors in future performances. Berry and Broadbent (1987) argued that implicit learning is slow compared to explicit learning. They proposed that implicit learning involves the encoding of all action-outcome possibilities and that improved performance is a result of a gradual accumulation of positive outcomes. In contrast, explicit learning involves the conscious selection of positive action-outcome possibilities and avoidance of negative ones. Thus, Maxwell et al. (2000; see also Bennett, 2000) contended that 3000 trials were insufficient to produce a convergence between implicit and explicit learning styles and thus proposed that further practice was required to achieve similar standards of learning.

Bright and Freedman (1998) questioned the validity of Masters (1992) and Hardy, Mullen and Jones's (1996) interpretation of their research. For this reason, Bright and Freedman (1998) partially replicated Hardy et al's (1996) study. Their findings indicated that the performance of the implicit learning group that continued to perform the secondary task did not improve under stress. In comparison, the performance of the implicit learning group released from the secondary task load improved under stress. Bright and Freedman (1998) concluded that implicit learners improve under stress simply because they are released from secondary task loading and thus refuted the implicit motor learning hypothesis (Masters, 1992). Mullen and Hardy (2000) recently criticised Bright and Freedmans's (1998) protocol. Stress was manipulated by Bright and Freedman (1998) after a learning phase of only 160 putts. In comparison, Masters' (1992) and Hardy, Mullen, and Jones's (1996) stress manipulation occurred after 400 putts. Hence, Mullen and Hardy (2000) argued that Bright and Freedman's (1998) participants were at an earlier stage in the learning process when stressed, in comparison to previous research.

A second experiment conducted by Bright and Freedman (1998) required participants to execute a putting task in either a hard dual-task group (e.g. generate random letters every second) or an easy dual-task group (e.g. generate random letters every 3 seconds). Bright and Freedman (1998) hypothesised that the hard dual-task group would demonstrate a greater increase in performance under stress, in comparison to the easy dual-task group, owing to the differing cognitive resources available when released from the secondary task load. The hard dual-task group demonstrated a significantly greater increase in performance under stress than the easy dual-task group following the release from the secondary task load. The results indicted support for Bright and Freedman's (1998) hypothesis and their initial conclusions drawn from their first experiment.

Another criticism of Bright and Freedman's (1998) protocol is the claim that the participants used in their experiments were novice golfers. However, some participants who reported having golfing experience were allowed to partake. Maxwell et al. (2000) argues that an individual with experience in golf is likely to have formed a pool of explicit knowledge and thus would confound the number of reported task-rules. Maxwell et al. (2000) contented that implicit-based learning research using novice performers can not be compared to experiments using non-novice performers due to the protocols used to distinguish between implicit and explicit learning being violated.

Hardy, Mullen, and Jones (1996) offered another explanation for their findings. They suggested that the implicit learning groups could have become partially immune to the effects of stress and anxiety owing to participants being required to perform the secondary task when putting. The secondary task was used to eliminate opportunities for participants to generate explicit task knowledge. Consequently, implicit learners could have become desensitised to self-regulated verbal distractions and thus, anxiety.

Neither Masters' (1992) nor Hardy, Mullen, and Jones's (1996) research was conclusive. Consequently, additional criticisms of their work need to be addressed. Firstly, both experiments only used performance outcome based measures to predict conscious processing (and its effects on the performance of explicit learners). Consequently, conscious processing under stress was assumed in such studies. Secondly, implicit learning might well be more robust under stress. However, the current techniques used to promote this style of learning (e.g. random letter generation task) might not be practical in an applied sport setting. For example, shouting out random letters to the sound of a metronome would not be considered acceptable when putting in golf. Thus, in its current format this technique could not be used in an ecologically valid environment. Thirdly, state anxiety induced by stress was only partially controlled for in these experiments. Both Masters (1992) and Hardy, Mullen, and Jones (1996) only measured the changes in physiological arousal (somatic anxiety) by monitoring heart rate. Consequently, it is not known whether stress was successfully manipulated or if state anxiety had any impact on performance. State anxiety is now considered a multidimensional response comprising somatic and cognitive sub-components, and self-confidence. Both intensity and directional components of such factors should be controlled for in future research. Further, Hardy (1998) argued that somatic anxiety and physiological arousal are not synonymous, which questions whether the preceding studies controlled for any aspect of state anxiety or indeed, psychological stress as claimed.

Hardy, Mullen, and Jones (1996) called for more practical learning methods that prevented the accumulation of verbal knowledge, but not at the expense of skill development. In response to this call research by MacMahon and Masters (2002) compared learning a golf putting task using a variety of secondary tasks, which loaded on different components of working memory[7]. The secondary tasks primarily either loaded on the central executive (random letter generation and counting backwards in sevens) or the phonological loop (repeated word and unattended speech). In study one results indicated that only the central executive loading tasks were successful in preventing the accumulation of explicit rules. Skill development was only inhibited in the counting backwards condition. MacMahon and Masters (2002) speculated that the random letter generation did not inhibit skill acquisition, as expected, owing to the relatively simple nature of the task (flat surface) in comparison to Masters' (1992) research (e.g. 1 in 4 incline putting surface).

Kleiman (1975) suggested that loading the phonological loop is only effective in disrupting the generation of rule acquisition on complex tasks that require additional storage facilities during processing. In other words, a task that fully loads on the central executive then relies on the phonological loop for rule acquisition. Loading the phonological loop minimizes rule acquisition, leaving the central executive free to execute the primary task. However, fully loading the central executive still minimises rule acquisition, at the expense of reduced capacity with which to execute a more complex task. Thus, MacMahon and Masters (2002) second study examined the effects using the repeated word and random letter generation conditions on a more complex putting task. They found that only the random letter generation task was successful in limiting the accumulation of explicit task knowledge, which still hampered skill development. Hence, MacMahon and Masters (2002) were unsuccessful in identifying a secondary task that minimised explicit knowledge and maximised skill acquisition of a golf putting task.

In an attempt to overcome the restrictions imposed on skill development under secondary task load Liao and Masters (2001) proposed an alternative learning strategy. This paradoxical technique has been termed Analogy learning and was proposed to enhance implicit skill acquisition, via explicit instruction, in novice performers (Liao & Masters, 2001). This learning strategy is designed to reduce the amount of information being consciously processed by abridging a number of task relevant rules into one, all

7 A review of working memory is provided in section 2.41)

encompassing biomechanical metaphor (Masters, 2001). In the belief that analogy learning could elicit similar characteristics to that of implicit learning styles Liao and Masters (2001) conducted two experiments.

In Experiment 1, novice performers learned a table tennis forehand topspin under implicitly (using a random letter generation task), explicitly (using 12 explicit instructions), or analogy (using the analogy of a right-angled triangle) conditions. All participants executed 300 trials, followed by a 50 trial secondary task transfer and a 50 trial delayed retention test. Liao and Masters (2001) found that the implicit and analogy learners reported similar levels of explicit task knowledge, which was significantly less than the explicit learners. In addition, when the secondary task was introduced the explicit learners experienced a significantly greater decrement in performance than the implicit and analogy learners who demonstrated similar performances.

In Experiment 2, Liao and Masters (2001) examined the robustness of analogy and explicit learning styles in a stress retention test. Wegner, Schneider, Carter, and White (1987) thought suppression technique was used in an attempt to manipulate thought processes relating to the task. Wegner et al. (1987) found that when participants were asked to suppress thoughts of a white bear, such thoughts were, ironically, magnified. Liao and Masters (2001) asked participants not to think about how to strike the ball, in the belief that such thoughts would be magnified; particularly in those with greater explicit knowledge. Results indicated that explicit learners experienced a decrement in performance as a consequence of stress and thought suppression. In comparison, the analogy learners were relatively unaffected by either stress or thought suppression. It was suggested that the results indicated that Analogy learning imposes a lighter load on attentional resources than explicit learning (Liao & Masters, 2001). Maxwell and Masters (2002), however, proposed an alternative explanation to the Analogy learning strategy. They suggest that Analogy instruction directed focus of attention, externally, to the movement of the bat, in comparisons to the explicit group whose instmctions were likely to direct conscious attention, internally, to the process of movement. Maxwell and Masters (2002) found some support for the contention that an external focus might place minimal demands on working memory, in comparison to an internal focus that imposes large demands on this system.

Liao and Masters (2001) concluded that analogy learning has similar characteristics to those of implicit learning, and claimed it would be practical to use in an applied sport setting. However, a criticism of this claim is that this strategy might impose restrictions on the development of a skill, similar to implicit learning strategies. In this case of using the analogy of an imaginary triangle to help shape a table tennis forehand topspin is likely to be detrimental when performing this stroke in an applied setting. At the top level table tennis is a fast sport involving extremely restrictive time constraints that demand rapid stroke recovery. Therefore, analogy learning might well reduce explicit task rules, but would almost certainly compromise the development of effective and efficient stroke production, otherwise required to compete at the top level.

Recently, Mullen and Hardy (2000) examined the effects of using a secondary task load, normally associated with implicit learning strategies, on the performance of skilled golfers. An aim of Mullen and Hardy's (2000) study was to investigate the desensitization hypothesis (Hardy et al. 1996). The desensitization hypothesis predicts that individuals who have learned a task implicitly become desensitized to self-generated verbalizations and thus immune to the effects of competitive anxiety (e.g. conscious processing). Another aim of the study was to examine Eysenck's (1992) processing efficiency theory. This theory suggested that performance decrements would occur if the attentional capacity threshold was exceeded. The final aim of the study was to examine the effects of increased state anxiety on the kinematic processes underpinning deautomatization.

In this study skilled golfers (handicap: 12-18) were required to perform a putting task in three experimental conditions under low and high stress environments. To control for anomalies in putting ability participants were classified as either 'better' or 'poorer' (predicted by mean absolute error scores from the low stress control condition). In the task-relevant condition golfers were required to use three performance-related coaching points to encourage lapses into conscious processing, which were verbalised throughout each trial. In the task irrelevant condition golfers were required to carry out a random letter generation task (Baddeley, 1966). Finally, in the control condition golfers were required to just putt as normal. A retrospective self-report measure was used to monitor effort after each condition, and the CSAI-2 (Martens et al., 1990) inventory was used to measure state anxiety prior to the low and high stress conditions.

Mullen and Hardy's (2000) findings indicated performance decrements were prevented in 'better' putters when using the random letter generation task under high stress. This alleviation of performance impairment suggested that sufficient attentional resources were available for successful task execution. This offers some support for the conscious processing hypothesis over and above the attentional threshold explanation (Eysenck & Calvo, 1992). In contrast, under low stress the random letter generation task impaired performance. Mullen and Hardy (2000) suggested that without incentive when a dual-task is introduced (random letter generation or task-relevant) a shift in attention occurs (Lewis & Linder, 1997). Thus, golfers might have recruited insufficient resources to produce successful performance as both task manipulations require active, controlled processing. Mullen and Hardy (2000) concluded that such tasks, under high stress only impair performance if they interfere with task automaticity. In contrast, no performance decrements were found for 'poorer' putters. Mullen and Hardy (2000) explained this finding through the conceptualization of automaticity. In that, poor putters might have attained partial automaticity, which might mean that putting execution relied upon both controlled and automatic processing systems (Kahneman & Treiman, 1984). Mullen and Hardy (2000) concluded that the flexible use of both controlled and automatic processing can facilitate the performance in those possessing partial automaticity. Hence, this could explain the differences between the 'better' and 'poorer' putters.

The increased effort reported by participants when anxious offers support for processing efficiency theory (Eysenck & Calvo, 1992), which predicted that performance might be maintained, in anxious individuals, by allocating additional resources to the task in hand. The 'better' performers reported an increase in effort when anxious, which maintained task performance in the control conditions and improved performance in the task irrelevant condition, but not in the task relevant condition. Mullen and Hardy (2000) argued that increases in effort in anxious performers could maintain or even improve performance provided that it is channeled towards appropriate procedures.

A criticism of Mullen and Hardy's (2000) study and indeed, all the performance breakdown under stress research is that the directional aspect of anxiety was not monitored. Clearly, future research needs to monitor directional anxiety as this might provide a more complete explanation of the relationship between state anxiety and automaticity disruption. A fundamental limitation of much of the research relating to the conscious processing hypothesis is that it is assumed from outcome based measures (e.g. Baumeister, 1984; Hardy et al. 1996; Masters, 1992; Masters et al., 1993). Beuter, Duda, and Widule (1967) proposed that performers that try and regain conscious control of a skill refreeze the degrees of freedom in the distal joints. Mullen and Hardy (2000) attempted to monitor movement characteristics of a putting task under stress but found equivocal results. However, they report trends in changes of acceleration during the putting action that may offer some explanation as to how increased effort as a function of anxiety is manifested in movement dynamics. Further research involving movement characteristics and outcome-based measures could offer a greater understanding of the relationship between conscious processing and motor performance.

2.53. Focus of Attention during Learning and Performance

Contrary to the stages of learning hypothesis (Anderson, 1982) research has consistently established that conscious processing of movement behaviour is not just detrimental to well-learned skills, but can also disrupt the acquisition of new skills (Baumeister, 1984; Maxwell et al., 2000; Maxwell, Masters, Kerr & Weedon, 2001; Wulf, McNevin, & Shea, 2001). Recently awareness learning strategies have been challenged (Singer, Lidor, & Cauraugh, 1993). Highly skilled individuals are generally considered to perform automatically, defined by the very nature of their fast and effortless performance, requiring no conscious attention (Fitts & Posner, 1967). Gallwey (1976), and Loehr (1982) contended that elite sport performers generally know what to do in a range of situations without the requirement for any conscious processing; in other words it is implicit in nature. Further, Gallwey (1976, 1981) suggested that reducing attention to conscious task processing and situational cues will enable greater sensory feedback awareness during the execution of a motor skill.

Singer et al. (1993) also questioned the effectiveness of process oriented strategies of learning. They hypothesised that beginners could be able to approach skills similar to the way experts do in sport. In addition, Singer et al. (1993) suggested that novices could benefit from taking a more holistic approach to learning by using a nonawareness performance strategy. This means learning with little or no conscious awareness of the explicit rules of the task and thus adopting the 'just do it' philosophy. However, Singer (1988) felt that for beginners to perform skills as if they were automatic was untenable.

Therefore he proposed the Five-step approach as a global strategy for self-paced skills that combined components of both awareness and nonawareness strategies. The five steps include: a) Readying - attaining a optimal emotional state, thinking positively; b) Imaging - mentally picturing oneself accurately and quickly executing the sequential movements; c) Focusing - on one relevant task cue; d) Executing - without thinking about the act itself; and e) Evaluating - the performance and the effectiveness of the four previous steps if time permits.

Singer, Lidor and Cauraugh (1993; see also Singer, 1988; Singer, Lidor & Cauraugh 1994) compared the effectiveness of the five-step approach to that of an "awareness" strategy (e.g. focusing on the specific explicit cues, movement, action and noise of the task) and a "nonawareness" strategy (e.g. focusing on the centre of the target only, ignoring movement and other contextual cues of the task) using a overhand throwing task, executed with the non-dominant hand. Results indicated that the non-awareness condition and five-step approach produced less error in performance and faster response times in a dual-task transfer for a sequential key-pressing task than did the awareness condition. Singer et al. (1993) concluded that novices can successfully adopt the mental style of experts when learning skills, which might have implications for the way coaches develop the skills of athletes in the future.

Singer and his colleagues' research has been influential in challenging traditional awareness approaches by proposing a potentially more effective attentional focus for performers whilst learning. Be that as it may, there are several criticisms of this research that need to be addressed. Firstly, the acquisition of a motor skill is highly task-specific (Beek, 2000). Hence, the five-step approach may not be generally applicable to all motor tasks. Although this approach was found to be effective for a variety of simple laboratory tasks Wulf and Weigelt's (1997; Shea & Wulf, 1999) results indicated that this was not transferable to more complex motor skills. Finally, Singer and his colleagues provide no theoretical explanation as to why the five-step approach and the non-awareness strategies were effective. In summary, both the five-step approach and the non-awareness strategies emphasised the same mode of attentional focus during execution, which produced a similar level of performance. Further, it appears that by focusing, externally, on one specific attentional cue leads to superior task performance on self-paced tasks. Hence, such findings indicate that there might be an optimal focus of attention, which facilitates performance above that of awareness strategies. However, Singer and his colleagues' approach was limited to simple motor skills and lacks theoretical underpinning.

Recent research has provided converging evidence that focus of attention induced by instructions or feedback is influential in motor learning and performance (McNevin, Shea, & Wulf, 2000; Shea & Wulf, 1999; Wulf, Hob & Prinz, 1998; Wulf, Lauterbach & Toole, 1999; Wulf, McConnel, Gartner & Schwarz., 2002; Wulf, McNevin, Fuchs, Ritter, & Toole, 2000; for review see Wulf & Prinz, 2001). These studies assessed the effectiveness of directing the learners' attention to their body movements (e.g. internal focus of attention) in comparison to directing the learners' attention on the effects of their movement (e.g. external focus of attention) in relation to the environment (e.g. apparatus). Wulf et al. (1998, Experiment 1) used a ski-simulator task and found that instructing performers when to exert force on the wheels of a platform (external focus) was more beneficial than instructing them to focus on when to exert force with their feet (internal focus). Similarly, learning was enhanced for participants undertaking a stabilometer balancing task when focusing on markers in front of their feet (external focus) in comparison to focusing on the feet themselves (internal focus) (Wulf et al, 1998, Experiment 2; Wulf, McNevin, & Shea, 2001; Wulf, Shea, & Park, 2001). Despite the relatively small differences between the loci to which attention was directed an external focus consistently resulted in greater learning benefits (as measured by performance in retention) than did an internal focus.

The benefits of learning through an external focus have also been reported for sport skills. Wulf et al. (1999) found that performance and learning of a pitching shot in golf were facilitated by directing learners' attention to the motion of the club rather than the swing motion of the arms. Enhancement of learning and performance has also been observed in other sport skills including tennis (Maddox, Wulf, & Wright, 2000) soccer and volleyball (Wulf, McConnel, Gartner & Schwarz. 2002) thus adding support to the generalisability of the effects.

Wulf and her colleagues' findings are consistent with the work of Singer et al. (1993, 1994) in demonstrating the detrimental effects of self-focused attention in comparison to an extemal-focus of attention. Singer (1984, 1988) advocated that focusing on a single, general external cue (e.g., target) would prevent performers from attending to their own movements. Wulf et al. (2000) challenged this contention. They hypothesised that by encouraging a specific external focus that related to the movement effects of a task would not only prevent a movement related focus, but would produce superior learning over and above a general external cue (as advocated by Singer and his colleagues). To test this hypothesis Wulf et al. (2000) used a tennis forehand stroke. Novice participants were required to practise hitting tennis balls at a target on the opposing side of the court. Participants were either instructed to focus on the ball approaching them (antecedent group) or to focus on the ball leaving the racket (effect group). Wulf et al.'s (2000) findings indicated that the movement effects related focus produced superior learning and performance of a tennis forehand drive in comparison to the antecedent group. Wulf et al. (2000) speculated that the movement effects related focus was not only successful in preventing performers from adopting an explicit, movement dynamic focus, but was also influential in promoting self-organisational motor systems to implicitly regulate task performance.

Trying to exert control over low-level co-ordination processes is thought to be disruptive to both learning and skilled performance (Hodge & Franks, 2002). Further, this could explain skill breakdown, which has consistently been associated with an internal focus of attention in the literature (Masters, 1992; Masters et al., 1993). This supported the contention that the motor system comprises different autonomous levels that are integrated to allow functional movement (Berstein, 1967). Hence, focusing on the movement effects of a skill appears to allow the motor system to use those autonomous processes, unconstrained by conscious control (Wulf et al., 2000; for review see Wulf & Prinz, 2001). Wulf, McNevin, and Shea (2001; see also Wulf, Shea, & Park, 2001) refer to this as the constrained-action hypothesis. This hypothesis proposed that an internal focus of attention (movement focus) constrains or interferes with normal automatic control processes that regulate movement (e.g. by freezing of the degrees of freedom), whereas an external focus (movement effects focus) enables the motor system to self-organize more naturally, unconstrained by conscious control.

To test the constrained-action hypothesis Wulf, McNevin, and Shea (2001) examined participants' movement kinematics in relation to balancing performance on a stabilometer platform using either an internal or external focus of attention. Results indicated that the external focus group (e.g. focused on markers attached to the platform) produced significantly smaller balance errors and responded at a significantly higher frequency than did the internal focus group (e.g. focused on their feet). The higher response frequency indicated greater confluence between voluntary and reflexive mechanism. These findings support the contention of Newell and Slifkin (1996) who interpreted increases in response frequency as an indication of an increased number of active degrees of freedom. In contrast, conscious attempts to intervene in motor control processes seem to result in a 'freezing' of the degrees of freedom (Vereijken, van Emmerik, Whiting, & Newell, 1992) in a less automatic movement execution thus inhibiting learning and performance.

In an attempt to measure the attentional demands required under the two attentional focus conditions Wulf, McNevin, and Shea. (2001) measured probe reaction times (RTs). Results indicated that the external focus group produced significantly lower probe reaction times in comparison to the internal focus group. This indicated that participants in the external focus group produced a greater amount of spare attentional capacity, which promoted a higher degree of automaticity in comparison to participants in the internal focus group. Wulf, McNevin, and Shea's. (2001) study provided three sources of evidence consistent with the constrained-action hypothesis. First, an external focus of attention resulted in increased balance performance, second, increased frequency of response, and third, reduced attentional demands relative to an internal focus of attention. These findings indicate that the constrained-action hypothesis provides a viable explanation for the attentional focus phenomenon. Recently, Al-Abood, Bennett, Hernandez, Ashford and Davids (2002; cf. McNevin & Wulf, 2002) assessed movement dynamic (movement form) versus movement effects (e.g. ball trajectory to basket) verbal instructions on a basketball free-throw task. Al-Abood et al's. (2002) findings also provide support for the constrained-action hypothesis.

A comparison across previous research (Shea & Wulf, 1999; Wulf et al., 1998; Wulf et al., 1999) indicated that the advantages of an external focus was enhanced (and found to occur earlier in the learning process) as the proximity of the external focus from the body increased (McNevin, Shea, & Wulf, 2003). For this reason, McNevin et al. (2003) hypothesised that increasing the proximity between the body and focus of attention would enhance the learning advantages associated with an external, movement effects related focus of attention. In testing this hypothesis McNevin et al. (2003) used participants that were required to learn to balance on a stabilometer by focusing on markers, which were attached to the platform and placed at three different distances away from their feet. Group one were instructed to focus on distance markers outside ("far-outside") of the platform. Group two were instructed to focus on distance markers inside ("far-inside") of the platform. Group three were instructed to focus on markers close to their feet ("near"). The results of a retention test indicated that all three external-focus groups indicated significantly more effective balance learning than the internal-focus control group. The far-outside and far-inside group produced similar performances; both groups indicated significantly more effective balance learning than the near group. Moreover, the two far-groups indicated higher-frequency movement adjustments than the near group. The findings of this study support the hypothesis that focusing on more distant effects facilitates learning by promoting the use of more naturally controlled processes. The findings are also in line with the constrained action hypothesis (Wulf, McNevin, & Shea, 2001) that account for restricted learning associated with attentional focus directed towards effects in close proximity to the body, or towards the body itself.

Recently, Wulf et al. (2002) investigated how the effectiveness of feedback for the learning of complex motor skills is affected by the focus of attention it induces. The feedback referred specifically either to body movements (internal focus) or to movement effects (external focus). In Experiment one advanced and novice volleyball players practiced a service task under either internal or external feedback conditions. Results of both practice and retention indicated that feedback style did not differentially affect movement quality. However, external-focus feedback did indicate significantly greater service accuracy than internal-focus feedback, independent of expertise level. In Experiment two the effects of relative feedback frequency as a function of attentional focus were assessed. Experienced soccer players were required to execute a lofted pass at a target using either internal or external feedback conditions. Results indicated that external-focus feedback produced significantly greater accuracy than internal-focus feedback. Moreover, reduced feedback frequency was found to be beneficial under internal-feedback conditions. In contrast, feedback frequencies provided for 100% or 33% of trials were equally effective under external focus conditions. Wulf et al. (2002) proposed that increased benefits were observed when feedback frequency was reduced in the internal-feedback condition due to relief of an incessant internal focus induced by every-trial feedback. The main findings of this Wulf et al.s' (2002) study indicate external-focus feedback induces superior learning and performance of a complex motor skill than internal-focus feedback. Wulf et al. (2002) concluded that like external-focus instructions, external-focus feedback promotes the use of automatic motor systems more so than feedback that directs attention to internal, movement-based mechanisms. Moreover, Wulf et al.'s (2002) findings offer support for the constrained-action hypothesis.

The research findings relating to the efficacy of adopting an external, movement effects related focus appear to be relatively stable with regards to both learning and performance. A criticism of Wulf and her colleagues' work is that they have primarily examined the effects of different attentional foci on novice performers during the acquisition of motor skills. Little attempt has been made to examine the specific effects of such foci of attention in skilled performers. Another criticism of the research is that the effects of different attentional foci have not been assessed under psychological stress.

One study that did attempt to examine the effects of different attentional foci under stress was carried out by Jackson and Wilson (1997). They tested whether the use of a 'swing thought' in the moment immediately prior to putting (Boutcher & Crews, 1987) could help prevent performance impairment under stress. Participants were required to focus attention to their body movement (using a single aspect of putting technique) or attend to a visual stimulus (e.g. dimple pattern of the ball or the texture of the putting surface). The results indicated that regardless of adopting an internal or external focus immediately prior to putting under stress performance was still maintained.

Jackson and Wilson (1997) argued that the verbal cue (internal focus) might have discouraged performers from concentrating on too many aspects of skill execution and thus prevented a performance decrement. This would appear unlikely as focusing on just one explicit aspect of movement dynamics can still disrupt automated control systems (Hodge & Franks, 2002; Wulf, McNevin, & Shea, 2001). In contrast, visual cues (external focus) have previously been found to be effective during skill acquisition (Singer et al., 1993, 1994). Thus, a performance decrement might have been prevented in Jackson and Wilson's study by discouraging an explicit, movement dynamic focus. Be that as it may, one criticism of Jackson and Wilson's (1997) work is that they did not monitor participants' foci. Consequently it is unclear as to what exactly they focused on during performance. Based on Wulf and her colleagues' findings the most effective focus to adopt prior to the initiation of a motor skill is one that elicits an external, movement effects related focus (Al-Abood et al., 2002; Wulf et al., 2000), or more specifically an external, movement effects related focus that is set at a greater distance from the body (McNevin et al. 2003).

Maxwell, Masters and Eves (2000) provided some evidence that indicated attending to the internal mechanisms of performance results in greater accumulation of explicit task knowledge. They found that individuals who were more susceptible to conscious processing reported using more explicit information to ensue goal success than those less susceptible to such an internal focus. Increased processing of explicit rules would have imposed greater demand on working memory. This supports the contention of the constrained-action hypothesis in that an internal focus demands greater attention capacity (Wulf, McNevin, & Shea., 2001). Further, participants in Wulf and her Colleague's research who adopted an internal learning focus might, effectively, have encouraged participants to accumulate a pool of explicit information relating to the movement dynamics of the task, which could be consciously processed. Whereas, participants who adopted an external learning focus might not have developed this information.

Maxwell, Masters, Kerr and Weedon (2001) examined the effects of errorless learning in comparison to errorful learning using a golf putting task. Maxwell et al. (2001) proposed that when errors are prevented or considerably reduced, a passive mode of skill acquisition will occur. In contrast, when errors are present and require correction, an explicit, hypothesis testing mode of skill acquisition will occur. That is, errorful learners were predicted to formulate and test hypotheses in order to correct errors, which, in turn, would load on working memory (Baddeley, 1986) and impair performance. Maxwell et al.'s (2001) findings indicated that the hypotheses testing strategy (errorful learning) produced a pool of explicit task knowledge and a reduction in performance under secondary task loading. In contrast, errorless-passive learning, which did not require any hypothesis testing, accumulated little explicit knowledge and thus performance was maintained under secondary task loading. Maxwell et al. (2001) concluded that minimising explicit hypothesis testing reduces the load on working memory, which is exemplified by the maintenance of motor performance under secondary task loading.

In the belief that an external focus minimises the load placed on working memory in comparison to an internal focus, which imposes greater demands on working memory, elicited by conscious processing, Maxwell and Masters (2002) conducted two experiments. A balancing task (measured in a single plane of motion - 'roll') was used, similar to that used by Wulf et al. (1998), in both experiments. Experiment one consisted of a learning phase and test phase. In the learning phase participants were required to complete the task using either an internal (focus on feet) or external (focus on balancing board) focus. In the test phase participants were required to complete a retention test, followed by a transfer test. The transfer test required participants to complete a secondary task during their performance. Maxwell and Masters (2002) hypothesised that the secondary task would have a detrimental effect on the performance of the internal focus group (owing to the need to process explicit knowledge), as apposed to the external focus group. The results indicated no difference in accuracy during learning or performance between the two groups. Post experimental reports suggested that participants instructed to use an internal focus might have switched to using an external focus. Further, Maxwell and Masters (2002) suggested that a ceiling effect might have occurred as some participants were able to attain perfect performance on some trials.

Experiment two was designed to overcome the limitations of Experiment one. A 3D movement analysis system was used to provide more accurate measures in two planes of motion ('pitch' and 'roll'). In addition, participants received no feedback during the experiment to encourage conformity with their instructed focus. All other aspects of the experiment were conducted in accordance with Experiment one. Similar to that of Experiment one, participants still appeared to adopt an external focus, regardless of the instruction given. However, the results still support the contention that an external focus might place minimal demands on working memory. Maxwell and Masters (2002) concluded an implicitly regulated, external focus is the default option, particularly when an explicitly regulated, internal focus is inadequate during learning and performance of a motor skill. This supports the contention of Wulf, Shea, and Park (2001) who found that when given the choice most participants chose an external (which was more effective) rather than an internal focus of attention.

In summary, there has been considerable evidence indicating the advantages of adopting an external focus of attention during skill acquisition, which in turn, promotes automaticity and minimises the load on working memory (Maxwell et al., 2002; Wulf, McNevin, & Shea, 2001). This evidence is based largely on the learning of novel motor tasks in novice performers. More recently Wulf et al. (2002) have found that the advantages of external-focus feedback are transferable to skilled performers (e.g. volleyball and soccer). Conversely, it would appear that consciously processing internal, movement-related information is detrimental to both learning and performance of a motor skill, which in turn, interferes with automatic regulation and loads heavily on working memory (Maxwell & Masters, 2002; Wulf, McNevin, & Shea, 2001).

A criticism of Wulf and her colleagues' research is that they failed to monitor whether participants conformed to the attentional focus instructions. Therefore caution must be taken when interpreting the underlying antecedents associated with benefits of using an external focus. Another criticism of Wulf and her colleagues' research is that their findings have not been tested under stress. Jackson and Wilson (1997) examined internal and external foci under stress. They found that regardless of the adopted attention focus performance under stress was maintained. However, their results were inconclusive. Further, there were confounding elements between their findings and both the constrained-action hypothesis (Wulf, McNevin, & Shea, 2001; Wulf, Shea, & Park, 2001) and the conscious processing hypothesis (Masters, 1992). Be that as it may, the visual cue used by Jackson and Wilson (1997) was comparable to that used in Singer et al.'s studies (1988, 1993, 1994). Thus, suggesting that an external, movement effects related focus (Al-Abood et al., 2002; Wulf, McNevin, & Shea, 2001; Wulf, Shea, & Park, 2001) could be more effective in skilled performers under stress. However, additional research is required to ascertain a richer understanding of the relationship between different attentional foci and skilled performance under stress. Further, no research to date has examined the relationship between skilled performers predisposed to conscious processing under stress (Baumeister, 1984; Hardy, Mullen, & Jones, 1996; Masters et al., 1993) and attentional strategies that are thought to promote automatic, implicit regulation of performance (Al-Abood et al., 2002; Wulf, McNevin, & Shea, 2001; Wulf, Shea, & Park, 2001).

2.6. DISPOSITIONAL FACTORS AND SEVERE PERFORMANCE LOSS IN COMPETITIVE SPORT

The limited research that has attempted to examine performance deterioration under stress in sport is largely based on two models, both of which comprise dispositional factors. These models are choking under pressure (Baumeister, 1984) and skill failure under pressure (Masters et al., 1993). Both models propose anxiety, attentional focus and automaticity disruption, in addition to dispositional factors, as antecedents associated with performance breakdown under stress. Nevertheless, these models possess conflicting elements that need to be addressed. Throughout this section a series of theoretical issues will be discussed relating to how dimensions of personality might influence performance breakdown under stress. This section begins with an overview and critique of choking (Baumeister, 1984). This is followed by an overview and critique of skill failure under pressure (Masters et al, 1993). Included in this section are the limitations and conflicting elements between the two models, followed by research that could remedy such limitations.

Choking under pressure has been defined as

> "a metaphorical expression used to describe the occurrence of inferior performance despite an individual striving and situational demands for superior performance." (Baumeister, 1984, p. 610)

Baumeister (1984) proposed a model (see Figure 2.4) that, he believed, explains choking under pressure. Baumeister (1984) hypothesised that arousal, created by pressure, heightens self-consciousness and thus, directs attention to the movement characteristics of the skill sequence. An attempt is then made to control the movement consciously to ensure the correct execution of the skill. This, ironically, disrupts automaticity and impairs performance owing to explicit knowledge being no longer consciously available to successfully guide skill execution. In an attempt to test the model of choking under pressure Baumeister (1984) carried out a series of experiments. A commercially available game called "roll-up" (e.g. a ball and rod task), which required a certain amount of motor and visual co-ordination (Martens & Landers, 1972) was used as the experimental task. Participants were required to focus attention on either their hand movements or the ball when executing the task. Results of Experiment 1 (pilot) and 2 were consistent with the model. Baumeister (1984) concluded that increased awareness to one's movements and efforts reduces the consistency of performance, which supports the contention of Wulf and her colleagues. Experiment 3 incorporated the public and private sub-scales of the dispositional self-consciousness scale (Fenigstein, et al., 1975). Baumeister (1984) hypothesised that dispositionally low self-conscious individuals would be more susceptible to the negative effects of an internal state during performance because they are habitually unaware of such processes. Results of Experiment 3 found that participants dispositionally low in public self-consciousness indicated the greatest susceptibility to decrements in performance when instructed to consciously control their movements.

In Experiment 4 implicit pressure through self-presentation concerns was created. A confederate's performance was manipulated to do either moderately better (high pressure condition) or moderately worse (low pressure condition) than the participants. It was assumed that pressure would be heightened when the performance of the confederate was moderately better and thus, hypothesised that choking would be more common. Baumeister's model of choking proposes that pressure directs greater attention to the process of performance. Low self-conscious individuals are not accustomed to performing whilst feeling self-conscious. Therefore, it was also hypothesised that dispositionally low self-conscious participants would show greater vulnerability to the act of choking under pressure. This hypothesis was supported as participants dispositionally low in private self-consciousness performed significantly worse under pressure than participants dispositionally high in private self-consciousness. However, interestingly during the non-pressure practice trials this was not the case, it was participants dispositionally high in self-consciousness that performed worse, than those low in self-consciousness. Baumeister (1984) concluded that dispositional private self-consciousness was a moderating factor in the choking under pressure process.

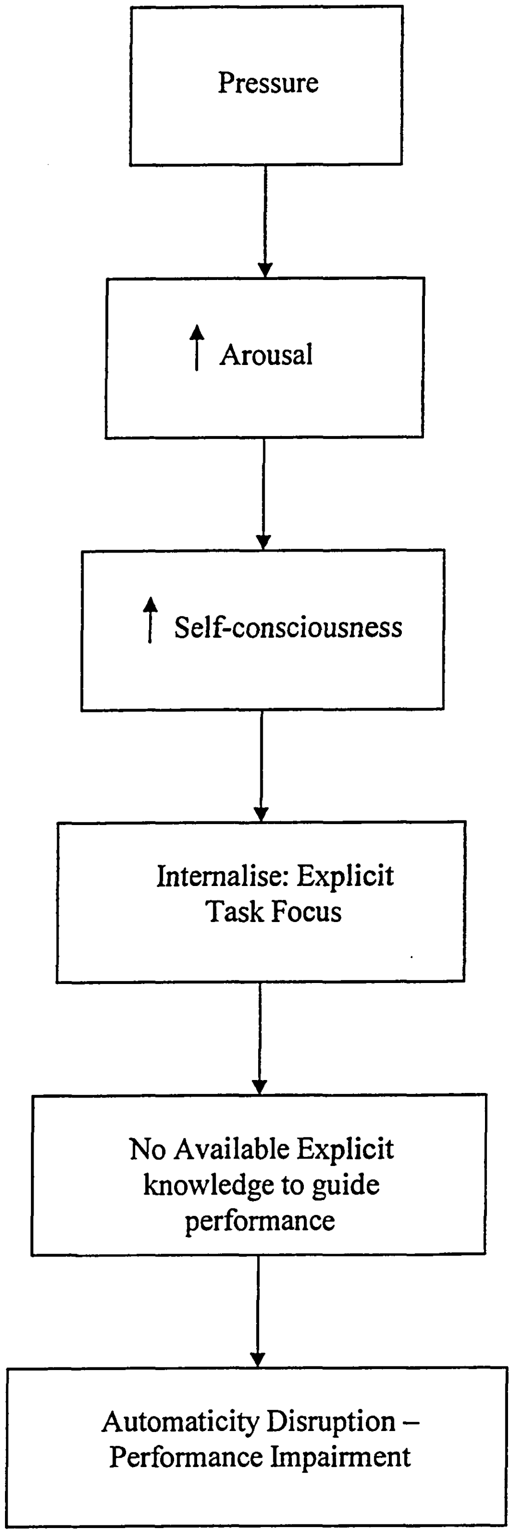


Figure 2.4. A Schematic of the Choking Under Pressure Model (Baumeister, 1984).

Experiment 5 manipulated explicit pressure using monetary reward. In the pressure condition participants were given a target score to reach individually determined by initial pre-test trials, which demanded a high degree of performance. Results indicated that participants dispositionally low in self-consciousness demonstrated a greater tendency to choke under pressure than participants dispositionally high in self-consciousness. However, it is worth clarifying that both the dispositionally high and low self-conscious participants produced a decrement in performance under pressure; only the low self-conscious result was significant.

In Experiment 6 a popular arcade game was used in an attempt to examine choking under pressure in a field setting. Performance evaluation of participants was used to induce explicit pressure (self-presentation concerns). Participants were required to score as high as possible on the task. Dispositional self-consciousness was not measured in this experiment. Results indicated an average decrease in performance of twenty-five per cent under pressure. Baumeister (1984) concluded that situational pressure does induce choking effects in a field setting.

The series of experiments undertaken by Baumeister (1984) led him to the overall conclusion that dispositionally low self-conscious individuals are more susceptible to choking under pressure, in comparison to dispositionally high self-conscious individuals. Baumeister (1984) argued that individuals high in dispositional self-consciousness simply find it easier to cope with pressure because they are used to performing whilst feeling self-conscious. In contrast, individuals low in dispositional self-consciousness are not accustomed to this process.

However, there are confounding elements to the research conducted by Baumeister (1984) that need to be addressed. Firstly, Baumeister (1984) stated that pressure must be present for choking to occur. Baumeister (1984) also stated arousal to be an important component of the choking process, which can heighten levels of self-consciousness. Nonetheless, he made no attempt to measure either construct during the series of experiments. Therefore, it would appear that such constructs were assumed on the basis that experimental groups demonstrated a reduction in performance under pressure. Further, it is not clear what levels of arousal are required to heighten self-consciousness and whether this differs between low and high self-consciousness individuals.

Secondly, the ambiguity of Baumeister's (1984) results means that they can be interpreted another way. The conclusion that dispositionally low self-conscious individuals were more susceptible to choking under pressure than dispositionally high self-conscious individuals is questionable. Masters (1992; Maxwell et al., 2000) argued that cognitive failure was common in individuals who are highly motivated to succeed. Eysenck and Calvo (1992) proposed that worry operates as a function of motivation by recruiting additional resources (e.g. mental effort), which are directed towards strategies created to prevent negative performance effects. Therefore, perhaps dispositionally high self-conscious individuals were worried about being negatively evaluated by relevant others by nature of their disposition and thus possessed a greater motivation to perform well under pressure. However, it is not known if additional resources were recruited or indeed, where they were allocate as Baumeister (1984) neither monitored motivation nor mental effort. Clearly, research needs to control for these limitations in the future.

Thirdly, the ball and rod task (used in experiments 1-5) might have had little relevance to participants' ego. Without any ego involvement the effects of pressure would be minimised thus, self-focused attention is unlikely to have occurred, particularly in individuals low in self-consciousness. This also suggests that motivation could have been an influential factor in the outcome of these results. In addition, Baumeister (1984) speculated that increased attention to oneself was responsible for disrupting automaticity and impairing performance in dispositionally low self-conscious participants. However, the task used by Baumeister was novel to participants (used in experiments 1-5) thus it is unlikely that the acquired skill was taken to an automatic level of functioning. Using participants that possess automatic skills might be a more suitable control for motivation (e.g. high ego involvement) and automaticity in future research. Finally, in the series of experiments conducted by Baumeister (1984) the two tasks used (ball and rod task and a video game) were not sport specific. Thus, the results are not generalisable to athletic performance.

Baumeister (1984) went on to argue that an individual does not need to have reached an automatic level of functioning in order to experience choking under pressure; it can occur at any phase in the learning process. For example, an introductory level athlete with minimal experience will not be proficient enough to execute a skill at an autonomous level. However, the athlete will still be aware of the fundamental difference between high (e.g. competition) and low (e.g. practice) pressure environments. Consequently, that athlete will still be susceptible to choking under pressure. According to Baumeister (1984) individuals that perform a skill automatically choke under pressure owing to the explicit knowledge of that skill being inaccessible to the conscious to guide performance. This implies that if the explicit knowledge of that skill were consciously available decrements in performance could be avoided. If this were the case, clearly knowledge of specific skills would still be consciously available to introductory level athletes as automaticity would not yet have been reached. This should enable such athletes to guide performance under pressure and essentially, prevent the choking process. Although it is recognised that low level performers can experience a decrement in performance under pressure, it is unlikely to be due to the lack of consciously available knowledge relating to the process of the skill. This suggests that Baumeister's (1984) model of choking under pressure possesses other confounding elements that require further investigation.

Masters et al. (1993) argued that skill failure under pressure, outlined by the conscious processing hypothesis[8] (Masters, 1992) (see Figure 2.5.) could have links with dimensions of personality. Masters et al. (1993) proposed certain skilled performers to have a disposition to reinvest in controlled processing, which can disrupt automatic skill functioning under stress. Reinvestment of controlled processing has been defined as

> "having a greater or lesser disposition than others to reinvest actions and percepts with attention – particularly when under pressure" (Masters et al., 1993, p.655)

It is important to clarify at this point where the discrepancy lies between Baumeister's (1984) model of choking under pressure and Masters et al.'s (1993) model of skill failure under pressure. Baumeister (1984) proposed that when a skill becomes automatic the explicit knowledge of that skill is inaccessible to the conscious attention to guide performance in times of stress thus, performance is impaired. In antithesis,

[8] For a review of the conscious processing hypothesis see section 2.52.

Masters et al. (1993) (cf. Hardy, Mullen, & Jones, 1996; Masters, 1992) argued that explicit knowledge of an automatic skill is readily available to the conscious attention to reinvest in under stress, which disrupts automaticity and impairs performance.

In an attempt to assess the relationship between dispositional factors and skill failure under pressure Masters et al. (1993) constructed the Reinvestment Scale. The twenty item Scale comprises items from the Cognitive Failure Questionnaire (Broadbent, Cooper, FitzGerald, & Parkes, 1982), Emotional Control Questionnaire (Roger & Nesshoever, 1987) and the public (6 items) and private (6 items) subscales of the Dispositional Self-consciousness Scale (Fenigstein et al., 1975). In an attempt to assess the predictive power of the reinvestment scale, Masters et al. (1993) conducted three experiments. Masters et al. (1993) hypothesised that individuals who scored high on the Reinvestment Scale would be more prone to skill failure under pressure, than those who scored low on the Scale.

In Experiment 1 participants scoring low (n = 7) or high (n = 9) on the Reinvestment Scale formed the two experimental groups. Participants using a pool of explicit instructions were required to leam a two-dimensional rod-tracing task (Seashore, Dudek, & Holtzman, 1949). Participants were then required to perform the task under stress, induced by audience evaluation and monetary reward (this was reduced each time participants made an error). Results found no significant differences between high and low reinvestment groups at a rod-tracing task.

In Experiment 2 specific data from Masters' (1992) study were used in which participants had learned a golf putting task and then their performance tested under stress (induced by monetary reward). Participants completed the Reinvestment Scale with those scoring low (n = 7) or high (n = 7) forming the two experimental groups. Results found a significant correlation ($r = 0.59$, $P < 0.05$) between participants scoring high on the Reinvestment Scale and a decrease in golf putting performance under stress.

In accordance with Experiments 1 and 2, Masters et al. (1993) suggested that the relatively simple rod-tracing task was not complex enough to elicit the reinvestment

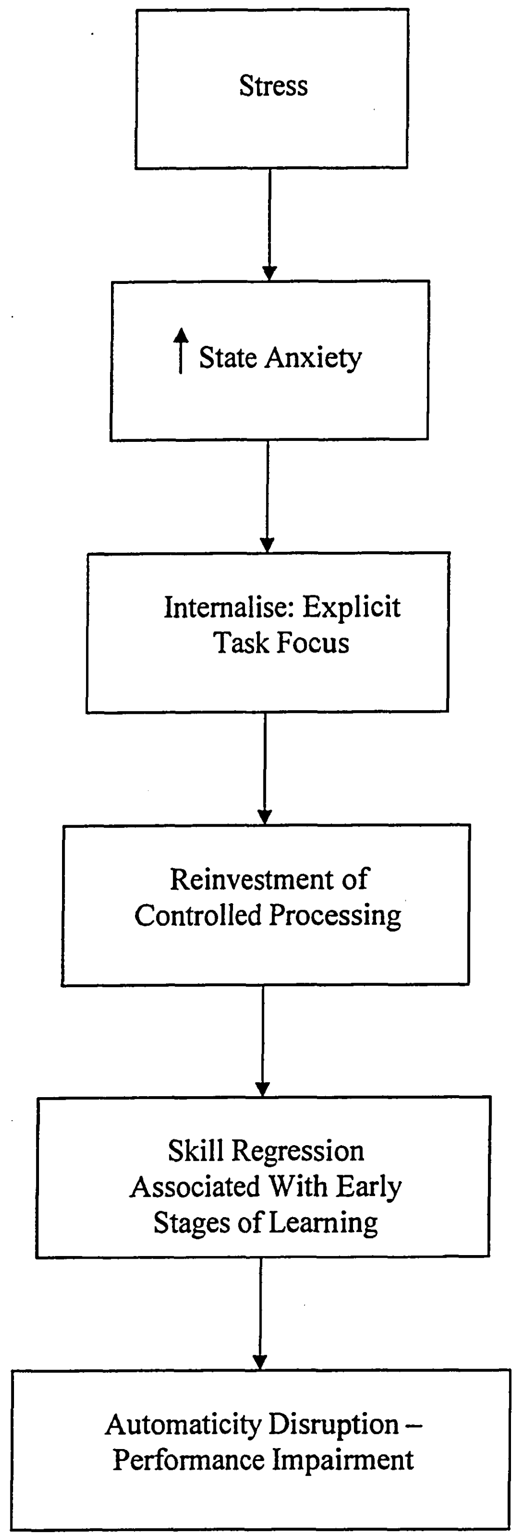


Figure 2.5. A Schematic of Skill Failure Under Pressure (Masters et al., 1993).

process. In contrast, the golf putting task was considered a more complex skill comprising many explicit components to elicit reinvestment. Thus, Masters et al. (1993) concluded the Reinvestment Scale to be a successful predictor of skill failure under pressure, precipitated by conscious processing.

A criticism of Experiment 2 is that Masters et al. (1993) proposed state anxiety to be a fundamental antecedent associated with skill breakdown under pressure. However, Masters et al. (1993) only measured the physiological (somatic) aspects of anxiety by recording heart rate; no provision was made for intensity or directional components of cognitive anxiety or self-confidence. State anxiety is considered a multidimensional construct comprising both somatic, cognitive, and self-confidence factors (Martens et al., 1990). Clearly, research needs to control for these constructs in the future. Secondly, the data used for Experiment 2 required participants to execute four hundred golf putts during the acquisition phase (Masters et al., 1993). During this phase participants would have acquired some degree of proficiency. However, it is unlikely that they developed their putting skills to an automatic level of functioning. Future research should test the Reinvestment Scale using athletes who already possess automatic skills. Further, this might also control for motivational factors (e.g. ego involvement) that could have influenced Masters et al.'s (1992) findings. That is, all participants were required to participate in the study as an obligatory part of their degree course, which might have affected motivation similar to that suggested for Baumeister's (1984) research.

In Experiment 3, Masters et al. (1993) used the top twelve ranked performers of the collegiate squash and tennis clubs, in an attempt to validate the Reinvestment Scale in a field based setting. All participants completed the Reinvestment Scale. Independently, the president and captain of each club were required to rate each team mates' tendency to choke or fail under pressure. Performers were ranked on a 0 (never chokes under pressure) to 4 (always chokes under pressure) likert scale. Data from the two sporting groups were collaborated. Results indicated a significant correlation ($r = 0.64$, $p < 0.01$) between the skill failure ratings (as predicted by presidents and team captains) and the scores of the Reinvestment Scale. Masters et al. (1993) concluded that the correlation between the propensity to reinvest and experience skill failure under pressure offered greater validity to the Reinvestment Scale.

A criticism of Experiment 3 (Masters et al., 1993) was that squash and tennis performers' susceptibility to failure under pressure was based on the subjective opinions of the team presidents and captains, respectively. Hence, this experiment does not examine whether athletes suggested to be susceptible to this phenomenon do actually consciously process explicit task knowledge in a field based setting. Thus, future research needs to examine the relationship between the Reinvestment Scale and performance outcomes in a field based setting.

Masters et al.'s (1993) research suggested that high reinvesters are more susceptible to skill failure under pressure, precipitated by conscious processing, than low reinvesters. Twelve out of the twenty items that comprise the Reinvestment Scale are common to the public and private subscales of the Dispositional Self-Consciousness Scale (Fenigstein et al., 1975). Thus, suggesting that those high in dispositional reinvestment were also high in dispositional self-consciousness. For this reason, Masters et al.'s (1993) findings (Experiment 2) are in contrast to Baumeister's (1984) who found that dispositionally low self-consciousness performers to be more susceptible to decrements in performance under pressure. Hence, high reinvesters might simply be highly self-conscious and more likely to become stressed and thus anxious particularly in conditions open to appraisal. This contention is supported by Maxwell et al's. (2000) data (unpublished), which indicated that the Reinvestment Scale and the trait section of the State-Trait anxiety inventory (Spielberger et al., 1970) were significantly correlated ($r = 0.55$, $n = 193$, $p < 0.001$). Thus, suggesting that high reinvesters are likely to be more anxious than low reinvesters, which might account for differing performances under stress in Masters et al.'s (1993) research. Further, Maxwell et al. (2000) found a negative correlation between performance during explicit learning and Reinvestment Scale scores. It would appear that low reinvesters learn more effectively than high reinvesters. Hence, perhaps self-consciousness can also influence the progression of learning. Clearly, future research needs to investigate the conflicting elements that exist between Baumeister's (1984) and Masters et al.'s (1993) work if an improved understanding of the stress-rehearsal-performance breakdown is to be established.

Finally, a further criticism of Masters et al.'s (1993) research is that they propose the Reinvestment Scale to be a strong predictor of reinvestment of controlled processing.

However, this inventory appears only to offer a measure of an individual's cognitive inhibitions, rather than the direct assessment of the processing system used to execute skills. Hence, conscious processing was assumed in participants dispositionally high in reinvestment from performance outcome based measures alone.

One such study that attempted to bridge the gap between conscious processing and outcome based measures is Crews (2001). Crews (2001) examined both situation and dispositional factors of skill failure under pressure. This study comprises three conditions, which all required golfers to execute a series of five-foot putts on a flat green. In phase one the golfers were required to execute twenty putts. In phase two golfers were required to complete the same task with the addition of being told that they would be filmed live, by a television company. In the final phase golfers were told they would receive a large monetary reward if they exceeded their previous score; failing to do so would decrease their prize money in proportion to their score. An electroencephalographic (EEG) instrument recorded brain activity throughout the experiment. The brain is divided into two hemispheres. The left hemisphere is thought to be involved with conscious, analytical activity, whereas the right hemisphere is thought to be involved with automatic, creative activity (Crews, 2001).

Results from Crew's (2001) study indicted that golfers who possessed a propensity to choke indicated an increase in activity, but predominantly used the brain's left hemisphere. In comparison, golfers who were consistent under pressure experienced equal amounts of increased activity. However, this was distributed evenly between the brain's left and right hemispheres. The findings of Crews (2001) indicate that golfers adopting the brain's conscious analytical side to process information are susceptible to experiencing a decrement in performance under pressure. This provides theoretical support for the conscious processing hypothesis (Masters, 1992) and the constrained-action hypothesis (Wulf, McNevin, & Shea, 2001). Both models propose that directing conscious attention internally to explicit movements can disrupt the implicit regulation of task performance otherwise suggested to facilitate learning (Wulf, McNevin, & Shea, 2001) and performance (Masters; 1992).

Crews (2001) concluded that if players are to be successful under pressure they need to learn to access the right side of the brain throughout performance, which promotes automatic processing systems. For this reason future research needs to examine psychological intervention strategies that help to promote right brain activity during learning and performance particularly, in individuals predisposed to conscious processing under stress.

2.7. SUMMARY AND AIMS OF RESEARCH

The preceding review of literature has shown that severe performance loss in competitive sport has been explained through a variety of psychological constructs. Further, this review has identified specific issues and conflicting elements relating to aspects of this phenomenon that require further investigation. First, both Masters et al.'s (1993) model of skill failure underpressure and Baumeister's (1984) model of choking under pressure have intuitive appeal in explaining severe performance loss in sport. Both models take into account dimensions of personality, and situational factors. Nevertheless the mechanisms that underpin such models have been derived from limited research, possessing no empirical or qualitative grounding in sport. Further, the research underpinning these theories has produced equivocal findings. Clearly, future research needs to explore psychological characteristics derived from the perceptions and interpretations of athletes that have experienced, first hand, severe performance loss in competitive sport. Through such an examination the value of the available theories used in the literature to explain severe performance loss, and the perceptions of athletes, can be explored.

Secondly, heightened arousal and state anxiety have been assumed in the literature to be constructs that underpin severe performance loss under stress. However, little attempt has been made to rigorously monitor these constructs. Thirdly, recent research has proposed both dispositional characteristics (Baumeister, 1984; Masters et al, 1993; Chell, Graydon, Crowley, & Child, 2003), and methods of skill acquisition (Hardy, Mullen, & Jones, 1996; Masters, 1992), coupled with environmental factors, to be influential in severe performance loss, precipitated by conscious processing under stress. Clearly, future research needs to examine the combined effect of manipulated explicit task knowledge during skill acquisition and dispositional factors on these phenomena, whilst controlling for the issues associated with using a dual task paradigm.

Finally, there has been considerable evidence (Wulf et al., 1998, 1999, 2000, 2001) indicating the advantages of adopting an external foci of attention, in comparison to an internal focus during skill acquisition. Recently Wulf and Shea (2002) have found that the advantages of an external focus are also transferable to skilled performance. Nevertheless, no research has examined the effects of different attentional foci on skilled performers predisposed to conscious processing under stress. Nor has current research identified a psychological intervention strategy for such performers to help prevent conscious processing in an ecologically valid environment.

The central purpose of this thesis was to examine in detail, using qualitative and quantitative procedures, psychological mechanisms that underpin severe performance loss in competitive sport. The following specific research aims were formulated:

1) To identify psychological mechanisms that underpin severe performance loss in competitive sport.

2) To explore how psychological mechanisms associated with severe performance loss in competitive sport interact.

3) To identify psychological coping strategies that could be used to counter severe performance loss in competitive sport.

3.0. STUDY 1. ANTECEDENTS AND CONSEQUENCES OF SEVERE PERFORMANCE LOSS IN COMPETITIVE SPORT: THE ATHLETES' PERSPECTIVE

3.1. INTRODUCTION

Examples where elite athletes occasionally have experienced severe performance loss in competitive sport (see Section 1.0) are characterised by a sudden and substantial deterioration of performance under stress. As a result of the complexity of such an experience several theories probably have a part to play in explaining this performance deterioration (e.g. choking under pressure (Baumeister, 1984); catastrophe theory (Hardy, 1990); conscious processing hypothesis (Masters, 1992); skill failure under pressure (Masters et al., 1993)). These theories provide different perspectives in attempting to explain severe performance loss phenomenon.

Current research has highlighted pressure and stress as fundamental antecedents associated with decrements in motor performance (Baumeister, 1984; Hardy, Mullen & Jones, 1996; Masters, 1992; Masters et ah, 1993; Mullen & Hardy, 2000). Pressure increases the demands of performing well; stress is the process involving one's appraisal of whether or not those demands can be successfully met (Lazarus, 1966, 1982, 2000; Lazarus & Folkman, 1985). The purported mechanisms through which such stress affects motor performance are wide ranging and depend on the theoretical position adopted. Some researchers have suggested that large deteriorations in performance can occur due to the effects of anxiety (Fazey & Hardy, 1988; Masters et ah, 1993) and arousal (Easterbrook, 1959) that emerge from stress. These researchers argued that the combination of high cognitive anxiety and physiological arousal would have catastrophic effects on skill execution. Some purported effects of experiencing arousal and anxiety are that they can cause either a distraction (Eysenck, 1979) or a self-focused attention (Baumeister, 1984; Masters, 1992).

Substantial support has been provided for the stress-self-focus relationship. For example, Masters (1992) proposed the conscious processing hypothesis, which stated that heightened state anxiety precipitated by stress can direct attention to the process by which a well-learned skill is executed. This argument has led to suggestions that such attentional shifts are influenced by the method through which the skill was learnt

(Masters, 1992). Motor skills have been proposed, initially, to be learned explicitly through conscious processing (Anderson, 1982; Fitts & Posner, 1967). Over time, with practise, motor skills are then thought to become implicit through automatic processing. It is therefore hypothesised by some authors that stress results in a regression to early learning phase strategies (Fuchs, 1962) and results in a movement characterised by inefficient co-ordination patterns and a freezing of the degrees of freedom within the movement sequence (Bernstein, 1967). Hence the movements lose effectiveness, which leads to large deteriorations of performance.

The phenomenon under investigation in this study has sometimes been labelled as choking and describes an athlete when he/she experiences a severe loss in performance during a critical moment in competition (Baumeister & Showers, 1986). This suggests that the timing of the deterioration in performance is linked to specific characteristics of the situation such as the competition environment and the moment by moment status of that performance and targets set. Baumeister (1984) proposed a model of choking, which hypothesised that arousal, created by pressure, heightens self-consciousness, which directs attention to the movement characteristics of a skill sequence. An anxious attempt is then made to consciously control the movement to ensure the correct execution of the skill. This disrupts automaticity and impairs performance because explicit knowledge is no longer available to the conscious attention to successfully guide the execution of a well-learned skill.

To test the choking model Baumeister (1984) conducted a series of experiments. The outcome was that it is easier for highly self-conscious individuals to cope with pressure because they are used to performing whilst feeling self-conscious, in contrast to low self-conscious individuals who are not so accustomed to this process (Baumeister, 1984). This suggests that the role of dispositional characteristics in a performer's personality might have an explanatory role in large performance decrements. Further to this Masters et al., (1993) regard the primary mechanism by which skill regression occurs as reinvestment of controlled processing. They described this occurrence as having a greater or less disposition to rehearse explicit task knowledge, particularly when under stress.

The severe performance loss literature has been hampered by two main limitations: first, research underpinning theories used to explain this phenomenon has produced equivocal findings (e.g. Baumeister, 1984; Masters etal., 1993). Second, mechanisms associated with these theories have been derived from limited research, possessing no empirical or qualitative grounding in sport. Hence, explanations for this problem have been based on the most readily available theory (Baumeister, 1986). Research has not considered the athlete's perspective on psychological mechanisms that might underpin severe performance loss in competition. Therefore, the primary aim of this study was to explore psychological characteristics derived from the perceptions and interpretations of competitive athletes that had experienced, first-hand, severe performance loss in competitive sport. Through such an examination the value of the available theories used to explain severe loss in performance, and the perceptions of athletes could be explored. The rationale for using a qualitative approach in this study was to access an improved understanding of severe performance loss in competitive athletes. Previous research has exclusively used quantitative, outcome-based measures to examine this phenomenon without a qualitatively derived understanding (Baumeister, 1984; Hardy et al, 1996; Lewis & Linder, 1997; Masters, 1992; Masters et al, 1993).

3.2. METHOD

3.21. Participants

With institutional ethics approval, ten participants (male n=8; female n=2) aged between 16 and 30 years (mean = 24.1 years) were interviewed. Participants were performers in soccer (1) golf (1), cricket (3), squash (1), tennis (3) and basketball (1). The rationale for using these sports was that they all have been commonly associated with performance deterioration from an anecdotal perspective. The rationale for using a wide range of sports was to access a broad understanding of severe performance loss across team and individual sports, involving fine, gross, open and closed motor skills. The standard of participants ranged from club (n=2), county (n=5) to national level (n=3). Participants possessed a mean average of 12 years competitive experience (range = 5-19 years) and were selected from a pool of 150 'Sporting Experience Surveys' administered equally amongst the sporting groups. The criterion for participation was that the athletes had reported experiencing a substantial deterioration to performance during competition. Athletes were prioritised to be interviewed based on the substantial deterioration of their reported experience(s). Participation in the study was voluntary.

Informed consent was sought from participants before data collection; confidentiality and anonymity was guaranteed (see Appendix 2).

3.22. Instruments

3.221. Sporting experience survey. Sports clubs were contacted to gain permission to distribute the survey to club members. The purpose of the survey was to highlight athletes that had experienced a severe loss in performance when competing. Participants were selected for a follow-up interview based on the substantial deterioration of their reported experience. The survey comprised questions in general demographics (e.g. age, sport, years of experience, and level) and specific questions about their experience(s) (see Appendix 3).

3.222. The interview guide. To standardise the interview protocol, an interview guide (see Appendix 4) was constructed that contained lead and elaboration-probe questions (Scanlan, Stein & Ravizza, 1991). The interview guide was piloted on athletes who had experienced severe performance loss during competition in order to develop and refine the protocol.

3.23. Procedure

3.231. Contacting participants. All participants were contacted and informed of the nature of the investigation. A generic interview guide, comprising the main lead- and elaboration-probe questions, was sent to participants one week prior to their interview. This guide was sent to make participants aware of what was required of them during the interview and to help standardise the interview protocol (Scanlan et al., 1991; Gould, Jackson, & Finch, 1993a; Gould, Jackson & Finch, 1993b).

3.232. The interview. The interview format comprised of four main sections: 1) general introduction, 2) description of most severe performance loss, 3) other experiences of severe performance losses, 4) final comments and summary questions. It was explained to the interviewee that the purpose of the interview was to develop an understanding of their experience(s) of severe performance loss in competitive sport and that this would be the focus of the interview. A Dictaphone was used to record the interviews. Each interview lasted approximately one hour. All questions were open ended, allowing participants the freedom to convey their actions, feelings, thoughts and emotions. It was stressed that participants should not guess if they could not remember certain aspects of their experience(s). After initial rapport was developed with each participant the interviewer asked the follow:

> "...Please describe to me your most severe experience when you felt you could not perform to your usual skill level."

Once participants had recounted their experiences in as much detail as possible general probe questions (Pattern, 1990) were used to gain an in-depth account of the event(s) (e.g., "Please could you describe for me any further actions, thoughts, feelings, or emotions that you remember experiencing that might have influenced this particular performance?"). Elaboration probe questions were also used to expand on participants' experiences (e.g., "What was it about these feelings (or actions, thoughts, emotions) that made them influential during this particular experience?"). To understand the information conveyed by participants clarification-probe questions were used (e.g., "Could you explain that in more detail please?"). Causal-probe questions were also used to identify the cause of specific feeling, thoughts and / or experiences (e.g. "Could you explain what caused that experience?"). Finally, before moving on to the next section a general probe-question was used to make certain no information had been omitted from the experience (e.g., "Can you think of any other actions, thoughts, feelings or emotions that you feel were influential during this particular experience?"). These procedures, recommended by Patton (1990), were used to prevent the interviewer leading participants in their response.

3.24. Data preparation and analysis

According to several reputed researchers there is no absolute way to analyse qualitative data (e.g., Miles & Huberman, 1994; Patton, 2002). Nevertheless, the most prominent technique used in sport psychology research has been some form of inductive content analysis (cf. Biddle, Markland, Gilbourne, Chatzisarantis, & Sparks, 2001). This analysis allows dimensions, theories and relationships to emerge from the raw transcript data without proposing in advance what these important areas will be. In contrast, in a deductive content analysis the main variables and statements associated with specific research hypotheses are specified prior to data collection (Patton, 2002). Thus, the present study used inductive procedures to analyse the raw transcript data as recommended by Patton (1990) and successfully adapted to sport by Gould et al. (1993a, b). The rationale for using this procedure was that research underpinning theories associated with severe performance loss has produced equivocal findings (Baumeister, 1984; Masters, 1993). Further, mechanisms associated with these theories have been derived from limited research that does not possess empirical or qualitative grounding in sport.

The same investigator conducted all interviews to ensure a standardised protocol. Two additional researchers read and re-read the transcripts and inductively analysed the data. This procedure required the researchers to organise the raw data into interpretable and meaningful themes that characterised the essence of the dialogue. These were then categorised using inductive techniques. Similar quotes were clustered, enabling researchers independently to generate higher-order themes. Where necessary, second higher order themes were also generated. The highest generality was labelled the 'general dimension'. This dimension clustered together higher order themes.

On completion of the inductive procedures a triangulation method was adopted to maximise the reliability and control for individual biasing during data analysis. During this process raw data themes were agreed on and interpretable and meaningful higher-order and general dimension themes employed. Finally, a validity check was conducted using deductive procedures to verify that the identified themes existed in the raw transcripts (Hanton & Jones, 1999). Any anomalies were discussed and rectified. The triangulation assessment produced an 82% agreement in the raw data themes. Consensus was required when employing definitive higher-order and general dimension themes; 100% agreement was achieved.

3.3 RESULTS AND DISCUSSION

The inductive procedure identified eight general dimensions comprising 56 high-order themes, generated from 464 raw data themes (see Figures 3.1 - 3.5). The data were divided into five categories: (1) factors influencing the occurrence of severe performance loss, (2) experiences during severe performance loss, (3) consequences of the occurrence of severe performance loss, (4) personality characteristics and (5) type of competition when severe performance loss was experienced. Numbers in parentheses, for all figures, highlight the number of athletes reporting identical raw data themes (when >1).

3.31. Factors influencing the occurrence of severe performance loss

3.311. Antecedents. The fourteen high-order themes, produced from 20% of raw data themes, were: 'high expectations of others', 'high expectations of self', 'crowd / significant others', 'reputation', 'prior experiences', 'situational / environmental variables', 'too much time', 'apprehension', 'fear of failure', 'pressure', 'importance of sport', 'playing well', 'consequences to poor performance', and 'payment / rewards'.

All participants were inhibited by high expectations of themselves and/or of others (i.e. coach, peers, and parents) prior to performance loss, which led to an increase in pressure to win. Participants commonly reported experiencing apprehension and a fear of failure in this occasion. One participant stated "I was frightened of losing to this player", another participant stated "I didn't want to play; I didn't want to be there (see Figure 3.1). This suggested that participants were in a negative frame of mind prior to the onset of performance disruption. This was further exemplified by statements like "I'm going to lose this, I've lost it before, just couldn't get that killer instinct", or "the umpire at my end used to no-ball me a lot and obviously the thought of no-balling a lot was on my mind", or "the more you wait the more your brain gets a little bit more muddled" (see Figure 3.1). In addition, all participants reported how important their sport was to them and how crucial it was to perform well and essentially, sustain their status or reputation as a performer.

3.32. Experiences during severe performance loss

3.321. Cognitive changes. The eleven higher-order themes, produced from 22 % of raw data themes, were: 'inappropriate focus', 'unable to stay in the present', 'negative thoughts', 'obsessional thinking about technique', 'lack of cognitive control', 'lack of confidence', 'self-presentation concerns/public self-consciousness', 'perception of what significant others were thinking', 'magnification of thoughts', 'complacency' and 'self-doubt'.

Figure 3.1. Factors Influencing the Occurrence of Severe Performance Loss

Raw Data Themes	Higher Order Themes	General Dimension
It had become an expectation just to rely on me	High expectations Of others	Antecedents
I was told that I was the fast bowler in the league and that I should be bowling really quick		
I felt built up within the league		
They expected me to win (2)		
You must win, you mustn't come off the court until you have won		
You've got to beat them; you can't let them win again		
There were expectations from others (2)		
Maybe they will expect a little bit more than I can deliver		
I was expected to do it but I knew the dangers out there that could spoil it		
I felt a great expectation		
They did expect that it would just go straight in and it didn't		
Again the expectations of others was there on myself		
I felt an increase pressure, tension and anxiety because I am expected to win		
My expectations were so high before hand nothing could make up for it, or even partly make up for what I'd just done	High expectations Of self	
I wanted to put on a good performance (2)		
My expectations were bowling fast, swinging the ball and taking wickets		
I would have to bowl quicker		
I honestly expected to beat him		
Got to win		
My expectations were 4 good serves		
I still had to impress		
High expectations of myself (4)		
Expectations were put on me by myself		
Its all on me now, maybe I can do this but I don't know, I've got to make it		
I was thinking the conditions are humid so the ball should be swinging		
I felt as if it was all resting on me		
I have to win as they are not as good as me		
I think it comes from the expectation I put on myself under when playing tennis		

Figure 3.1. *(Cont.)* Factors Influencing the Occurrence of Severe Performance Loss

Raw Data Themes	Higher Order Themes	General Dimension
Paying attention to others, rather than going through my normal routine My attention was focused on, is that person there is this person there He's one of those guys I've got it into my head that I don't like to play I knew these guys were going to be judging me You know everyone is watching you (2)	Crowd / significant Others	Antecedents
You know a lot is riding on this, a lot of pride at stake There was more rivalry when playing this club Being the captain of the side and having the reputation of being one of the better players in the county I'm quite nervous as to what the rest of the team thing of me	Reputation	
I had played a couple of big matches in the past and just frozen so I was aware of that I was thinking back to when I was 15 when I missed that penalty I remembered the game when we lost to this team by 1 point last year and I just thought I want to make this shot I didn't feel like I do other weeks things really didn't feel right from the start I'm going to lose this, I've lost it before, just couldn't get that killer instinct	Prior experiences	
The umpire at my end he used to no-ball me a lot and obviously the thought of no-balling a lot was on my mind I hadn't been bowling as much as I'd liked and this was the first time I had opened for Cornwall's under 21s There was an umpire that I really didn't like I was captain opening the bowling The fact that he was a friend or so called friend There was also a problem with the court	Situational / environmental variables	
I always find that the more time you have to think the more scenarios go through your head We had a to wait a long time for the group in front to play, I had too much time to think about what club I was going to take The more you wait the more your brain gets a little bit more muddled	Too much time	

Figure 3.1. *(Cont.)* Factors Influencing the Occurrence of Severe Performance Loss

Raw Data Themes	Higher Order Themes	General Dimension
I was apprehensive (2) I didn't want to play; I didn't want to be there I wasn't 100% committed to the shot I wanted to play Tentative and apprehensive	Apprehension	Antecedents
Its sort of a fear, a fear of losing That's what it is fear of failure, definitely I've always had this inherent fear of bowling wides The adrenaline had sort of left me from the last hole and the fear had come I was frightened of losing to this player because you know he's not even a team player I didn't know what was happening, it was like the fear of the unknown Fear of not being able to close the game out It's almost like I was frightened of making mistakes When someone drives into the back of you, this awful feeling of dread and fear, it like that, very, very specific Its sort of a fear; a fear of losing You are nervous and feel crippled by the fear I was frightened of making mistakes Fear of failure does play on your mind and results in performance loss There is always that fear of failure	Fear of failure	
Self-pressure (2) Pressure from peers (2) The pressure I felt was because it was only my second match for the college The pressure started to build and build as my score got better and better In pressure situations everything seems to come in like that and all I could see on this particular occasion was a very narrow strip of fairway I felt a lot of pressure I really did They were putting pressure on me (spectators) I think I put myself under to much pressure I don't know what happened it must have been the pressure I felt I cracked under the pressure As soon as things start to go wrong the pressure debilitates your performance Self made pressure and wanting to come back with a bang	Pressure	

Figure 3.1. *(Cont.)* Factors Influencing the Occurrence of Severe Performance Loss

Raw Data Themes	Higher Order Themes	General Dimension
It became so important to me, the course record was on It was a very important match (2) In the back of your mind you know how important this shot is	Importance of Sport	Antecedents
I was shooting 3 pointers and not missing Never had a problem with my serve so it wasn't a problem at all I'd been playing well keeping us in there at one point I had got back to full fitness and I was bowling well in matches	Playing Well	
That affects my performance maybe knowing that you are going to get substituted in the back of your mind I knew at that point I had blown the course record	Consequences to Poor performance	
You've lost the chance of getting your handicap cut. I would have probably been cut to almost scratch being as I was 6 under, but mainly the course record	Payment / Reward	

All participants experienced some form of inappropriate focus. This included a preoccupation with negative thoughts, with little or no ability to control such thoughts from manifesting. This was typified by comments like "my mind was working on excuses straight away", and "I'm standing over the ball knowing that I am going to do it (shank) again and there is nothing I can do about it", and "mentally I was shot to pieces" (see Figure 3.2). Seven participants also reported an "extreme lack of confidence" (see Figure 3.2), which was accompanied by feelings of self-doubt of whether or not, in some cases they could actually perform at all. All participants expressed some feelings of self-consciousness and concerns about what others thought of their performance. One participant stated "I thought about what people might think if I lost", another stated "I felt conscious that they (spectators/peers) were probably analysing my weaknesses while I was playing" (see Figure 3.2). In addition, four participants were unable to get a perspective on the situation, which led to an extreme magnification of thoughts. One athlete stated "I thought I can't bowl", another stated "I felt a massive sense of regret, in one over I was undoing 10 years of good" (figure 3.2).

3.322. Somatic changes. The ten higher-order themes, produced from 19% of raw data themes, were: 'nerves', 'tension', 'panic', 'general somatic responses', 'lethargy / fatigue', 'injury /illness', 'emotional intensity', 'body language', 'lack of activation', 'arousal and emotional control'.

All participants reported experiencing some kind of somatic and /or emotional change during performance disruption. Eight participants reported somatic changes, which manifested themselves in the form of butterflies, shaking, an increase in breathing, heart rate and sweating, and a sense of panic; one athlete stated "I think I was having what most people refer to as a panic attack" (see Figure 3.2). Conversely, two athletes experienced a sense of lethargy and fatigue during performance. Seven athletes experienced intense emotions, this is typified by statements like "I felt like I could cry at that second", "I felt down on myself and didn't feel like I could bounce back, and "internally I was being chewed up" (see Figure 3.2). In some cases, participants felt their body language was affected by their emotions; one participant stated "my body language became very defeatist" (see Figure 3.2).

Figure 3.2. Experiences During Severe Performance Loss

Raw Data Themes	Higher Order Themes	General Dimension
My focus was on everything bar the target area	Inappropriate focus	Cognitive Changes
My mind set was totally inappropriate prior to delivery		
I was shouting and screaming to myself inside		
My focus was taken away from other cues that required my focus, like the target		
I was thinking about my opponent and what he was doing		
I was thinking how I could get one over on the marker rather than focusing on the game		
I'm trying to coach myself while I am playing and you can't really do that		
My focus just went out of the window		
I wasn't concentrating on the shots I just wanted to get them out of the way		
My mind was working on excuses straight away		
Willing him to lose it		
Attention wasn't on what I'm actually trying to do but the process of worrying about my Feet and where they were going to land		
The fitness thing was on my mind the most and the fact that felt lethargic		
The thought of no-balling was on my mind		
I was worried about where my feet were going because this guy used to no-ball me a lot		
I was worried, thinking what is he going to say (father)		
Your mind drifts back to, what's going on?	Unable to stay in the present	
I think in your head you are still thinking well that was in		
I think all the shots I played on that hole I wasn't focused on the shot, all I was thinking about was that first shot. Thinking why did I do that, why didn't I take this club instead of that one?		
You are not concentrating on what you are doing you are off somewhere else		
I was focused on the fact that I thought she was cheating rather than the serve		
I was thinking about the end goal and winning		
I was thinking about what was going on in front of me		

Figure 3.2. *(Cont.)* Experiences During Severe Performance Loss

Raw Data Themes	Higher Order Themes	General Dimension
I was thinking what is going to go wrong with this one Negative thinking I just wanted to let go of the thing and hope it made it down the wicket I started to get negative about things I was having negative thoughts, which was transferred across to the way I was playing If it's a bad serve I'll hang back on this one The first thing that comes into your head is, I've blown the course record I'm standing over the ball knowing that I am going to do it (shank) again and there is nothing I can do about it Very, very negative I thought, am I good enough to be here? Its like you are useless I was worried about bowling	Negative thoughts	Cognitive changes
I was thinking don't over step for the no-ball, focus on your run up I was totally obsessed with my run up I became totally obsessed with hitting that patch of I became obsessed	Obsessional Thinking about technique	
I'd mentally got myself into a state I crippled myself mentally Your brain gets scrambled there's to many thoughts My mind was too cloudy to concentrate Mentally I wasn't all there Mentally I was shot to pieces I lost everything, talent, focus, ability, you name it, it just plummeted There were other personal issues going on in my head You start thinking too much, like the more you wait the more your brain gets a little bit more muddled I'd put myself in such a bad state of mind I was running in trying to stop myself feeling anxious I had a full mind that day All sorts of thing were whizzing round my brain I lost all sort of brainpower I couldn't get it out of my head of what I'd done, it was so stupid These things are going round in your head and take priority over the shot that you are trying to play	Lack of cognitive Control	

Figure 3.2. *(Cont.)* Experiences During Severe Performance Loss

Raw Data Themes	Higher Order Themes	General Dimension
My confidence was drained	Lack of Confidence	Cognitive Changes
My self-confidence had gone to rock bottom		
Your confidence just leaves you		
I lost all belief in my ability to be able to hit these shots		
My self-confidence plummeted (2)		
Self-confidence was very low		
I didn't have any confidence at all		
Confidence was visibly low		
I didn't feel confident that it was going to happen that day		
There was an underlying lack of confidence that I could still do it as well as I had done it before (2)		
I had an extreme lack of confidence		
I felt that the confidence of the team wasn't really behind me		
Obviously I wanted to look the best	Self-presentation concerns / public self-consciousness	
I have to look good, I have to look good rather than we need a goal for the team		
As far as I was concerned I looked like a prick		
I felt self-conscious about what others were thinking of me		
I was aware that my parents were watching me		
I was concerned about what my coach thought of my performance		
I thought what people might think if I lost		
I felt conscious that they were probably analysing my weaknesses while I was playing		
When things started to go wrong the evaluation became more salient, as in, they are coming to watch me play		
I wasn't thinking about taking wickets, just to not make an idiot of myself		
I'd better not mess up because I'm going to make myself look a pratt		
I was trying to say, 'oh, don't be so self-conscious'		
I'm pretty self-conscious of people watching me		
My goals changed, usually my only thought would be how am I going to get this guy out, now I thought don't look a fool get the ball down the other end please		
You are self-conscious because of your own expectations and you know when you are not fulfilling your own expectations		
I felt self-conscious about what others were thinking of me		

Figure 3.2. *(Cont.)* Experiences During Severe Performance Loss

Raw Data Themes	Higher Order Themes	General Dimension
You've got father looking at me as much to say come on what are you doing, you are serving for the match here My perception was that the rest of the team was not that sympathetic because it was embarrassing for them My team mates were getting angry There was like a buzz going round the ground from the crowd of like semi-laughter, semi sort of embarrassment I was aware of what everyone else was thinking I was aware of what the parents must be thinking I was aware of what the captain must be thinking I was aware of the banter coming from the pavilion	Perception of what Significant others were Thinking	
I'm just losing it completely in myself I bowled one bad over which just crucified me I thought, I can't bowl I didn't have any direction as to what I was trying to do I felt a massive sense of regret, in one over I'm undoing 10 years of good You are thinking what could go wrong rather than what could go right	Magnification of thoughts	Cognitive Changes
I thought well she's not that strong this shouldn't be a problem I thought this was going to be a walk over I'm thinking, 'hey look I'm serving for the match going to be off court soon My thoughts were I'm going to be off in a minute because I've won this I suddenly went from not really knowing whether I would win the match, to thinking it should be a forgone conclusion, that I should go on and win from there	Complacency	
I suddenly started to question my ability There was a nagging element of doubt because I hadn't been doing it how I would usually do it You've got to put the ball on the spot can you do it? I thought I can't bowl anymore, I can't bowl, I can't bowl Seeds of doubt were sown in my mind I suddenly started to question my ability I knew I wasn't going to play a very good shot	Self doubts	

Figure 3.2. *(Cont.)* Experiences During Severe Performance Loss

Raw Data Themes	Higher Order Themes		General Dimension
I was starting to feel nervous and worried	Nerves	Somatic Changes	Somatic changes
I was shaking a bit			
I was getting the shakes and getting nervous, and couldn't understand what was going on			
Nerves making me shake			
I felt physically gripped by nerves			
I remember getting so nervous I literally felt like I could swing straight through the ball			
I was very nervous			
I was shaking so much I was still stuck in my head			
I felt very nervous before the match started (3)			
I always used to feel a bit nervous when bowling anyway, but I did feel extra anxious			
My legs were complete and utter jelly because I was so nervous			
I became more nervous and I think part of that was the fact that I was 3-0 up			
When you are up there playing you do shake a little bit			
Nerves didn't come into it when I was playing the game			
I was excited and nervous			
I wasn't nervous before it happened			
I felt physically crippled by nerves			
The tension was all the way up my back, my hamstrings and my neck	Tension		
The tension was whether I was going to be able to control it or not			
I was getting tense and uptight			
Very tense, all my shots had a very short swing			
I felt even more stressed and more tense			
Tension built up			
I was tensed up and using my wrist rather than my arm			
Tension right up, butterflies, you name it everything just scales			
I really did tense up			
I felt I tensed up because I didn't think I shot that first ball as well I as I should have done			
I felt hot and tight			

Figure 3.2. *(Cont.)* Experiences During Severe Performance Loss

Raw Data Themes	Higher Order Themes		General Dimension
All of a sudden my body was becoming so panicky You start to panic when the ball comes towards you I remember I started to panic I think I was having what most people refer to as a panic attack I went from being sort of normal nerves to extreme panic	Panic	Somatic Changes *(Cont.)*	Somatic changes *(Cont.)*
My legs turned to jelly, my whole body felt numb My breathing was going fast, my arms were shaking, my legs were shaking I felt shaky, my head hurt My heart rate increased, I felt hot, sweating, feeling incredibly light, airy, fuzzy I can remember my hands being very sweaty Massive butterflies (2) I felt lead legged	General somatic responses		
I felt lethargic I felt really lethargic and everything felt so heavy I think I was physically tired I'd had a long week You just become lethargic and that results in your technique breakdown I just felt exhausted I couldn't do anymore I just felt so tired Suddenly I felt tired, but there was no reason for me feel tired I felt very tired, mentally and physically	Lethargy / Fatigue		
I have had a back injury in the past, so that was playing on my mind I had an injury doing some athletic training, which meant I didn't bowl for a while I had been injured last year I had a shoulder injury I was conscious about my back being bad I'd been ill I wasn't feeling particularly well Physically sick	Injury / illness		
Anxiety levels rocketed I felt extremely anxious Everything just seemed to slow down Something got in side of me I felt very down and annoyed with myself I was feeling that things weren't right, wasn't comfortable with the way I was playing	Emotional Intensity		

Figure 3.2. *(Cont.)* Experiences During Severe Performance Loss

Raw Data Themes	Higher Order Themes	General Dimension
The whole experience was frightening I felt down on myself and didn't feel like I could bounce back Shear frustration I was annoyed with the way I was playing I got angry after the bad line call It felt absolutely horrid Internally I was being chewed up Gut wrenching I felt really shit and down I felt completely unnatural, it felt scary, it felt very odd I felt like I could cry at that second I was feeling incredibly upset I felt incredibly emotionally upset a big sense of letting myself and everyone down Things just got worse and worse and worse I couldn't get the game together I became very frustrated I was fighting back the tears and I was thinking please god don't hit the ball to me I was so embarrassed I got quite angry I was feeling anxious so self-confidence was not quite as high The anxiety started to grip me I was traumatised I just felt sorrow	Emotional Intensity *(Cont.)*	Somatic changes *(Cont.)*
My body language became very defeatist My body language was very mechanical, very robotic	Body language	
I felt anger and a lack of control I felt a complete lack of control I remember feeling angry when I was bowling I really lost it At this point I am just crumbling Anxiety was way too high	Lack of activation, Arousal & Emotional control	

3.323. Movement, technical, and sensation characteristics. The ten higher-order themes, produced from 19% of raw data themes, were: 'movement, tactical, and technical changes', 'directing focus to the process of the task', 'mechanical', 'lack of fluidity', 'compensatory strategies', 'behavioural changes', 'disrupted perception and sensation', 'lack of automaticity', 'self-absorption', and 'paralysis by analysis'. Seven participants began analysing their movement patterns associated with performance. This is typified by statements such as "my run up went, it wasn't bouncy", and "you just try and push it down there and it isn't your usual swing", and "the balls were getting worse so I focused more on the technique; my action wasn't side on", and "I started trying to bowl, trying to bowl thinking what I was doing" (see Figure 3.2). Similarly, during skill disruption five participants reported a loss of sensation, things didn't feel "comfortable", "normal", or "the same" as it usually did. Participant made statements such as "the ball felt like a lump of jelly in my hand", "I ran into bowl and didn't feel my arm turn over", and "I felt incredibly light, I felt that if a strong wind had come it would have blown me away" (see Figure 3.2). Another prevalent factor reported by participants was a feeling of being mechanical, and having no fluidity, which affected the natural flow of their performance. One participant stated "it's a nervie swing, it's not a full swing, its more of a mechanical swing, it's not fluid", another participant reported "my run up attributed to me not having flow" (see Figure 3.2).

3.324. Lack of control and understanding: The eleven higher-order themes, produced from 9% of raw data themes, were: 'instantaneous change', 'lack of opportunity for help', 'vividness / high recollection', 'the need to escape', 'lack of control of outcome', 'motivation to perform', and 'lack of understanding'. Five participants experienced an instantaneous change in their perception of themselves and their performance. As one participant described "one minute it (good performance) was there the next it wasn't", another participant described "a light had been on and someone had come and turned it off" (see Figure 3.2). In addition, six participants reported a complete lack of control relating to the outcome of the skill they were executing and further, had no understanding of why and how it was happening. One athlete stated "I was hitting balls that were hitting the back fence without bouncing" (see Figure 3.2). Finally, five athletes reported an intense compulsion to escape from the present situation that they were in. One athlete stated that "if someone had said to me look take this pill and you will die I would have taken it right there", another stated

Figure 3.2. *(Cont.)* Experiences During Severe Performance Loss

Raw Data Themes	Higher Order Themes	General Dimension
My run up went, it wasn't bouncy It was an important point I've got to keep it in court so I won't do what I've done all the other times that I've kept the ball in play, I'll do something a little bit different to keep the ball in play but inevitably it went into the bottom of the net You just try and push it down there and its not your natural swing I went from really swinging at the ball to sort of just pushing it around My grip had become so tight and the ball was going all over the place Almost stopping half way through my swing I'll just ease off a wee bit so that the shot will be nice and smooth and then dump it in the net	Movement / Tactical / technical changes	Movement, technical, & sensation characteristics
I was thinking where is my arm going to come in I was focusing on getting the seam right in my hand The balls were getting worse so I focused more on the technique; my action wasn't side on I started to focus on the end product of the shot, on the swing or how I came through the ball I need to come over the ball more and these are all the things in my head that I am thinking I was thinking, right the ball is coming to my forehand I must rotate When I was serving I focused on throwing the ball up and making sure I extended my arm and throwing the racket through the ball I'm thinking about the arc and my feet and all these things I remember thinking a lot about my feet and where I let go of the ball I started to think well where am I letting go of the ball here, am I holding onto it to long or not long enough I started trying to bowl, trying to bowl thinking what I was doing I just tried to focus on shooting the shot using the right technique I thought hang on lets get the technique right to make sure you don't throw it instead of shooting it and try just try and do it right I was focusing so much on this end of what I was trying to do, when it got to the other end, it had gone I am looking at my feet to make sure they are landing in the right place	Directing focus to the process of the task	

Figure 3.2. *(Cont.)* Experiences During Severe Performance Loss

Raw Data Themes	Higher Order Themes	General Dimension
I became totally mechanical I was so stuttery Very robotic I was ridged and very mechanical Its like a nervie swing, its not a full swing, its more of a mechanical swing, its not fluid	Mechanical	Movement, technical, & sensation characteristics *(Cont.)*
I never really got into a rhythm My run up attributed to me not having flow The rhythm goes I think that when I became anxious everything become a bit more rushed, you don't take your time you just want to get it out of the way Its not a full swing, its more of a mechanical swing, its not fluid I rushed it and off it went	Lack of Fluidity	
I tried to experiment with how I held the ball either with the my wrist cocked or my wrist loose Just need to move my feet and give myself a nice big arc I was trying to grip the ball harder because it felt totally alien to me I decided to hold the ball a bit tighter so it didn't slip out I focused even more on my run up I was trying to get my feet in the right place I thought I'll let the ball go later and the next ball bounced about 6 times I just wanted to guide it down the hole	Compensatory Strategies	
I wasn't playing my natural strokes My routine ceased to exist I stopped moving my feet (1) Every time I would play a shot I would mess up I kept hitting daft shots The first serve started to go Just can not hit the ball for toffee Your pre-shot routine goes out of the window Slow between points as if I wasn't keen to get on with it I didn't feel relaxed, your swing goes completely to pot It was just a complete collapse There were a lot of unforced errors on my part I tripped over my own feet	Behavioural Changes	

Figure 3.2. *(Cont.)* Experiences During Severe Performance Loss

Raw Data Themes	Higher Order Themes	General Dimension
The ball, I was gripping it so tight I felt like I had to control it I wasn't bowling I was letting it go like an apology The ball didn't feel real in my hand I just felt I was grabbing it rather than just letting it settle inside of my hand It didn't feel natural; it didn't feel normal The ball felt like a lump of jelly in my hand I felt incredibly light; I felt that if a strong wind had come along it would have blown me away I ran in to bowl and didn't feel my arm turn over I couldn't feel my arm therefore I didn't know how to correct it I couldn't even feel the ground underneath my feet I stood there turning my arm over but I was still bowling wides, I couldn't get the ball to go straight Its like I hadn't bowled before I couldn't feel how to let go of the ball I ended up with the worst swing ever I couldn't recreate the feeling that I wanted I never felt my muscles respond in the right way I felt my body, well it wasn't part of me and the ball was like a shot putt in my hand My whole arm felt numb When you don't feel, in reality, what you want to feel there is a miss match there and your self-confidence is attached and a lot of self-doubt	Disrupted perception & sensation	Movement, technical, & sensation characteristics *(Cont.)*
He (professional player) can automatically go back to basics where as someone like myself doesn't have that robotic routine When I go to hit a tennis ball I don't normally think feet, arms, head, brain yes, can I sweep the ball, yes you can do that now excellent	Lack of Automaticity	
I was conscious about being lethargic and maybe I was thinking about that I was already justifying my own values during the game It was eating away inside of me and I hadn't had chance to refocus I was shouting and screaming to myself inside	Self-absorption	

Figure 3.2. *(Cont.)* Experiences During Severe Performance Loss

Raw Data Themes	Higher Order Themes	General Dimension
You start thinking too much, like I've missed before/what happens if I scuff it The more you wait the more you are thinking of what can go wrong rather than what could go right I was trying to think to much about how I was playing and that's not a good thing I remember thinking about a lot of things, like my feet and where I let go of the ball I started trying to bowl, trying to bowl thinking what I was doing, you cant do that, you cant try and bowl I think about them initially then I over think I think I had psyched myself up too much, I'd got it into my mind and was thinking to deeply into the game The more you think the worse it gets because you get too many negative thoughts in your mind	Paralysis by analysis	Movement, technical, & sensation characteristics *(Cont.)*
A light had been on and someone had come and turned it off (2) Seeing the ball go like that, in an instant everything goes One minute it was there the next it wasn't My grip had gone, just like that My run up had just gone The technique just went completely out of the window During this downward spiral I felt like suddenly everything got tight and I wasn't really swinging anymore All of a sudden the ball comes over the net and I couldn't return the ball, it just dropped into the bottom of the net My focus had gone	Instantaneous Change	Lack of Control and understanding
I wanted to speak to my coach, unfortunately we had only been out there 20 minutes so it was at least 2 hours before I could talk with someone	Lack of opportunity for help	
The experience is very vivid, I can remember everything about it	Vividness / high recollection	

"you just feel like the whole world is watching you and you just want someone to open up a hole and just jump down it" (see Figure 3.2).

3.33. Consequences of the occurrence of severe performance loss

3.331. Situational factors. The four higher-order themes, produced from 4% of raw data themes, were: 'impact on future mental states towards performance', 'transfer to other tasks', 'perception of why experience occurred' and 'tactical changes'.

All participants reported the experience had a profound impact on their lives and future performances, this was indicative of the vivid recollection that athletes had of this particular performance(s). Future performances of six participants were, and in some cases are still, inhibited by the experience(s). One participant stated "it's always in the back of your mind if it can happen once it can happen again", another stated "I still now sometimes feel mechanical and that is 5 years later" (see Figure 3.3). One participant reported not having taken a penalty kick since her experience when she missed. This negative experience has also transferred to other tasks as the participant now refuses to take free-kicks, and furthermore, will no longer take penalties in hockey, or shoot when playing netball. Four participants reported changes to their tactics since their experience(s). One participant stated "I have always taken a driver on that hole because of memories of what happened before" (see Figure 3.3).

3.34. Personality Characteristics

3.341. Personality characteristics. The higher-order themes, produced from 5% of raw data themes, were: 'positive characteristics', 'negative characteristics', and 'others'. Examples of participants' perceived positive characteristics after their experience of severe performance loss were "I'm quite smart" and "I don't feel pressure as captain, I enjoy it" (see Figure 3.4). Examples of participants' perceived negative characteristics were "I'm quite a self-conscious person", "I'm not the most confident of people", and "I definitely have too much fear I think" (see Figure 3.4). Three athletes reported having an "obsessive" nature to their personality, which had manifested itself in their sport. One participant admitted to be "extremely competitive" (see Figure 3.4).

Figure 3.2. *(Cont.)* Experiences During Severe Performance Loss

Raw Data Themes	Higher Order Themes	General Dimension
I just need to get away from it I was thinking I don't want to be here anymore I just wanted to get off court and go home I was ready to just walk off court (2) I was like please god let this ball go down the other end and let me get off this cricket field I wanted to get the hole over as quickly as possible If someone had said look take this pill and you'll die I would have taken it right there You just feel like the whole world is watching you and you just want someone to open up a hole and just jump down it I really didn't want to be there	The need to escape	Lack of Control and understanding *(Cont.)*
All of a sudden I didn't have a clue what I was doing The ball was going all over the place I wasn't controlling the ball properly I started to make more unforced errors, which just felt out of control I was not in control at all of what I was doing Totally out of control I felt worried, I didn't know whether I was going to be able to control the ball I was just waiting for the lucky balls to come I started to hit balls, which were hitting the back fence without bouncing I actually hit one straight out of court The first ball shot over the wicket keepers head and went for 4 byes I eventually bowled 6 balls without bowling a legal delivery	Lack of control of outcome	
I was so determined to win I wasn't really up for it I was motivated to do well I was striving for that extra bit of pace We had a bit of a grudge against this team and I was determined to beat them	Motivation to perform	
Negative thoughts were there of what's going on here I was focused on my target but didn't know how to get it there, I couldn't understand it Obviously I didn't know what was going on At the time I could not understand, I could not work out what I was doing differently I just lost it, its like how, why?	Lack of Understanding	

Figure 3.2. *(Cont.)* Experiences During Severe Performance Loss

Raw Data Themes	Higher Order Themes	General Dimension
It has negatively affected my performance After this I didn't play tennis for a while Not as confident I haven't taken a penalty since You know it can happen again It's always in the back of your mind, if it can happen once it can happen again I continually doubted myself whether it (bowling action) was going to come back to me My confidence was drained I still now sometimes feel mechanical and that is 5 years later I really didn't want to play again	Impact on Future mental states towards performance	Situational Consequences
I won't take penalties in hockey I wont shoot in netball I'm very reluctant to take free-kicks	Transfer To other tasks	
I choked basically I think that when you start to get protective of your score that is when things go wrong	Perception of why Experience occurred	
I remember staying back, erm, and err...I would normally serve volley I had to think about it, I had sort of changed my whole game plan and reassess exactly where I was and what score I had I found myself hitting back very negatively hoping that he would make the mistakes and he would give me the win rather than me looking for it I have always taken a driver on that hole because of memories of what happened before	Tactical Changes	

Figure 3.4. Personality Characteristics

Raw Data Themes	Higher Order Themes	General Dimension
Reputation now of being cool as a captain I don't feel pressure as captain I enjoy it Enjoyment (2) I wouldn't say I was the kind of person that gets jittery I'm quite smart Passion for the sport I like a big stage	Positive Characteristics	Personality Characteristics
I am very conscious of what other people think about me (1) I sometimes dwell on things I am generally worried about what people think of me I am like Jekyll and Hyde I'm a totally relaxed person until I get that ball in my hand It makes me feel terribly nervous at times I hate it when everyone looks at you, I hate it I always hate taking penalties I'm quite a self-conscious person I'm not the most confident of people I definitely have to much fear I think I do worry about other people's opinions and views I think it does matter I am not suited to individual sports at all	Negative Characteristics	
Extremely competitive Controlled obsession I have to look good Obsessive (2)	Others	

Figure 3.5. Type of Competition

County match (2) League match Club championship final Premier league match Club match Family handicap final Club championships First team match Quarter final cup game	Level of performance	Type of Competition

3.35. Type of Competition when severe performance loss was experienced

3.351. Type of competition. The higher-order theme produced from 2% of the raw data themes was 'level of performance' (see Figure 3.5). The theme produced under this general dimension encompasses the competitive level at which participants were performing when they experienced severe performance loss. The competitive standard of participants ranged from club to national level.

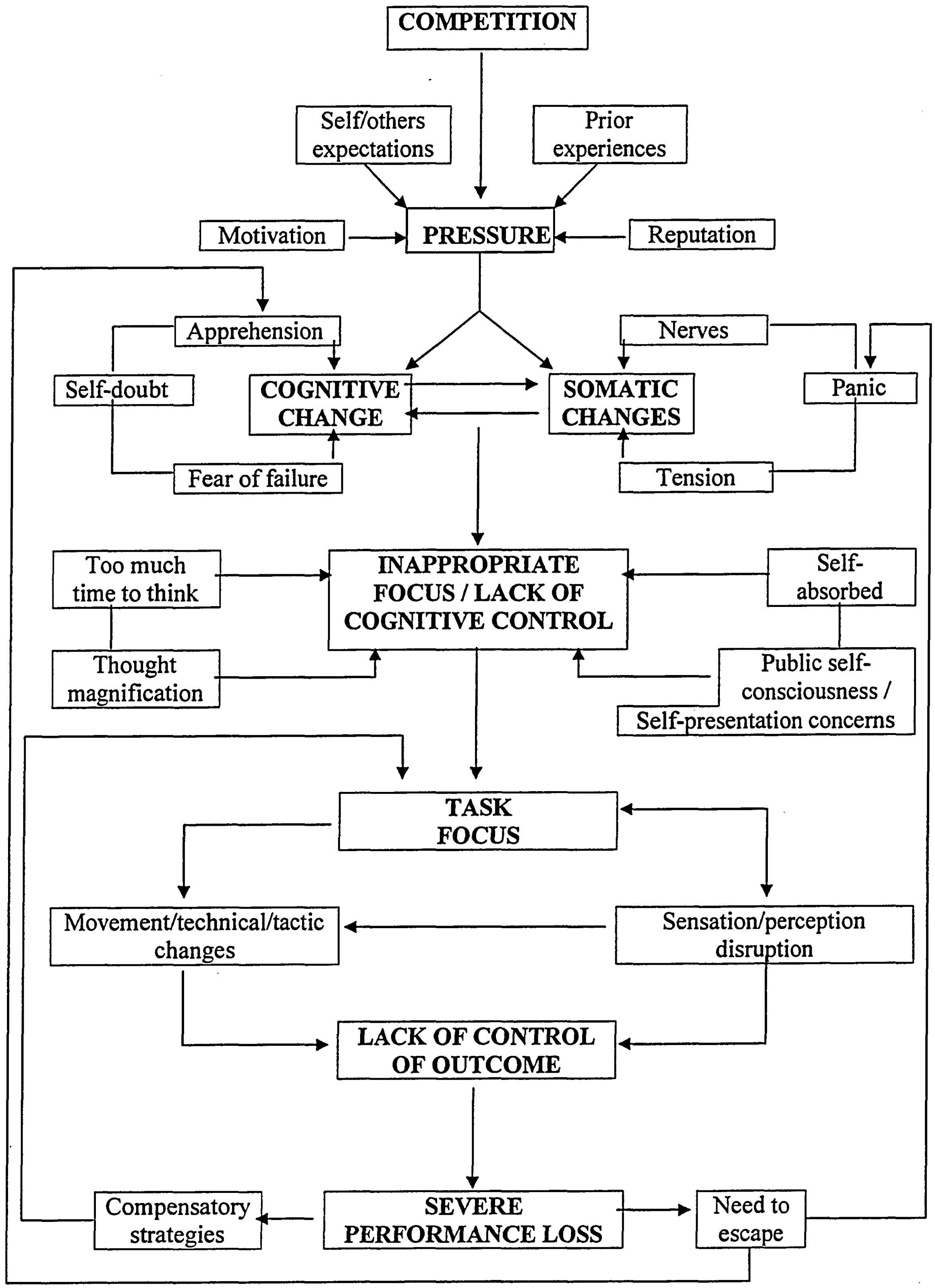
3.4. GENERAL DISCUSSION

The primary aim of this qualitative analysis was to explore psychological mechanisms derived from the perceptions and interpretations of athletes that had experienced first-hand, severe performance loss in competitive sport. Through such an examination the value of the available theories used in the literature to explain severe performance loss, and the perceptions of athletes, could be explored. A schematic of the themes generated from this analysis was formulated to help reinforce the complex but interrelated nature of the phenomena under investigation (see Figure 3.6.).

The main findings of this study support self-focused attention rather than distraction theories to explain severe performance loss in competitive sport. Specifically, throughout the experiences described athletes follow a similar sequence of events outlined by Masters' (1992) conscious processing hypothesis. This can be seen from the links between the generated higher-order and general-dimension themes. The themes of 'pressure', 'cognitive and somatic changes', 'inappropriate foci' (e.g. self-absorbed), 'task focus', and 'lack of control of outcome' are all characteristics that athletes reported experiencing during severe performance loss.

Masters (1992) proposed that heightened state anxiety precipitated by stress directs attention to the movement repertoire of a normally automatic motor skill. Because of the importance of correct skill execution performance is guided consciously by the explicit task knowledge associated with early stages of learning. This interferes with the normal processing of the motor schema, which disrupts automaticity and impairs performance. This switch from an automatic to a conscious processing system was characterised here by inappropriate foci and a lack of cognitive control. This

Figure 3.6. A Schematic of Severe Performance Loss in Competitive Sport



immediately preceded a movement focus and led to a preoccupation with the process by which skills were executed. The similarities between the conscious processing hypothesis (Masters, 1992) and the sequence of events experienced in this study are exemplified by reported statements of feeling mechanical, followed by a disruption to the natural flow of skill execution.

It was proposed that inappropriate foci and lack of cognitive control were the pivotal mechanism associated with automaticity disruption. This proposal is underpinned by the links made between the associated higher-order themes: 'self-absorbed', 'too much time to think', 'thought magnification', 'public self-consciousness / self-presentation concerns'. Self- absorption was the dominant theme. This process was heightened by 'too much time to think' about a particular skill and magnified concerns about being negatively evaluated by others. This had an additive effect in terms of the athletes' inability to rationalise or maintain a perspective on the situation, which further exacerbated the introspective process.

Baumeister (1984) proposed that self-absorption or what he calls self-consciousness can be heightened by anxiety and perceived negative evaluation by others; a contributing factor to the phenomenon of choking under pressure. Baumeister (1984) reported that individuals dispositionally low in self-consciousness were more susceptible to the choking process than those high in dispositional self-consciousness. Confounding elements were identified between Baumeister's (1984) research and the findings of this study. Athletes in this study reported being preoccupied with their feelings and thoughts (self-absorption), and having self-presentational concerns during their experiences which implied that they were high in self-consciousness. One athlete even stated "I'm quite a self-conscious person". Baumeister's (1984) research findings were in contrast to the results of this study. Further, the contention that explicit knowledge is no longer consciously available to guide performance to prevent choking under pressure (Baumeister, 1984) was clearly not supported by this study.

Masters et al. (1993) found a correlation ($r = 0.59$, $P < 0.05$) between high scores on the Reinvestment Scale and an individual's propensity to experience skill failure under pressure. The Reinvestment Scale comprises all the items used by Baumeister (1984) to measure dispositional public and private self-consciousness. It can therefore be inferred that individuals high in reinvestment were also high in dispositional self-consciousness.

Further, Masters (1992) suggested conscious processing of explicit task knowledge to be the pivotal mechanism in the occurrence of skill breakdown under pressure which supports the findings of this study. These similarities add further support to the contention that athletes in this study followed a similar sequence of events outlined by Masters' (1992) conscious processing hypothesis. In addition, it was speculated that the present athletes were predisposed to this phenomenon which supports the findings of Masters et al. (1993). However, caution must be taken with the interpretation of these conclusions as this study did not formally measure dimensions of personality in relation to severe performance loss and therefore requires further investigation.

Heightened pressure was reported by athletes in this study to be contributing factors to the demise of their performance. 'Expectation of self and others', 'motivation', 'reputation and prior experiences', were all linked to competition and an increase in pressure to win. When one or more of these factors were combined, the negative effects on performance appeared to be additive, which supports Baumeister and Showers' (1986) prediction. Similarly, heightened state anxiety was reported. 'Somatic / emotional changes' manifested themselves in the form of 'nerves', and/or 'tension', and/or 'panic'. 'Cognitive changes' manifested themselves in the form of 'apprehension', and/or, 'self-doubt', and/or 'fear of failure'. Catastrophe model (Fazey & Hardy, 1988), developed to explain the interactive nature of physiological arousal and cognitive anxiety on performance, offers some explanation as to why athletes in this study experienced a large and sudden loss of performance. However, this model does not take into account additional characteristics identified by this study to be influential. In addition, neither state anxiety nor pressure has been adequately monitored in the research on severe performance loss in competitive sport (Baumeister, 1984; Masters, 1992; Masters et al., 1993). Hence, the present study provides a richer understanding and clarification of the antecedents and consequence of the two constructs.

As already highlighted, the experiences described by the athletes in the present study follow a similar sequence of events outlined by the conscious processing hypothesis (Masters, 1992). However, additional characteristics of this phenomenon have been identified by this study. One finding reported in this study that has not been identified in the literature is the higher-order theme of 'disruption to perception and sensation'. Athletes reported a discrepancy in sensation between how their skilled action and body felt during previous successful performances, to how their skilled action and body felt during this experience. One athlete stated "when you don't feel, in reality, what you want to feel there is a mismatch there, and your self-confidence is attached to this and a lot of self-doubt". This suggested that the interpretation of the movement sensation is an important factor for correct skill execution.

Clearly, the correct sensation was not available during this experience. Wulf, McNevin, and Shea (2001) suggested that promoting an external movement-related focus can prevent performers from adopting an explicit (internal) focus on their movement dynamics. In addition, this type of focus is influential in allowing self-organised, automatic processes implicitly to regulate task execution. This suggests that athletes experience the correct movement dynamic coupled with the appropriate sensation when executing that movement via automatic processing. Therefore, by athletes adopting an internal movement-related focus in this study might have compounded the disruption of movement sensation, rather than appeased it, owing to an explicit, rather than a self-organised approach to skill execution.

This disruption to movement sensation might be a precursor that elicits a sudden switch in processing systems used to execute a skill (automatic to conscious processing). This is typified by one athlete who stated "I felt like I had to control it (the ball)". Therefore, it was proposed that in an attempt to recreate the desired movement sensation (which was perceived to be vital for successful performance), athletes in this study focused on the movement characteristic of the skill, thus promoting conscious processing. By regression to a conscious processing system there is a tendency to re-freeze the degrees of freedom in the distal joints (Fuchs, 1962). Therefore, attempting to use this process to reinstate the desired sensation might explain why athletes experienced an increase in muscle tension and feelings of being mechanical and having no fluidity or control over the outcome of their performance.

In an attempt to compensate for the loss of sensation, fluidity and disruption to performance, athletes reported using compensatory strategies. Another important finding reported in this study that has not emerged elsewhere. One athlete stated "I started trying to bowl, trying to bowl thinking what I was doing". Athletes began to use additional conscious strategies, relating to the movement characteristics of the task, which normally were executed automatically. This, ironically, led to a similar focus that had elicited performance loss in the first place and only served to exacerbate the perceived loss of sensation and further disrupt the normal repertoire of the skill sequence.

Finally, athletes reported the need to escape from the situation; a further factor that has not been reported in the literature. One athlete stated, "if someone had said look take this pill and you'll die I would have taken it right there". This statement exemplifies the extreme panic, apprehension, and desperate need to escape the situation. Furthermore, these negative cognitions were exacerbated when athletes realised that there was no escape and they must continue to compete. This continued to heighten feelings of panic. Bandura (1986) proposed that the belief to execute a specific task successfully is essential in obtaining the desired outcome. Schlenker and Leary (1982) suggested that the discrepancy between expectation (self and others) to perform successfully, coupled with the apprehension and self-doubt to do so would intensify pressure. This might explain why athletes in the present study experienced an intense compulsion to escape the situation.

In conclusion, the exploratory nature of this study has identified antecedents and consequences of severe performance loss in a range of competitive athletes. Distraction theories could not adequately explain the complex interrelated nature of this phenomenon. Clearly, athletes in this study had access to large amounts of technical rule-based knowledge associated with the skills being performed. It would appear that, under stress, such athletes were susceptible to consciously rehearsing rule-based knowledge, particularly when questioning their ability to perform successfully. Consequently, athletes experienced a substantial deterioration to their performance. An aim of this qualitative study was to examine empirically the value of the available theories used in the literature to explain severe performance loss. The themes generated from this study suggested that athletes experienced similar characteristics associated with the conscious processing hypothesis (Masters, 1992). However, additional characteristics were reported that have not been reported in the literature. It was proposed that the higher-order theme of 'disruption to perception and sensation' served as a precursor to athletes becoming preoccupied with the task components and the process of skill execution, which led to conscious processing and automaticity disruption. Similarly, compensatory strategies, ironically, adopted to recreate 'normal' movement sensation and successful skill execution, only served to promote greater conscious processing, automaticity disruption, and the need to escape.

The study has identified characteristics from the athlete's perspective that have provided an improved understanding of severe performance loss in competitive sport. Specifically, this study has established that having access to technical rule-based knowledge can lead certain athletes to use this information to guide performance while experiencing stress. This in turn disrupts the automatic skill sequence and impairs performance. Nevertheless, unanswered questions remain that require further investigation. Research should explore ways of developing more beneficial compensatory strategies that prevent conscious processing and promote automaticity, particularly in individuals who might be susceptible to this problem. For example, learning strategies that minimising the accumulation of rule-based knowledge during skill acquisition and performance strategies that suppress explicit knowledge during skill execution might be a way of countering this phenomenon. However, before such areas can be investigated this research programme needs to establish whether or not some individuals are more susceptible to rehearsing rule-based knowledge while experiencing stress than others. Clearly, athletes in this study possessed common characteristics. Two commonly reported characteristics central to the problem were 'directing focus to the process of the task' and 'self-absorption' during performance. Both constructs have been linked to dimensions of personality, but possess conflicting elements in the literature (Baumeister, 1984; Masters et al., 1993). Future research needs to examine whether or not there are personality characteristics that mean some performers more susceptible to conscious processing of explicit task knowledge than others, particularly while experiencing stress.

4.0 STUDY 2. DISPOSITIONAL REINVESTMENT AND STRESS IN SKILLED SOCCER PLAYERS

4.1 INTRODUCTION

Study one identified antecedents and consequences of severe performance loss in competitive sport, derived from the perceptions and interpretations of competitive athletes that had experienced, first hand, this phenomenon. Throughout the experiences described the results suggested athletes followed a similar sequence of events as outlined by Masters' (1992) conscious processing hypothesis. In particular, 'self-absorption' (including public and private self-consciousness and self-presentational concerns) and 'directing focus to the process of the task' were recurrent themes. Research has identified these themes as factors that predispose performers to choking (Baumeister, 1984) and skill failure under pressure (Masters et al., 1993) respectively. However, the research underpinning these theories is equivocal. Although the preceding study successfully overcame some of the disparities between previous theories and research, it did not control for dimensions of personality. Hence, the purpose of this study was to examine whether or not performers with specific personality characteristics were susceptible to severe performance loss in competitive sport.

Baumeister (1984) reported that individuals low in self-consciousness were more susceptible to choking than those high in self-consciousness as predicted by the public and private subscales of the dispositional self-consciousness scale (Fenigstein et al. 1975). In contrast to Baumeister (1984), Masters et al. (1993) found a correlation ($r = 0.59$, $P < 0.05$) between high scores on the Reinvestment Scale (comprising items from the Dispositional Self-consciousness Scale) and individuals' predisposition to skill failure under pressure, precipitated by conscious processing. In study one high self-consciousness and conscious processing were highlighted as antecedents to severe performance loss under stress. However, it is not known whether participants were predisposed to self-consciousness or conscious processing as these factors were not formally measured. Therefore, the main aim of this study was to examine the effects of manipulated stress on performers either dispositional high or low in reinvestment as predicted by the Reinvestment Scale (Masters et al. 1993). The rationale for using the reinvestment scale (Masters et al., 1993) over the Dispositional Self-consciousness Scale (Fenigstein et al., 1975) was that the findings of study one followed a similar sequence of events to Masters' (1992) conscious processing hypothesis. Moreover, this hypothesis provides the mechanisms that underpin the reinvestment process (Masters et al., 1993). Further, the Reinvestment Scale was specifically constructed as a predictor of skill failure under pressure in sport whereas the Dispositional Self-consciousness Scale was constructed to assess individual differences in self-awareness.

Study one of this thesis also identified heightened levels of pressure and state anxiety as important antecedents to severe performance loss. Arousal (Baumeister, 1984) and state anxiety (Masters et al., 1993) have been identified as fundamental antecedents in the choking and skill failure under pressure literature, respectively. However, Baumeister (1984) made no attempt to monitor arousal or stress in his research. Further, Masters et al. (1993) only attempted to measure the somatic (physiological) sub-component of state anxiety, by recording heart rate. No provision was made for cognitive anxiety or self-confidence. Both of these factors were identified as influential factors in the preceding study. In addition, research has not established directional (e.g. facilitative and debilitative) interpretations of individuals with a propensity to experience severe performance loss, which might allow a greater understanding of anxiety-rehearsal-performance breakdown. Therefore, another aim of the present study was to establish whether individuals low or high in reinvestment (Masters et al., 1993) differ in their responses and interpretation of anxiety under different conditions of stress. The sub-components of state anxiety were monitored using the Anxiety Rating Scale (ARS) (Cox, Russell, & Robb, 1996). The ARS primarily served as a stress manipulation check, as state anxiety is generally considered to be a by-product of stress (Levitt, 1980). Further, the ARS was used to assess the participants' level of anxiety prior to performance. In addition, a modified directional scale in line with the work of Swain and Jones (1992) was used to assess the participants' interpretation (e.g. facilitative or debilitative) of their anxiety prior to performance.

Finally, recent research that has tested explanations of choking (Baumeister, 1984) and skill failure under pressure (Masters et al., 1993) has exclusively used experimental tasks which require fine, static motor skills (e.g. golf; commercial game "Role-up"). Further, such research has used only a short learning phase before testing the robustness of skills under stress. Although participants would have acquired some degree of proficiency, it is unlikely that they developed their skills to an automatic level of functioning. An additional criticism of Masters et al. (1993; Experiment 3) was their contention that the predictive power of the Reinvestment Scale had been enhanced in field-based settings. This claim was based solely on a correlation found between collegiate squash and tennis players' scores on the Scale and the presidents' and team captains' subjective opinion of their players' susceptibility to fail under pressure. No other methods were used to ascertain whether such athletes were prone to skill breakdown, precipitated by conscious processing during competition. It is for these reasons the current predictive power of inventories that claim to estimate performance deterioration under stress possess limitations.

Masters et al. (1993) called for future research to examine the predictive power of the Reinvestment Scale using different motor tasks. Therefore, a further aim of this study was to examine the predictive power of the Reinvestment Scale using a well-learned (automatic) gross, dynamic motor skill under stress. To remedy the limitations of Experiment 3 (Masters et al., 1993) a field-based wall-volley soccer task was used in this study; a complex, dynamic motor skill involving several explicit components.

In summary, the main aim of study two was to examine the effects of manipulated stress on experienced soccer players who were either dispositionally high or low in reinvestment. The intent was to assess whether those players who scored high on the Reinvestment Scale would be more susceptible to conscious processing and therefore experience deterioration in performance under stress. Based on the predictions of Masters et al. (1993) the following hypotheses were formulated.

H_1: Participants low in reinvestment will experience no significant difference in performance between the low and high stress conditions.

H_2: Participants high in reinvestment will perform significantly worse in the high stress, than in the low stress condition.

4.21. Participants

With institutional ethics approval, fourteen (mean age 21.4yrs) experienced (1st / 2nd team) male university soccer players participated in this study. Participation in the study was voluntary. Informed consent was sought from participants before data collection; confidentiality and anonymity was guaranteed.

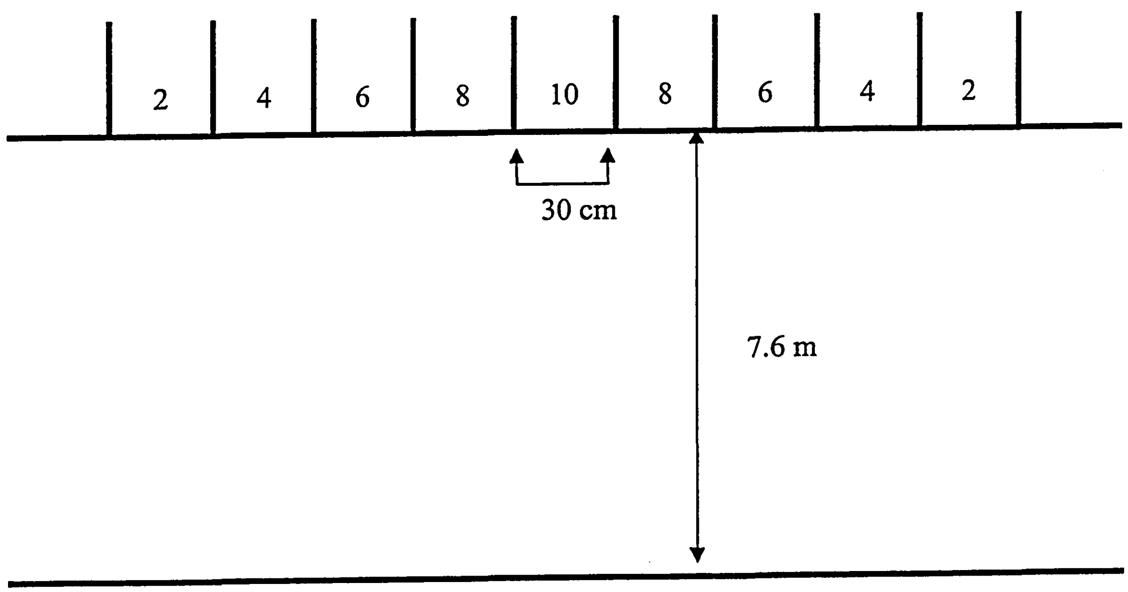
4.22. Experimental Task

McDonald's (1951) Wall Volley Test, adapted and validated by McMorris, Gibbs, Palmer, Payne, and Torpey (1994), was used as the task for this study. This test involved performers kicking a soccer ball continuously at a wall target 7.6 metres away. The target comprised 9 zones, each of which were 30 cm wide (see Figure 4.1). The ball striking the centre zone scored 10 points, the next zone 8, the next zone 6, the next zone 4, and the last zone 2. Any ball striking outside the target zone scored zero. For each individual score to count, the ball had to hit the target and then rebound over the 7.6 metre line. Test-retest reliability for this task was assessed using an Intra-Class Coefficient for total points scored (0.79). McMorris et al. (1994) suggested that the test is a valid measure of passing accuracy in soccer. The rationale for using the wall-volley soccer task was three fold: first, this task enabled the qualitative soccer data in study one to be expanded by using a quantitative group-based design. Second, this task was an available, valid measure of key skills in soccer, which could provide accurate performance data. Third, this field-based task required gross, dynamic motor skills which remedied the limitations of previous research.

4.23. Measures

4.231. Reinvestment. The Reinvestment Scale (Masters et al., 1993) (see Appendix 6) was administered to assess the extent to which participants were predisposed to conscious processing under stress. This scale comprises 20 items (cf. Masters et al., 1993) which were taken from three associated inventories. These inventories were the Cognitive Failure Questionnaire (Broadbent, Cooper, FitzGerald,

Figure 4.1. The Wall-Volley Soccer Task



12 m Base Line

& Parkes, 1982), the Emotional Control Questionnaire (Roger & Nesshoever, 1987) and the Dispositional Self-Consciousness Scale (Fenigstein, Scheier, & Buss, 1975). One item from the Cognitive Failure Questionnaire (Broadbent et al., 1982) was incorporated. This inventory was designed to assess slips of action, a concept defined as "the occasion when one's actions do not proceed in accordance with intention" (Broadbent, et al., 1982, p. 1). The item used from the Cognitive Failure Questionnaire was "Do you have trouble making your mind up?". Seven items were used from the rehearsal factor of the Emotional Control Questionnaire (Roger & Nesshoever, 1987). This inventory was developed to assess individual differences in emotional control. Examples of the Emotional Control Questionnaire include "I often find myself thinking over and over about things that have made me angry" and "When I am reminded of past failures I feel as if they are happening all over again". The remaining items were taken from the public (6 items) and private (6 items) subscales of the Dispositional Self-Consciousness Scale (Fenigstein et al., 1975). This scale was constructed to measure the concept of self-awareness, that is "the existence of self-directed attention, as a result of either transient situational variables, chronic dispositions, or both" (Fenigstein, et al., 1975, p. 522). The public component of self-consciousness is the awareness and concerns of being a social entity. Examples of public self-consciousness items include "I'm concerned about the way I present myself" and "I'm concerned about what other people think of me". The private component of self-consciousness relates to the mulling over of specific thoughts about oneself. Examples of private self-consciousness items include "I'm always trying to figure myself out" and "I reflect about myself a lot". Participants were required to endorse either true/false or yes/no for each item (scores range from a low of 0 to a high of 20). A coefficient alpha (Cronbach, 1951) calculated by Masters, et al. (1993) indicated a suitable internal reliability of the reinvestment factor (0.80). Test-retest reliability was obtained by a percentage of the original sample completing the scale four months later. A Pearson product moment correlation of 0.74 was found between the original and repeated scores.

4.232. Competitive State Anxiety. The Anxiety Rating Scale (ARS) (Cox et al., 1996), a condensed version of the Competitive State Anxiety Inventory–2 (CSAI-2) (Martens et al., 1990), was used throughout this study (see Appendix 7). This served primarily as a stress manipulation check. The ARS comprises three items, each item relates to one of the three subscales (somatic anxiety, cognitive anxiety & self-confidence) on the original CSAI-2. The first statement relates to somatic anxiety, which states "I feel nervous, my body feels tight and / or my stomach tense". The second statement relates to cognitive anxiety, which states "I feel concerned about performing poorly and that others will be disappointed with my performance". The final statement relates to self-confidence, which states "I feel secure, mentally relaxed, and confident of coming through under pressure". For each of the three items, participants were required to assess both the intensity and direction of their emotional response. Intensity responses to each item were scored on a Likert scale ranging from 1 (not at all) to 7 (intensely so). The Cronbach alpha reliability coefficients (across three samples of athletes) for the three intensity sub-scales ranged from .79 to .83 for cognitive anxiety, from .82 to .83 for somatic anxiety, and from .87 to .90 for self-confidence, thus indicating the scale to have sufficient reliability. An additional directional scale was incorporated into the questionnaire, which was adapted from the modified CSAI-2[9] (Swain & Jones, 1992). Directional responses to each item were scored on a Likert scale ranging from 1 (debilitative to perf.) to 7 (facilitative to perf.).

4.24. Procedure

The 14 participants were selected from a pool of 35 experienced soccer players who completed the Reinvestment Scale (Masters et al., 1993). Scores ranged from a low of 2 to a high of 15 (M = 8.91, SD = 2.88). In accordance with Masters' et al. (1993) protocol, participants scoring greater than 1 SD above the mean (n=7) were placed in the high reinvestment group (M+SD = 11.79; range = 12-15); those scoring greater than 1 SD below the mean (n=7) were placed in the low reinvestment group (M+SD = 6.03; range 2-6). Participants scoring between 6 and 12 were omitted.

All participants were required to perform in a high-and low-stress condition. Each condition lasted 90 s. Immediately prior to each condition participants completed the ARS (Cox, Russell, & Robb, 1996). An habituation phase was obligatory one day before participants undertook their first test session, which required them to execute the soccer task (wall-volley) for 90 s. Performance and ARS (intensity & direction) scores were used as the dependent variable for each condition.

[9] For an in-depth review of the modified CSAI-2 (Swain & Jones, 1992) see section 6.2.

Prior to performing in the low stress condition participants were simply instructed to accumulate as many points as possible by repeatedly kicking the ball at the target from behind the 7.6 m line within a time constraint of 90 s.

In the high stress condition several techniques were used to create pressure. All 14 participants were required to be present to evaluate each other's performance throughout the duration of this condition (Hardy, Jones, & Gould, 1996). When observing, participants were required to sit in a semicircle approximately 3 m away from the 7.6 m performance line. Primarily, participants were told that the purpose of this task was to analyse the accuracy of individual passing techniques. A confederate was introduced to participants as a soccer coach to analyse individual techniques. The 'coach' then explained that each participant's technique would be analysed on three separate constructs: control, footwork and recovery. These techniques were used to increase performers' awareness that they were being evaluated (Baumeister, 1984, Masters, 1992). In addition, a camera was used to increase the evaluative process.

Second, performers were told that a negative scoring system was going to be used. Consequently, if participants did not consistently hit the centre zone (10 points), points would be deducted. As a result, striking the 8 point zone subtracted 2 points; the 6 point zone 4 points; the 4 point zone 6 points; and the 2 point zone 8 points, while missing the target zone completely subtracted 10 points. These deductions were not used in the statistical analysis.

Finally, performers were told that 14 college soccer players were participating in this experiment and subsequent to testing they would be placed in rank order in accordance with both their score and evaluated technique. It was further stated that a ranking list would be sent to all participants for them to confirm their ability compared with other competitors.

To counteract any learning effects each experimental group was divided to form a randomised counter-balanced design.

4.25. Data Analysis

To examine the interaction between reinvestment scores and performance under pressure a series of two-way (reinvestment x stress) analysis of variance (ANOVA) with repeated measures on the second factor were calculated. A separate analysis of variance was calculated using intensity and directional scores for each of the three subscales of the ARS. Specific differences were established using pairwise comparisons. The bonferroni technique was used to control for potential Type I errors. A paired-samples t-test was used to assess stress manipulation. Normality of distributions, homogeneity of variances and sphericity were confirmed (see Appendix 17 for statistical output).

4.3 RESULTS

4.31. Anxiety Data (ARS)

Anxiety as indicated by the means and standard deviations for the intensity and directional scores for high and low reinvestment groups are present in Tables 4.1 and 4.2 respectively, for each experimental condition. A paired-samples t-tested carried out on the ARS intensity scores for somatic anxiety ($t_{(13)} = -2.86$, $P < .05$) and cognitive anxiety ($t_{(13)} = -2.28$, $P < .05$) indicated that stress was successfully manipulated.

4.311. Somatic Anxiety. The reinvestment by stress interaction for the ARS intensity Scale for somatic anxiety was significant ($F_{(1,12)} = 15.00$, $P < .01$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated that participants in the high reinvestment group reported significantly greater levels of somatic anxiety in the high stress than the low stress condition. Additionally, they reported significantly greater somatic anxiety in the high stress condition than the low reinvestment group. There was no significant main effect for either the ARS intensity scale for somatic anxiety between the high and low stress conditions ($F_{(1,12)} = 5.17$, $P > .05$), or the high and low reinvestment groups ($F_{(1,12)} = .53$, $P > .05$).

The reinvestment by stress interaction for the ARS directional scale for somatic anxiety was significant ($F_{(1,12)} = 9.35$, $P < .05$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated that participants in the high reinvestment group reported somatic anxiety was significantly more debilitative in the high stress versus the

Table 4.1. Anxiety Rating Scale Intensity Scores for the High and Low Reinvestment Groups in each Experimental Condition. Values are Means (M) ± Standard Deviations (SD)

	Somatic Anxiety				Cognitive Anxiety				Self-confidence			
Reinvestment group	Low Stress		High Stress		Low Stress		High Stress		Low Stress		High Stress	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Low	1.86	1.21	2.43	0.53	2.00	1.53	2.14	1.07	5.00	1.53	4.57	1.13
High	1.43	0.53	3.43	1.40	1.57	0.79	3.29	1.38	5.29	0.49	2.57	1.13

Table 4.2. Anxiety Rating Scale Directional Scores for the High and Low Reinvestment Groups in each Experimental Condition. Values are Means (M) ± Standard Deviations (SD)

	Somatic Anxiety				Cognitive Anxiety				Self-confidence			
Reinvestment	Low Stress		High Stress		Low Stress		High Stress		Low Stress		High Stress	
Group	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Low	5.29	1.11	4.71	1.25	4.43	1.62	4.71	1.11	5.57	0.79	5.29	1.25
High	5.29	1.25	3.43	1.40	3.57	1.40	3.14	1.46	5.71	0.76	3.86	1.86

low stress condition. Additionally, they reported somatic anxiety to be significantly more debilitative in the high stress condition than the low reinvestment group. There was a significant main effect for the ARS directional scale for somatic anxiety between the high and low stress conditions ($F_{(1,12)} = 9.63$, $P < .05$). There was no significant main effect for the ARS directional scale for somatic anxiety between the high and low reinvestment groups ($F_{(1,12)} = .70$, $P > .05$).

4.312. Cognitive Anxiety. No significant interaction or main effects were found for the ARS intensity or directional scale for cognitive anxiety.

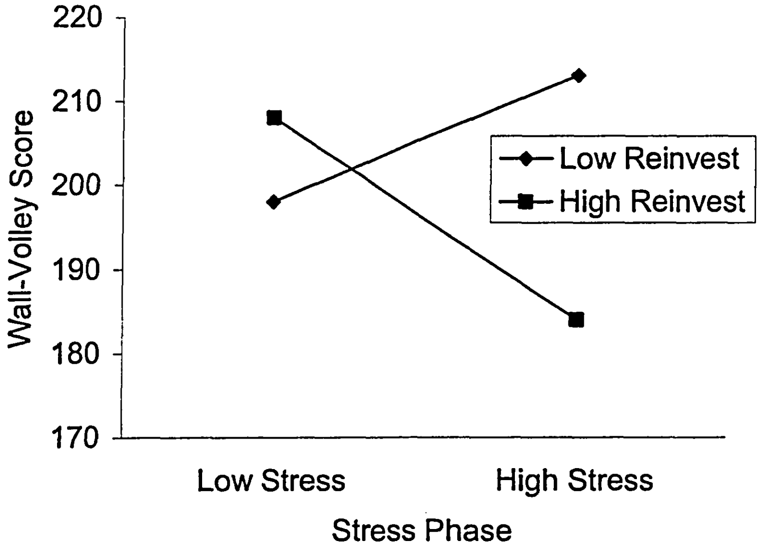
4.313. Self-confidence. The reinvestment by stress interaction for the ARS intensity scale for self-confidence was significant ($F_{(1,12)} = 16.34$, $P < .01$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated that the high reinvestment group reported significantly lower levels of self-confidence in the high stress versus the low stress condition. Additionally, they reported significantly lower levels of self-confidence in the high stress condition than the low reinvestment group. A significant main effect for the ARS intensity scale for self-confidence was found between the high and low stress conditions ($F_{(1,12)} = 16.69$, $P < .05$). There was no significant main effect for the ARS intensity scale for self-confidence between the high and low reinvestment groups ($F_{(1,12)} = 1.89$, $P > .05$).

The reinvestment by stress interaction for the ARS directional scale for self-confidence was found to be significant ($F_{(1,12)} = 18.15$, $P < .05$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated that participants in the high reinvestment group reported self-confidence to be significantly more debilitative in the high stress than in the low stress condition. Additionally, they reported self-confidence to be significantly more debilitative in the high stress condition than the low reinvestment group. A significant main effect for the ARS directional scale for self-confidence was found between the high and low stress conditions ($F_{(1,12)} = 10.23$, $P < .05$). A significant main effect for the ARS directional scale for self-confidence was not found between the high and low reinvestment groups ($F_{(1,12)} = 1.03$, $P > .05$).

4.34. Soccer Performance.

The means and standard deviations for the performance scores in each experimental condition for the high and low Reinvestment Groups are presented in Figure 4.2.

Figure 4.2. Performance Scores for the High and Low Reinvestment Groups in each Experimental Condition. Values are Means (M)



Assumptions for sphericity were met. The reinvestment by stress interaction for soccer performance was significant ($F_{(1,12)} = 19.50$, $P < .05$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated that the players in the high reinvestment group performed significantly worse in the high stress than in the low stress condition. Additionally, they performed significantly worse in the high stress condition than players in the low reinvestment group. There was no significant main effect for soccer performance between the high and low stress conditions ($F_{(1,12)} = 2.78$, $P > .05$.), or for the performance between the high and low reinvestment groups ($F_{(1,12)} = .14$, $P > .05$).

4.4 DISCUSSION

The main aim of this field-based study was to examine the effects of manipulated stress on experienced soccer players who were either dispositional high or low in reinvestment (Masters et al. 1993). The intent was to assess whether or not those players who scored high on the Reinvestment Scale would be more susceptible to the breakdown of a gross dynamic motor skill, precipitated by conscious processing under stress. Another aim of this study was to examine participants' levels and interpretations of anxiety to assess stress. A further aim of this study was to examine the predictive power of the Reinvestment Scale using a well-learned (automatic) gross, dynamic motor skill under stress. A paired-samples t-tested carried out on the ARS intensity scores for somatic anxiety and cognitive anxiety indicated that stress was successfully manipulated in this study.

Hypothesis one of this study, which stated that participants low in reinvestment would experience no significant difference in performance between the low and high stress conditions, was supported. Further, hypothesis two of this study, which stated that participants high in reinvestment would perform significantly, worse in the high stress, than in the low stress condition, was also supported. Therefore, the main findings of study two support Masters et al's. (1993) contention, that individuals high in reinvestment have a greater propensity to experience performance deterioration, precipitated by conscious processing, under stress than those low in reinvestment. As already established high reinvesters are also considered to be high in self-consciousness (Maxwell et al., 2000). Baumeister (1984) reported dispositionally high self-conscious individuals to be less likely to choke under pressure as they are used to performing whilst feeling self-conscious. Consequently, the present findings are in direct contrast to the contention of Baumeister (1984).

It was proposed that high reinvesters were susceptible to heightened state anxiety (and low levels of self-confidence) precipitated by stress and thus, attempted to control consciously, automatic implicit processes by explicit rule utilisation. This disrupted automaticity and impaired performance (Masters et al., 1993). Conversely, for participants low in reinvestment it was proposed that they were less susceptible to the deleterious effects of stress, which is indicative of their comparatively low levels of state anxiety and high levels of self-confidence. Presumably, this, in turn, enabled them to continue to adopt an appropriate focus, which promoted automatic, implicit regulation and thus, consistent performance under stress. However, the attentional processes underpinning the performances of low and high reinvesters were assumed in this study. Thus, the Reinvestment Scale offered a measurement of an individual's cognitive predisposition, rather than the direct assessment of specific information processing systems during performance.

A limitation of previous research is that state anxiety and stress manipulation had not been adequately monitored. In this study the ARS (Cox et al., 1996) was used as a stress manipulation check, whilst also measuring intensity and direction of somatic and cognitive anxiety and self-confidence. It was proposed that this method would be a rigorous way of measuring stress manipulation and state anxiety prior to the experimental conditions.

The ARS intensity scores indicated that high reinvesters reported significantly greater somatic anxiety, and significantly lower self-confidence in the high stress than in the low stress condition. Further, high reinvesters reported significantly greater somatic anxiety and lower self-confidence in the high stress condition than low reinvesters did. High reinvesters indicated no significant difference in cognitive anxiety between the two experimental conditions. However, trends indicated an increase in cognitive anxiety but this did not reach significance. McDaniel et al. (1989) suggested that if consistent deterioration is experienced during performance, pressure may be exacerbated. Therefore, in situations where successful performance is expected cognitive anxiety is heightened. This could be true of those players high in reinvestment during the high stress condition. However, anxiety was not assessed during the soccer task so this hypothesis could not be tested.

Conversely, low reinvesters reported similar levels and interpretations of state anxiety and self-confidence between the high and low stress conditions. It was suggested that low reinvesters might possess a greater stress threshold than high reinvesters. Baumeister (1984) suggested that highly self-consciousness individuals have a propensity to rehearse more in conditions where evaluation is likely. The Reinvestment Scale incorporates all the items from the Public and Private subscales of the Dispositional Self-consciousness Scale (Fenigstein et al., 1975). Hence, high reinvesters are considered to be highly self-conscious and thus, more likely to become anxious and stressed in conditions open to appraisal (Maxwell et al., 2000). Further, high reinvesters, because of their high self-consciousness, might also possess higher trait anxiety than low reinvesters. Unpublished data referred to by Maxwell et al. (2000) indicated a significant correlation ($r = 0.55$) between the Reinvestment Scale and the trait section of the State-Trait Anxiety Inventory (Spielberger et al., 1970). This suggests that high reinvesters are likely to be more anxious than low reinvesters, which might account for their differing performance in this study. In addition, perhaps the stress manipulation in the present study was not enough to create sufficient anxiety to elicit detrimental performance effects in participants low in reinvestment. Clearly, research needs to clarify this ambiguity if improved understandings of the processes that mediate the stress-rehearsal-performance breakdown occurrence are to be established.

Of specific interest to this investigation were the reported directional scores of the three subscales of the ARS. High reinvesters reported somatic anxiety to be significantly more debilitative in the high stress than the low stress condition. It was suggested that the increase in somatic anxiety was responsible for high reinvesters perceiving such an emotion to have negative performance effects in the high stress condition. Similarly, participants reported their self-confidence levels to be significantly more negative towards performance in the high stress than in the low stress condition. This hindrance to performance is reinforced by significantly lower levels of self-confidence being reported by high reinvesters prior to the completion of the high stress condition. Conversely, no significant difference was found in cognitive anxiety directional scores for high reinvesters between the high and low stress conditions. It was proposed that this was due to such participants experiencing no significant difference in the intensity levels of cognitive anxiety between the two experimental conditions prior to performance.

According to Eysenck and Calvo (1992) additional resources are recruited as a by-product of increased anxiety. Maxwell et al. (2000) found that high reinvesters produce a greater pool of explicit task knowledge and rehearse that knowledge more frequently than low reinvesters under stress conditions. Therefore, perhaps it is the additional resources (as a by-produced of increased anxiety) that encourage and allow the frequent rehearsal of explicit task knowledge in high reinvesters under stress. This could also explain why such performers interpreted these additional, anxiety induced, resources as debilitative to their performance in this study. Hence, it was proposed that additional resources, perceived to be debilitative to performance in high reinvesters might be a moderating factor in the rehearsal-performance breakdown cycle.

In conclusion, study two of this thesis incorporated several changes in design to overcome the limitations of previous research. In doing so this study has indicated that high reinvesters have a greater predisposition towards severe performance loss, precipitated by conscious processing under stress, than low reinvesters in a gross, dynamic motor skill. The present findings support the research of Masters et al. (1993) and offer greater predictive power to the Reinvestment Scale in a field-based gross, dynamic motor skill. Further, high reinvesters were more susceptible to heightened somatic anxiety and decreased self-confidence which they perceived to be debilitative to performance under stress (which presumably were allocated to inappropriate task processes) than low reinvestment did.

The Reinvestment Scale can identify performers that might be susceptible to a loss in performance when executing either fine, static motor skills (Masters et al., 1993) or a gross dynamic motor skill under stress. The practical implications to these findings could enable coaches and sport psychologists to become aware and thus, make provision for performers who are susceptible to the negative effects of stress in the future.

Study one of the thesis established that certain athletes with access to explicit task knowledge led them to consciously process such information while experiencing stress; this was considered a central tenet in the occurrence of severe performance loss. Study two identified performers possessing specific traits (e.g. high reinvesters) that were susceptible to conscious processing; this was also considered a central mechanism in this phenomenon. Given that coaches consistently use orthodox, rule-based coaching styles performers consequently tend to possess large pools of explicit task knowledge. Hence, this knowledge is readily available to consciously rehearse, which is particularly problematic for those individuals predisposed to this phenomenon. First, future research needs to examine ways to minimise the accumulation of explicit knowledge during skill acquisition. Second, research needs to establish whether or not doing so, can enhance the performance of athletes who are predisposed to conscious processing under stress. A central aim of this thesis was to explore how psychological mechanisms of severe performance loss interact. For this reason, the interrelationship between explicit task knowledge, conscious processing and dispositional reinvestment under stress will be examined throughout the remainder of this thesis.

5.0 STUDY 3. DISPOSITIONAL REINVESTMENT, STRESS AND LEARNING STYLE IN BASKETBALL SKILL ACQUISITION

5.1 INTRODUCTION

The findings of study two support the prediction that individuals high in reinvestment are predisposed to conscious processing, which can disrupt automaticity and impair performance (Masters et al., 1993). An explanation of the conscious processing hypothesis, according to Masters (1992), is anchored in early stages of motor learning during which time large amounts of explicit task knowledge are developed. Moreover, the susceptibility to conscious processing is characterised by dispositional reinvestment and stress (Masters et al., 1993). However, no research to date has examined the combined effects of explicit knowledge manipulation during learning, dispositional reinvestment and stress. Hence, the logical progression of this thesis was to identify a learning method that fulfilled two aims: the first aim was to reduce the opportunity for conscious processing in individuals predisposed to this problem by minimise explicit knowledge accumulation. The second aim was to prevent learning progression from being inhibited as this has limited previous learning studies that have used a secondary task load to suppress explicit knowledge (Hardy et al., 1996; Masters, 1992; Maxwell et al., 2000). Thus, the purpose of this study was to examine the combined effects of two learning styles on dispositional reinvestment, tested under stress.

Initially, skills develop explicitly through conscious processing (Anderson, 1982; Fitts & Posner, 1967). Early stages of skill acquisition involve overtly controlled (declarative or explicit) procedures, which are characterised by inconsistent, effortful and slow performance (Anderson, 1982; Fitts & Posner, 1967). Over time, with practice, motor skills are thought to become covertly controlled (procedural or implicit) and automatic in nature, which are characterised by consistent (McLeod, McLaughlin, & Nimmo-Smith, 1985; Naveh-Benjamin & Jonides, 1984), effortless (Logan, 1978; 1979; Schneider & Shiffrin, 1977), and fast (Neely, 1977; Posner, & Snyder, 1975) performance.

Masters (1992) found a motor skill learned implicitly (without the knowledge of rules) was more robust under stress than a skill learned explicitly (with the rules of the task).

Masters concluded that this was owing to implicit learners having limited rule-based knowledge available to the conscious to rehearse under stress (cf. Hardy, Mullen, & Jones, 1996; Hayes & Broadbent, 1988; Reber, 1967; Roger & Nesshoever, 1987). Hardy, Mullen, and Jones (1996) replicated and extended this work and found support for Masters (1992). Hardy et al. (1996) proposed the secondary task enabled participants to become desensitised to self-regulated verbal distractions and thus, partially immune to the negative effects of competitive anxiety.

Using a dual task paradigm has affected the way in which Masters' (1992) and Hardy, Mullen, and Jones's (1996) results have been interpreted. The explicit learning group demonstrated no significant decrease in performance under stress; data indicated that the learning curve of this group reached a plateau whereas the implicit group carried on improving. Consequently, it could be that the implicit learning group progressed at a slower rate owing to the dual task placing greater demands on working memory. Perhaps the participants in the implicit learning group had not yet reached their plateau and thus, continued to improve regardless of the created stress condition. This contention is supported by Maxwell et al. (2000) who found that an implicitly learned skill, using a secondary task, suppressed acquisition even after the completion of 3000 trials.

Hardy, Mullen, and Jones (1996) called for future research to examine alternative ways to manipulate explicit task knowledge during skill acquisition. In this study two methods of learning were used – process and holistic. A holistic method of learning was chosen over an implicit method of learning because of the heavy load that a dual-task paradigm places on working memory, so inhibits learning progression (cf. Hardy, Mullen, & Jones, 1996; MacMahon & Masters, 2002; Masters 1992; Maxwell et al., 2000). In the holistic learning method participants were required simply to just 'do their best'. It was suggested that this learning method would not overload working memory and therefore not impede skill development. Furthermore, it was expected that holistic learning would allow skill acquisition to develop with little or no conscious awareness of the explicit rule-based knowledge of the task. Hence, it was assumed that holistic learners would gain a smaller pool of explicit knowledge than process learners. The process learning method was developed in accordance with Masters' (1992) explicit learning protocol.

In summary, recent research has proposed both that dispositional characteristics (Baumeister, 1984; Chell, Graydon, Holder, 2003; Lewis & Linder, 1997; Masters et al., 1993), and methods of skill acquisition (Hardy, Mullen, & Jones, 1996; Masters, 1992), coupled with environmental factors (e.g. stress) influence severe performance loss, precipitated by conscious processing, under stress. However, no research has examined the combined effect of these factors. Hence, the primary aim of this study was for participants dispositionally low or high in reinvestment to learn a skill using either a holistic or process method of learning. The effectiveness of the two learning methods was then examined under low and high conditions of stress. The intent was to determine whether or not a skill learned with restricted explicit knowledge could prevent severe performance loss under stress, precipitated by conscious processing in individuals predisposed to this process.

A basketball free-throw task was chosen for this study, as it is a static, closed skill involving several component parts. The ARS (Cox et al, 1996) was again administered immediately prior to the two experimental conditions. The ARS assessed stress manipulation and participants' levels and interpretations of anxiety. In accordance with previous research (Masters, 1992; Masters et al., 1993; Hardy, Mullen, & Jones, 1996) the following hypotheses were formulated.

H_1: Low reinvesters using the process learning method will experience no significant difference in performance between the low and high stress conditions.

H_2: Low reinvesters using the holistic learning method will experience no significant difference in performance between the low and high stress conditions.

H_3: High reinvesters using the process learning method will perform significantly worse in the high stress, than in the low stress conditions.

H_4: High reinvesters using the holistic learning method will experience no significant difference in performance between the low and high stress conditions.

5.21. Participants

With institutional ethics approval, forty male novice basketball players (mean age = 19.38; range = 18-42) participated in this study. Criterion for participation in this study was for individuals to have had no consistent recreational practice or formal training in basketball. Participation in the study was voluntary. Informed consent was sought from participants before data collection; confidentiality and anonymity was guaranteed.

5.22. Experimental Task

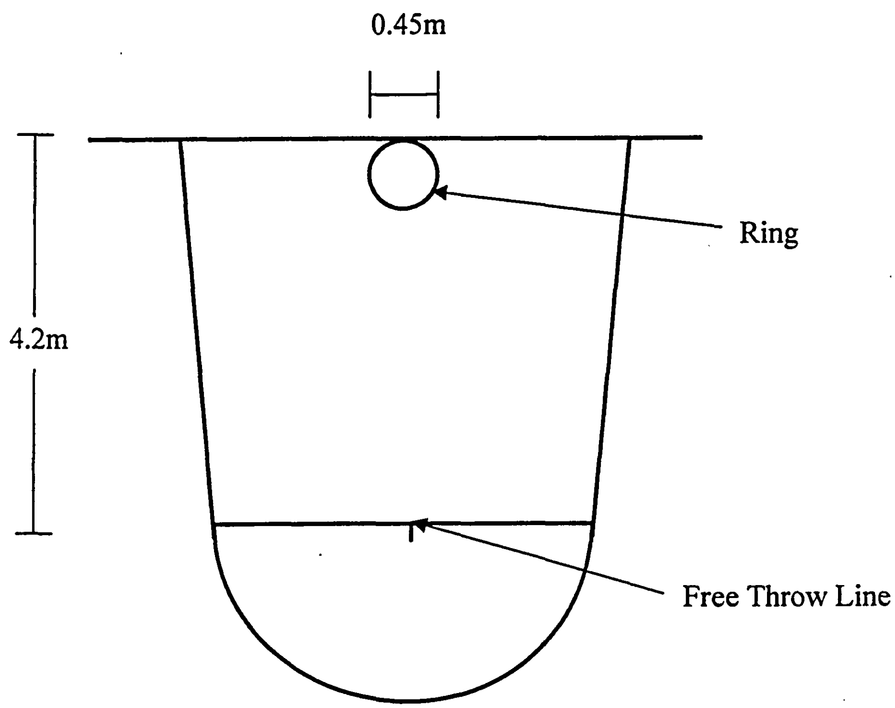
An adapted version of Landin, Herbert, and Fairweather's (1993) basketball free-throw shooting task was used for this study. Participants had to shoot at a standardised basketball ring (diameter 0.45 m) and backboard (1.22 x 1.88 m) set at a height of 2.5 m from behind a free-throw line 4.2 metres away (see Figure 5.1). Throughout the experiment participants received five points for a swish (in without hitting backboard or ring), four for in-off-the-ring, three for in-off-the-backboard, two for striking the ring, one for striking the backboard, and zero points for missing completely. The rationale for using a basketball free-throw task was two fold: first, this task enabled the qualitative basketball data in study one to be expanded by using a quantitative group-based design. Second, research has not examined the interaction between basketball skills and severe performance loss.

5.23. Measures

5.231. Reinvestment. The Reinvestment Scale (Masters et al., 1993) (see Appendix 6) was administered to assess the extent to which participants were predisposed to conscious processing under stress. For details of the Reinvestment Scale see section 4.231 (study 2).

5.232. Competitive State Anxiety. The Anxiety Rating Scale (Cox, Russell, & Robb, 1996) (ARS), a condensed version of the Competitive State Anxiety Inventory–2 (CSAI-2) (Martens et al., 1990), was used throughout this study (see Appendix 7). For details of the ARS see section 4.232 (study 2).

Figure 5.1. The Adapted Basketball Free-Throw Task



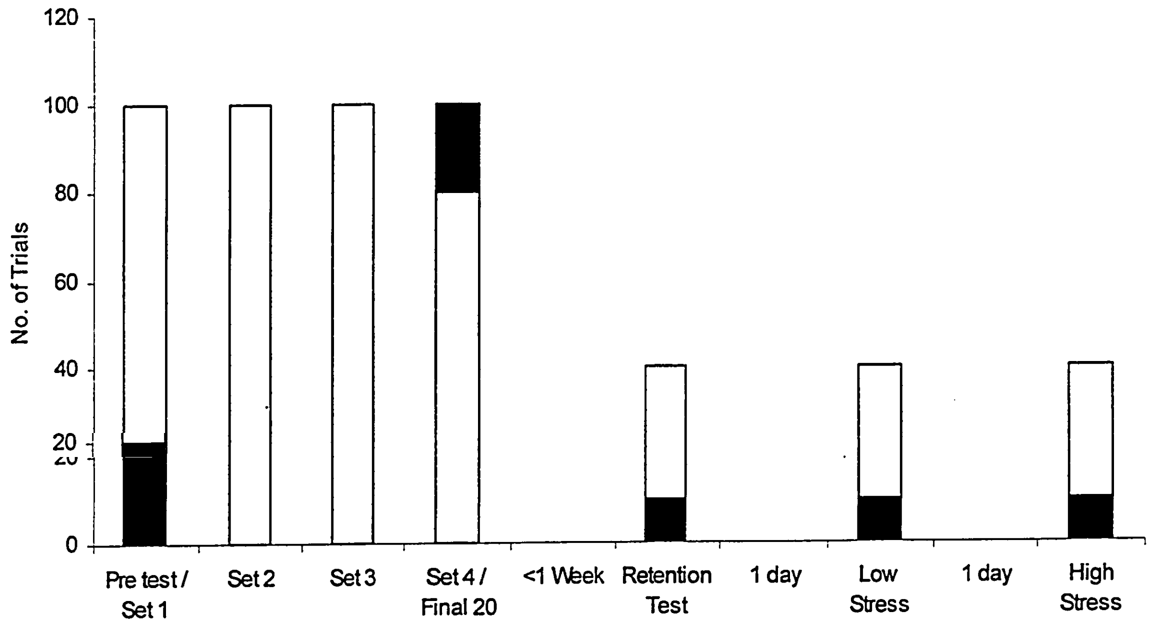
5.24. Procedure

The 40 participants were selected from a pool of 150 novice basketball players who had completed the Reinvestment Scale (Masters et al., 1993). Scores ranged from a low of 0 to a high of 18 (M = 8.50, SD = 3.70). In accordance with Masters' et al. (1993) protocol, participants scoring greater than 1 SD above the mean (n = 20) were placed in the high reinvestment group (M+SD = 12.20; range = 14-18); those scoring greater than 1 SD below the mean (n = 20) were placed in the low reinvestment group (M+SD = 4.80; range 0-4). Participants scoring between 4 and 14 were omitted.

5.241. Learning Phase. In the skill acquisition phase participants were required to learn an adapted basketball free-throw shooting task, individually, either using a holistic (no task instructions) or process (task instructions) method. The learning phase took place over a period of two weeks, which incorporated four sessions (see Figure 5.2). In accordance with Masters' (1992) protocol, in each session participants had 100 free-throw shots as 10 blocks of 10. Participants learning the basketball free-throw task holistically were required simply to do their best, and were not given any explicit instruction on the technical aspects of the task. The only proviso was that participants improved as much as possible.

Participants learning the task using a process method were given 8 explicit instructions about the specific components required to perform the shooting task successfully. Eight explicit rules were chosen for this learning method as advocated by a professional basketball coach (Cousy & Power, 1975) for the successful development of a free-throw technique. The technical instructions were as follows:- 1. Feet should be shoulder width apart. 2. The ball should be bounced to compose oneself prior to shooting. 3. The ball should be placed onto the fingertips of the dominant hand and balanced with the non-dominant hand. 4. The ball should be brought forward over the right eye. 5. The knees should flex then extend upward during the shot. 6. The ball should be released directly above the head. 7. The extension of the legs should be co-ordinated with the upward movement of the arm. 8. After the ball had been released the hand and wrist should follow through, reaching as if to dunk the ball into the basket (Cousy & Power, 1975). Participants were required to read the 8 instructions prior to each learning phase and after every set of 10 free-throw trials. Scores from each set of learning trials were recorded and used for data analysis. Participants were instructed not to practise

Figure 5.2. Experimental Format



Learning phase shaded areas = pre test and final 20 trials

Test phase shaded areas = warm-up trials basketball free-throw shooting outside the prescribed skill acquisition phase and test phase, respectively.

5.242. Retention Phase. Within a week of completing the skill acquisition phase and up to 4 days prior to undertaking the test phase, each participant was required to complete a learning retention test. The retention test comprised 30 free-throw trials; the first 10 trials were used as a warm-up phase and were not used for data analysis (see Figure 5.2).

5.243. Test Phase. In the test phase participants performed 30 free-throw trials in both a low and high stress environment. The first 10 trials of each stress condition were used as a warm-up phase and were not used for statistical analyses (see Figure 5.2). Immediately prior to each condition participants completed the Anxiety Rating Scale (ARS; Cox et al., 1996). Participants were made aware of the 5 point scoring system immediately prior to each test condition. Performance and ARS scores were used as the dependent variables for each condition.

In the high stress condition several techniques were used to create pressure. In accordance with the randomised-counterbalanced format, participants from half of each experimental sub-group were required to evaluate each other's performance during this condition (cf. Hardy, Jones, & Gould, 1996). Participants were told that the purpose of the task was to analyse individual shooting techniques, in relation to accuracy. A confederate was introduced to the participants as a 'professional basketball coach'. This technique was used to heighten performers' awareness that they were being evaluated (Baumeister, 1984, Masters, 1992). The coach explained that participants would be assessed on their accuracy and shooting technique. It was also explained to participants that they would be analysed on three separate constructs of their technique; these were control, balance, and fluidity. In addition, a camera was used to heighten the evaluative process. Participants were informed that the video footage would be used for an additional analyse of their technique.

Finally, performers were told that they would be placed in rank order in accordance with their score and evaluated technique. It was further stated that a ranking list would be distributed to all participants for them to confirm their ability compared with other competitors.

In the low stress condition, participants were simply instructed to accumulate as many points as possible from the 30 basketball free-throw shots; pressure was kept to a minimum. To counteract any biasing effect each reinvestment-by-learning group was divided to form a randomised-counterbalanced design for the two stress conditions. At the end of the study participants were debriefed and thanked for their involvement.

5.25. Data Analysis

To examine whether all participants were at a similar skill level at the outset of the learning phase a one-way (reinvestment) analysis of variance was calculated. To examine whether learning had taken place during the skill acquisition phase, and been retained by the two reinvestment groups, and each learning subgroup a three-way (Reinvestment x Learning Group x Time) analysis of variance with repeated measures on the third factor was calculated. The effectiveness of holistic and process learning methods, on participants high or low in reinvestment, under different conditions of stress was examined using a series of two-way (Learning x Stress) analyses of variance (ANOVA) with repeated measures on the second factor. These analyses were calculated independently on the test scores for the high and low reinvestment groups, respectively. In addition, independent analyses of variance were calculated on each of the three intensity sub-scales of the ARS for the high and low reinvestment groups, respectively; this served primarily as a stress manipulation check. Specific differences were established using pairwise comparisons. The bonferroni technique was used to control for potential Type I errors. Normality of distributions, homogeneity of variances and sphericity were confirmed (see Appendix 18 for statistical output).

5.3 RESULTS

5.31. Pre-test Phase

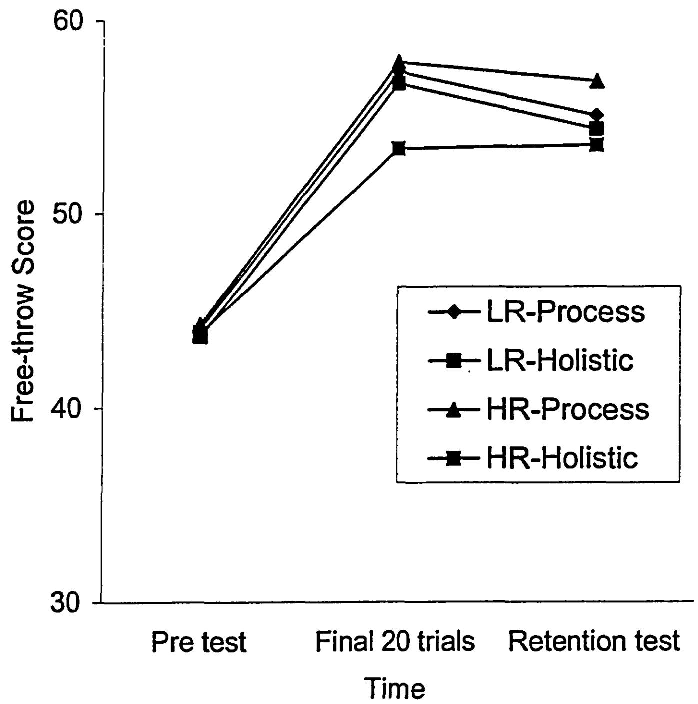
A one-way analysis of variance was calculated on the pre-test scores to ensure that the two reinvestment groups were similar prior to the onset of the study. Assumptions for sphericity were met. There was no significant difference between the high and low reinvestment groups ($F_{(1,38)} = .102$, $P > 0.1$). This indicated that levels of performance were similar prior to the onset of this study regardless of reinvestment group.

5.32. The Skill Acquisition / Retention Phase

The learning curves for each of the high and low Reinvestment groups, in each learning Subgroup are depicted in Figure 5.3. A three-way (Reinvestment x Learning group x Time) analysis of variance with repeated measures on the third factor was calculated for the skill acquisition phase. Assumptions for sphericity were met. The free-throw scores for the pre-test, final 20 trials of the skill acquisition phase, and the retention test were used as the dependent variables. The reinvestment by learning by time interaction for free-throw performance was not significant ($F_{(2,12)}$ = .46, $P > 0.1$). This indicated not only that all participants, regardless of reinvestment or learning group acquired a similar amount of skill at the task, but that they had also retained a similar amount of skill up to one week later. There was a significant main effect for time ($F_{(2,72)}$ = 85.00, $P < 0.001$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated that all participants were significantly better at the free-throw task in the final 20 trials of the skill acquisition phase than in the pre-test. Similarly, all participants performed the task significantly better in the retention test than in the pre-test. This indicated that a significant amount of learning had taken place for all participants, during the skill acquisition phase. In addition, no significant difference in free-throw performance was found between the final 20 trials of the skill acquisition phase, and the retention test. This indicated learning that had taken place over the skill acquisition phase had been retained up to a week later. There was no significant main effect for free-throw performance between the high and low reinvestment groups ($F_{(2,72)}$ = .51, $P > 0.1$), or the holistic and process learning subgroups ($F_{(2,12)}$ = .58, $P > 0.1$). Figure 5.3 depicts the learning curves for the two Reinvestment Groups, in each learning subgroup.

Results from the learning and retention phases of this investigation indicated that skill acquisition did not differ significantly between the high and low reinvestment groups, regardless of the method in which they learned the task. For this reason, a statistical comparison was not necessary between the two reinvestment groups for the test phase of this investigation. Therefore, separate two-way (learning group x stress) analyses of variance with repeated measures on the second factor were calculated on the high and low reinvestment groups, respectively.

Figure 5.3. Learning Curves for each of the High and Low Reinvestment Groups, in each Learning Subgroup



5.33. Test Phase: Anxiety Data (ARS)

Anxiety as indicated by the means and standard deviations for the intensity and direction scores for the low and high reinvestment groups, in each learning subgroup, are present in Tables 5.1 and 5.2 respectively, for each stress condition. Analysis of the ARS data, predominately, served as a stress manipulation check. A separate series of two-way analyses of variance with repeated measures on the second factor were carried out on the intensity of the three components of the ARS for the low and high reinvestment groups, respectively. Assumptions for sphericity were met.

5.331. Low Reinvestment Group

5.3311. Somatic Anxiety. The learning group by stress interaction for the ARS intensity scale for somatic anxiety was not significant ($F_{(1,18)} = 0.10$, $P > .05$). There was a significant main effect for the ARS intensity scale for somatic anxiety between the high and low stress conditions ($F_{(1,18)} = 12.23$, $P < .01$). This indicated that stress was successfully manipulated. There was no significant main effect for the ARS intensity scale for somatic anxiety between holistic and process learning subgroups ($F_{(1,18)} = 2.15$, $P > .05$).

The learning group by stress interaction for the ARS directional scale for somatic anxiety was not significant ($F_{(1,18)} = 0.12$, $P > .05$). There was no significant main effect for the ARS directional scale for somatic anxiety between the high and low stress conditions ($F_{(1,18)} =$ 1,88., $P > .05$). There was no significant main effect for the ARS directional scale for somatic anxiety between holistic and process learning subgroups ($F_{(1,18)} = 1.40$, $P > .05$).

5.3312. Cognitive Anxiety. The learning group by stress interaction for the ARS intensity scale for cognitive anxiety was not significant ($F_{(1,18)} = 0.18$, $P > .05$). There was a significant main effect for the ARS intensity scale for cognitive anxiety between the low and high stress conditions ($F_{(1,18)} = 22.22$, $P < .001$). This also indicated that stress was successfully manipulated. There was no significant main effect for the ARS intensity scale for cognitive anxiety between holistic and process learning subgroups ($F_{(1,18)} = 0.88$, $P > .05$). The learning group by stress interaction for the ARS

Table 5.1. Anxiety Rating Scale Intensity Scores for the Low and High Reinvestment Groups in each Learning Sub-Group for each Stress Condition. Values are Means (M) ± Standard Deviations (SD)

	Somatic Anxiety				Cognitive Anxiety				Self-Confidence			
	Low Stress		High Stress		Low Stress		High Stress		Low Stress		High Stress	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
LR-Process	1.80	0.63	2.30	0.82	1.80	0.79	2.40	0.70	5.10	0.74	4.70	0.95
HR-Process	2.80	0.42	5.10	0.74	2.40	0.84	4.80	1.03	4.80	1.14	2.30	1.06
LR-Holistic	2.10	0.57	2.70	0.48	1.60	0.52	2.10	0.57	4.60	0.97	4.10	1.20
HR-Holistic	2.40	0.84	5.20	1.14	2.50	1.08	5.20	1.14	4.20	1.03	4.00	1.42

LR = Low Reinvestment Group

HR = High Reinvestment Group

directional scale for cognitive anxiety was not significant ($F_{(1,18)} = 1.10$, $P > .05$). There was no significant main effect for the ARS directional scale for cognitive anxiety between the low and high stress conditions ($F_{(1,18)} = 0.20$, $P > .05$). There was no significant main effect for the ARS directional scale for cognitive anxiety between holistic and process learning subgroups ($F_{(1,18)} = 3.04$, $P > .05$).

5.3313. Self-Confidence. The learning group by stress interaction for the ARS intensity scale for self-confidence was not significant ($F_{(1,18)} = 0.03$, $P > .05$). There was no significant main effect for the ARS intensity scale for self-confidence between the high and low stress conditions ($F_{(1,18)} = 2.71$, $P > .05$), or the holistic and process learning subgroups ($F_{(1,18)} = 2.61$, $P > .05$).

The learning group by stress interaction for the ARS directional scale for self-confidence was not significant ($F_{(1,18)} = 0.18$, $P > .05$). There was no significant main effect for the ARS directional scale for self-confidence between the high and low stress conditions ($F_{(1,18)} = 1.62$, $P > .05$), or the holistic and process learning subgroups ($F_{(1,18)} = 1.73$, $P > .05$).

5.332. High Reinvestment Group

5.3321. Somatic Anxiety. The learning group by stress interaction for the ARS intensity scale for somatic anxiety was not significant ($F_{(1,18)} = 1.64$, $P > .05$). There was a significant main effect for the ARS intensity scale for somatic anxiety between the high and low stress conditions ($F_{(1,18)} = 170.87$, $P < .001$). This indicated that stress was successfully manipulated. There was no significant main effect for the ARS intensity scale for somatic anxiety between the holistic and process learning subgroups ($F_{(1,18)} = 0.35$, $P > .05$).

The learning group by stress interaction for the ARS directional scale for somatic anxiety was not significant ($F_{(1,18)} = 1.95$, $P > .05$). There was a significant main effect for the ARS directional scale for somatic anxiety between the high and low stress conditions ($F_{(1,18)} = 140.60$, $P < .001$). There was no significant main effect for the ARS directional scale for somatic anxiety between the holistic and process learning subgroups ($F_{(1,18)} = 1.03$, $P > .05$).

Table 5.2. Anxiety Rating Scale Directional Scores for the Low and High Reinvestment Groups in each Learning Sub-Group for each Stress Condition. Values are Means (M) ± Standard Deviations (SD)

	Somatic Anxiety				Cognitive Anxiety				Self-Confidence			
	Low Stress		High Stress		Low Stress		High Stress		Low Stress		High Stress	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
LR-Process	4.50	1.43	4.20	1.03	4.60	1.07	4.10	1.20	5.90	1.29	5.70	1.25
HR-Process	4.60	0.84	2.70	0.67	4.20	1.34	2.70	1.16	4.50	0.97	2.60	1.17
LR-Holistic	5.10	1.20	4.60	0.84	4.90	1.88	5.10	1.29	5.40	0.84	5.0	1.15
HR-Holistic	4.70	1.25	3.20	1.03	4.30	1.25	3.10	1.20	4.40	0.97	3.60	1.51

LR = Low Reinvestment Group

HR = High Reinvestment Group

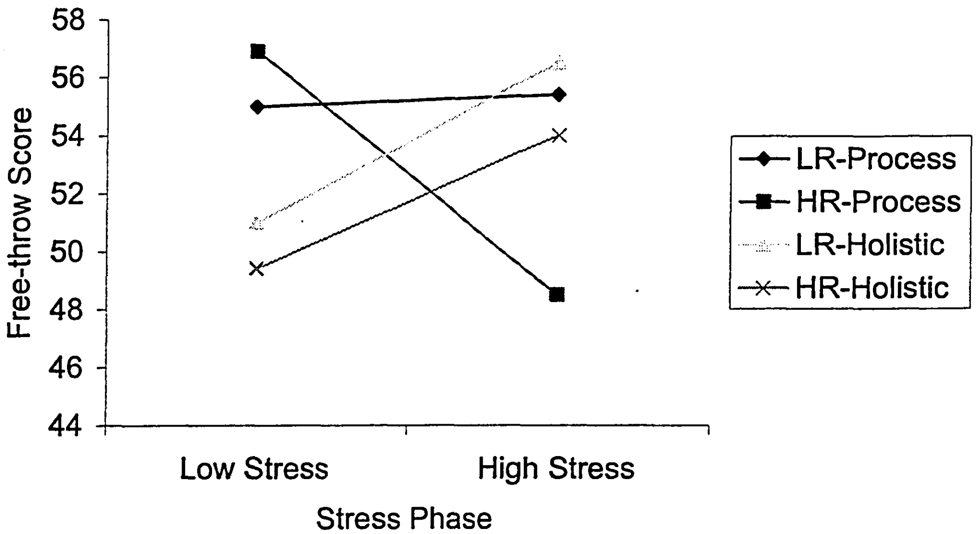
5.3322. Cognitive Anxiety. The learning group by stress interaction for the ARS intensity scale for cognitive anxiety intensity was not significant ($F_{(1,18)} = 0.21$, $P > .05$). There was a significant main effect for the ARS intensity scale for cognitive anxiety intensity between the high and low stress conditions ($F_{(1,18)} = 60.80$, $P < .001$). This also indicated that stress was successfully manipulated. There was no significant main effect for the ARS intensity scale for cognitive anxiety intensity between the holistic and process learning subgroups ($F_{(1,18)} = 0.60$, $P > .05$).

The learning group by stress interaction for the ARS directional scale for cognitive anxiety intensity was not significant ($F_{(1,18)} = 0.31$, $P > .05$). There was no significant main effect for the ARS directional scale for cognitive anxiety between the high and low stress conditions ($F_{(1,18)} = 25.14$, $P > .05$). There was no significant main effect for the ARS directional scale for cognitive anxiety between the holistic and process learning subgroups ($F_{(1,18)} = 0.30$, $P > .05$).

5.3323. Self-Confidence. The learning group by stress interaction for self-confidence intensity was significant ($F_{(1,18)} = 21.54$, $P < .001$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated that participants in the high reinvestment – process group reported significantly lower levels of self-confidence in the high stress versus the low stress condition. There was a significant main effect for the ARS intensity scale for self-confidence between the high and low stress conditions ($F_{(1,18)} = 29.69$, $P < .001$). There was no significant main effect for the ARS intensity scale for self-confidence between the holistic and process learning subgroups ($F_{(1,18)} = 1.42$, $P > .05$).

The learning group by stress interaction for self-confidence direction was significant ($F_{(1,18)} = 7.51$, $P < .05$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated that participants in the high reinvestment - process group reported self-confidence to be significantly more debilitative in the high stress than in the low stress condition. Further, participants in the high reinvestment - process group reported self-confidence to be significantly more debilitative in the high stress condition than the high reinvestment – holistic group did in the low stress condition. There was a significant main effect for the ARS directional scale for self-confidence between the high and low stress conditions ($F_{(1,18)} = 45.25$, $P < .001$). There was no significant

Figure 5.3. Performance Scores for the Low and High Reinvestment Groups in each Learning Sub-Group in each Stress Condition. Values are Means (M)



LR = Low Reinvestment Group

HR = High Reinvestment Group

main effect for the ARS directional scale for self-confidence between the holistic and process learning subgroups (F (i^g)= 0-86, P > .05).

5.34. Test Phase: Free-Throw Performance

The means for test scores for the low and high reinvestment groups, in each learning sub-group, for each stress condition are presented in Figure 5.3. Separate two-way analyses of variance with repeated measures on the second factor were carried out on the low and high reinvestment groups, respectively. Assumptions for sphericity were met.

5.341. Low Reinvestment Group. The learning group by stress interaction for test scores was not significant (F (i'lg) = 1.55, p = .23). There was no significant main effect for test scores between the high and low stress conditions (F (i^g) = 2.12, P > .05), or the holistic and process learning subgroups (F (i^g) = .405, P > .05). This indicated that participants low in reinvestment performed the basketball skill to a similar level regardless of stress, or method used to leam the task, which supports hypothesis 1 and 2 of this study.

5.342. High Reinvestment Group. The learning group by stress interaction for test scores was found to be significant (F (i,ig) = 7.71, P < .05). Follow-up pairwise comparisons corrected using the bonferroni technique indicated that those in the high reinvestment - process learning group performed significantly worse in the high stress versus the low stress condition, which offers support for hypothesis 3 of this study. There was no significant main effect for test scores between the high and low stress conditions (F (i,ig) = .659, P > .05) or the holistic and process learning subgroups (F (i,ig) = .155, P > .05). These findings also indicated that the high reinvestment - holistic learning group performed the basketball skill to a similar level regardless of stress, which offers support for hypothesis 4 of this study.

5.4 DISCUSSION

The main aim of this study was to assess participants dispositionally low and high in reinvestment when using either a holistic or process method of learning. The effectiveness of the two learning methods was then examined under different conditions of stress. The primary intent was to assess whether by limiting explicit knowledge during skill acquisition severe performance loss could be prevented in individuals predisposed to conscious processing under stress.

The ARS primarily served as a stress manipulation check, whilst also examining the participants' levels and interpretations of anxiety prior to performance. Participants low and high in reinvestment reported their perceptions of cognitive and somatic anxiety to be significantly greater in the high stress in comparison to the low stress condition. These findings suggest that the method used to manipulate stress in a laboratory setting was successful.

Hypotheses one and two of this study, which stated that low reinvesters would maintain performance under high conditions of stress, regardless of adopting either a holistic or process learning method were supported. The present findings support Masters et al. (1993; Chell et al, 2003) as low reinvesters performed to similar levels under low and high conditions of stress. This was regardless of explicit task knowledge manipulated during skill acquisition. It was proposed that low reinvesters were not predisposed to performance loss, precipitated by conscious processing. Consequently, performance under different conditions of stress was relatively uninfluenced by manipulated levels of explicit knowledge during skill acquisition.

Hypothesis three of this study, which stated that high reinvesters adopting the process learning method would perform significantly worse in the high stress in comparison to the low stress condition was supported. It was proposed, in accordance with Masters et al. (1993; Chell et al., 2003) that anxiety-induced conscious rehearsal of explicit rules associated with early stages of learning led to automaticity disruption and performance impairment in high reinvesters under stress.

Hypothesis four of this study, which stated that high reinvesters adopting the holistic learning method would perform to similar levels under low and high conditions of stress, was also supported. This finding does not support the contention of Masters et al. (1993; cf. Chell at al., 2003). They, as part of the validation of the Reinvestment Scale, used data relating to participants who had learned a motor skill explicitly, from Masters' (1992) study. A significant correlation was revealed between high reinvesters and a performance decrement under stress. However, direct comparisons could not be made between the present findings and Masters et al's (1993) study, as they did not examine different learning styles. Of specific interest to this study would have been for Masters and his Colleagues to have also examined the relationship between the implicit learning data (Masters, 1992) and the Reinvestment Scale. Further, neither could a direct comparison be made between the present findings and Masters (1992) study, as he did not measure dispositional reinvestment. In combination, however, Masters' (1992) and Masters et al's. (1993) research does offer support for the findings of this study. It was proposed that by minimising explicit task knowledge through holistic learning, severe performance loss, precipitated by conscious processing, under stress could be prevented in individuals high in reinvestment.

Of particular interest were the trends that indicated participants who learned the task holistically, regardless of reinvestment, performed better in the high stress than the low stress condition (see Figure 5.4 and 5.5). This suggested that high conditions of stress facilitated the performance of participants who had used a holistic learning method. Masters (1992; Hardy, Mullen, & Jones, 1996) found that participants who learned a skill implicitly continued to improve under high conditions of stress. It was suggested that these participants had not reached asymptote, owing to the secondary task placing greater demands on working memory. Consequently, the participants continued to improve regardless of stress (Hardy et al., 1996). This study attempted to control for this anomaly in two ways. Firstly, a holistic learning method was used, instead of an implicit learning method. This was to eliminate the ramifications of using a secondary task. Secondly, the comparison made between the last twenty trials of the learning phase and the retention phase ensured that all participants, regardless of their adopted learning style, had reached asymptote. It was proposed that the holistic learning method used in this study did not place additional demands on working memory, unlike implicit learning styles. Consequently, this method not only helped prevent learning retardation, but appeared to facilitate performance under stress.

Wulf et al. (1998; Wulf et al., 1999) provided evidence that an external focus resulted in greater benefits for learning and performance, than an internal focus. Wulf et al. (2000; also see Al Abood et al., 2002; Wulf, McNevin, & Shea, 2001; Wulf, Shea, & Park, 2001) found that an external-movement effect related focus facilitated superior learning and performance, in comparison to focusing on other external sources of information. Thus, preventing an explicit focus and allowing self-organisation processes to implicitly regulate task performance. Further, an external focus has been suggested to place minimal demands on working memory in comparison to an internal focus, which imposes large demands on working memory (Maxwell & Masters, 2002). Participants adopting the holistic learning method in the present study were given no explicit task rules and were instructed to just 'do their best'. It was speculated that this might have encouraged participants to focus on the outcome (e.g. external-movement effects related focus) of performance, which allowed systems to self-organise more naturally, unconstrained by conscious control (Wulf et al., 2000; Wulf, McNevin, & Shea, 2001; Wulf, Shea, & Park, 2001). This contention is supported by Maxwell and Masters (2002) who found that an implicit, external mode of learning and performance was the default option for performers, even when an explicit, internal focus is stipulated (Maxwell & Masters, 2002).

A processing efficiency perspective (Eysenck & Calvo, 1992) suggests increased effort might compensate for anxiety induced distractions by increasing attentional resources under stress. This can facilitate performance in cases where additional resources are channelled into appropriate processes (e.g. external-movement effects related). Hence, if holistic learners in the present study did allocate additional resources into systems that promote automaticity, this might explain their incremental performance trends under stress. However, it is important to note that neither mental effort nor attentional focus was controlled for in this study. Future research should monitor these factors in order to gain a richer understanding of the relationship between attentional foci, mental effort and dispositional reinvestment.

Of further interest to this investigation were the ARS scores. Low reinvesters indicated a significant increase in both somatic and cognitive anxiety in the high stress, in comparison to the low stress condition (no significant differences were found for self-confidence). Low reinvesters indicated no significant differences for the directional component of the ARS, even though a main effect for intensity was observed for somatic and cognitive anxiety. Be that as it may, scores for state anxiety were still relatively low, even in the high stress condition. The mean state anxiety scores were similar for high reinvesters under low stress in comparison to scores for low reinvesters under high stress conditions (see Figure 5.1 & 5.2). The ARS scores in this study follow a similar pattern to those found in study two and therefore, offer further support to the proposed relationship between dispositional reinvestment and trait anxiety (Maxwell et al., 2000)

Analysis of the ARS (intensity and direction) scores for high reinvesters indicated no significant differences between the holistic and process learning groups for somatic or cognitive anxiety, in either the low or high stress conditions. This suggests that additional factors, other than anxiety, were responsible for the lack of consistency in free-throw performance for the high reinvestment-process learning group under high stress. The high reinvestment - process group reported a significant decrease in self-confidence in the high stress, which they reported to be negative to performance, in comparison to the low stress condition. Where as, the high reinvestment - holistic group reported similar levels of self-confidence in the high and low stress conditions. Further the high reinvestment - process group reported significantly lower levels of self-confidence in the high stress condition than the high reinvestment - holistic group did.

Bandura (1986) proposed that the belief to execute a specific task successfully is essential in obtaining the desired outcome. Schlenker and Leary (1982) suggested that the discrepancy between expectation (self and others) to perform successfully coupled with the apprehension and self-doubt to do so would intensify pressure. Therefore, perhaps self-confidence when performing under pressure was a mediating factor, which offers additional support as to why the high reinvestment-process group demonstrated a significant decrement in performance and the high-reinvestment-holistic group, did not. This finding also supports Hardy (1990) who contended that self-confidence increases the probability that individuals will be able to sustain performance even when experiencing high levels of cognitive anxiety and physiological arousal. Be that as it may, it is still not clear why the two learning groups reported significantly different levels of self-confidence in the high stress condition. The answer may lie in the different processes that underpin the two distinct styles of learning. Clearly, additional research is needed in this area if a more definitive explanation is to be established.

In summary, minimising the accumulation of explicit knowledge during skill acquisition can prevent severe performance loss, precipitated by conscious processing in high reinvesters executing a basketball free-throw task under stress. Low reinvesters were not predisposed to this phenomenon in the present study (Masters et al., 1993; Chell at al., 2003). Consequently, performance, under different conditions of stress was relatively uninfluenced by manipulated levels of explicit knowledge during skill acquisition. High reinvesters were predisposed to performance loss under stress in this study (Masters et al., 1993; Chell at al., 2003). Anxiety-induced conscious rehearsal of explicit rules associated with early stages of learning led to automaticity disruption and performance impairment in those who adopted the process learning method. In contrast, by minimising explicit task knowledge conscious processing and thus, performance impairment were prevented in those who adopted the holistic learning method. Further, it was speculated that, as a default option (Maxwell & Masters, 2002), this learning style could have evoked an external movement-effects related focus, which, in turn, allowed the motor system to more naturally self-organise, unconstrained by conscious control (Wulf et al., 2000; Wulf, McNevin, & Shea, 2001; Wulf, Shea, & Park, 2001).

The main findings of this study indicate that severe performance loss under stress, predicted by dispositional reinvestment (Masters et al., 1993), is not just contingent upon the interaction between personality and environmental factors, but also the way in which a skill is learned. Furthermore, the findings of this study question the predictive power of the Reinvestment Scale (Masters et al., 1993) in athletes that may have acquired a skill through a limited pool of explicit knowledge.

The ARS (Cox et al., 1996) used in studies two and three of this thesis to assess stress manipulation and participants' levels and interpretations of anxiety possesses limitations (Krane, 1994). The rationale for using the ARS in studies two and three was based on its simplicity and short user-friendly format. In an attempt to glean a richer understanding of the relationship between anxiety and conscious processing a direction scale was incorporated into the questionnaire. This was adapted from the modified CSAI-2 (Swain & Jones, 1992), but possessed no psychometric data (See Section 4.232). Clearly, stress was successfully manipulated in these studies. However, the changes in ARS intensity and direction scores for the three subscales that took place between studies two (see Section 4.31) and three (see Section 5.33) for low and high reinvesters under stress were inconsistent. The reasons proposed for this anomaly were two fold; first, the intensity scale was not sensitive enough to ascertain an accurate and consistent level of state anxiety due to the limitation associated with single item measures (Krane, 1994). Second, the adapted direction scale had no psychometric qualities established. For these reasons, caution should be taken when using the ARS in future research.

This study has practical implications for coaches and sport psychologists. First, the present findings of this study question the orthodox coaching strategies commonly used in sport today. Perhaps coaches should minimise the amount of explicit knowledge that is given to athletes during skill acquisition. As a consequence, such athletes might develop more holistic skills, which are implicitly regulated, unconstrained by conscious control (Wulf et al., 2000). However, minimising explicit knowledge during skill acquisition might be less beneficial in such sports as rock climbing, than in fast ball sports like tennis (Hardy et al., 1996). For this reason, more research is required in this area to examine the effect of explicit knowledge reduction during learning on a variety of different sporting skills.

Second, recent research has endorsed the use of technical-orientated goals, which require athletes to focus on specific components of a skill during performance (Orlick & Partington, 1988; Kingston, Hardy, & Markland, 1992). The present findings challenge the effectiveness of using technical-oriented goals. Coaches and sport psychologists advising performers to focus on multiple technical-orientated goals might serve as a catalyse for conscious processing, rather than automaticity, particularly in those high in reinvestment. Therefore, perhaps athletes should be encouraged to use pre-performance routines (Boutcher, 1990) that promote holistic orientated goals, which direct attention towards more global aspects of skills. This might help athletes develop more productive mechanisms such as chunking and automaticity (Hardy, Mullen, & Jones, 1996; Kingston & Hardy, 1994).

An aim of this thesis was to identify psychological coping strategies that could be used to counter severe performance loss in competitive sport. A challenge for this research programme is that coaches still consistently use orthodox, rule-based coaching styles in sports today. Hence, athletes generally possess explicit knowledge of the skills required to perform their sport. Thus, the holistic-based learning strategy adopted in this study is inapplicable to such athletes. Specifically, this learning strategy is unable to help high reinvesters counter the problem. Consequently, strategies that promote a more holistic-based approach to skill execution need to be established for experienced performers who already have access to explicit task knowledge. For example, Wulf et al. (2000) found that adopting an external movement-effect related focus promoted automatic motor performance, unconstrained by conscious control. Further, Mullen and Hardy

(2000) found that using a secondary task during putting execution enhanced the performance of skilled golfers while experiencing stress. Nevertheless, research has not examined coping strategies for performers who are predisposed to conscious processing. A challenge for future research will be to try and help high reinvesters to maintain performance by establish strategies that promote automaticity and prevent conscious processing while experiencing stress.

CHAPTER VI

6.0. STUDY 4. DISPOSITIONAL REINVESTMENT, STRESS AND FOCUS OF ATTENTION IN SKILLED GOLFERS

6.1. INTRODUCTION

The findings of study three indicated that by minimising explicit task knowledge during skill acquisition, performance deterioration could be avoided in those predisposed to this problem while experiencing stress. It was suggested that this could be because of limited task rules being available in which to reinvest in. However, because of the orthodox way motor skills are taught the majority of experienced athletes will already possess a pool of explicit knowledge. Consequently, this knowledge is already available to the conscious to reinvest in, which is particularly problematic for those individuals predisposed to this phenomenon. Therefore, the purpose of study four was to examine ways of preventing conscious processing, in skilled performers who were predisposed to this problem, by manipulating attentional foci or loading on working memory.

The preceding studies of this thesis have indicated support for the contention that focusing internally on the movement characteristics of a skill sequence can disrupt automaticity and impair performance (Baumeister, 1984; Gallwey, 1976, 1981; Scheider & Fisk, 1983; Wulf & Weigelt, 1997). Wulf and her colleagues have provided evidence that an external focus consistently results in greater learning benefits than an internal focus in several different motor skills (Wulf et al., 1998). Specifically, recent research has observed an extemal-focus that directed performers' attention to the movement effects, rather than to other external sources of information, facilitated superior learning and performance (Al-Abood et al, 2002; Wulf, McNevin, & Shea, 2001; Wulf, Shea, & Park, 2001; Wulf et al, 2002). Enhancement in learning and performance has also been observed in sport skills including golf (Wulf et al, (1999) tennis (Maddox, Wulf, & Wright, 2000) soccer and volleyball (Wulf et al, 2000) thus adding support to the generalisability of the effects.

Conscious attempts to control movement interfere with automatic motor control processes, whereas focusing on the movement effects enable the systems to self-organise more naturally, unconstrained by conscious control (Wulf, McNevin, & Shea, 2001). Wulf, McNevin, and Shea (2001; see also Wulf, Shea, & Park, 2001) referred to this concept as the constrained-action hypothesis. Kingston and Hardy (1994) called for a more holistic goal type to motor control in the belief that this would promote productive mechanisms such as chunking and automaticity. Although an external-movement effects related focus advocated by Wulf, McNevin, and Shea (2001) is not necessarily a holistic goal per se, it promotes a holistic, automatic response in terms of movement dynamics.

The research of Wulf and her Colleages (1997; 1998; 1999; 2000) has primarily investigated the impact of different attentional foci on skill acquisition. More recently Wulf et al. (2002) have found that adopting an external focus of attention also advantages experienced sport performers (e.g. volleyball & soccer). However, Wulf's research has not tested findings under competitive stress where the temptation to reinvest in explicit task knowledge is at its utmost (Masters 1992); nor have they used participants who are predisposed to this process. An aim of this study was to examine different attentional foci (internal and external) on skilled golfers, high in reinvestment under stress. This was to establish whether promoting an external-movement effects related focus could prevent conscious processing and in turn, performance loss under stress.

An alternative to preventing individuals from developing explicit knowledge about how to perform skills is to reduce the opportunity for reinvesting in that knowledge when under stress (Jackson & Wilson, 1997). Limiting the amount of explicit knowledge during skill acquisition by suppressing working memory with a secondary task has been found to be more robust under stress (Hardy, Mullen, & Jones, 1996; Masters, 1992). However, as discussed in the previous study this implicit method of skill acquisition has practical implications (Masters, 1992). Primarily, skill progression is suppressed as a result of unmanageable processing demands placed on the learner by the secondary task (Maxwell et al., 2000). Recently Mullen and Hardy (2000) used a random letter generation task (Baddeley, 1966) in skilled golfers and found that performance decrements under stress were prevented. However, no research has examined whether interfering with the operation of the central executive of the working memory system could prevent skilled performers, predisposed to conscious processing, from experiencing performance loss under stress.

Another aim of this study was to examine whether interfering with the operation of the central executive through the use of a random letter generation task (Baddeley, 1966) could prevent skilled golfers, predisposed to conscious processing, accessing their explicit knowledge base during the execution of a putting task. Schneider and Shiffrin (1977) postulated that skills, which are over-learned, are "activated automatically without the necessity of active control or attention" (p. 2). If automatic skills require no conscious attention, by suppressing working memory, via random letter generation, conscious processing should be prevented and automaticity promoted. However, by placing maximal demands on working memory it was not known whether this would prevent critical environmental cues from being processed and thus, still lead to a reduction in performance. Mullen and Hardy (2000) suggested that owing to the random letter generation preventing performance decrements under stress sufficient attentional resources were available for successful skill execution. Be that as it may such participants were not predisposed to conscious processing.

A further aim of this study was to measure mental effort (Zijlstra, 1993) and time-on-task. This was to explore the conflicting predictions of the processing efficiency theory (Eysenck & Calvo, 1992) and the conscious processing hypothesis (Masters, 1992) in accordance with directing increased effort to performance as a result of heighten anxiety. Both theories predict that anxiety will result in additional effort expenditure and a desire to tell oneself what to do (Oldham, 2001). From a conscious processing perspective increased effort is thought to lead to performance decrements owing to a switch in task control from an automatic to conscious processing systems. This process is thought to be exemplified by performers spending greater time-on-task (Masters, 1992). From a processing efficiency perspective, increased effort may compensate for anxiety induced distractions by increasing attentional resources, thus preventing performance impairment. However, these predictions are contingent upon where these additional resources are allocated. If, for example, additional effort is directed towards appropriate processes (e.g. external-holistic movement related effects), performance might be facilitated. Conversely, if directed toward inappropriate processes (e.g. internal movement dynamics), performance might be impaired (Mullen & Hardy, 2000).

A golf putting task was chosen as the experimental task for this study as it's a fine motor skill involving many component parts that could be rehearsed or consciously controlled under stress (Masters, 1992). In an attempt to remedy the limitations (see Section 5.4 - study 3) identified in the preceding two studies relating to inconsistencies in the ARS (Cox et al., 1996) the modified CSAI-2 was used to assess stress manipulation and participants' levels and interpretations of anxiety in the present study. It was expected that this instrument would provide a more sensitive measure of anxiety and thus provide a richer understanding of the anxiety-performance loss relationship. In accordance with the conscious processing hypothesis (Masters, 1992), the constrained-action hypothesis (Wulf, McNevin, & Shea, 2001) and the processing efficiency theory (Eysenck & Calvo, 1992) the following hypotheses were formulated.

H_1 – Participants performing in the internal-process condition under stress will perform significantly worse in comparison to the baseline measure.

H_2 – Participants performing in the external-holistic condition under stress will perform to a similar level in comparison to the baseline measure.

H_3 – Participants performing in the arbitrary-random letter generation condition under stress will perform to a similar level in comparison to the baseline measure.

H_4 – Participants will invest significantly greater mental effort in all 3 experimental conditions in comparison to the baseline measure.

H_5 – Participants will spend significantly greater time-on-task in all 3 experimental conditions in comparison to the baseline measure.

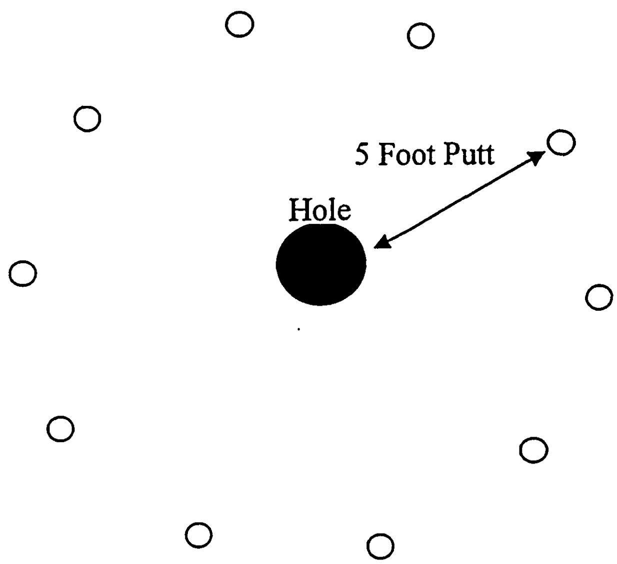
6.21. Participants

With institutional ethics approval, 12 (mean age = 27.8; range = 19-41 years) experienced (playing experience ranged from 7-26 years) male golfers possessing a handicap of 15 or less (Handicap - M = 9.83; SD = 4.53; range = 4-15) participated in this study. Three golfing professionals independently agreed that handicappers of 15 or less would have well established putting skills. Mullen and Hardy (2000) used less experienced golfers with a handicap of 18 or less who were assumed to possess automatic putting skills. Participation in the study was voluntary. Informed consent was sought from participants before data collection; confidentiality and anonymity was guaranteed.

6.22. Experimental Task

A laboratory-based golf putting task was used for this study. The putting surface was flat, with no undulation around the putting area and was composed of 'astro-turf' (short tufted, artificial green grass). Participants used their own putter throughout the experiment. Standardised white Pinnacle golf balls were provided (4.27 cm in diameter). The hole was a standard size of 10.8 cm in diameter. Ten golf balls were placed 5 feet away from the hole (see Figure 6.1.). Bawden, Maynard, Graydon and Chell (1999) found putts of between 3 and 4 feet to be a prime distance for this skill to fail under pressure. However, rigorous pilot testing suggested that 5 foot putts were more appropriate to prevent a ceiling effect in laboratory based conditions. Skilled golfers would expect to hole such a putt and failing to do so would intensify pressure when faced with a similar situation (Masters, 1992; McDaniel et. al., 1989). The rationale for using a golf putting task was two fold: first, this task enabled the qualitative golf data in study one to be expanded by using a quantitative group-based design. Second, severe performance loss is arguably more prevalent in golf putting than any of the other sports used in study one.

Figure 6.1. The Adapted Golf Putting Task Format



6.23. Measures

6.231. Reinvestment. The Reinvestment Scale (Masters et al., 1993) (see Appendix 6) was administered to assess to what extent the participants were predisposed to conscious processing under stress. For details of the Reinvestment Scale see Section 4.231 (study 2).

6.232. Competitive State Anxiety. The modified Competitive State Anxiety Inventory - 2 (CSAI-2; Swain & Jones, 1992) was used throughout this study (see Appendix 8). Participants were required to complete the modified CSAI-2 immediately prior to the baseline measure and 3 experimental conditions. This served primarily as a stress manipulation check. This scale comprises three subscales; cognitive anxiety, somatic anxiety and self-confidence. The inventory comprises 27 items, with nine items in each subscale. Each participant rated the intensity with which each symptom was being experienced on a scale anchored by 1 (not at all) and 4 (very much so). Scores on each subscale ranged from 9 to 36. Internal consistency (cronbach coefficient alpha) ranged from 0.79 to 0.90 (Martens et al., 1990). Swain and Jones' (1992) directional subscales were also used in the assessment. For the directional scale each symptom was rated on a scale ranging from -3 (very debilitative) to +3 (very facilitative). Direction scores ranged form -27 to + 27. Internal reliability has been reported with a coefficient of 0.89 for cognitive anxiety and 0.81 for somatic anxiety (Swain & Jones, 1996).

6.233. Mental Effort. The Mental Effort Scale (MES; Zijlstra, 1993) was used throughout this study (see Appendix 9). Participants were required to complete the MES immediately after the baseline measure and 3 experimental conditions. This unidimensional scale provides a retrospective measure of invested effort into the execution of a predetermined task. The scale is presented as a vertical axis with a range from 0 to 150. There are three verbal anchors on the right-hand side of the scale corresponding to 0 (not at all effortful), 75 (moderately effortful) and 150 (very effortful). Individuals are required to mark a point on the scale that represents the effort they have invested in the task. This scale has reliability across a range of laboratory and real-life settings (r = 0.88 in the laboratory and r = 0.78 in work settings). The MES has also been shown to correlate strongly with validated psychophysiological measures of mental load (e.g. spectral variations in heart period variability; Zijlstra, 1993).

6.234. Time-on-task. The total time taken for participants to complete each set of 10 trials in the baseline measure and the 3 experimental conditions were recorded in seconds (secs.). An overall average was found for completing the task in the baseline measure and the 3 experimental conditions. Time-on task was measured from addressing the first ball to striking the last ball for each set of 10 trials.

6.235. Social Validation interviews. Conscious processing has predominantly been assumed in the literature from outcome based measures (Hardy et al, 1996; Masters, 1992; Masters et al., 1993). Thus, to establish a richer understanding of the influence of the three experimental conditions in relation to performance semi-structured social validation interviews (see Appendix 13) were conducted (Bennett, 2000; Kazdin, 1992). Further these interviews were also used to ascertain the thoughts, feelings, emotions and focus of participants prior to, and during performance.

6.24. Procedure

Twelve participants were selected from a pool of 256 experienced golfers who had completed the Reinvestment Scale (Masters et al., 1993). Scores ranged from a low of 1 to a high of 17 (M = 8.03, SD = 3.80). In accordance with Masters' et al. (1993) protocol twelve participants scoring greater than 1 SD above the mean were selected for this experiment (M+SD = 14.22; 1.48; range = 13-17). All other participants were omitted. Informed consent was sought from participants before data collection.

6.241. Experimental Conditions. This study included 3 conditions, other than the baseline condition, each requiring a different focus and demand on working memory. These were an 'internal-process focus' (I-P) condition, an 'external-holistic focus' (E-H) condition and an 'arbitrary-random letter generation focus' (A-RLG) condition.

6.242. Internal-Process Focus. In this condition participants were required to focus on internal aspects relating to explicit components of their putting performance. By promoting an internal focus whereby participants focused on explicit task knowledge, it was expected that this process would lead to conscious processing and automaticity disruption (Masters et al., 1993). Participants were instructed to focus on specific coaching points in the 3 stroke phases prior to each putt (e.g. Back Swing Phase - rotate the hands backwards, transferred weight on to the back foot; Contact Phase - head still at ball impact; Follow-through Phase – rotate the hands forward, transfer weight onto the front foot) (see Appendix 11).

6.243. External-Holistic Focus. In this condition participants adopt an external-effects related focus associated with performance outcome (e.g. ball trajectory, direction and velocity). It was expected that this focus would discourage an internal movement-based focus and thus, promote a holistic, automatic movement response by allowing self-organisation processes to implicitly regulate performance (Al-Abood et al., 2002, Wulf, McNevin, & Shea, 2001). Participants in this study were instructed to focus their attention towards the ball, its intended direction, speed and outcome. Specifically, they were asked to see the line and speed of each putt and its ideal destination prior to each putt (see Appendix 11).

6.244. Arbitrary-Random Letter Generation Focus. In this condition participants were required to carry out a secondary task to suppress any explicit task knowledge being available to working memory whilst executing the putting task. By occupying the central executive of the working memory system, it was expected that conscious processing would be prevented. In accordance with Baddeley's (1966) random letter generation task participants in this study were required to call out a random letter every 1.5 seconds (see also Hardy, Mullen, & Jones, 1996; Masters, 1992) to the click of a metronome. It was made salient to participants that they must continue to generate letters throughout the putting task. In addition, participants were instructed to give priority to the randomness of the letters generated (see Appendix 11).

Participants were instructed to incorporate the prescribed focus of each condition into their regular putting routine during the practice phase. This was to keep the test phase consistent with the baseline measure. Before each condition it was highlighted to all participants the importance of adhering to the specific instructions of each condition, regardless of how it affected their performance. Adherence to each condition was evaluated through the semi-structured interviews. After each set of 10 trials participants were asked to reiterate their focus for each condition, respectively. This was to ensure that participants were continuing to use the prescribed focus, along side their regular putting routine.

6.245. Baseline Measure. At the outset of this study participants were required to complete 30 putts to gain a baseline measure of putting performance. The first 10 were used as practice putts. No stress manipulations were administered. Participants were instructed to hole as many putts as possible.

6.25. Practice Phase

In this phase participants were required to complete 30 practice putts in each of the 3 conditions. Stress was not manipulated. This was to familiarise participants with each of the 3 prescribed foci. Participants were instructed to hole as many putts as possible using the specified focus.

6.26. Test Phase

In the test phase participants were required to perform all 3 experimental conditions in a high stress environment. Each condition comprised 20 trials. Participants completed the experiment on the same day. Two hours was allowed to elapse between each condition. This was to control for any potential crossover effect between the different foci strategies used in each condition. To counteract any biasing effect participants were divided into subgroups to form a randomised-counterbalanced design for the three conditions. Each practice phase for the respective conditions was immediately followed by the test phase.

6.27. Stress Manipulation

Several techniques were used to create stress. Participants in each of the three sub-groups, in accordance with the randomised-counterbalanced format, were required to be present to evaluate each other's performance during each experimental condition (cf. Hardy, Jones, & Gould, 1996). Firstly, participants were told that the purpose of the task was to analyse different attentional foci on individual putting techniques, in relation to accuracy. A confederate was introduced to the participants as a 'professional golf coach'. This technique was used to heighten participants' awareness that they were being evaluated (Baumeister, 1984, Masters, 1992). The coach explained that participants would be assessed on their putting technique, accuracy and ability to adhere to the specific prescribed focus. In addition, a camera was used to heighten the evaluative process. Participants were informed that the video footage would be used to further analyse their overall performance by the university's biomechanists.

Secondly, a negative scoring system was used. Participants were told that they would receive one point for holing a putt and minus one point for missing a putt, further point deductions would be made for missing additional putts required to complete the task. The experimenter verbalised the score after each putt. This technique was used to give participants the impression that they were performing to a lower level than they actually were. These deductions were not used in the statistical analysis.

Finally, a competitive element was used. Participants were told that they would be placed in rank order in accordance with their overall performance. It was further stated that a ranking list would be distributed to all participants for them to confirm their positioning in respect to other competitors.

Participants were instructed that they would have to hole any missed putts at the end of each 10 trials. This was to prevent participants simplifying the task by striking the ball at an unrealistic pace to hole putts and to promote greater ecological validity. Balls that were found to be in the line of subsequent putts were marked, removed and replaced for putting completion at the end of the 10 trials. The marking process did not inhibit the continuity of the participants' performance. The additional time taken to complete the task and the additional performance score were omitted from the statistical analysis. At the end of the experiment, when all data had been collected, participants were debriefed and thanked for their involvement.

6.28. Data Analysis

To examine the robustness of internal, external and arbitrary foci tested under stress in participants' dispositionally high in reinvestment a series of one-way analyses of variance with repeated measures (ANOVA) were calculated on the putting scores, mental effort and time-on-task, respectively. Separate one-way analyses of variance were calculated on each of the three intensity and direction sub-scales of the modified CSAI-2 for each experimental condition. Specific differences were established using pairwise comparisons. The bonferroni technique was used to control for potential Type I errors. Normality of distributions, homogeneity of variances and sphericity were confirmed (see Appendix 19 for statistical output).

6.3 RESULTS

6.31. Anxiety Data (Modified CSAI-2)

Anxiety as indicated by the means and standard deviations for the intensity and direction scores is presented in Table 6.1 for the baseline measure and each experimental condition. Analysis of the modified CSAI-2 data indicated that stress was successfully manipulated in this study. A series of one-way analysis of variance with repeated measures were carried out on the intensity and direction of the three components of the modified CSAI-2. Assumptions for sphericity were met.

6.311. Somatic Anxiety. There was a significant main effect for the intensity scale for somatic anxiety ($F_{(3, 33)} = 7.40$, $P < .01$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated significantly greater levels of reported somatic anxiety in the 3 experimental conditions in comparison to the baseline measure. There was a significant main effect for the direction scale for somatic anxiety ($F_{(3, 33)} = 18.41$, $P < .01$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated somatic anxiety to be significantly more debilitative in the 3 experimental conditions in comparison to the baseline measure.

Table 6.1. CSAI-2 Intensity and Direction Scores for the Baseline Measure and Three Experimental Conditions. Values are Means (M) ± Standard Deviations (SD)

	Somatic Anxiety				Cognitive Anxiety				Self-Confidence			
	Intensity		Direction		Intensity		Direction		Intensity		Direction	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Baseline	17.17	3.24	3.08	6.49	16.83	4.15	2.42	7.08	23.50	4.70	4.67	8.22
I-P	22.83*	3.95	-4.25*	9.01	23.33*	2.35	-3.75*	6.97	20.42	4.87	2.58	8.39
E-H	22.58*	5.95	-5.25*	9.11	23.08*	3.50	-4.92*	7.46	20.58	5.02	2.50	10.04
A-RLG	24.33*	6.61	-6.50*	10.06	25.50*	4.10	-7.75*	10.52	17.17*	4.97	-4.58*	12.40

* = < 0.05 compared with Baseline

I-P = Internal-Process Condition

E-H = External-Holistic Condition

A-RLG = Arbitrary-Random Letter Generation Condition

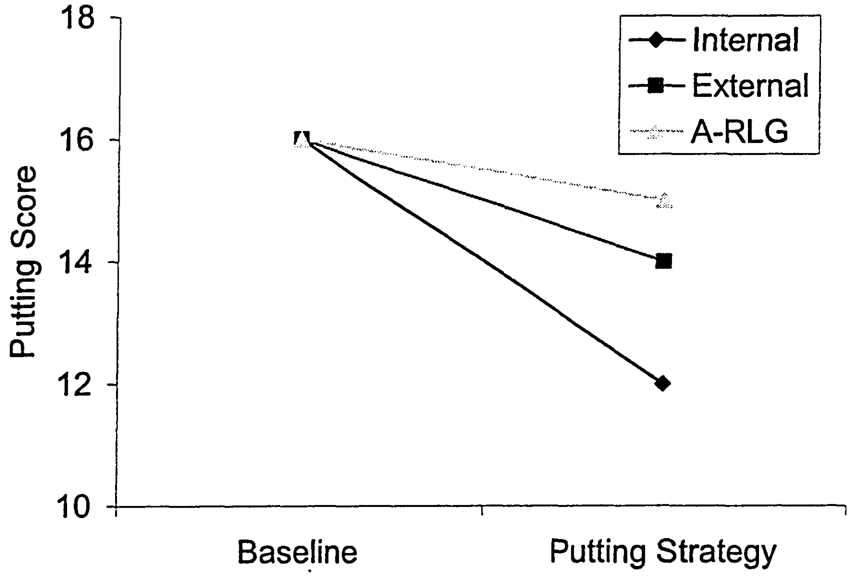
6.312. Cognitive Anxiety. There was a significant main effect for the intensity scale for cognitive anxiety ($F_{(3, 33)} = 28.09$, $P < .001$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated significantly greater levels of reported cognitive anxiety in the 3 experimental conditions in comparison to the baseline measure. There was a significant main effect for the direction scale for cognitive anxiety ($F_{(3,33)} = 16.47$, $P < .001$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated cognitive anxiety to be significantly more debilitative in the 3 experimental conditions in comparison to the baseline measure.

6.313. Self-Confidence. There was a significant main effect for the intensity scale for self-confidence ($F_{(3, 33)} = 9.30$, $P < .001$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated significantly lower levels of reported self-confidence in the arbitrary-random letter generation condition than in the baseline measure. There was a significant main effect for the direction scale for self-confidence ($F_{(3,33)} = 7.59$, $P < .001$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated self-confidence to be significantly more negative to performance in the arbitrary-random letter generation condition than in the baseline measure.

6.32. Putting Performance

The means for putting scores for the baseline measure and 3 experimental conditions are presented in Figure 6.2. A one-way analysis of variance with repeated measures was carried out on the putting scores for the baseline measure and 3 experimental conditions, respectively. Assumptions for sphericity were met. There was a significant main effect for putting scores ($F_{(3,33)} = 13.60$, $P < .001$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated that participants performed significantly worse in the internal-process condition in comparison to the baseline measure. In addition, participants performed significantly worse in the external-holistic condition in comparison to the baseline measure. Participants also performed significantly worse in the internal-process condition in comparison to the arbitrary-random letter generation condition.

Figure 6.2. Putting Scores in the Baseline Measure and Three Experimental Conditions. Values are Means (M)



6.33. Mental Effort

The means and standard deviations for the mental effort baseline measure and 3 experimental conditions are presented in Table 6.3. A one-way analysis of variance with repeated measures was carried out on the effort scores for the baseline measure and 3 experimental conditions. Assumptions for sphericity were met. There was a significant main effect for effort ($F_{(3, 33)} = 25.55$, $P < .001$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated that participants reported significantly greater effort in all 3 experimental conditions in comparison to the baseline measure. In addition, participants reported significantly greater levels of effort in both the internal-process ($P = .006$) and arbitrary-random letter generation ($P = .021$) conditions than in the external-holistic condition.

6.34. Time-on-Task

The means and standard deviations (secs.) for time-on-task baseline measure and 3 experimental conditions are presented in Table 6.4. A one-way analysis of variance with repeated measures was carried out on the mean time-on-task data for the baseline measure and 3 experimental conditions. Assumptions for sphericity were met. There was a significant main effect for time-on-task ($F_{(3, 33)} = 15.19$, $P < .001$). Follow-up pairwise comparisons corrected using the bonferroni technique indicated that participants spent significantly greater time-on-task in the internal-process and external-holistic conditions in comparison to the baseline measure. In addition, participants spent significantly more time-on-task in the internal-process condition than in the arbitrary-random letter generation condition ($P = .000$).

6.35. Social Validation Data

The aims of the semi-structured interviews were three fold. First was to assess participants' adherence to each experimental foci. Second was to derive a richer understand of the effects of the different attentional foci on performance. Third was to examine the participants' feelings, thoughts and emotions during each condition. The interviews took place after completing each condition. The data were divided into five sections: baseline,

Table 6.2. Mental Effort Baseline Measure and Three Experimental Conditions. Values are Means (M) ± Standard Deviations (SD)

Baseline		I-P		E-H		A-RLG	
M	SD	M	SD	M	SD	M	SD
102.08	18.15	132.08*+	8.38	114.58*	17.38	131.67* +	10.94

* = < 0.05 compared with Baseline

+ = < 0.05 compared with E-H

I-P = Internal-Process Condition

E-H = External-Holistic Condition

A-RLG = Arbitrary-Random Letter Generation Condition

Table 6.3. Time-on-Task Baseline Measure and the Three Experimental Conditions. Values are Means (M) ± Standard Deviations (SD) (secs.)

Baseline		I-P		E-H		A-RLG	
M	SD	M	SD	M	SD	M	SD
98.96	13.32	130.93*+	19.29	127.79*	12.45	100.96	26.71

* = < 0.001 compared with Baseline

+ = < 0.0001 compared with A-RLG

I-P = Internal-Process Condition

E-H = External-Holistic Condition

A-RLG = Arbitrary-Random Letter Generation Condition

internal-process, external-holistic, arbitrary-random letter generation and general characteristics. Each section produced common themes within the data.

6.351. Baseline Phase. Three common themes were elicited from the interviews. These were feeling relaxed, self-expectation and pressure. During the baseline measure the most commonly cited characteristics were feelings of being relaxed with the nature of the putting task. One participant stated "I felt relaxed, I always do when there's no pressure on". Participants commonly reported that they would expect to successfully hole a 5 foot putt. However, one participant stated that 5 foot was "certainly a distance where a shot could be dropped". Although participants commonly reported being at ease with the task during the baseline measure, two participants reported feeling some increase in the importance to perform well. One participant stated "I felt some pressure in the fact that I wanted to hole every putt and generate a good score". This is indicative of high reinvesters who, regardless of pressure, still always want to give a good account of themselves and hence invest a considerable amount of mental effort into the task (Masters, 1993).

6.352. Internal-Process Focus. Four common themes were elicited from the interviews. These were focus adherence, normal focus / compensatory strategies, cognitive responses and the loss of sensation / rhythm. Participants commonly reported being able to adhere to the specific foci stipulated for this condition. However, 3 participants reported attempting to revert back to their normal focus when things started to go wrong. Be that as it may, their normal focus still directed attention towards explicit task information, which compounded the problem.

Five participants reported the internal-process condition to be similar to their normal focus when playing golf. Four of these participants also admitted to being over analytical and consequently inconsistent when putting. Three participants reported this focus to be in antithesis to their normal attentional style. One participated stated "thinking about the technique is the worst thing I can do, I started to think I'm going to pull this one to the left and I did every time". Another stated "normally, I stand there and just do it". Two participants reported stating "I preferred the technical focus, think you've got to have technique." And "It's something I know I need to do when I'm putting (focus on technical aspects), whereas normally I don't really think about it a great deal".

The most common cognitive characteristics were thinking too much, negative thoughts / self-consciousness and mental effort. Three participants reported 'thinking too much', in particular about the technical aspects of putting. One participant stated "Thinking too much about the technique, you know wrist over the ball, head still and all that, getting the ball in the hole becomes a problem". Five participants reported becoming more aware of their negative feelings and thoughts and the fact that others were watching, particularly when performance started to deteriorate. One participant stated "I started to think, you could end up with a negative score here and that started to eat away at me". Another stated "I felt tense and aware of what I was doing". Another participant stated "I was thinking about missing it (the putt) and how far it's going to go past for when I'm putting back – it's the wrong focus". One participant started to focus more on the outcome, stating "Because it was competition I started to think about my score more".

Two participants reported the internal-process focus to require high mental effort. One participant stated "It took a lot of effort (the internal-process focus) – I normally feel rather than think". "I started to put more effort into putts following a miss, than the putts after I'd holed" another stated. This supports Masters (1992) belief that automatic skills are not meant to be effortful and explicit, but rather effortless and implicit. Three participants reported a loss of sensation / rhythm during their putting stroke. One participant stated "I had no feeling of the putt". Another stated "You know when your putter has gone back too far, but it's too late you've lost your rhythm". The themes generated from this interview data are in-line with the main characteristics reported in study one by athletes who had experienced a severe loss to their performance during competition.

<u>6.353. External-Holistic Focus.</u> Three common themes were elicited from the interviews. These were focus adherence, normal focus, and cognitive responses. Seven participants reported being able to adhere to the specific foci stipulated for this condition. Five participants reported, at times, reverting back to an explicit based focus, particularly after missing putts. One participant did state "once I had gone through the process of watching the ball go in the hole, I found it really difficult then not to focus on a couple of swing thoughts". Four participants reported the external-holistic focus to be similar to their normal mode of focus. Participants making statements like "It's important to picture the

direction of the ball" typified this. "It was a natural reaction, keeping a straight line and just putting the ball, no thought of stance or head, I found that easy" and "It's what I feel most comfortable with, it's where my strengths lie". In contrast, one participant stated "focusing on the direction of the ball is all very well, but if you haven't got the technique it's not going to go in the hole".

The most common cognitive characteristics were mental effort and negative thoughts. Six participants reported investing the majority of their effort into seeing the correct line and destination of the putts rather than the process of putting itself. One participant stated "I normally stand there and just do it rather than thinking about it, coz if I think I put too much effort into it and make a right hash of it". Seven participants reported experiencing negative thoughts, in particular in between seeing the line and destination of the putt and actually striking the ball. One participant stated "when I missed a few, you know the negatives start to creep in". This suggests at times some participants invested additional effort into worrying about their performance (Eysenck & Calvo, 1992).

6.354. Arbitrary-Random Letter Generation. Four common themes were elicited from the interviews. These were focus adherence, cognitive responses, loss of sensation and rhythm / automaticity. Participants commonly reported being able to adhere to the specific foci stipulated for this condition. The most common cognitive characteristics were effort, non-awareness, negative thoughts / over-analysis prevention. All participants reported investing a high amount of effort into this condition. Moreover, participants reported investing this effort predominantly into the randomness of the letters they generated rather than the putting itself. In addition, participants commonly reported finding the task mentally tiring. Participants also commonly reported having no awareness of anything outside the process of generating random letters. Eight participants reported not even knowing their score at the end of the test phase. Four participants were not even aware of aiming the ball at the hole or as to whether each putt had gone in the hole or not. Seven participants reported the secondary task to prevent any negative thoughts or over-analysis occurring. One participant stated "It stops you thinking negatively and getting over analytical or thinking about the previous putt, you couldn't do both at the same time – you just get on and putt". Another stated "any negative thoughts or distractions were masked by the random letter generation". In contrast, one participant stated "it (secondary task) was too distracting".

Participants commonly made reference to the impact that the secondary task had on rhythm and automaticity of their putting stroke. One participant stated "I could get into a rhythm with the metronome – it helps you get in your zone". Another stated "I could not focus at all on the line or putting technique it was just habit, that was walking up and bum, bum, bum like a machine gun – I was just focused on the randomness of the letters". "I definitely didn't concentrate as hard on the putting – it became something I just did. I almost wasn't bothered what result I got" another participant stated. These statements suggest that the secondary task not only helped to promote rhythm and automaticity, but also helped participants to become desensitised to the negative effects of stress. Finally, two participants reported having no feeling at all during this condition.

6.355. General Characteristics. Three common themes were elicited throughout the series of interviews, which relate to general characteristics of the participants. These were an inability to deal with pressure, self-consciousness, and high expectation / competitiveness.

Five participants reported an inability to perform when the pressure was really on. One participant stated "the difference is pressure – there are those who can handle it and those that can't, I think I'm one that just bottles it". Another stated "I felt under pressure, I'm not very good under pressure – found it difficult to relax". Four participants reported being self-conscious and in particular concerned what others thought of them. One participant stated "I find it hard when people are watching, I hate the first tee coz you've always got people watching you – it's a distraction". Finally, six participants reported having high expectations and / or being extremely competitive. One participant stated "I think I could have done better, having said that even if I had got 10 out of 10 I would have still thought I could have done better, that' just the way I am. I'm very competitive in sport and every day life as well". Another stated "I know it's only a game, but you always want to win". The themes within this data offer additional support for the successful manipulation of stress in this study.

6.4 DISCUSSION

The main aim of this study was to examine different attentional foci on skilled golfers, high in reinvestment to establish whether severe performance loss could be prevented under stress. All participants completed the modified CSAI-2 (Swain & Jones, 1992) prior to carrying out the baseline measure and each experimental condition. The CSAI-2 primarily served as a stress manipulation check, whilst also examining the participants' levels and interpretations of anxiety prior to performance. Participants reported their perceptions of cognitive and somatic anxiety to be significantly greater and more debilitative to performance in the three experimental conditions in comparison to the baseline measure. These findings suggest that the stress manipulation was successful. No significant differences in cognitive or somatic anxiety for intensity or direction were found between the three experimental conditions. This suggests that additional factors were responsible for lack of consistency in putting performance between the three conditions.

In the social validation interviews participants reported experiencing negative thoughts in the internal-process and external-holistic conditions particularly when performance started to deteriorate. Skilled golfers would expect to hole such putts and failing to do might have intensified pressure when faced with a similar situation (Masters, 1992; McDaniel et. al., 1989). This suggests that anxiety might have been heightened during performance, particularly, subsequent to putts being missed, which would not have been assessed by the modified CSAI-2.

Hypothesis one, which stated that participants would experience a significant deterioration in performance when adopting the internal-process focus in comparison to the baseline measure, was supported. Individuals high in reinvestment are predisposed to conscious processing, which can disrupt automaticity under stress (Masters et al. 1993). By adopting an internal focus, performance can be impaired as this prevents self-organisation processes implicitly regulating task performance (Wulf, McNevin, & Shea 2001). The findings of the present study support the conscious processing hypothesis (Masters et al., 1993) and the constrained-action hypothesis (Wulf, McNevin, & Shea, 2001). It was proposed that the internal-process focus served as an additional catalyst for promoting conscious processing, compounded by the negative affects of stress, in individuals with a propensity to this phenomenon.

Hypothesis two, which stated that participants would perform to a similar standard when adopting the external-holistic focus in comparison to the baseline measure, was not supported. In the present study participants performed significantly worse in the external-holistic condition than in the baseline measure. These results were not supportive of Wulf, McNevin, and Shea (2001) who found an extemal-effects related focus to facilitate performance, via automatic systems unconstrained by conscious control. However, Wulf et al. (2001) neither manipulated stress nor dispositional reinvestment.

The main objective of the external-holistic focus was to discourage an explicit task focus and direct attentional resources (plus additional effort elicited from anxiety) into systems that promote automaticity. The results suggest that this did not happen and periods of conscious processing still occurred. In the social validation interviews participants commonly reported having explicit task thoughts (e.g. "swing thoughts"), particularly after missing putts. This might have intensified pressure when participants were faced with the next putt (Masters, 1992; McDaniel et. al., 1989). In addition, participants commonly reported experiencing negative thoughts in between seeing the correct direction and destination of each putt, and striking the ball. This supports Oldham’s (2001) contention, which suggested that anxiety can result in a desire to tell oneself what to do. This process is exacerbated in those predisposed to reinvestment through the rehearsal of explicit task knowledge (Maxwell et al., 2000). It was speculated that participants were able to channel their attention towards automatic, implicit processing systems during successful spells in performance (Wulf, McNevin, & Shea, 2001). This was supported by the social validation interviews. However, this focus was unable to prevent participants, under stress, from experiencing some negative thoughts and accessing their explicit knowledge base during critical times throughout the task, in particular after missing putts. Consequently, this led to periods of internalisation and episodes of conscious processing.

A limitation of the external-holistic condition is that participants might have imaged the direction, speed and destination of some putts internally, which might have encouraged a movement dynamic (internal) rather than a movement effects related focus. Weinberg and

Gould (1995) stated that 'internal imagery makes it easies to bring in the kinesthetic sense, feel of movement, and approximate performance skills. For example using an internal imagery perspective a golfer might become more aware of how their body feels and looks during their swing' (p.287). Thus, perhaps conscious processing, at times, might have been heightened in skilled golfers under stress by the use of an internal imagery perspective. Clearly, future research needs to control for the utilization of imagery perspectives, which might inadvertently encourage rather than discourage an internal focus of attention in high reinvesters under stress.

Hypothesis three, which stated that participants would perform to a similar level when adopting the arbitrary-random letter generation condition in comparison to the baseline measure, was supported. In addition, participants performed significantly better in the arbitrary-random letter generation condition than in the internal-process condition. In the social validation interviews participants commonly reported having no awareness of their putting action or in some cases even the outcome in the random letter generation condition. Further, participants commonly reported the secondary task to prevent them thinking negatively or becoming over analytical. Mullen and Hardy (2000) found that performance decrements were prevented when participants generated random letters under stress. Similar results were found in the present study with the addition of using participants predisposed to conscious processing. In the social validation interviews participants commonly reported concentrating less on putting and more on generating random letters. Consequently, putting became 'something they (the participants) just did'. This suggests that participants high in reinvestment became desensitized to state anxiety and stress (e.g. self-regulated verbal distractions and conscious processing), which supports the contention of Hardy, Mullen, and Jones (1996). It was proposed that participants in the arbitrary-random letter generation condition were prevented from processing explicit task knowledge and self-regulated verbal distractions, owing to the demands imposed on working memory by the secondary task. This promoted automaticity and enabled skilled golfers, high in reinvestment, to sustain a consistent level of performance under stress.

Of particular interest was that participants reported their self-confidence levels to be significantly lower, which they perceived to be more negative to performance in the arbitrary-random letter generation condition in comparison to the baseline measure. In the social validation interviews participants reported this focus to be completely new and alien to them in relation to their usual routines and focus, which could explain this finding. This indicates that participants might have benefited from additional practice using this focus. Hardy, Mullen, and Jones (1996) suggested that a random letter generation task enabled participants to become desensitized to the potential negative effects of state anxiety. Presumably, therefore such participants also became desensitized to the potential positive effects of self-confidence. Thus, it was proposed that self-confidence was not an influential factor during this condition owing to the interference with the operation of the central executive, which prevented participants having any recourse to their feelings, thoughts or emotions. No significant differences in self-confidence for intensity or direction were found between the internal-process or external-holistic conditions in comparison to the baseline measure. However, trends were in the expected direction. Similar to anxiety, self-confidence might also have fluctuated when performing in either the internal-process or external holistic conditions particularly when performance started to deteriorate.

A further aim of this study was to assess the predictions that participants would invest greater mental effort (Eysenck & Calvo, 1992) and spend greater time-on-task under stress (Masters, 1992) as a function of heightened anxiety. This additional effort was expected to facilitate or debilitate performance depending upon where this additional effort was invested (Eysenck & Calvo, 1992). Mullen and Hardy (2000) proposed that increases in effort as a function of anxiety could maintain or even improve performance provided it's directed towards promoting automatic processing systems. However, reinvestment was not measured in these studies.

Hypothesis four, which stated that participants would invest significantly greater mental effort in all three experimental conditions in comparison to the baseline measure, was supported. Interestingly, participants reported investing a similar amount of effort in the internal-holistic condition in comparison to the arbitrary-random letter generation condition. When in the internal-process condition, participants commonly reported directing their effort into "thinking too much about the technical aspects of putting". It was proposed that additional effort invested into adopting this focus exacerbated the deautomatisation process and promoted inconsistent performance, in high reinvesters, under stress (Eysenck & Calvo, 1992; Masters et al., 1993).

In contrast, when in the arbitrary-random letter generation condition participants commonly reported directing their effort into generating random letters, to the point where one individual stated "It (putting) became something I just did". Study one called for compensatory strategies, during the loss of form, which promoted automaticity rather than disrupted it. It was proposed that additional effort invested into prioritising the generation of random letters was a strategy that promoted automaticity and consistent performance, in individuals predisposed to conscious processing, under stress. Although it would appear that investing additional effort into the secondary task was a successful compensatory strategy, this would have almost certainly been at the expense of processing efficiency (Eysenck & Calvo, 1992). This was due to loading heavily on working memory via the secondary task, not skill execution. Mullen and Hardy (2000) suggested that additional effort as a function of anxiety was required for participants to cope with the demands of the secondary task and successful skill execution under stress. This suggests that in the present study additional attentional resources were essential for high reinvesters to maintain performance in comparison to the baseline measure.

During the external-holistic condition participants reported investing significantly less effort into the task than the other two conditions under stress. It could be contended that that at times participants did successfully adopt an external focus as this has been reported to discourage conscious processing and thus minimise the demands imposed on working memory (Maxwell et al., 2001;2002; Wulf, McNevin, & Shea, 2001). However, it would appear that this focus was unable to prevent high reinvesters from periodically investing effort into accessing explicit task knowledge and negative thoughts during performance. It was proposed that this condition periodically encourage participants to invest effort into motor systems that more naturally self-organise unconstrained by conscious control, which promoted automaticity. Be that as it may, this was not enough to discourage bouts of conscious processing (particularly after missing putts) and prevent performance decrements in conditions open to negative appraisal.

Hypothesis five, which stated that participants would spend significantly greater time-on-task in all three experimental conditions in comparison to the baseline measure, was only partial supported. In the present study participants spent significantly more time-on-task in the internal-process and external-holistic conditions in comparison to the baseline measure. It was proposed that in the internal-process condition participants used this additional time to focus on explicit task knowledge, which increase the demands imposed on working memory whilst exacerbating the deautomatisation problem. Similarly, but to a lesser extent, in the external-holistic condition it was speculated that participants used some of this additional time to focus on explicit task knowledge (particularly after missing putts), in between the preparation and execution of putts. During other periods it would appear that time was spent focusing externally, which minimised conscious processing and working memory load thus promoting episodes of automaticity. These findings were supported by the social validation data.

Interestingly, participants spent a similar amount of time-on-task in the arbitrary-random letter generation condition (M = 98.96) in comparison to the baseline measure (M = 100.96). It can be inferred that participants in this condition were not able to access explicit task knowledge or process negative cognitions, which can take up additional time and resources when performing (Masters, 1992). It was proposed that the secondary task in this condition served two purposes. Firstly, it enabled participants to become desensitised to stress. And secondly, it promoted automaticity during task execution, which encouraged participants to spend less time-on-task.

Of further interest was that some participants in the practical assessment interviews reported experiencing a loss of sensation in their putting stroke both in the internal-process and arbitrary-random letter generation condition. In the internal-process condition one participant stated "I couldn't feel the putt". This offers support for study one of this thesis in that processing explicit task knowledge disrupts the natural flow of performance to the point where individuals can lose that all important 'feeling' associated with correct skill execution. Athletes in study one commonly reported a loss of sensation as a consequence of severe performance loss. Such athletes reported using compensatory strategies to recreate the correct sensation, which directed greater effort and attention towards the task rules and thus, continued to impair performance. However, participants in the arbitrary-random letter generation condition might have experienced a perceived loss of sensation, simply because the demands placed on working memory prevented them from processing this information. Similarly, it could be that no performance decrement took place, as participants were unable to direct attention towards recreating the correct sensation, which might involve the processing of explicit task knowledge (see Section 3.4 - study one).

In summary, manipulation of attentional foci under stress can influence putting performance in high reinvesters. The internal-process focus encouraged high reinvesters to execute the putting task via conscious processing. This disrupted automaticity and impaired performance under stress (Masters et al., 1993). The external-holistic focus encouraged high reinvesters to execute the task via automaticity. However, participants still lapsed into bouts of conscious processing, particularly after missing putts, which impaired performance under stress. Finally, the arbitrary-random letter generation condition desensitised high reinvesters to stress. By taking up working memory this prevented conscious processing and promoted automaticity. This enabled participants to perform to their usual standard when under stress.

This study found that interfering with the operation of the central executive, severe performance loss under stress could be avoided in skilled golfers, high in reinvestment. However, there are two main limitations of the random letter generation task used in the present study that might prevent this strategy being used as an applied intervention for skilled golfers. Firstly, participants commonly reported the metronome to facilitate the rhythm of their putting action. It is not known whether it was the sound of the metronome, the generation of random letters or the combination of both that helped participants maintain performance under stress. Furthermore, verbalising random letters to the sound of a metronome might not be a practical strategy in a golfing environment. Secondly, golfers performing on a course are still required to consciously process critical environmental cues (e.g. green undulation) to ensure the correct direction and destination of each putt prior to execution. These limitations prevent the present findings being extrapolated into the world of golf or indeed, other sports. Clearly, future research needs to identify an intervention strategy that can be practically applied to sport, which reduces access to explicit task knowledge, whilst still enabling environmental cues to be processed.

CHAPTER VII

7. 0. STUDY 5. DISPOSITIONAL REINVESTMENT AND STRESS IN SKILLED GOLFERS: A PSYCHOLOGICAL PUTTING INTERVENTION

7.1 INTRODUCTION

This thesis has identified psychological mechanisms that could underpin severe performance loss in competitive sport. Further, this research has established factors that could influence intervention strategies for individuals predisposed to this problem. Study four found that, in a stressful environment, skilled golfers high in reinvestment maintained performance in a secondary task loading condition. It was proposed that the secondary task (Baddelely, 1966) prevented explicit task knowledge and self-regulated verbal distractions being processed thus, enabling desensitization to the negative effects of state anxiety (Hardy, Mullen, & Jones, 1996; Mullen & Hardy, 2000). This promoted implicit, automatic regulation of putting execution, which in turn, enabled skilled golfers, high in reinvestment to maintain performance under stress.

Limitations from study 4 question the ecological validity of using a random letter generation task. Shouting out random letters to the sound of a metronome is not practical whilst playing competitive golf. Nor is it functional in allowing critical environmental cues (e.g. green speed / undulation) to be processed whilst putting. Further, it was not known what effect the metronome had on performance. Finally, study 4 was conducted in a laboratory environment. Hence, the purpose of the present study was to establish a practical and functional psychological intervention for skilled golfers predisposed to conscious processing and automaticity disruption under stress in an ecologically valid environment.

Findings from study 4 indicated that participants became desensitized to the negative effects of stress (Mullen & Hardy, 2000), which could have simplified the nature of the task. It was the perceived negative evaluation by others that is coupled with the missing of a 5 foot putt that made the task demanding for skilled golfers, high in reinvestment, rather than the putt per sa. However, golfers in the preceding study were not required to process critical environmental cues, which is an essential part of putting whilst playing golf.

Therefore, it is not known whether the random letter generation task would inhibit the execution of a more complex putting task where golfers would have to make decisions in relation to the correct direction, speed and destination for each putt.

Study 4 used an external-holistic focus in an attempt to prevent conscious processing and promote automaticity. This focus was unable to prevent skilled golfers (high in reinvestment), from experiencing some negative thoughts and at times processing explicit knowledge during putting execution, which led to a decrement in performance under stress. However, this focus did enable golfers to process external information (e.g. direction, speed and destination) prior to each putt. It was proposed that an external-holistic focus (decision making phase) combined with secondary task load (execution phase) would enable environmental cues to be processed prior to putting, whilst preventing conscious processing during putting. In addition, it was also proposed that the use of external imagery during the decision making phase of the intervention might also help promote an external focus and thus, prevent an internal, process focus.

The random letter generation task has been used in laboratory-based skill acquisition (Hardy et al., 1996; MacMahon & Masters, 2002; Masters, 1992; Maxwell, 2000) and one performance study (Mullen & Hardy, 2000) to suppress the development and processing of explicit knowledge. However, no research has attempted to adapt the random letter generation task as part of a putting intervention for skilled golfers predisposed to conscious processing, in an ecologically valid environment. Likewise, current research has not incorporated a decision making phase to enable golfers to process environmental cues prior to putting in an ecologically valid environment.

The present study sought to establish whether a psychological putting intervention could help promote automaticity and maintain the performance of skilled golfers predisposed to conscious processing under stress. An aim of the present study was to establish a two-phase putting intervention. It was proposed that the decision making phase (phase 1) would enable golfers to focus externally on processing critical environmental cues prior to putting. It was also proposed that introducing a secondary task load (a random letter generation task) during the putting execution phase (phase 2) would prevent conscious processing and promote automaticity.

The modified CSAI-2 (Swain & Jones, 1992) was used as a stress manipulation check, whilst also examining the golfers' levels and interpretations of anxiety prior to performance. Mental effort (Zijlstra, 1993) and time-on-task (secs.) were also measured to explore the conflicting predictions of the processing efficiency theory (Eysenck & Calvo, 1992) and the conscious processing hypothesis (Masters, 1992) in accordance with directing increased effort to performance as a result of heighten anxiety. A single subject replication-reversal (ABAC) design was considered the most beneficial for this study as it controlled for the monitoring of reversals in behaviour (Kazdin, 1992).

The following research hypotheses were formulated:

H_1 - Golfers will experience a decrement in putting performance in a stress condition without the use of a psychological intervention (phase B).

H_2 - Golfers using the two-phase psychological intervention will be able to maintain their putting score in a stress experimental condition (phase C).

7.2. METHOD

7.21. Participants

With institutional ethics approval, three (mean age = 30; range = 20-42 years) experienced (competitive experience - range 5-18 years) male golfers, high in reinvestment, possessing a handicap of 10 or less (mean handicap = 7; range = 2-10) participated in this study. It was a requisite of this study that participants possessed a well-learned, automatic putting stroke. Three golfing professionals independently agreed that handicappers of 15 or less would have well established putting skills (Mullen & Hardy (2000) used less experienced golfers with a handicap of 18 or less who were assumed to possess automatic putting skills). Participation in the study was voluntary. Informed consent was sought from participants before data collection; confidentiality and anonymity was guaranteed.

7.22. Experimental Task

A golf putting task was used for this study. The putting surface used was a practice green located at the Hallamshire Golf Club (Sheffield, UK.). Participants were required to use their own putter throughout the experiment. Standardised white pinnacle golf balls were provided (4.27 cm in diameter). The holes were all a standard size of 10.8 cm in diameter. The practice green consisted of 10 holes. Ten balls were placed around the green; each ball related to a specific hole. The 10 balls were placed a distance of 5 feet away from each hole. To prevent participants from establishing a learning effect that could occur by continually putting from the same position two additional procedures were incorporated. Firstly, the balls were placed in one of five predetermined positions, within a lateral range of 2' feet, for each set of 10 trials. Secondly, for every other set of 10 trials throughout the study participants were required to complete the series of putts in reverse order. Both the predetermined position and reverse order of each set of 10 trials was identical for each participant and each experimental phase. This and the undulating nature of the green ensured that participants had to make a decision about the correct direction, speed and destination of each putt. The number of putts holed during each experimental phase measured golf putting performance. Each experimental phase consisted of four sets of 50 putts over a duration of two weeks. Prior to completing each set of 50 trials participants were permitted 10 habituation trials. These habituation trials were placed in predetermined positions, which differed from those used for the experimental task. Participants were required to perform a total of 1000 putts, on twenty occasions (10 x 50 putts) throughout the ten week of this study. The rationale for using a golf putting task was two fold: first, this task enabled the findings of study four to be expanded by using a single-subject replication-reversal design. Second, the lack of ecological validity of the putting task used in study four could be rectified.

7.23. Measures

7.231. Reinvestment. The Reinvestment Scale (Masters et al., 1993) (see Appendix 6) was administered to assess to what extent the participants were predisposed to conscious processing under stress. For details of the Reinvestment Scale see Section 4.231 (study 2).

7.232. Competitive State Anxiety. The modified Competitive State Anxiety Inventory – 2 (CSAI-2; Swain & Jones, 1992) was used throughout this study (see Appendix 8). Participants were required to complete the modified CSAI-2 immediately prior to each phase of the experiment, with the exception of the intervention phase. The modified CSAI-2 served as a stress manipulation check. This inventory was also used to assess whether the two-phase putting intervention influenced perceived state anxiety and self-confidence levels prior to performance under stress. For details of the modified CSAI-2 see Section 6.232 (study 4).

7.233. Mental Effort. The Mental Effort Scale (MES; Zijlstra, 1993) was used throughout this study (see Appendix 9). Participants were required to complete the scale immediately after each phase of the experiment. For details on the Mental Effort Scale see Section 6.234 (study 4).

7.234. Time-On-Task. The total time taken for participants to complete the initial 10 trials for each set of 50 putts, in each experimental phase was recorded in seconds (s). A mean average for time-on-task was identified in the initial 10 trials of each set of 50 putts, for each experimental phase. Study four found that participants spent 'too much time thinking' about each putt, which resulted in indecisive and ambivalent decision making. Golfers were asked to keep their analysis-time consistent for each putt.

7.235. Imagery. The revised version of the Movement Imagery Questionnaire (MIQ-R; Hall & Martin, 1997) was used to assess the participants' visual and kinesthetic imagery ability (see Appendix 10). The MSQ-R is a shortned version of the Movement Imagery Questionnaire (Hall & Pongrac, 1983). This eight item inventory assesses visual and kinesthetic imagery ability on a 7-point Likert scale, anchored by 1 (very hard to see or feel) and 7 (very easy to see or feel). Participants are provided with descriptions of specific actions that they perform, then image, and then rate themselves on their imaging ability. A sample item from the MSQ-R is as follows: *Starting position:* Stand with your feet slightly apart and your hands at your side. *Action:* Bend down low and then jump straight up in the air as high as possible with both arms extended above your head. Land with your feet apart and lower your arms to your sides. *Mental task:* Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease or difficulty with which you were able to do this mental task (Hall & Martin, 1997). The MIQ factorial integrity has been supported (Atienza, Balaguer & Garcia-Merita, 1994). The MIQ-R has indicated high correlations with the MIQ for both the visual (r = -.77) and kinesthetic (r = -.77) scales (Hall & Martin, 1997). The MIQ-R is scored in the opposite direction to the MIQ, which is reflected in the negative correlations. These high correlations indicate convergent validity between the already validated MIQ and the MIQ-R. It was considered, in accordance with Hall and Martin (1997) that participants scoring 16 or more on the visual and kinesthetic subscales of the MIQ-R were proficient at using imagery and therefore, did not require formal imagery training during the intervention phase.

7.236. Social Validation Interviews. Conscious processing has, predominantly been assumed in the literature from outcome based measures (Hardy et al, 1996; Masters, 1992; Masters et al., 1993). Thus, to establish a richer understanding of the intervention effectiveness social validation interviews (see Appendix 16) were conducted after the second stress phase (phase C) of this study (Bennett, 2000). For questions 1, 3, 7, 8, and 9 participants were asked to provide a score from a 7-point Likert scale, anchored by 1 (not at all) and 7 (very much so).

7.24. Experimental Design

A single subject A1, B, A2 and C research design (Kazdin, 1992) was used to investigate the effects of a psychological intervention strategy upon experienced golfers who were predisposed to severe performance loss, precipitated by conscious processing under stress. This design ensured that the stress manipulation was sufficient to induce a substantial decrement in performance prior to introducing the intervention strategy. Before introducing the initial stress phase a stable putting performance baseline was established for each golfer (Kazdin, 1992). The initial baseline (A1) was examined over four sets of 50 trials (200 putts), which were conducted on four occasions over a two week period. Subsequent to establishing a stable baseline the first stress phase (B) was introduced. The second baseline (A2) was then introduced, followed by the intervention phase. Finally, the second stress phase was introduced (C). In accordance with Kazdin (1992) all phases of this study comprised equal putting trials (4 x 50 trials) and time frames (2 week). The present study lasted a total of ten weeks. Rigorous pilot testing suggested that participants required 200 trials to produce a stable baseline and adapt to the invention strategy. Pilot testing also indicated that participants became more confident in using the random letter generation task whilst putting, after a practice phase of 200 putts. The rationale for using 200 trials in each experimental phase was based on the findings from the pilot testing.

7.25. Treatment : The Psychological Intervention

The psychological intervention for the present study consisted of two phases: a decision making phase and an execution phase. The intervention was administered to all participants subsequent to the completion of the second baseline phase. The intervention was administered and developed over a period of two weeks. All participants were required to complete 4 sets of 50 trials on four separate occasions. This phase took place on a different practice green from the one used for the experimental task to control for participants getting used to the undulation of the green. The trials were set at a predetermined distance of between 4 and 6 feet away from the hole to control for participants practicing the putting distance used in the experimental task. Participants were asked not to practice the intervention or experimental task at any other time throughout the duration of the experiment.

7.251. Decision-Making Phase of Each Putt. The primary aim of this phase was to promote an external focus whilst enabling participants to process critical environmental cues, in a holistic manner, to help prevent over-analysis prior to putting. During the decision-making phase of the intervention participants were required to image the correct direction, speed and destination prior to the execution of each putt. This phase was similar to the external-holistic foci used in study four. In an attempt to control for limitations of study four golfers were required to follow an imagery script (see Appendix 14), which was specifically developed to help keep them externally focused during this phase. In addition, to encourage golfers to image, externally during the decision making phase, they were required to watch a two minute video of a golf professional putting[10]. Golfers were then encouraged to image the correct direction, speed and destination of each putt as though they were watching themselves on a television screen. Golfers were required to watch the video after every 20 putts to help sustain an external imagery perspective. Golfers were also encouraged to keep their analysis-time consistent for each putt. If participants were unsure of the correct line, speed and destination of a certain putt they were encouraged to stop, walk away and start their routine again.

7.252. Execution Phase of Each Putt. During the execution phase participants were required to complete the random letter generation task (Baddeley, 1966). Immediately after completing the decision-making phase participants were required to start generating random letters. This was the cue for participants to address the ball and 'just putt'. Participants were required to stop generating random letters after striking the ball for each putt. Participants were instructed to prioritize the randomness of the letters generated. In the first set of trials participants were required to execute 50 putts whilst verbalising letters out loud to the sound of a metronome every 1.5 seconds. During the second set of 50 putts participants were required to execute each putt whilst generating random letters without the sound of the metronome. In the third set of trials participants were required to execute the first 25 putts following the same format used for the previous set of trials. In the final 25 putts of the third set of trials participants were required to execute each putt whilst generating random letters internally every 1.5 seconds. For the internal putting phase one trial in every set of ten putts was randomly chosen. During this trial participants were required to generate random letters verbally. This was used to check that participants were continuing to use the random letter generation task under non-verbal conditions. In the fourth set of trials participants were required to follow the same format used for the final fifty putts of the previous set of trails. In addition, during this set of putts participants were required to hole out each putt using the same intervention strategy. Participants were asked not to practice the intervention strategy or play any additional golf during this time.

[10] The rational for using a video of a golf professional putting rather than the participants themselves was that a video recorder would have to be present in order to gain footage. A video camera was used as a stressor in phase 1 and 2 of the competition. Thus, it was felt that using a video camera whilst leaning the putting intervention might confound the results in the second stress condition.

7.26. Procedure

Three golfers were selected from a pool of 256 experienced golfers who had completed the Reinvestment Scale (Masters et al., 1993) for study 4 of this thesis. None of the golfers selected for this study had been involved in any previous research. In accordance with Masters et al.'s (1993) protocol 3 participants scoring greater than 1 SD above the mean were selected for this experiment (mean = 14.3; range = 14-15). All other participants were omitted.

7.261. Phase A1. In the initial baseline phase participants were required to hole as many putts as possible (200 trials). Stress was kept to a minimum. This phase was completed independently of the other participants; the experimenter was the only other person present. To keep the baseline phase consistent with the stress phase participants were required to hole any missed putts, at the end of each set of ten trials. This was to prevent participants simplifying the task by striking the ball at an unrealistic pace to hole putts. The additional time taken to complete the task and the additional performance score were omitted from the statistical analysis.

7.262. Phase B. In the initial stress phase several techniques were used to create a stressful environment. All participants were required to be present to evaluate each other's performance during this phase (cf. Hardy, Jones, & Gould, 1996). Firstly, participants were told that the purpose of this phase of the experiment was to analyse individual putting techniques in relation to accuracy. A confederate was introduced to the participants as a 'professional golf coach'. This technique was used to heighten participants' awareness that they were being evaluated (Baumeister, 1984; Masters, 1992). The coach reiterated that participants would be assessed on their putting technique and accuracy. In addition, a camera was used to heighten the evaluative process. Participants were informed that the video footage would be used by the University's biomechanists (who was also present) to further analyse their overall performance.

Secondly, a negative scoring system was used. Participants were told that they would receive one point for holing a putt and minus one point for missing a putt, further point deductions would be made for missing additional putts required to complete the task. The experimenter verbalised the score after each putt. This technique was used to give participants the impression that they were performing to a lower level than they actually were. These deductions were not used for analysis.

Thirdly a competitive element was used. Participants were told that the winner of the competition would be awarded £50. Participants were also told that they would be placed in rank order in accordance with their overall performance. It was further stated that a ranking list, displaying their results would be distributed to all participants for them to confirm their positioning in respect of other competitors.

Finally, an additional evaluation element was used. Participants were told that following the recent success of the European 'Ryder Cup' team the BBC was producing a documentary entitled 'Putting on the Pressure'. Participants were informed that as part of the documentary the University had been contacted in relation to the sport science support that they were providing for the members of the English Golf Union (EGU). It was explained to participants that the BBC were also interested in using footage from the cutting edge golf research that was currently being conducted through the University. Hence, footage from the experiment might be incorporated into the documentary, which was due to be broadcast in January 2005. A confederate, possessing as a cameraman was introduced as an employee of the subsidiary broadcasting company Meridian. The confederate used an authentic professional television camera and equipment to record phase one and two of the competition.

Several measures were taken to promote an ecological valid environment. Firstly, participants were required to hole any missed putts. This was to prevent participants simplifying the task by striking the ball at an unrealistic pace to hole putts. The additional time taken to complete the task and the additional performance score were omitted from the statistical analysis. Secondly, participants played one hole at a time in accordance with golf etiquette. Thus, the winner of each hole had the honor of going first on the subsequent hole (followed by the participant who achieved the next lowest score). During each hole participants were required to play in sequence. The participant furthest away from the hole was required to play their next shot. The exception to this strategy was the first 10 putts for each set of 50 trails, which were executed individually so that an average measure of time-on-task could be established.

7.263. Phase A2. The second baseline phase was identical to the initial baseline measure. This ensured that participants returned back to their original performance level after the stress phase. On completion of this phase the psychological intervention was introduced.

7.264. Phase C. Stress manipulation was identical to that of Phase B of the study. Participants were required to use the psychological strategy developed during the intervention phase. At the end of the experiment, when all data had been collected, participants were debriefed and thanked for their involvement.

7.3 RESULTS

7.31. Pre-Experimental Measures

The scores from the Reinvestment Scale and the MIQ-R are presented in Table 7.1. The scores from the Reinvestment Scale indicate that all three participants were high in reinvestment based on the criteria from the preceding study. The scores from the MIQ-R indicate that all three participants met the imagery proficiency level (16 or more on the visual and kinesthetic subscales) stipulated by Hall and Martin (1997). Therefore, participants did not receive formal imagery training during the intervention phase of this study.

7.32. Anxiety Data (Modified CSAI-2)

The Modified CSAI-2 intensity and directional scores for somatic anxiety, cognitive anxiety and self-confidence are presented in Table 7.2 and 7.3 respectively. The modified CSAI-2 was predominantly used as a stress manipulation check. A comparison of anxiety responses was made between the four phases of the study.

Table 7.1. Scores for the Reinvestment Scale and Movement Imagery Questionnaire - Revised

	Reinvestment Scale	Movement Imagery Questionnaire – Revised	
		Visual	Kinesthetic
Participant 1	15	24	24
Participant 2	14	20	22
Participant 3	14	20	21

Table 7.2. Modified CSAI-2 Intensity Scores for Somatic Anxiety, Cognitive Anxiety and Self-Confidence

	A1			B			A2			C		
Participants	Som	Cog	S-C	Som	Cog	S-C	Som	Cog	S-C	Som	Cog	S-C
1	10	10	36	18	19	18	10	9	36	20	19	21
2	16	15	24	25	23	16	12	15	26	25	19	20
3	15	17	28	24	25	13	16	14	28	26	23	14

Key

Som – Somatic Anxiety (intensity)
Cog – Cognitive Anxiety (intensity)
S-C – Self-Confidence (intensity)

A1 = Phase one – The initial baseline measure
B = Phase two – The initial stress condition
A2 = Phase three – The second baseline measure
C = Phase four – The two-phase putting strategy condition

Table 7.3. Modified CSAI-2 Direction Scores for Somatic Anxiety, Cognitive Anxiety and Self-Confidence

	A1			B			A2			C		
Participants	Som	Cog	S-C	Som	Cog	S-C	Som	Cog	S-C	Som	Cog	S-C
1	27	27	27	-1	-2	3	27	27	27	-2	-1	9
2	2	1	14	-9	-9	1	3	2	15	-9	-11	7
3	12	10	17	-3	-3	1	12	10	15	-5	-5	-1

<u>Key</u>

Som – Somatic Anxiety (direction)
Cog – Cognitive Anxiety (direction)
S-C – Self-Confidence (direction)

A1 = Phase one – The initial baseline measure
B = Phase two – The initial stress condition
A2 = Phase three – The second baseline measure
C = Phase four – The two-phase putting strategy condition

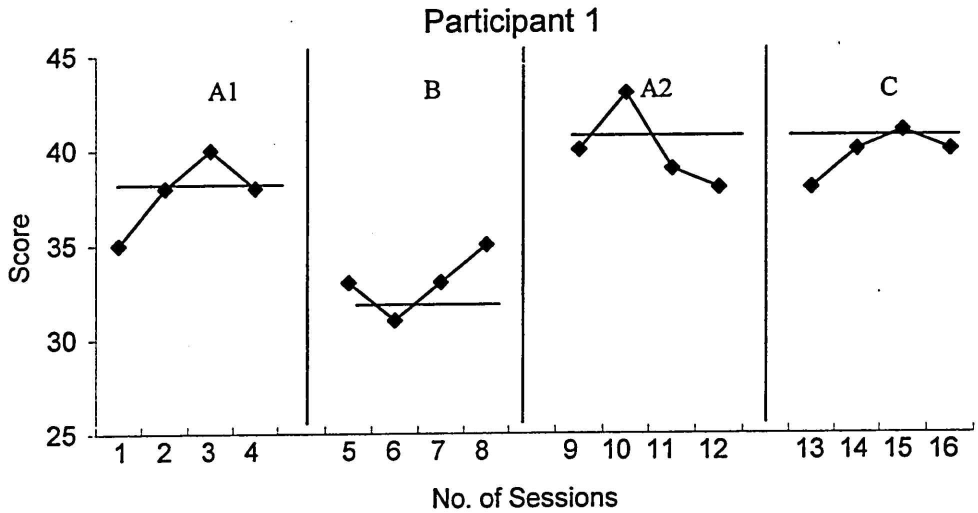
7.321. Somatic Anxiety. Participant 1 reported greater intensity scores for somatic anxiety in the initial stress (18) and treatment (20) conditions in comparison to the initial baseline (10) and second baseline (10) conditions. The directional scores for participant 1 reported somatic anxiety to be largely more debilitative to performance in the initial stress (-1) and treatment (-2) conditions in comparison to the initial baseline (27) and second baseline (27) conditions. Participant 2 also reported greater intensity scores for somatic anxiety in the initial stress (25) and treatment (25) conditions in comparison to the initial baseline (16) and second baseline (12) conditions. The directional scores for participant 2 indicated somatic anxiety to be more debilitative to performance in the initial stress (-9) and treatment (-9) conditions in comparison to the initial baseline (2) and second baseline (3) conditions. Similarly, participant 3 reported greater intensity scores for somatic anxiety in the initial stress (24) and treatment (26) conditions in comparison to the initial baseline (15) and second baseline (16) conditions. The directional scores for participant 3 indicated somatic anxiety to be more debilitative to performance in the initial stress (-3) and treatment (-5) conditions in comparison to the initial baseline (12) and second baseline (12) conditions. The intensity and directional scores for somatic anxiety suggest that stress was successfully manipulated in this study.

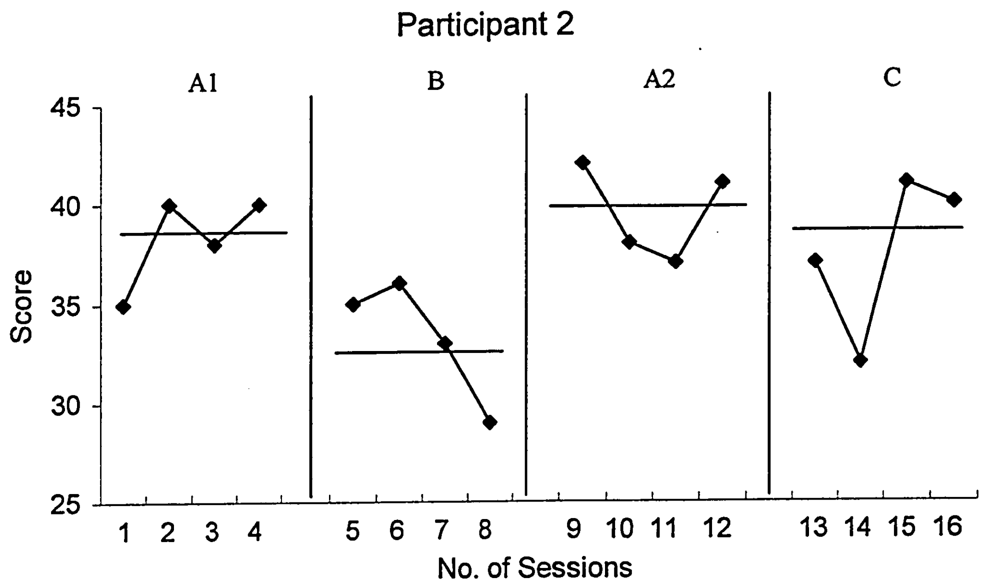
7.322. Cognitive Anxiety. Participant 1 reported greater intensity scores for cognitive anxiety in the initial stress (19) and treatment (19) conditions in comparison to the initial baseline (10) and second baseline (9) conditions. The directional scores for participant 1 reported cognitive anxiety to be largely more debilitative to performance in the initial stress (-2) and treatment (-1) conditions in comparison to the initial baseline (27) and second baseline (27) conditions. Participant 2 also reported greater intensity scores for cognitive anxiety in the initial stress (23) and treatment (19) conditions in comparison to the initial baseline (15) and second baseline (15) conditions. The directional scores for participant 2 indicated cognitive anxiety to be more debilitative to performance in the initial stress (-9) and treatment (-11) conditions in comparison to the initial baseline (1) and second baseline (2) conditions. Similarly, participant 3 reported greater intensity scores for cognitive anxiety in the initial stress (25) and treatment (23) conditions in comparison to the initial baseline (17) and second baseline (14) conditions. The directional scores for participant 3 indicated cognitive anxiety to be more debilitative to performance in the initial stress (-3) and treatment (-5) conditions in comparison to the initial baseline (10) and second baseline (10) conditions. The intensity and directional scores for somatic and cognitive anxiety in phase one and two of the competition suggest that stress was successfully manipulated in this study.

7.323. Self-confidence. Participant 1 reported lower intensity scores for self-confidence in the initial stress (18) and treatment (21) conditions in comparison to the initial baseline (36) and second baseline (36) conditions. The directional scores for participant 1 reported self-confidence to be largely more debilitative to performance in the initial stress (3) and treatment (9) conditions in comparison to the initial baseline (27) and second baseline (27) conditions. In addition, participant 1 reported higher levels of self-confidence to be more facilitative to performance in the treatment condition in comparison to the initial stress condition. Participant 2 also reported lower intensity scores for self-confidence in the initial stress (16) and treatment (20) conditions in comparison to the initial baseline (24) and second baseline (26) conditions. The directional scores for participant 2 indicated self-confidence to be more debilitative to performance in the initial stress (1) and treatment (7) conditions in comparison to the initial baseline (14) and second baseline (15) conditions. In addition, participant 2 reported higher levels of self-confidence to be more facilitative to performance in the treatment condition in comparison to the initial stress condition. Participant 3 reported lower intensity scores for self-confidence in the initial stress (13) and treatment (14) conditions in comparison to the initial baseline (28) and second baseline (28) conditions. The directional scores for participant 3 indicated self-confidence to be more debilitative to performance in the initial stress (1) and treatment (-1) conditions in comparison to the initial baseline (17) and second baseline (15) conditions.

7.33. Putting Performance Data

The putting performance scores for each participant are presented in Figure 7.1 and Table 7.4. Each participant indicated an increase in performance in the second stress condition in comparison to the initial stress condition. Further, each participant demonstrated an increase in performance in the second stress condition in comparison to the initial baseline measure. In addition, each participant performed to a similar level in the second stress condition in comparison to the second baseline measure. Participant three performed consistently better in the second stress condition than in any other phase of the experiment.


Participant 1
A1
B
A2
C
Score
45
40
35
30
25
1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 16
No. of Sessions


Participant 2
A1
B
A2
C
Score
45
40
35
30
25
1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 16
No. of Sessions

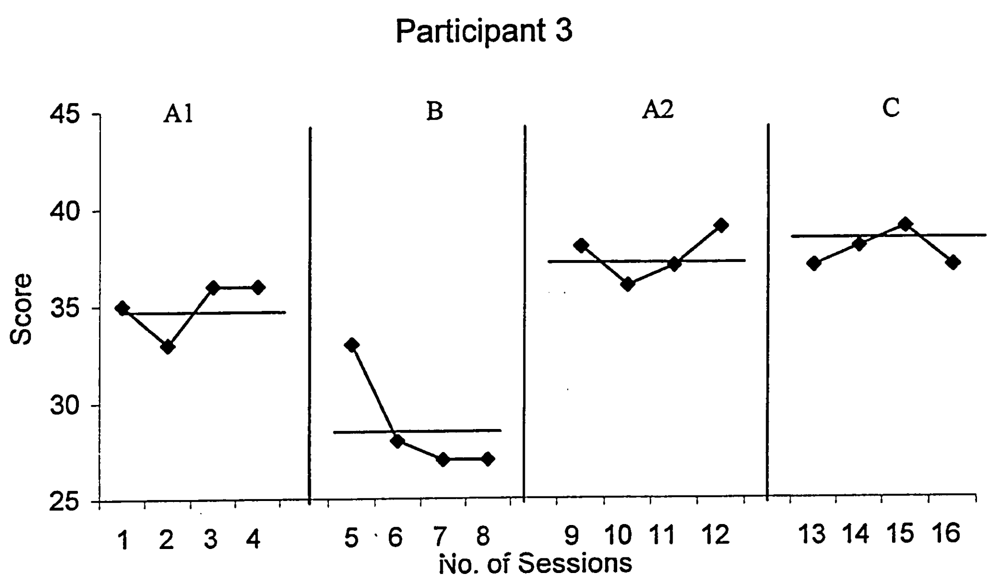

Participant 3
A1
B
A2
C
Score
45
40
35
30
25
1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 16
No. of Sessions

Table 7.4. Golf-Putting Scores at each Experimental Phase of the Study. Values are Means (M) ± Standard Deviations (SD)

	A1		B		A2		C	
Participants	M	SD	M	SD	M	SD	M	SD
1	37.75	2.06	33.0	1.63	40.0	2.16	39.75	1.26
2	38.25	2.36	33.5	3.87	39.5	2.38	37.5	4.04
3	35.0	1.41	28.75	2.87	37.5	1.29	38.25	1.71

<u>Key</u>

A1 = Phase one – The initial baseline measure
B = Phase two – The initial stress condition
A2 = Phase three – The second baseline measure
C = Phase four – The two-phase putting strategy condition

Participant 1 improved from a mean score of 33.0 during the initial stress condition to a score of 39.75 in the treatment condition. The putting scores of participant 2 also improved from a mean score of 33.5 in the initial stress condition to a score of 37.5 in the treatment condition. Similarly, participant 3 improved performance from a mean score of 28.75 in the initial stress condition to 38.25 in the treatment condition. These findings suggest that the two-phase putting intervention consistently improved performance. Further, it can be inferred that the intervention prevented golfers high in reinvestment from consciously processing explicit task knowledge and thus, experiencing severe performance loss under stress.

7.35. Mental Effort Data

The mental effort scores for each participant are presented in Table 7.5. Each participant reported a large decrease in mental effort in the second stress condition in comparison to the initial stress condition. Further, each participant reported greater mental effort in the initial stress phase than any other phase of this study. Participant 1 reported a decrease in mental effort from a mean score of 120 during the initial stress condition to a score of 50 in the treatment condition. The mental effort scores of participant 2 also decreased from a mean score of 140 in the initial stress condition to a score of 90 in the treatment condition. Similarly, participant 3 reported a decrease in mental effort from a mean score of 140 in the initial stress condition to 30 in the treatment condition. These findings suggest that the two-phase putting intervention consistently reduced mental effort taken to perform the putting task under stress. It can be inferred that mental effort was taken up by generating random letters rather than the explicit putting knowledge, which high reinvesters are susceptible to processing under stress. Thus, suggesting that putting became secondary to generating random letters, which might have promoted automaticity during the task. Finally, all participants invested greater mental effort into putting in the two baseline measures in comparison to the second stress condition. This suggests that the participants still invested considerable resources into putting, which might have detracted away from automatic performance, under low stress conditions.

Table 7.5. Mental Effort Scores at each Experimental Phase of the Study. Values are Means (M)

Participants	A1 M	B M	A2 M	C M
1	100	120	90	50
2	140	140	140	90
3	130	140	90	30

Key

A1 = Phase one – The initial baseline measure
B = Phase two – The initial stress condition
A2 = Phase three – The second baseline measure
C = Phase four – The stress intervention condition

Table 7.6. Time-on-Task (secs.) for the First Ten Putts, for each Set of 50 Trials at each Experimental Phase of the Study. Values are Means (M) ± Standard Deviations (SD)

	A1		B		A2		C	
Participants	M	SD	M	SD	M	SD	M	SD
1	120	8.29	211	11.22	168	9.00	197	5.48
2	253	21.21	286	30.77	249	15.25	262	8.66
3	187	12.69	205	15.26	158	9.64	143	4.03

Key

A1 = Phase one – The initial baseline measure
B = Phase two – The initial stress condition
A2 = Phase three – The second baseline measure
C = Phase four – The stress intervention condition

7.36. Time-On-Task Data

Time-on-task for each participant is presented in Table 7.6. Each participant spent less time-on-task in the second stress condition in comparison to the initial stress condition. Participant 1 spent more-time-on-task indicated by an average time of 211 s. during the initial stress condition in comparison to a time of 197 s. in the treatment condition. Participant 2 also spent more-time-on-task indicated by an average time of 286 s. during the initial stress condition in comparison to a time of 262 s. in the treatment condition. Similarly, participant 3 spent more-time-on-task indicated by an average time of 205 s. during the initial stress condition in comparison to a time of 143 s. in the treatment condition. These findings suggest that the two-phase putting intervention consistently reduced time spent executing the putting task under stress. However, participant 1 and 2 still spent more time-on-task in the treatment conditions than the two baseline conditions. In contract, participant 3 spent less time-on-task in the treatment condition than the two baseline conditions.

7.37. Social Validation Data

At the end of the study social validation interviews were conducted independently with each participant. The questions addressed to participants in the interviews served to establish a richer understanding of the intervention effectiveness, whilst assessing their feelings, thoughts and emotions throughout the study. Each participant was asked a series of 10 questions. Participants were also asked to provide a score for questions 1, 3, 7, 8 and 9 (relating to the treatment condition) from a 7-point Likert scale, anchored by 1 (not at all) and 7 (very much so). Social validation scores for these questions are presented in Table 7.7.

7.371. Participant 1. In the initial stress phase participant one stated "as you get better and as you start playing more your expectations obviously go up, so, therefore, you start looking at it (the putt) more from different angles, or different ways. At the professional level it's serious stuff where they take ages looking at everything (e.g. line, speed and destination of putts)...I think the competition made me look at putts

Table 7.7. Score for Questions 1, 3, 7, 8 and 9 of the Social Validation Data for the Treatment Condition

Practical Assessment Questions	Participant 1	Participant 2	Participant 3
Qu. 1. Were you able to use the two-phase putting strategy consistently throughout the task?	6	4	6
Qu. 3. Are you able to recall the putts you holed and missed?	7	6	6
Qu. 7. Did you find the two-phase putting strategy positive or negative?	7	6	7
Qu. 8. Would you feel confident using this strategy during competition?	7	6	7
Qu. 9. How smooth did your putting stroke feel?	7	5	7

more…sometimes I stood over putts and, you know, I had two or three possible lines in my head, I couldn't decide. Then you miss and get even more tentative. Whereas, in the second stress phase participant one stated "the strategy (two-phase putting intervention) was very basic, but good, because it helped keep things very simple. You can't question things when you're over the putt, coz, well you're too busy thinking of letters. In the decision-making phase I found it easy to line putts up, but having that sort of out-of-body experience, seeing yourself putting (external imagery), I didn't like that. The second phase though (random letter generation), that helped me to stay positive, it meant I had to choose one line and just go with it, coz you know you have to, you can't do both (e.g. think of several lines and generate random letters)". In addition, participant one suggested replacing the first phase of the two-phase putting strategy with random letters when faced with short putts. He stated "you see a putt and it's there, you don't need a lot of thought about it, but I end up thinking too much and talk myself out of it. The random letters will help me to see the putt and have a go at it".

7.372. Participant 2. In the initial stress phase participant two stated "I spend too much time thinking about it (the putt)…I stood over the ball and started dithering and thinking…I started to pull, push, tweak and actually play the ball…when you square the club up you start thinking is it square, I might need to…should I…do I need to…all sorts of things…and you know that with a 5 footer your club needs to go back 3"…it's after a couple of bad shots, because I've spent so long on the set-up, I commit then think I need to do more – every golfer will say the same, they tweak, it's human nature, it's competition and you want to do the best. One thing I do have is a photographic memory for golf, I can recall every bad shot I've ever played and from what position. I think that's the down fall for me, I do that in putting and then I start tweaking it. It's that couple of seconds before you strike the putt, that's when things go wrong". Whereas, in the second stress condition participant two stated "After about 4 or 5 putts (in the second set of 50 trials) I was doing really well, then I missed a couple and started tweaking instead of just accepting it…Whether it was the edge of competition – do you stick with what you know or do you use something that's new…slightly didn't get into the groove at the start – it's purely because I'd reverted back to my old style of putting, I started questioning myself and I suffered. I realized I was going wrong and went back to generating random letters. Once I started generating random letters again I holed putts. I am going to use that (the random letter generation task), I think it's great. It's all about commitment (referring to making a decision on the line of the putt), you need that distraction (random letters) to enable you to go with that line and prevent the tweaking. I need something to distract me as soon as I've picked the line of the ball. I'm going to use that (two-phase putting strategy) not only with my putting, but with my irons and with my driver".

7.373. Participant 3. In the initial stress phase participant three stated "I spent a lot of time looking and thinking about it (putts), too many thoughts in my head. I spent a lot of time watching everyone else's line and putts". Whereas in the second stress phase participant three stated "I was a lot more confident than in the first competition phase...I was looking at a quick line and then just hitting it (the ball). I thought a lot less than I did several weeks ago (initial stress phase). I wasn't watching everyone else's line. I was focused on myself. Once I had decided on a line and speed I started the second phase of the putting strategy (random letters). In the decision making phase there was not much change to my normal routine. In the execution phase I felt like a metronome, just up, over it, practice swing and go. I didn't even bother watching the ball to the hole, just stayed focused on the letters. I wasn't aware of anything when I was standing over the ball, you don't have to think how smoothly the club is going through the ball that just seems to come. In the first competition phase I was having two or three bad putts every ten holes. I only had one during the whole of the second phase, so a massive improvement...best it's been for a long time, in fact I don't remember it being better. The reason for that is I spent less time thinking about it (putting) and it made me feel more confident". It was a lot better than a few weeks ago (initial stress phase) because you know I was trying too hard, I got behind and then you try even harder and I was watching everybody's putt and everybody's line, trying to get back and they were sinking theirs (putts) and I'd still got to take mine, but in the second competition phase I felt confident in my putting stroke".

In response to the social validation procedure all the participants stated that both competition phases were very important to them, that the treatment facilitated their performance, in particular the random letter generation task. Further, all the participants stated that they would feel confident in using the two-phase putting strategy in a normal competitive environment.

7.4 DISCUSSION

The aim of this study was to examine whether a two-phase psychological putting intervention could promote automaticity and, in turn, enhance the performance of skilled golfers, in an ecologically valid environment, who were susceptible to severe performance loss under stress. The scores from the modified CSAI-2 (Swain & Jones, 1992) indicated that stress was manipulated as all three participants reported higher intensity levels of somatic and cognitive anxiety and that this anxiety was more debilitative in phases one and two of the competition, in comparison to the two baseline conditions.

Hypothesis one, which stated that golfers would experience a decrement in putting performance under stress without the use of a psychological intervention, was supported (phase B). Golfers high in reinvestment are predisposed to conscious processing, which can disrupt automaticity under stress (Masters et al. 1993). This was supported by the social validation interviews which indicted that all three participants were consistently over analytical (thinking too much about putts), questioning of their decision making (e.g. negative and apprehensive) and preoccupied with making changes to their putting stroke during the initial stress phase. The findings of the present study support the conscious processing hypothesis (Masters et al., 1993) and the constrained-action hypothesis (Wulf et al., 2002). It was proposed that all three participants adopted an internal, movement-related focus (Wulf et al., 2000) during their performance in the initial stress phase. This focus increased the demands on working memory through the processing of explicit task knowledge and thus disrupted the implicit, automatic regulation of the skill and ultimately impaired performance.

Hypothesis two, which stated golfers using the two-phase psychological intervention would be able to maintain their putting score in a stress experimental condition (phase C) was supported. In the social validation interviews all three participants reported thinking less in both the decision making and execution phase of each putt, in comparison to the initial stress condition. They also reported feeling positive and self-confident in their decision making and fluid in their putting stroke. Further, they indicated having little or no awareness of their putting action during execution.

The problem, particularly for skilled golfers, high in reinvestment, appears to lie in their inability to switch from left (e.g. conscious; analytical) to right (e.g. creative; automatic) brain functioning between the decision making and execution phases of putts. Further, even when skills are being executed via right brain activity it would appear that such individuals still often revert back to left brain, conscious processing, particularly when questioning their ability in situations open to appraisal. This is indicative of high reinvesters who tend to be left-brain dominant when attempting to execute motor skills under stress (Crews, 2001). Clearly, during the decision making phase of golf putting conscious attention is required to assess the undulation and grain of the green; this requires some left-brain functioning. It was proposed that phase one of the putting intervention enabled the participants to visualize the appropriate line, speed and destination prior to each putt. Further, it was speculated that an external imagery perspective might discourage the processing of movement-based mechanisms that could be associated with more intrinsic-based imagery perspectives (e.g. internal / kinesthetic). Presumably, external imagery also minimized load on working memory and helps the motor system to self-organise more natural when skill execution takes place. Clearly, future research needs to investigate the effects of different imagery perspectives on motor control systems.

During the execution phase, skilled golfers carry out putts automatically; this requires right-brain functioning. It was proposed that phase two of the putting intervention promoted right-brain activity and thus, enabled participants to consistently execute putts automatically. In addition, it was proposed that during the putting execution phase participants became desensitized to state anxiety and stress (e.g. self-regulated verbal distractions and conscious processing), which supports the contention of Hardy et al. (1996). In phase two of the putting intervention participants were prevented from processing explicit task knowledge and self-regulated verbal distractions, owing to the demands imposed on working memory by the secondary task. It was suggested that this elicited a sustained switch from left to right-brain functioning, which promoted an implicit, automatically regulated putting stroke and, in turn, consistent performance during each putt under stress. These findings also support the work of Crews (2001) who found that golfers that use techniques to promote right-brain functioning are more adept at dealing with stress than those who are more left-brain oriented.

All three participants reported investing greater mental effort into their putting strokes in the initial stress phase than any other phase of this study. Further, all participants reported a large decrease in mental effort in the second stress condition in comparison to the initial stress condition. These findings support the contention that an internal, explicit task focus increases the load on working memory whereas an external, implicit task focus minimises loading on working memory (Maxwell et al., 2001; 2002; Wulf, McNevin, & Shea, 2001). In the social validation interviews all participants reported 'trying too hard' and 'feeling the need to do more' in the initial stress condition, which led them to investing large amounts of mental effort into their putting action. Whereas, in the second stress condition participants reported being able to create a 'smooth' and 'automatic' putting stroke, without having to focus on explicit task knowledge (e.g. technique). Thus, suggesting that prior to the introduction of the putting strategy participants felt the need to focus on technique in order to recreate a 'smooth' and 'automatic' putting stroke. It was proposed that the two-phase putting intervention consistently reduced the investment of mental effort into the putting task under stress. Further, it was suggested that mental effort was invested into generating random letters rather than the technical aspects of putting performance. Thus, suggesting that putting became secondary to generating random letters, which might have helped the motor system to naturally self-organise, unconstrained by conscious control.

All three participants spent less time-on-task in the second stress condition in comparison to the initial stress condition. These findings suggest that the two-phase putting intervention consistently reduced time spent evaluating and executing the putting task under stress. In the social validation interviews all participants reported spending 'too much time thinking' about each putt during the initial stress condition. In contrast, when competing in the second stress condition participants reported the two-phase putting strategy to help 'keep things simple' by making a decision on the line and 'just putting'. Of specific interest to this study was that participant 3 spent less time-on-task than all other phases of this study. It was proposed that encouraging participants to keep the time they spent evaluating and executing each putt under stress consistent with the baseline conditions helped prevent over-analysis, whilst also promoting decisive decision making.

Of specific interest to this study were the results of the modified CSAI-2 (Swain & Jones, 1992) in comparison to the statements made in the social validation interview. In accordance with the modified CSAI-2 all participants reported a decrease in self-confidence, which were perceived to be more detrimental to performance prior to the two stress phases in comparison to the two baseline measures. The intensity and direction scores for self-confidence were marginally higher in the second stress condition in comparison to the initials stress condition. Be that as it may, there was still a comparatively larger difference in self-confidence intensity and directional scores between the second stress phase and the baseline measures. In accordance with the social validation interviews all the participants stated feeling more self-confident and / or positive in their putting stroke during the second stress condition in comparison to the initial stress condition. This discrepancy in self-confidence between the modified CSAI-2 scores reported prior to performance and the retrospective social validation statements that reflected on experiences during performance suggest that there were changes in the participants' perceptions. It was proposed that participants' self-confidence was enhanced by the combination of an automatic putting stroke (promoted by the random letter generation task), a consistent putting routine, and a successful performance outcome. Clearly, future research needs to assess perceptions and interpretations of self-confidence and state anxiety in high reinvesters when using the two-phase putting strategy in an ecologically valid competitive environment.

A consideration when conducting a single subject intervention study is the possible change in performance which occurs simply as a result of being in a study, this is known as the Hawthorne effect (Drew, 1976). It is the contention of Pates and Maynard (2000) that the scrutiny of performers in a single subject design might heighten this effect. Drew (1976), however, did acknowledge that this effect was reduced as participants became accustomed to the study. During this study participants were required to attend twenty sessions, over a period of ten weeks. Thus, it was suggested that the combination of the amount of sessions and duration of the study might have controlled for this effect.

There is a potential limitation with the experimental design of this study that needs to be addressed. The ABAC design meant that the treatment phase was the final stage of the study. Hence, a criticism of this study is that participants might have continued to improve throughout the study, and then peaked during the last phase. In the repeated baseline condition, scores returned back to baseline following a decrease in performance under stress, which might have controlled for this limitation. Other single subject design studies have provided additional evidence that support the effectiveness of their intervention strategies. Pates and Maynard (2000) used an ABACB design, which enabled them to 'turn off' the intervention during the final stage of their study. This might have allowed them to observe, more accurately, the impact of the intervention. However, in the present study it was not possible to reverse the intervention process by virtue of the fact that the participants had been exposed to new psychological skills; nor was it deemed ethical. Due to participants' personality characteristics and susceptibility to the negative effects of stress it was felt that they should complete the study with a positive perception of performance. Hence, the final phase of the study was the treatment condition.

One of the aims of this study was to test a two-phase putting intervention in an ecologically valid environment. The psychological intervention was tested on a natural putting surface, in accordance with 'Royal and Ancient' golf competition etiquette and rules. However, a limitation of this study is that the experimental task did not accurately reflect the true nature of competitive golf. Throughout competition golfers are required to play a range of different strokes and putts on a variety of fairways and greens. In addition, golfers have long periods of time to reflect on poor performance, between shots. Although the participants did have time to reflect between putts, as they played alternatively, this was not representative of playing a round of golf. Hence, it was suggested that the putting intervention was tested in an ecologically valid environment, but that the strategy might not be ecologically valid per se. Nevertheless, all participants in this study stated that they would feel confident using the intervention out on the course, in a golf competition. Further, it is not known to what extent the two-phase putting intervention can be adapted to longer putts or indeed, other golf strokes, where conscious processing might occur.

Future research should investigate whether the two-phase putting intervention can be successfully taken on to the course and adapted to a range of putting scenarios during a golf competition. In addition, further research should examine whether the psychological intervention can be adapted to other shots played during a round of golf. Finally, research should also investigate whether this type of psychological intervention could be adapted to athletes that are susceptible to conscious processing under stress in additional sports such as those investigated in study one; basketball, tennis, squash, cricket, and football.

8.0. SUMMARY, DISCUSSION AND CONCLUSIONS

8.1. INTRODUCTION

The final chapter of this thesis comprises three sections: first, a summary section that provides detail of the central aims of the research programme and outlines the key findings of the five studies. Second, the discussion section highlights theoretical and research issues, the central practical implications derived from the research programme, the strengths and limitations of the studies and recommendations for future research in the domain of severe performance loss in competitive sport. The final section draws together the conclusions of the thesis.

8.2. SUMMARY

Paucity research has attempted to offer explanations as to why athletes occasionally experience a severe loss of performance when competing; definitive explanations elude sport psychologists and researchers. Previous research has not explored, from a qualitative perspective, the interactive nature of dominant psychological mechanisms that underpin severe performance loss, nor have specific intervention strategies been identified that counteract this phenomenon in an ecologically valid environment. Therefore, the central purpose of this thesis was to examine in detail psychological mechanisms that underpin severe performance loss in competitive sport. The main aims of this thesis were to identify dominant psychological mechanisms that underpin severe performance loss in competitive sport, examine how such mechanisms interact and establish coping strategies to counteract the phenomenon.

Masters et al.'s (1993) model of skill failure under pressure and Baumeister's (1984) model of choking under pressure have largely influenced the direction of research into performance deterioration under stress. However, the mechanisms that underpin such models have been derived from limited research and possess no empirical or qualitative grounding in sport. Further, the research underpinning these theories has produced equivocal findings (Maxwell et al., 2000). Therefore, an eclectic research programme, incorporating qualitative and quantitative methods, was designed to establish a richer understanding of the relationship between dominant mechanisms that underpin severe performance loss and strategies to counteract the phenomenon.

The aim of the first study was to explore psychological mechanisms derived from the perceptions and interpretations of athletes that had experienced, first hand, severe performance loss in sport. Through such an examination the value of the available theories used in the literature to explain this phenomenon, and the perceptions of athletes, could be explored. Study two examined the effect of dispositional mechanisms and skilled motor performance upon severe performance loss under stress. Study three examined the relationship between dispositional mechanisms and different learning methods on severe performance loss under stress. The final two studies explored psychological intervention strategies that could counteract severe performance loss under stress in those predisposed to this phenomenon.

8.21. Psychological Mechanisms that Underpin Severe Performance Loss in Competitive Sport

8.211. Study 1. The rationale for study one was to access a richer understanding of severe performance loss in sport using qualitative techniques. Previous research has exclusively used quantitative, outcome-based measures to examine this phenomenon without a qualitatively derived understanding (Baumeister, 1984; Hardy, Mullen, & Jones, 1996; Lewis & Linder, 1997; Masters, 1992; Masters et al, 1993). Participants were selected from a pool of 'Sporting Experience Surveys' administered equally amongst different sporting groups. Semi-structured interviews were conducted on participants who ranged from club to national level in soccer (1) golf (1), cricket (3), squash (1), tennis (3) and basketball (1). Inductive techniques (Scanlan et al., 1991) applied to the transcribed data produced eight general dimensions that were descriptors of the overall experiences of the athletes: antecedents, cognitive changes, somatic / emotional changes, movement / technical / sensation characteristics, lack of control / understanding, situational factors, personality characteristics and types of competition. The dominant, interrelated high-order themes were: ‘pressure’, ‘cognitive and somatic changes’, ‘inappropriate foci’ (e.g., self-absorbed), ‘task focus’, and ‘lack of control of outcome’ (e.g., automaticity disruption).

The findings of this study supported self-focused attention rather than distraction theories as an explanation of severe performance loss in sport. Specifically, mechanisms underpinning the athletes’ experiences followed a similar sequence of events outlined in Masters' (1992) conscious processing hypothesis. Additional interrelated themes were identified that have not previously emerged in the literature. These themes were 'disruption to perception and sensation', 'compensatory strategies' and the 'need to escape'. It was proposed that 'disruption to perception and sensation' served as a precursor to athletes becoming preoccupied with the task components and the process of skill execution, which led to conscious processing and disruption of automaticity. Consequently, 'compensatory strategies' were adopted in an attempt to recreate 'normal' movement sensation and successful skill execution. This ironically served only to promote greater conscious processing, automaticity disruption and the 'need to escape'.

Athletes in this study possessed common characteristics. Two commonly reported characteristics central to the problem were 'directing focus to the process of the task' and 'self-absorption' during performance. Both constructs have been linked to dimensions of personality, but possess conflicting elements in the literature (Baumeister, 1984; Masters et al., 1993). Hence, the next step was to examine whether or not there are personality characteristics that make some performers more susceptible to conscious processing of explicit task knowledge than others, particularly while experiencing stress.

8.212. Study 2. Study two examined whether or not performers with specific personality characteristics (assessed by the Reinvestment Scale) were susceptible to severe performance loss under stress. The predictive power of the Reinvestment Scale using a well learned (automatic) gross, dynamic motor skill was also assessed. Fourteen experienced male university soccer players participated in this study. As measured by the Reinvestment Scale (Masters et al., 1993), the two experimental groups consisted of participants who dispositionally were either high or low in reinvestment. All participants were required to perform a wall-volley soccer task (McMorris et al., 1994), which involved kicking a ball repeatedly against a wall target zone for 90 s, under conditions of high and low stress. The ARS (Cox et al., 1996) was completed prior to each condition to assess stress manipulation and the participants' levels and interpretations of anxiety.

The ARS scores indicated that stress was successfully manipulated in this study. Performance results indicated that high reinvesters were more prone to conscious processing and automaticity disruption than low reinvesters. The findings of this study clearly support the predictive power of the Reinvestment Scale. The next step was to examine ways to minimising the accumulation of explicit knowledge during skill acquisition. This was to establish whether or not by doing so could enhance the performance of athletes who were predisposed to conscious processing under stress.

8.22. How Psychological Mechanisms Interact within Severe Performance Loss

8.221. Study 3. Study three investigated the effects of different learning methods and reinvestment on performance under stress. Both reinvestment and learning style have been independently identified in the literature as key mechanisms in the performance loss; however, the combined effects of such mechanisms had not been assessed. The intent was to assess whether limiting explicit knowledge during skill acquisition could prevent performance loss, precipitated by conscious processing in individuals predisposed to reinvestment. Implicit learning styles using a dual task paradigm have been found to suppress the accumulation of explicit task knowledge at the expense of skill development (Hardy et al., 1996; Masters 1992; Maxwell et al., 2000). Participants either dispositionally high or low in reinvestment (Masters et al., 1993) learned a basketball task using either a holistic or process method. This study chose a holistic method of learning over an implicit method of learning owing to the ramifications of using a dual task paradigm. The process learning method was developed in accordance with Masters' (1992) explicit learning protocol. The effectiveness of the two methods was examined under low and high stress conditions. The ARS (Cox et al., 1996) was completed prior to each condition to assess stress manipulation and the participants' levels and interpretations of anxiety.

Performance scores indicated that the low reinvestment group maintained performance under high stress, regardless of the learning method. The high reinvestment group who learned holistically also maintained performance under high stress; however, those who learned using a process method demonstrated a decrement in performance under stress. It was proposed that by minimising explicit knowledge during skill learning conscious processing could be avoided in those predisposed to conscious processing under stress.

8.223. Study 4. Study one of this thesis called for an appropriate focus and compensatory strategies to be established that facilitate rather than impair performance.

The findings of study three indicated that minimising the accumulation of explicit task knowledge during skill acquisition was effective in preventing conscious processing and maintaining performance under stress. However, given that coaches still consistently use orthodox, rule-based coaching styles these findings are inapplicable to skilled athletes who already possess a pool of explicit task knowledge. Study four investigated the use of different attentional foci and articulatory suppression on skilled golfers, high in reinvestment (Masters et al., 1993) to establish whether conscious processing could be prevented. Twelve skilled male golfers, possessing a handicap of 15 or less, completed a series of five-foot putts under low stress (baseline) then in three different foci conditions under stress: internal-process, external-holistic and arbitrary-random letter generation. The ARS (Cox et al., 1996), used in studies two and three to assess anxiety, had limitations. Hence, the modified CSAI-2 (Swain & Jones, 1992) was completed prior to each condition to assess stress manipulation and the participants' levels and interpretations of anxiety. To explore the conflicting predictions of the processing efficiency theory (Eysenck & Calvo, 1992) and the conscious processing hypothesis (Masters, 1992) time-on-task and mental effort (Zijlstra, 1993) were assessed; semi-structured interviews were also conducted after each condition.

The modified CSAI-2 scores indicated that stress was successfully manipulated in this study. Putting scores indicated that when the arbitrary-random letter generation focus was adopted participants maintained performance under stress. However, when the internal-process focus was adopted participants demonstrated a decrement in performance. Further, findings indicated that when adopting the external-holistic focus participants were encouraged to execute the task via automaticity. However, participants still lapsed into bouts of conscious processing, particularly after missing putts, which impaired performance under stress. Participants spent significantly more time-on-task in the internal-process and external-holistic conditions compared with the baseline measure. Based on the findings of the interviews, it was suggested that this additional time was used to focus on explicit task knowledge, which exacerbated the deautomatisation process. In contrast, participants spent a similar length of time-on-task in the arbitrary-random letter generation condition compared with the baseline measure. It was speculated that participants in this condition could not access explicit task knowledge or process negative cognitions, which can take up additional time and resources when performing (Masters, 1992).

In summary, adopting an internal-process focus can promote conscious processing, which disrupts automaticity and impairs performance under stress. Adopting an external-holistic focus can promote automaticity, but bouts of conscious processing still occur, particularly after missing putts, which impairs performance under stress. Finally, adopting an arbitrary-random letter generation focus can desensitise high reinvesters to stress. Loading on working memory can counteract conscious processing and promote automaticity, which enables consistent performance under stress.

8.23. Intervention Strategies to Counteract Severe Performance Loss

8.231. Study 5. The rationale for study five was based on the lack of ecological validity of the preceding study, which consequently prevents the findings being extrapolated to golf or indeed, other sports. This study investigated whether a two-phase psychological putting intervention could promote automaticity and enhance the performance of skilled golfers, high in reinvestment, from experiencing severe performance loss in ecologically valid conditions under stress. A single subject replication-reversal (ABAC) design was used for this study. Three skilled male golfers, possessing a handicap of 10 or less, completed a series of five-foot putts in low and high stress conditions. During the intervention phase of the study golfers learnt a putting strategy consisting of two phases: a decision making phase (which involved imaging externally the correct direction, speed and destination prior to the execution of each putt) and an execution phase (which involved generating random letters internally during the execution of each putt). The modified CSAI-2 (Swain & Jones, 1992) was completed prior to each experimental phase to assess stress manipulation and the participants' levels and interpretations of anxiety. Time-on-task and mental effort (Zijlstra, 1993) were assessed. To establish a richer understanding of the intervention effectiveness semi-structured interviews were also conducted.

The modified CSAI-2 scores indicated that stress was successfully manipulated in this study. Putting scores indicated that performance was greatly improved in the second stress phase (post-intervention) compared with the initial stress phase. All golfers reported a large decrease in mental effort in the second stress phase compared with the initial stress phase. In the semi-structured interviews all participants reported 'trying too hard' and 'feeling the need to do more' in the initial stress phase; it was speculated that this led them to invest undue mental effort into their putting action. In the second stress phase, however, participants reported being able to create a 'smooth' and 'automatic' putting stroke, without having to focus on explicit task knowledge (e.g. technique). All participants spent less time-on-task in the second stress phase compared with the initial stress phase. These findings suggest that the two-phase putting intervention consistently reduced time spent evaluating and executing the putting task under stress. In the interviews all participants reported spending 'too much time thinking' about each putt during the initial stress phase. In contrast, when competing in the second stress phase participants reported the intervention strategy to help 'keep things simple' by making a decision on the line and 'just putting'. All participants in this study stated that they would feel confident using the intervention during competition.

It was proposed that the putting strategy counteracted conscious processing and elicited desensitisation to stress (Hardy et al., 1996) in skilled golfers high in reinvestment. Moreover, this intervention enabled performers to visualize externally the appropriate line prior to each putt. It was speculated that this helped to promote right-brain, automatic functioning during putting execution which produced consistent performance.

8.3. DISCUSSION

8.31. Theoretical and Measurement Issues

The following section outlines the main theoretical implications that have arisen from the programme of research. This is followed by an outline of the measurement issues relating to the Reinvestment Scale and the ARS, the central inventories used in this thesis.

8.311. Theoretical Issues. Baumeister's (1984) model of choking under pressure and Masters et al.'s (1993) model of skill failure under pressure have largely directed the current research into performance deterioration under stress. However, there are three main issues with the two models: first, the mechanisms associated with such models have been derived from paucity research, possessing no empirical or qualitative grounding in sport. Second, there are conflicting elements between the two models on dispositional factors and explicit knowledge accessibility during the execution of well learned skills. Third, previous research has made assumptions about the information processing systems used during such phenomena, based predominantly on quantitative, outcome-based measures alone (Baumeister, 1984; Hardy et al, 1996; Lewis & Linder, 1997; Masters, 1992; Masters et al, 1993).

First, Baumeister (1984) proposed that when a skill becomes automatic the explicit knowledge of that skill is inaccessible to the conscious attention to guide performance in times of stress thus, performance is impaired. In contrast, Masters et al. (1993; Hardy, Mullen, & Jones, 1996; Masters, 1992) argued that explicit knowledge of an automatic skill is readily available to the conscious attention to reinvest in under stress, which disrupts automaticity and impairs performance. Second, Baumeister (1984) contended that individuals dispositionally low in self-consciousness have a greater propensity to experience decrements in performance under pressure, whereas Masters et al. (1993) argued that it is those dispositionally high in self-consciousness that are more prone to performance decrements under pressure.

The qualitative data, derived from perceptions and interpretation of experienced athletes in this thesis (see studies one, four, and five), has allowed the value of Baumeister's (1984) and Masters et al.'s (1993) models to be examined. For this reason, the programme of research has helped to remedy the conflicting elements between the two explanations and overcome some limitations of the research that underpins such theories. First, the contention that explicit knowledge is no longer consciously available to guide performance in order to prevent decrements in performance under pressure (Baumeister, 1984) was not supported by the findings of the thesis. In comparison, participants commonly reported rehearsing the component parts of a specific motor schema during competition. Additionally, participants also commonly reported using compensatory strategies. Participants began to use additional conscious strategies, in the movement characteristics of the task, which normally were executed automatically. This, ironically, led to a similar focus that had elicited performance loss in the first place and only served as a catalyst further to disrupt the normal skill sequence repertoire. Hence, the qualitative data collected throughout this thesis offer support to Masters et al.'s (1993; Masters, 1992) model of skill failure under pressure.

Second, Baumeister (1984) reported that individuals dispositionally low in self-consciousness were more prone to decrements in performance under pressure. In comparison, participants involved in the programme of research consistently reported being preoccupied with their feelings and thoughts (self-absorption), and having self-presentational concerns during their performance, which implied that they were high in self-consciousness. This process was heightened by 'too much time to think' about a particular skill, which in turn magnified concerns about being negatively evaluated by others. Consistent qualitative findings of the thesis offer further support for Masters et al.'s (1993) model of skill failure under pressure.

Finally, the main findings of this programme offer empirical and qualitative support for the psychological mechanisms that underpin Masters et al.'s (1993) model of skill failure under pressure. In particular, the qualitative data (in studies one, four and five) have gone partway to bridging the gap between the assumption that conscious processing systems are used to execute motor tasks during the occurrence of severe performance loss based on outcome measures. Further, the secondary task (e.g. random letter generation task) used in studies four and five has also helped to bridge the gap between such assumptions. For example, using such a secondary task loads heavily on the central executive and phonological loop, which suppresses working memory. As a consequence this process promotes automatic, right brain activity as conscious processing is no longer feasible.

In summary, although consistent support was found for Masters and his colleagues' model this thesis still generated additional common mechanisms associated with severe performance loss in competitive sport that have not been reported previously (see Section 8.211). This suggests that the sequence of events outlined by Masters et al.'s (1993) model is by no means complete in explaining the severe performance loss phenomenon. Moreover, there are still limitations with their model, particularly with the Reinvestment Scale, that need to be overcome (see Section 8.313).

8.312. Long Term Performance Disorders. Finally, the learning (e.g., holistic) and performance (e.g., articulatory suppression task) intervention strategies investigated throughout this programme of research might counter long-term forms of skill breakdown such as the 'yips'. The 'yips' is a long-term motor disorder and is thought to affect finely controlled motor skills by causing involuntary movement during execution (McDaniel et al., 1989). The 'yips' has been reported to induce a sudden and severe loss in performance similar to that of skill failure under pressure. Recent research has identified psychological mechanisms such as self-consciousness, conscious processing and automaticity disruption as key psychological factors in the 'yips' phenomenon (Bawden & Maynard, 2001).

It could be hypothesised that a one-off experience where severe performance loss ensued could elicit negative expectation and a fear of failure, two constructs generated from study one (see Section 3.31), when faced with a similar situation. Hence, such constructs might have lead to the same experience reoccurring, which in turn could result in behaviour impairment and essentially, the 'yips'. Athletes, in study one, who made statements such as "It's always in the back of your mind, if it can happen once it can happen again" and "I still now sometimes feel mechanical and that is five years later" typifies this. Thus, from the findings of this thesis it is plausible that in certain circumstances severe performance loss could be a precursor to the 'yips' disorder. Therefore, both the learning and performance intervention strategies identified by this programme of research to counteract the negative effects of stress should be explored by practitioners as possible techniques to prevent the onset or indeed reverse the 'yips' phenomenon. However, it is important to acknowledge that the link made between the 'yips' and severe performance loss is speculative as investigations into the 'yips' phenomenon were outside the remit of this research programme.

8.313. Reinvestment Scale. Throughout this programme of research the Reinvestment Scale was used as a predictor of severe performance loss under stress. This inventory is based on dispositional characteristics that are clearly related to this phenomenon. However, this scale offers a measurement of an individual's cognitive predisposition, rather than the direct assessment of specific information processing systems used during performance. Therefore, the differing attentional processes claimed to underpin the performances of low and high reinvesters were assumed in this study. It is the author's belief that the qualitative data collected throughout this thesis successfully strengthened such assumptions. Nevertheless, this does not offer conclusive evidence that conscious processing of an automatic skill sequence is the central tenet in the severe performance loss phenomenon.

Study one of this thesis identified 'task focus' and 'tension' to be prevalent in the occurrence of severe performance loss. By regression to a conscious processing system there is a tendency to re-freeze the degrees of freedom in the distal joints, similar to that of the early stages of learning (Fuchs, 1962). Thus, to bridge the gap fully between dimensions of personality, conscious processing and outcome-based measures of severe performance loss a greater understanding of kinematic changes in performance is necessary. In addition, electrocardiogram (ECG) and electromyogram (EMG) should also be examined so that changes in brain wave and muscle activity can be identified.

Finally, as explained in study one of this thesis the Reinvestment Scale incorporates all the items from the Public and Private subscales of the Dispositional Self-consciousness Scale (Fenigstein et al., 1975). Hence, high reinvesters are considered to be highly self-conscious and thus, more likely to become anxious and stressed in conditions open to appraisal (Maxwell et al., 2000). Further, high reinvesters, because of their high self-consciousness, might also possess higher trait anxiety than low reinvesters. Unpublished data referred to by Maxwell et al. (2000) indicated a significant correlation ($r = 0.55$, $P < 0.05$) between the Reinvestment Scale and the trait section of the State-Trait Anxiety Inventory (Speilberger et al., 1970). This suggests that high reinvesters are likely to be more anxious than low reinvesters, which might account for differences in performance between the two groups seen throughout this thesis. Clearly, research needs to clarify what it is that such trait inventories actually measure and how they interrelate if the understanding of the stress-rehearsal-performance breakdown occurrence is to evolve.

8.314. State Anxiety Assessment. Two interrelated mechanisms that underpin severe performance loss in sport are stress and anxiety. A limitation of previous research that has investigated these phenomena is the unsatisfactory way such mechanisms have been assessed. In an attempt to remedy this limitation this programme of research used self-report anxiety measures. Studies two and three of this thesis used the Anxiety Rating Scale (ARS) (Cox et al., 1996), a condensed version of the Competitive State Anxiety Inventory–2 (CSAI-2) (Martens et al., 1990) to assess stress manipulation and participants' levels and interpretations of anxiety. The ARS comprises 3 items. Each item relates to one of the 3 subscales (somatic anxiety, cognitive anxiety & self-confidence) on the original CSAI-2 and possesses sufficient reliability (Cox et al., 1996). A direction scale was incorporated into the questionnaire. This was adapted from the modified CSAI-2 (Swain & Jones, 1992), but possessed no psychometric data. The rationale for using the ARS was based on its simplicity and short user-friendly format. The adapted directional scale was used to develop a greater understanding of the participants' perception and interpretation of anxiety.

Clearly, stress was successfully manipulated in studies two and three of this thesis. However, the changes in ARS intensity and direction scores for the three subscales that took place between studies two (see Section 4.31) and three (see Section 5.33) for low and high reinvesters under stress were inconsistent. The reasons proposed for this anomaly were two fold: first, the intensity scale was not sensitive enough to identify an accurate and consistent level of state anxiety due to the limitations associated with single item measures (Krane, 1994). Second, the adapted direction scale had no psychometric qualities established. For this reason studies four and five used the Modified Competitive State Anxiety Inventory – 2 (Swain & Jones, 1992) to assess stress manipulation and participants' levels and interpretations of anxiety. The modified CSAI-2 possesses adequate reliability for the intensity and directional components of the three anxiety subscales. Clearly, the modified CSAI-2 indicated consistent changes in scores for intensity and direction across the three subscales under stress in studies four (see Section 6.31) and five (see Section 7.32) of this thesis. However, studies four and five only investigated participants who were high in reinvestment.

As discussed earlier in this section high reinvesters are considered to be highly self-conscious and thus, more likely to become anxious and stressed in conditions open to appraisal (Maxwell et al., 2000). Thus, high reinvesters, because of their high self-consciousness, might also possess higher trait anxiety than low reinvesters. Because of the structure of studies four and five of this thesis it is not known whether the modified CSAI-2 is able to produce more accurate and consistent state anxiety data in individuals' low in reinvestment. Future research should investigate state anxiety, precipitated by stress in low reinvesters using the modified CSAI-2. In the mean time caution should be taken when administering the ARS in future research due to the limitations of using single-item measures (Krane, 1994).

8.4. PRACTICAL IMPLICATIONS

This programme of research has raised important implications for practitioners working with sports performers. The results of this thesis indicate the Reinvestment Scale (Masters et al., 1993) to be a strong predictor of severe performance loss, in both gross dynamic and fine static motor skills. These findings also indicate that this scale could be used as an awareness tool for coaches and practitioners so that appropriate support can be provided for performers susceptible to conscious processing in an attempt to prevent this phenomenon. However, further research needs to assess the Reinvestment Scale in ecologically valid sport setting, across a range of sports. In addition, findings from study three of this thesis indicated that high reinvesters who acquired skills through a limited pool of explicit knowledge were able to perform consistently under stress. Thus, coaches and practitioners should be cautious when interpreting score from the Reinvestment Scale in performers who have acquired skills with minimal explicit knowledge.

A primary consideration borne out of the findings of this thesis is to ensure that explicit task knowledge accumulation is kept to a minimum during skill acquisition (Masters, 1992). A further consideration is to ensure that conscious processing of automatic skills under stress does not take place in performers who have already developed a pool of explicit task knowledge through orthodox learning methods (Masters et al., 1993). The findings from study three indicated that by minimising explicit task knowledge during skill acquisition, performance impairment precipitated by conscious processing under stress could be avoided, particularly in those predisposed to this phenomenon.

Study three has practical implications for coaches and sport psychologists that are two fold. First, the findings question the orthodox coaching strategies commonly used in sport. Perhaps coaches should minimise the amount of explicit knowledge that is given to athletes during skill acquisition. As a consequence, athletes might develop holistic skills that are implicitly regulated and unconstrained by conscious control (Wulf, McNevin, & Shea, 2001). This process would minimise the opportunity for conscious processing, which is of particular importance to those predisposed to this problem. However, minimising explicit knowledge during skill acquisition might be less beneficial in such sports as rock climbing, than in fast-ball sports like tennis as the role of explicit and implicit learning strategies will vary as a function of task demands. Thus, explicit instruction might play more of a central role in the successful performance of strategic sports (e.g., rock climbing) compared with fast ball sports (e.g., tennis) where implicit regulation of skills could be required for effective performance (Hardy, Mullen, & Jones, 1996). Furthermore, it is not known how these learning methods might affect the long-term technical development of such skills. Clearly, further research is required in this area to examine the effect of explicit knowledge reduction during skill acquisition on a variety of different sports using longitudinal research designs.

A second practical implication for coaches and sport psychologists is that research has endorsed the use of technical-orientated goals, which require athletes to focus on specific components of a skill during performance (Kingston, Hardy, & Markland 1992; Orlick & Partington, 1988). The present findings challenge the effectiveness of using technical-oriented goals. Coaches and sport psychologists advising athletes to focus on multiple technical-orientated goals might serve as a catalyst for conscious processing rather than automaticity. Based on the findings in this thesis the use of holistic goals which focus on more global aspects of performance could be more beneficial to athletes. However further, research is needed to examine the impact of holistic goals on a variety of sports and skills.

A further consideration for practitioners is the use of articulatory suppression of already accumulated explicit task knowledge to counteract the negative effects of conscious processing. In study four of this thesis, using a secondary task to load on working memory ensured that individuals who were prone to reinvestment became desensitised to stress and thus, could not access explicit task knowledge or be aware of self-regulated verbal distractions. Loading working memory prevented conscious processing and promoted automaticity and thus, consistent putting performance in skilled golfers under stress. Based on the results of study four, study five of this thesis developed a two-phase putting intervention strategy which incorporated external imagery (decision making phase) and a secondary task (execution phase). The findings of this study indicated that external imagery enabled golfers to focus externally on processing critical environmental cues prior to putting, whilst the secondary task load prevented conscious processing and promoted automaticity during putting execution. Social validation data indicated that the putting intervention helped participants to execute a smooth stroke, which they felt confident and positive about using in competition. Clearly, the use of external imagery and secondary task loading should also be explored by practitioners as possible techniques to prevent conscious processing, particularly in those prone to this process under stress.

8.5. STRENGTHS OF THE RESEARCH PROGRAMME

A considered strength of this thesis was the progressive 'theory into practice' structure of the research programme. The specific aims of the programme were to identify dominant psychological mechanisms underlying severe performance loss, examine how such mechanism interact and then based on these findings establish an ecologically valid intervention strategy to counteract the phenomenon. This process, in turn, directed the research to the challenge of developing practical and functional strategies that could be used in sport. It is the author's belief that the transition between theory and practice was successfully achieved. Further, the author believes that the eclectic research methods adopted in the programme have facilitated this transition and thus are also considered a strength of this thesis. This approach has not only helped to fulfil the aims of this programme of research, but also has allowed the establishment of an improved conceptual and practical understanding of severe performance loss in competitive sport.

Specifically, three types of research method were used in the programme: study one used qualitative inductive techniques, studies two, three, and four adopted quantitative group-based designs, which also incorporated semi-structured interview techniques, and the final study of the programme used a single-subject replication-reversal (ABAC) design. The current research on severe performance loss has predominantly used quantitative group-based methods. This research programme has uniquely used qualitative and single-subject based methods to investigate this phenomenon. Moreover, the eclectic approach used in the programme has allowed anomalies in the literature that have existed for over a decade to be understood more clearly. Understanding the perception and interpretation of competitive athletes who had experienced severe performance loss and examining the relationship between reinvestment and learning styles exemplifies this progression. Further, this research programme answered recent calls to examine alternative ways to manipulate explicit task knowledge during skill acquisition that do not inhibit skill progression (Hardy, Mullen, & Jones, 1996; MacMahon & Masters, 2002; Masters, 2000; Maxwell et al., 2000).

An additional strength to this thesis was the breath and depth of qualitative data gathered throughout this research programme, in particular that produced by study one.

A schematic of the themes generated from the analysis of study one was formulated to help reinforce the complex but interrelated nature of the phenomena under investigation (see Figure 3.6.). Additional themes of this phenomenon were identified that have not been reported before. These themes were 'disruption to perception and sensation', 'compensatory strategies' and the 'need to escape'. The impact and interaction of these themes are outlined in Section 8.211.

Finally, the programme of research provides a starting point to help coaches and sport psychologists identify characteristics of athletes that could make them prone to severe performance loss. Furthermore, the programme has provided practitioners with practical strategies to help athletes counteract the problem.

8.6. LIMITATIONS OF THE RESEARCH PROGRAMME

Perhaps the most limiting factor to this research programme is the use of the Reinvestment Scale (Masters et al., 1993). The limitations and concerns about what precisely the inventory measures were addressed in Section 8.313. Clearly, the Reinvestment Scale is a predictor of performance behaviour. Nevertheless, it is still not clear what it is the Scale is actually measuring, apart from dimensions of personality. Future research needs to identify what it is, exactly, the Scale measures in terms of movement dynamics and information processing systems.

Another limitation of the thesis is the use of the ARS (Cox et al., 1996). The limitations and concerns about the Scale's lack of sensitivity were addressed in Section 8.312. Thus, if time allows, the author advises other research and practitioners to use the modified CSAI-2 (Swain & Jones, 1992) as this inventory is a more sensitive and valid measure of state anxiety compared with the ARS (Krane, 1994).

A further limiting factor to the thesis is the narrow focus directed specifically toward golf-putting in the latter studies of the research programme. The intervention strategy developed for putting in study five could have a practical use for golfers in the future. Nevertheless, it is not known whether such an intervention strategy can be adapted to a range of putting scenarios, other golf strokes and indeed, other sports such as those examined in study one (e.g. basketball, tennis, squash, cricket and football).

Finally, another limitation of the thesis is the use of an inductive content analysis as a qualitative approach in study one. This is the most prominent technique used in sport psychology research (cf. Biddle et al., 2001). The qualitative approach used in this research programme was based on the work of Scanlan et al. (1991; see also Gould, Jackson, & Finch, 1993a; Gould, Jackson & Finch, 1993b) who advocated the inductive content technique. However, this method is limited by the fact that it has no theoretical underpinning in qualitative research methods. For this reason, on reflection the author of the thesis would have used a more tradition qualitative approach such as grounded theory. The benefits of using such an approach are three fold: First, this approach lends itself to research areas that are difficult to examine through quantitative methods. Second, grounded theory is beneficial when no comprehensive theoretical models exist, but there is still some research available in the area. Finally, grounded theory is particularly effective in unearthing of processes that might underpin a particular phenomenon (Johnston, Corban, & Clarke, 1999).

In following a grounded theory approach to qualitative research several methodological changes would need to take place to the protocol used in the thesis. First, in grounded theory data collection the interview format is flexible and open allowing change throughout the duration of the study. This is in contrast to the standardised, semi-structured interview protocol used in the thesis. Second, the themes generated from each interview should be investigated further until saturation (e.g. no more themes are generated) is reached. For this reason, the amount of participants can not be predefined. In the thesis, saturation might not have been reach as the sample of ten was predetermined prior to the onset of the study.

8.7. RECOMMENDATIONS FOR FUTURE RESEARCH

There are six main areas identified in this research programme that require further investigation. First, although this thesis has gone partway to achieving this (as outlined in Section 8.313), there is still a need for researchers interested in severe performance loss to examine ways of bridging the gap between an individual's cognitive predisposition (e.g. Reinvestment Scale) and the use of cognitive processing systems during performance. Future research should investigate electrocardiogram (ECG) and electromyogram (EMG) data so that changes in brain wave and muscle activity can be examined. Limited research has focused on changes in brain wave activity (Crews,

2001) and kinematics (Mullen & Hardy, 2000) of performance loss. Crews (2001) observed that golfers who experienced skill breakdown under stress predominantly used the conscious analytical side of the brain during performance, which supports the conscious processing hypothesis (Masters, 1992). However, Crews' (2001) laboratory-based research used a five-foot straight putt on a flat green that required no decision making for the line of each putt. Therefore, future research should investigate the relationship between brain wave activity and skill breakdown in ecologically valid conditions such as competition. In addition, throughout this thesis it has been proposed that during reinvestment individuals regress to a more basic level of skill processing associated with early stages of learning. However, the programme of research did not directly examine his assumption. For this reason, future research should investigate the relationship between reinvestment and stages of learning.

The findings of the kinematic element of Mullen and Hardy's (2000) research were equivocal. To assess the kinematics of a golf-putting task under stress, Mullen and Hardy (2000) used a two-dimensional analysis. It can be argued that this analysis was not a sensitive enough measure to identify what could only be finite changes in movement dynamics. Hence, perhaps a three-dimensional analysis would be more effective in developing an improved understanding in this area. Clearly, a thorough examination of these constructs is required to establish an unequivocal understanding of the relationship between dispositional factors, information processing systems and outcome measures. Such examinations should take place in a variety of sports, involving static, dynamic, open-and closed-loop skills, in ecologically valid conditions such as competition. Thus, perhaps from such investigations the Reinvestment Scale could be modified in accordance with changes in information processing systems, movement dynamics, and muscular activity, which specifically relate to competitive sport.

Second, study one of this thesis identified 'disruption to perception and sensation', 'compensatory strategies' and the 'need to escape' as influential factors in the severe performance loss phenomenon. It was proposed that 'disruption to perception and sensation' served as a precursor to athletes becoming preoccupied with the task components and the process of skill execution, which led to conscious processing and automaticity disruption. Consequently, 'compensatory strategies' were adopted in an attempt to recreate 'normal' movement sensation and successful skill execution. This ironically served only to promote greater conscious processing, automaticity disruption, and the 'need to escape'. Future research needs to examine collectively these three constructs if a greater understanding of this area of research is to evolve.

Third, study three of this thesis used holistic methods during the acquisition of a free-throw. It was speculated that this learning method might have encouraged an outcome-based (e.g. external-movement effects related focus) focus, which allowed systems to self-organise more naturally, unconstrained by conscious control (Al Abood et al., 2002). This contention is supported by Maxwell and Masters (2002) who found that an implicit, external focus, mode of learning and performance is the default option for performers, even when an explicit, internal focus is stipulated (Maxwell & Masters, 2002). Moreover, holistic learners might have allocated additional resources into systems that promote automaticity; this might explain their incremental performance trends under stress. Future research should investigate the relationship between holistic learning, focus of attention, mental effort and dispositional reinvestment. Specifically, such constructs should be examined in a variety of sports, involving static, dynamic, open and closed loop skills, in ecologically valid competitive conditions. The effect of pre-performance routines (Boutcher, 1990) that promote holistic orientated goals, which are thought to direct attention towards more global aspects of skills such as chunking and automaticity should also be investigated (Hardy, Mullen, & Jones, 1996; Kingston & Hardy, 1994). Finally, coaches and athletes need to be made aware of the implications of developing and using large pools of explicit task knowledge during performance. Current coaching methods used in sport should be revised (Wulf et al., 2002) then perhaps the need for interventions to counteract conscious possessing might be reduced.

A processing efficiency perspective (Eysenck & Calvo, 1992) suggests increased effort might compensate for anxiety induced distractions by increasing attentional resources under stress. This can facilitate performance in cases where additional resources are channelled into appropriate processes (e.g. external-movement effects related). Hence, if holistic learners in study three did allocate additional resources into systems that promote automaticity, this might explain their incremental performance trends under stress. However, it is important to note that neither mental effort nor attentional focus was controlled for in this study. Future research should monitor these factors to gain an improved understanding of the relationship between attentional foci, mental effort and dispositional reinvestment.

Fourth, study five of this thesis developed and tested a two-phase putting intervention in an ecologically valid setting. All participants stated that they would feel confident about using the putting intervention during competition. However, it was concluded that the strategy was tested in an ecologically valid environment, but was not necessarily ecologically valid per se. Future research should investigate whether the two-phase putting intervention can be successfully taken on to the course and adapted to a range of putting strokes during competition. It would also be beneficial to examine the long-term implications of such strategies on technical putting development. In addition, further research should examine whether the psychological intervention can be adapted to other shots played during a round of golf. Finally, research should also investigate whether this type of psychological intervention could be adapted to athletes that are susceptible to conscious processing under stress in other sports involving gross dynamic open-loop skills as well as fine static closed-loop skills.

Fifth, the initial two group-based studies of this thesis produced inconsistent state anxiety data. Limitations of the ARS (Cox et al, 1996) were suggested to be the primary reason for this as the modified CSAI-2 used in the latter studies remedied the problem. Although, self-report measures should remain a feature of future research, perhaps a combination of cortical and endocrine measures should also be obtained to enhance understanding in this area (Mullen & Hardy, 2000).

Finally, this thesis has identified certain characteristics that have been associated with the 'yips' phenomenon. Future research should investigate possible links with severe performance loss and long-term disorders such as the 'yips'. As understanding in this area evolves in the research practical guidelines can be established that equip coaches with the knowledge to minimise opportunities for athletes consciously to process explicit task rules during both learning and competitive performance, particularly in those prone to severe performance loss.

8.8. CONCLUSIONS

The purpose of this thesis was to examine in detail psychological mechanisms that underpin severe performance loss in competitive sport. The main aims were to: establish dominant psychological mechanisms that underpin severe performance loss, examine how such mechanisms interact, and establish coping strategies to counteract the phenomenon. Results indicated that the central tenets of this phenomenon were dispositional high reinvestment, conscious processing and automaticity disruption. With these tenets in mind, attempts were made to minimise the accumulation of rule-based knowledge during skill acquisition and suppress explicit task knowledge during skill execution. Specifically, due to the load placed on working by the secondary task (in studies 4 and 5) it can be inferred that this encouraged performers prone to severe performance loss to adopt automatic, right-brain processing systems to moderate performance, unconstrained by conscious control, which in turn enhanced their consistency under stress. It is the author's belief that, although unanswered questions remain, this research programme has furthered the conceptual and practical understanding of severe performance loss in competitive sport for researchers, practitioners and coaches. This has only been accomplished by making the progression from theory into practice, a fundamental requisite of sport psychology if this discipline is to continue to evolve.

REFERENCES

REFERENCES

Abraham, M., & Reber, A.S. (1988). Implicit learning: Robustness in the face of psychiatric disorders. Journal of Psycholinguistics Research, 17, 425-439.

Al-Abood, S.A., Bennett, S.J., Hernandez, F.M., Ashford, D., & Davids, K. (2002). Effect of verbal instructions and image size on visual search strategies in basketball free throw shooting. Journal of Sports Sciences, 20, 271-278.

Allen, R., & Reber, A.S. (1980). Very long term memory for tacit knowledge. Cognition, 8, 175-185.

Anderson, J.R. (1982). Acquisition of cognitive skill. Psychological Bulletin, 89, 369-406.

Atienza, F., Balaguer, I., & Garcia-Merita, M.A. (1994). Factor analysis and reliability of the Movement Imagery Questionnaire. Perceptual and Motor Skills, 78, 1323-1328.

Bandura, A. (1977). Self-efficacy: Towards a unifying theory of behavioural change. Psychological Review, 84, 191-225.

Baumeister, R. F. (1984). Choking under pressure: self-consciousness and paradoxical effects of incentives on skilful performance. Journal of Personality and Social Psychology, 46, (3), 610-620.

Baumeister, R. F., & Showers, C. J. (1986). A review of paradoxical performance effects: choking under pressure in sports and mental tests. European Journal of Social Psychology, 16, 361-383.

Baddeley, A. D. (1966). The capacity for generating information by randomization. Quarterly Journal of Experimental Psychology, 18, 119-129.

Baddeley, A. D. (1986). Working Memory. Oxford: University Press.

Baddeley, A. D. (1992). Working memory. Science, 255, 556-559.

Baddeley, A. D., & Hitch, G. (1974). Working memory. In G.A. Bower (Ed.), Recent advances in learning and motivation, Vol 8. New York: Academic Press.

Baddeley, A. D., & Wilson, B.A. (1994). When implicit learning fails: Amnesia and the problem of error elimination. Neuropsychologia, 32, 53-68.

Baddeley, A. D., & Woodhead, M. M. (1982). Depth of processing, context, and face recognition. Canadian Journal of Psychology, 36, 148-164.

Bawden, M., & Maynard, I. (2001). Towards an understanding of the personal experience of the 'yips' in cricketers. Journal of Sports Science, 19, 937-953.

Bawden, M., Maynard, I Graydon, J., & Chell, B. (1999). The effects of manipulated stress and self-consciousness on a golf putting performance. Proceedings of the 4th annual congress of the European College of Sport Science. Ed. Parisi, F. Pigozzi, G Prinzi. Sport Science '99 in Europe. Pub: University Institute of motor science. Rome. p. 215.

Beek, P.J. (2000). Toward a Theory of Implicit Learning in the Perceptual-Motor Domain. International Journal of Sport Psychology, 31, 547-554.

Bennett, S.J. (2000). Implicit Learning Should It Be Used In Practice? International Journal of Sport Psychology, 31, 542-546.

Bernstein, N. (1967). The coordination and regulation of movement. Oxford : Pergamon Press.

Berry, D.C., & Broadbent, D.E. (1984). On the relationship between task performance and associated verbalization knowledge. Quarterly Journal of Experimental Psychology, 36A, 209-231.

Berry, D.C., & Broadbent, D.E. (1987). The combination of explicit and implicit learning processes in task control. Psychological Research, 49, 7-15.

Beuter, A., Duda, J.L., & Widule, C.J. (1989). The effect of arousal on joint kinematics and kinetics in children. Research Quarterly for Exercise and Sport, 60, 109-116.

Biddle, S.J.H., Markland, D., Gilbourne, D., Chatzisarantis, M.L.D., & Sparkes, A.C. (2001). Research methods in sport and exercise psychology: Qualitative issues. Journal of Sports Sciences, 19, 777-809.

Boutcher, S.H. (1990). The role of performance routines in sport. In G. Jones & L. Hardy (Eds), Stress and Performance in Sport. Chichester: Wiley.

Boutcher, S.H., & Crews, D.J. (1987). The effect of a preshot attentional routine on a well learned skill. International Journal of Sport Psychology, 18, 30-39.

Bright, J.E., & Freedman, O. (1998). Differences between implicit and explicit acquisition of a complex skill under pressure. British Journal of Psychology, 89, 249-263.

Broadbent, D.C., & Aston, B. (1978). Human control of a simulated economic system. Ergonomics, 21, 1035-1043.

Broadbent, D. E., Cooper, P. F., FitzGerald, P., & Parkes, K. R. (1982). The cognitive failures questionnaire (CFQ), and its correlates. British Journal of Clinical Psychology, 21, 1-16.

Broadhurst, P.L. (1975). Emotionality and the Yerk-Dodson law. Journal of Experimental Psychology, 54, 345-352.

Brooks, L. R. (1978). Nonanalytic concept formation and memory for instances. In E. Rosch & B. B. Lloyd (eds.), Cognitions and categorization. Wiley: New York.

Burton, D. (1988). Do anxious swimmers swim slower? Re-examining the elusive anxiety-performance relationship. Journal of Sport and Exercise Psychology, 10, 45-61.

Burton, D. (1990). Multimodel stress management in sport: Current status and future directions. In J.G.Jones & L.Hardy (eds.). Stress and Performance in Sport. Chichester: Wiley, pp. 171-201.

Burton, D. (1998). Measuring competitive state anxiety. In J.L Duda (Ed.), Advances in sport and exercise psychology measurement. Morgantown, WV: fitness Information Technology.

Carr, T.H., McCauley, C., Sperber, R.D., & Parmalee, C.M. (1982). Words, pictures and priming: On semantic activation, conscious identification, and the automaticity of information processing. Journal of Experimental Psychology: Human Perception and Performance, 8, 757-777.

Carver, C.S., Blaney, P.H., & Scheier, M.F. (1979). Focus of attention, Chronic expectancy, and responses to feared stimulus. Journal of Personality and Social Psychology, 37, 1186-1195.

Carver, C.S., Peterson, L.M., Follansbee, D.J., & Scheier, M.F. (1983). Effects of self-directed attention on performance and persistence among persons high and low in test anxiety. Cognitive Therapy and Research, 7, 333-354.

Carver, C.S., & Scheier, M. (1978). Self-focusing effects of dispositional self-consciousness, mirror presence, and audience presence. Journal of Personality and Social Psychology, 36, 324-332.

Carver, C.S., & Scheier, M.F. (1981). Attention and Self Regulation. New York: Springer-Verlag.

Carver, C.S., & Scheier, M.F. (1984) Self-focused attention in test anxiety: A general theory applied to a specific phenomenon. In Advances in Test Anxiety Research, Vol. 3, (ed.) H.M. van der Ploeg, R. Schwarzer and C.D Speilberger, pp3-20 Lisse/Hillsdale. Swets and Zeitlinger/Erlbaum: NJ.

Carver, C.S., & Scheier, M.F. (1988). Functional and dysfunctional responses to anxiety: The interaction between expectancies and self-focused attention. In self-related cognitions in Anxiety and Motivation, (ed.) R.Schwarzer, pp. 111-141. Erlbaum: Hillsdale NJ.

Chase, W.G., & Simon, H.A. (1973) Perception in chess. Cognitive Psychology, 4, 55-81.

Chell, B.J. Graydon, J.K., Crowley, P.L., & Child, M. (2003). Manipulated stress and dispositional reinvestment in a wall-volley soccer task: An investigation into controlled processing. Perceptual and Motor Skills, 97, 435-448.

Christensen, D. (1982). The relationship between self-consciousness and interpersonal effectiveness and a new scale to measure individual differences in self-consciousness. Personality and Individual Differences, 3, 177-188.

Cousy, B., & Power, F.G. (1975). Basketball concepts and techniques. New York: Wiley.

Cox, R. H., Russell, W. D., & Robb, M. (1996). Validity of the MRF and ARS competitive state anxiety rating scale for volleyball and basketball. Research Quarterly for Exercise and Sport, 67, 52-67.

Crews, D. (2001). Who chokes and when? Situational and dispositional factors in failure under pressure. Golf Magazine, 43 (3), 94-96.

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. Pyschometrica, 16, 297-334

Davidson, R.J., & Schwartz, G.E. (1976). The psychobiology of relaxation and related states: a multiprocess theory, in D.I. Mostofsky (ed.). Behaviour Control and Modification of Physiological Activity. Englewood Cliffs, NJ: Prentice Hall.

Deikman, A. J. (1969). Deautomatization and the mystic experience. Journal of Personality and Social Psychology, 58, 330-341.

Douchamps, J. (1988). A metatheoretical approach of operational performance. In J.P. Leonard (Ed.), Vigilance: Methods, Models, and Regulation, pp. 23-34. Long: Frankfurt.

Drew, C.J. (1976). Introduction to design and conducting research. St Louis, MO: C.V. Mosby.

Duffy, E. (1962). Activation and Behaviour. New York: Wiley.

Duval, S., & Wickland, R.A. (1972). A theory of object self-awareness. New York Academic Press.

Duval, S., & Wicklund, R.A. (1973). Effects of objective self-awareness on attribution of causality. Journal of Experimental Social Psychology, 9, 17-31.

Easterbrook, J.A. (1959). The effect of emotion on the utilisation and the organisation of behaviour. Psychological Review, 66, 183-201.

Eysenck, M.W. (1979). Anxiety, learning and memory: A reconceptualisation. Journal of Research in Personality, 13, 363-385.

Eysenck, M.W. (1985). Anxiety and cognitive-task performance. Personality and Individual Differences, 6, 579-586.

Eysenck, M.W., & Calvo, M.G (1992). Anxiety and performance: The processing efficiency theory. Cognition and Emotion, 6 (6), 409-434.

Fazey, J.A., & Hardy, L. (1988). The Inverted -U Hypotheses: A Catastrophe for Sport Psychology. British Association of Sport Sciences Monograph No.1 National Coaching Foundation, Leeds.

Fenigstein, A., Scheier, M F., & Buss, A. H. (1975). Public and private self-consciousness: assessment and theory. Journal of Consulting and Clinical Psychology, 43, 522-527.

Fisher, A.C. (1976). Psychology of Sport: Issues and Insights. Palo Alto, CA: Mayfield.

Fitts, P., Bahrick, H., Noble, M., & Briggs, G. (1991). Skilled Performance. New York: Wiley.

Fitts, P., & Posner, M. (1967). Human Performance. Brooke/Cole: Belmont CA.

Folkman, S., & Lazarus, R.S. (1985). If it changes it must be a process: Study of emotion and coping during three stages of a college examination. Journal of Personality and Social Psychology, 48, 150-170.

Foster, J.B. (1977). Putting on the agony. World Medicine, 29, 26-27.

Fuchs, A.H. (1962). The progression-Regression hypothesis in perceptual motor skill learning. Journal of Experimental Psychology, 63, 177-183.

Gallwey, T.W. (1976). Inner tennis. Random House: New York.

Gallwey, T.W. (1981). The inner game of golf. Random House: New York.

Gibbons, F.X., Carver, C.S., Scheier, M.F., & Hormuth, S.E. (1979). Self-focused attention and the placebo effect: Fooling some of the people some of the time. Journal of Experimental Social psychology, 15, 263-274.

Gould, D., Jackson, S.A., & Finch, L. (1993a). Life at the top: The experiences of U.S. national champion figure skaters. The Sport Psychologist, 7, 354-374.

Gould, D., Jackson, S.A., & Finch, L. (1993b). Sources of stress in national champion figure skaters. Journal of Sport and Exercise Psychology, 15, 134-159.

Gur, R.C., & Sackeim, H.A. (1979). Self-deception: A concept in search of a phenomenon. Journal of Personality and Social Psychology, 37, 147-169.

Hall, C.R., & Martin, K.A. (1997). Measuring movement imagery abilities: A revision of the Movement Imagery Questionnaire. Journal of Mental Imagery, 21, 143-154.

Hall, C.R., & Pongrac, J. (1983). Movement imagery Questionnaire. London, ON: University of Western Ontario.

Hamilton, V. (1983). The cognitive structure and processes of human motivation and personality. Chichester: Wiley.

Hanton, S., & Jones, G. (1999). The acquisition and development of cognitive skills and strategies: I making the butterflies fly in formation. The Sport Psychologist, 13, 1-21.

Hardy, L. (1990). A catastrophe model of anxiety and performance. In J.G.Jones and L.Hardy (eds), Stress and Performance in Sport, Wiley, Chichester, pp. 81-106.

Hardy, L. (1996). A test of catastrophe models of anxiety and sports performance against multidimensional anxiety theory models using the method of dynamic differences. Anxiety, Stress and Coping, 9, 69-86.

Hardy, L. (1998). Responses to reactants on three myths in applied consultancy work. Journal of Applied Sport Psychology, 10, 212-219.

Hardy, L., Jones, G., & Gould, D. (1996). Understanding psychological preparation for sport: Theory and practice of elite performers. Chichester: John Wiley & Sons.

Hardy, L., Mullen, R., & Jones, G. (1996). Knowledge and conscious control of motor actions under pressure. British Journal of Psychology, 87, 621-636.

Hayes, N. A., & Broadbent, D. E. (1988). Two models of learning for interactive tasks. Cognition, 28, 80-108.

Hefferline, R., Keenan, B., & Harford, R. (1959). Escape and avoidance conditioning in human subjects without the observation of their response. Science, 130, 1338-1339.

Hockey, G.R.J., & Hamilton, P. (1983). The cognitive patterning of stress states. In G.R.J. Hockey (ed.). Stress and Fatigue in Human Performance. Wiley: Chichester, pp. 331-362.

Hodge, N.J., & Franks, I.M. (2002). Learning a coordination skill: Interactive effects of instruction and feedback. Research Quarterly for Exercise and Sport, 72, 132-142.

Hull, C.L. (1943). Principles of Behaviour. New York: Appleton-Century.

Innes, J.M. & Young, R.F. (1975). The effect of presence of an audience, evaluation apprehension and objective self-awareness on learning. Journal of Experimental Social Psychology, 11, 35-42.

Innes, J.M., & Young, R.F. (1975). The effect of the presence of an audience, evaluation apprehension and objective self-awareness on learning. Journal of Experimental Social Psychology, 11, 35-42.

Jackson, R.C., & Wilson, R.J. (1997). Using 'Swing Thoughts' to Prevent Paradoxical Performance Effects in Golf Putting. In: M.R. Farrally & A.J. Cochrane, (Eds.), Science and Golf III: Proceedings of the World Scientific Congress of Golf, (pp. 166-173). London: E. & F.N. Spon.

Johnston, L.H., Corban, R.M., & Clarke, P. (1999). Multi-method approaches to the investigation of adherence issues within sport and exercise: Qualitative and quantitative techniques. In: S. J. Bull, (Eds.), Adherence Issues in Sport and Exercise, (pp. 263-284). Chichester: Wiley.

Jones, G. (1990). A cognitive perspective on the processes underlying the relationship between stress and performance in sport. In J.G. Jones & L.Hardy. (Eds). Stress and Performance in Sport. Chichester: Wiley.

Jones, G. (1991). Recent issues in competitive state anxiety research. The Sport Psychologist, 4, 152-155.

Jones, G. (1995). More than just a game: Research developments and issues in competitive anxiety in sport. British Journal of Psychology, 86, 449-478.

Jones, G. & Hanton, S. (1996). Interpretation of competitive anxiety symptoms and goal attainment expectations. Journal of Sport and Exercise Psychology, 18, 144-157.

Jones, G., Hanton, S., & Swain, A.B.J. (1994). Intensity and interpretations of anxiety symptoms in elite and non-elite sport performers. Personality and Individual differences, 17, 467-472.

Jones, G., & Hardy, L. (1989). Stress and cognitive functioning in sport. Journal of sport science, 7, 41-63.

Jones, G., & Hardy, L. (1990). Stress and Performance in Sport. Wiley, Chichester.

Jones, G. & Swain, A.B.J. (1992). Intensity and direction dimensions of competitive state anxiety and relationships with competitiveness. Perceptual and Motor Skills, 74, 467-472.

Jones, G., & Swain, A.B.J. (1995). Predispositions to experience debilitative and facilitative anxiety in elite and non-elite performers. The Sport Psychologist, 9, 202-212.

Jones, G., Swain, A.B.J., & Hardy, L. (1994). Intensity and direction dimensions of competitive state anxiety and relationships with performance. Journal of Sports Science, 11, 525-532.

Kahneman, D. (1973). Attention and effort. Englewood Cliffs, NJ; Prentice-Hall.

Kahneman, D., & Treisman, A. (1984). Changing views of attention and automaticity. In varieties of attention (edited by R. Parasuraman and D.R. Davies), pp. 29-61. London: Academic Press.

Kazdin, A.E. (1992). Single case research designs: Methods for clinical and applied settings. New York: Oxford Press.

Keele, S. W. (1973). Attention and human performance. Pacific Palisades, CA: Goodyear.

Kerr, J. H. (1973). The experience of arousal: A new basis for studying arousal effects in sport. Journal of Sport Science, 3, 169-179.

Kingston, K.M., & Hardy, L. (1994). Factors affecting the salience of outcome performance and process goals in golf. In A.J. Cochran & M.R. Farally (Eds.), Science and golf II (pp. 144-149). London: Chapman and Hall.

Kingston, K.M., Hardy, L., & Markland, D. (1992). A study to compare two different goal orientations on a number of situationally relevant performance components. Journal of Sports Sciences, 10, 610-611.

Klatzky, R. L. (1984). Memory and awareness: an information processing perspective. New York: W. H. Freeman.

Kleiman, G.M. (1975). Speech recording in reading. Journal of Verbal Learning and Verbal Behaviour, 14 (4), 323-339.

Krane, V. (1994). The mental readiness form as a measure of competitive state anxiety. The Sport Psychologist, 8, 189-202.

Lacey, J.I. (1967). Somatic response patterning of stress: Some revisions of activation theory. In M. Appley & R. Trumbell (eds.). Psychological Stress in Research. Appleton: New York.

Landers, D.M., & Boutcher, S.H. (1986). Arousal-performance relationships. In J.M.Williams (ed.). Applied Sport Psychology. Mayfield, Palo, Alto, CA.

Langer, E., & Imber, L. G. (1979). When practice makes imperfect: debilitating effects of overlearning. Journal of Personality and Social Psychology, 37, 2014-2024.

Ladin, D.K., Herbert, E.P., & Fairweather, M. (1993). The effects of variability practice on the performance of a basketball skill. Research Quarterly for Exercise & Sport, 64, 232-237.

Lazarus, R.S. (1966). Psychological stress and coping process. New York: McGraw-Hill.

Lazarus, R.S. (1982). Thoughts of the relation between emotion and cognition. American Psychologist, 37, 1019-1024.

Lazarus, R.S. (2000). How emotions influence performance in competitive sports. The Sport Psychologist, 14, 229-252.

Lazarus, R.S., & Folkman, S. (1984). Stress, Appraisal and Coping. New York: Springer-Verlag.

Lee, T.D., & Swinnen, S.P. (1993). Three legacies of Bryan and Harter: Automaticity, Variability and Change in skilled performance. In: cognitive Issues In Motor Expertise, (eds.) J.L. Starkes and F. Allard, pp. 295-944. Elsevier: Amsterdam.

LeUnes, A., & Nation, J. (1996). Sport Psychology : An Introduction. 2nd ed. Nelson-Hall Inc. Chicago.

Levitt, E. E. (1980). The Psychology of Anxiety. Hillsdale, NJ : Erlbaum.

Lewis, B.P., & Linder, D.E. (1997). Thinking about choking? Attentional processes and paradoxical performance. Personality and Social Psychology Bulletin, 23, 937-944.

Liao, C., & Masters, R.S.W. (2001). Analogy learning: A means to implicit motor learning. Journal of Sports Science, 19, 307- 319.

Liebert, R.M., & Morris, L.W. (1967). Cognitive and emotional components of test anxiety: A distinction and some initial data. Psychological Reports, 20, 975-978.

Liebling, B.A., & Shaver, P. (1973). Evaluation, self-awareness, and task performance. Journal of Experimental Psychology, 9, 297-306.

Light, L.L., & Singh, A. (1987). Implicit and explicit memory in young and older adults. Journal of Experimental Psychology: Learning, Memory and Cognition, 13, 531-541.

Loehr, J.E. (1982). Mental toughness training for sport, Boston: Greene.

Logan, G.D. (1978). Attention in character classification: Evidence for the automaticity of component stages. Journal of Experimental Psychology: General, 107, 32-63.

Logan, G.D. (1979). On the use of concurrent memory load to measure attention and automaticity: Journal of Experimental Psychology: Human Perception and Performance, 5, 189-207.

Logie, R.H. (1995). Viso-spacial working memory. Hove: Lawrence Erlbaum.

Logie, R.H. (1999). Working Memory. The Psychologist, 14, (4), 174-178.

MacMahon, K.M.A., & Masters, R.S.W (2002). The effects of secondary tasks on implicit motor skill performance. International Journal of Sport Psychology, 33, 307-324.

Maddox, D., Wulf, G., & Wright, D.L. (2000). The effects of an internal vs. external focus of attention on the learning of a tennis backhand. Unpublished manuscript, Texas A & M University, USA.

Mandler, G, & Sarason, S.B. (1952). A study of anxiety and learning. Journal of Abnormal Psychology, 47, 166-173.

Marcel, A.T. (1983). Conscious and unconscious perception: An approach to the relationship between phenomenal experience and perceptual processes. Cognitive Psychology, 15, 238-300.

Martens, R. (1971). Anxiety and motor behaviour: A review. Journal of Motor Behaviour, 3, 151-179.

Martens, R., Burton, D., Rivkin, F., & Simon, J. (1980). Reliability and validity of the Competitive State Anxiety Inventory (CSAI). In, C.H. Nadeau, W.C. Halliwell, K.M. Newell, & G.C. Roberts (Eds.), Psychology of motor behavior and sport – 1979 (pp.91-99). Champaign, IL: Human Kinetics.

Martens, R., Burton, D., Vealey, R.S., Bump, L.A., & Smith, D.E. (1990). Development and validation of the Competitive State Anxiety Inventory-2 (CSAI-2). In, Competitive Anxiety in Sport (edited by R. Martens, R.S. Vealey, & D. Burton), pp. 117-213. Champaign: Human Kinetics.

Martens, R., & Landers, D.M. (1972). Evaluation potential as a determinant of coaction effects. Journal of Experimental Social Psychology, 8, 347-359.

Masters, R. S. W. (1992). Knowledge, knerves and know-how: the role of explicit versus implicit learning in the breakdown of a complex motor skill under pressure. British Journal of Psychology, 83, 343-358.

Masters, R. S. W. (2000). Theoretical aspects of implicit learning in sport. International Journal of Sport Psychology, 31, pp. 530-541.

Masters, R. S. W., Polman, R. C. J., & Hammond, N. V. (1993). 'Reinvestment': a dimension of personality implicated in skill breakdown under pressure. Personality and Individual Differences, 14, 655-666.

Maxwell, J.P., Masters, R.S.W., & Eves, F.F. (2000). From novice to know-how: A longitudinal study of implicit motor learning. Journal of Sports Sciences, 18, 111-120.

Maxwell, J.P., & Masters, R.S.W. (2002). External versus internal instructions: Is the learner paying attention? International Journal of Applied Sport Science, 14 (2), 70-88.

Maxwell, J.P., Masters, R.S.W., Kerr, E., & Weedon, E. (2001). The implicit benefit of learning without errors. Quarterly Journal of Experimental Psychology, 54A, 1049-1068.

McDaniel, K. D., Cummings, J. L., & Shain, S. (1989). The "Yips": a focal dystonia of golfers. Neurology, 39, 192-195.

McDonald, L. G. (1951). The construction of a kicking skill test as an index of general soccer ability. Unpublished Master's thesis, Springfield College, cited in J. S. Bosco and W. F. Gustafson (1983), Measurement and evaluation in physical education, fitness, and sports, Englewood Cliffs, NJ, Prentice Hall.

McLeod, P., McLaughlin, C., & Nimmo-Smith, I. (1985). Information encapsulation and automaticity: Evidence from the visual control of finely timed actions. In M.I Posner & O.S Marin (eds.), Attention and PerformanceXI, pp. 391-406. Erlbaum: Hillsdale, NJ.

McMorris, T., Gibbs, C., Palmer, J., Payne A., & Torpey, N. (1994). Exercise and performance of a motor skill. The British Journal of Physical Education: Research Supplement, 15, 23-27.

McNevin, N.H., Shea, C.H., & Wulf, G. (2003). Increasing the distance of an external focus of attention enhances learning. Psychological Research, 67, 22-29.

McNevin, N.H., & Wulf, G. (2002). Attentional focus on supra-postural tasks affect postural control. Human Movement Science, 21, 187-202.

Miles, M.B., & Huberman, A.M. (1994). Qualitative Data Analysis: An Expanded Sourcebook, 2nd Edition. Thousand Oaks CA: Sage.

Moody, L. (1993). The mental and physical condition known as the yips. Cricketer International, 74, 2, 36-37.

Morris, L.W., Davis, D. & Hutchings, C. (1981). Cognitive and emotional components of anxiety: Literature review and revised worry-emotionality scale. Journal of Educational Psychology, 75, 541-555.

Morris, L.W., & Liebert, R.M. (1969). Effects of anxiety on timed and untimed intelligence tests. Journal of Consultancy and Clinical Psychology, 33, 240-244.

Mullen, R., & Hardy, L. (2000). State anxiety and motor performance: Testing the conscious processing hypothesis. Journal of Sports Sciences, 18, 785-799.

Naveh-Bejamin, M., & Jonides, J. (1984). Maintenance rehearsal: A two-component analysis. Journal of Experimental Psychology: Learning, Memory, and Cognition, 13, 595-605.

Neely, J.H. (1977). Semantic priming and retrieval from lexical memory: Roles of inhibitionless spreading activation and limited-capacity attention. Journal of Experiential Psychology: General, 106, 226-254.

Neiss, R. (1988). Reconceptualising arousal: Psychobiological states in motor performance. Psychological bulletin, 103, 345-366.

Newell, K.M., & Slifkin, A.B. (1996). The nature of movement variability. In J. Piek (Ed.), Motor control and human skill: A multidisciplinary perspective. Champaign, IL: Human Kinetics.

Nissen, M.J., & Bullemer, P. (1987). Attentional requirements of learning: Evidence from performance measures. Cognitive Psychology, 19, 1-32.

Oldham, A.R.H. (2001). Factors affecting the conscious control of movement. Unpubished Ph.D. thesis, University of Wales, Bangor.

Orlick, T., & Partington, J. (1988). Mental links to excellence. The Sport Psychologist, 2, 105-130.

Pates, J., & Maynard, I. (2000). Effects of hypnosis on flow states and golf performance. Perceptual and Motor Skills, 91, 1057-1075.

Patton, M. Q. (1990). Qualitative evaluation and research methods (2nd ed.). Newbury Park: Sage.

Patton, M.Q. (2002). Qualitative Research and Evaluation Methods 3rd Edition. London: Sage.

Paulus, P.B., Annis, A.B., & Risner, H.T. (1978). An analysis of the mirror-induced self-wareness effects. Bulletin of the Psychonomic Society, 12, 8-10.

Posner, M.I., & Synder, C.R.R. (1975). Attention and cognitive control. In R.L. Solso (ed.), Information Processing and Cognition: The Loyola Symposium, pp. 55-85. Erlbaum: Hillsdale, NJ.

Pribram, K.H., & McGuiness, D. (1975). Arousal, activation and effort in the control of attention. Psychological Review, 82, 116-149.

Prinz, W. (1997). Perception and Action Planning. European Journal of Cognitive Psychology, 9, (2), 129-154.

Raffety, B.D., Smith, R.E., & Ptacek, J.T. (1997). Facilitating and debilitating trait anxiety, situational anxiety and coping with an anticipated stressor: A process analysis. Journal of Personality and Social Psychology, 72, 892-906.

Reber, A. S. (1967). Implicit learning of artificial grammars. Journal of Verbal Learning & Verbal Behaviour, 5, 855-863.

Reber, A.S. (1989). Implicit learning and tacit knowledge. Journal of Experimental Psychology: General, 118, 219-235.

Reber, A.S. (1993). Implicit learning and tacit knowledge: An essay on the cognitive unconscious. New York: Oxford University Press.

Reber, A.S., & Allen, R. (1978). Analogy and abstraction strategies in synthetic grammar learning: A functional interpretation. Cognition, 6, 189-221.

Rogers, C.R. (1980). A way of being. Houghton Mifflin: Boston.

Roger, D., & Nesshoever, W. (1987). The construction and preliminary validation of a scale for measuring emotional control. Personality and Individual Differences, 8, 527-534.

Sachdev, P. (1992). Golfers' cramp: Clinical characteristics and evidence against it being an anxiety disorder. Movement Disorders, 4, 326- 332.

Salmoni, A.W. (1989). Motor skills learning. In Holding, D.H. (ed.), Human Skills: Second edition, pp261-332. John Wiley & Sons: London.

Sarason, I.G. (1972). Experimental approaches to test anxiety: Attention and the uses of information. In C.D. Speilberger (Ed.), Anxiety: Current Trends in Theory and Research, 2, New York: Academic Press.

Scanlan, T.K., Stein, G.L., & Ravizza, K. (1991). An in-depth study of former elite figure skaters: III. Sources of stress. Journal of Sport and Exercise Psychology, 13, 103 - 120.

Schacter, D.L. (1987). Implicit memory: History and current status. Journal of Experimental Psychology: Learning, Memory and Cognition, 13, 501-518.

Scheier, M.S., Fenigstein, A., & Buss, A.H. (1974). Self-awareness and physical aggression. Journal of Experimental Social Psychology, 10, 264-273.

Scheier, M.S. Carver, C.S., & Gibbons, F.X. (1979). Self-directed attention, awareness of bodily states, and suggestibility. Journal of Personality and Social Psychology, 37, 1576-1588.

Schlenker, B.R., and Leary, M.R. (1982). Social anxiety and self-presentation: A conceptualisation and model. Psychological Bulletin, 92, 641-669.

Scheider, W., & Fisk, A.D. (1983). Attenion theory and mechanisms for skilled Performance. In R.A. Magill (Ed.), Memory and Control of Action (pp. 119-143). Amsterdam: North-Holland.

Schneider, W., & Shiffrin, R.M. (1977). Controlled and automatic human information processing: 1. Detection, search, and attention. Psychology Review, 84, 1-66.

Shea, C.H., & Wulf, G. (1999). Enhancing motor learning through external-focus instructions and feedback. Human Movement Sciences, 18, 553-571.

Simon, H.A. (1967). Motivational and emotional control of cognition. Psychological Review, 74, 29-39.

Singer, R.N. (1984). The learning of athletic skills and the use of strategies. International Journal of Sport Psychology, 15, 271-282.

Singer, R.N. (1988). Strategies and metastrategies in learning and performing self-paced athletic skills, The Sport Psychologist, 2, 49-68.

Singer, R.N. Defancesco, C., & Randall, L.E. (1989). Effectiveness of a global learning strategy practiced in difficult context on primary and transfer self-paced motor task. Journal of Sport and Exercise Psychology, 11, 290-303.

Singer, R.N., Lidor, R., & Cauraugh, J.H. (1993). To Be Aware or Not Aware? What to think About While Learning and Performing a Motor Skill. The Sport Psychologist, 7, 19-30.

Singer, R.N., Lidor, R., & Cauraugh, J.H. (1994). Focus of attention during motor skill performance. Journal of Sports Sciences, 12, 335-340.

Smith, A.M., Malo, S.A., Laskowski, E.R., Sabick, M., Cooney, W.P., Fennie, S.B., Crews, D.J., Eischen, J.J., Hay, I.D., Detling, N.J., & Kaufman, K. (2000). A multidisaplinary study of the 'yips' phenomenon in golf: An exploratory analysis. Sport Medicine, 30 (6), 423-437.

Speilberger, C.S. (1966). Theory and research on anxiety. In C.S. Speilberger (ed.), Anxiety and Behaviour, Academic Press, New York, pp. 3-20.

Speilberger, C.S., Gorsuch, R.I:, & Lushene, R.L. (1970). Manual for the State-Trait Anxiety Inventory. Palo Alto, CA: Consulting Psychologist.

Spence, J.T., & Spence, K.W. (1966). The motivational components of manifest anxiety: Drive and Drive stimulus. In Speilberger, C.D. (eds.). Anxiety and Behavior. New York: Academic press.

Swain, A.B.J., & Jones, J. G. (1992). Intensity and direction dimensions of competitive state anxiety and relationships with competitiveness. Perceptual and Motor Skills, 74, 467-472.

Swain, A.B.J., & Jones, J. G. (1996). Explaining performance variance: The relative contribution of intensity and direction dimensions of competitive state anxiety. Anxiety, Stress, and Coping: An International Journal, 9, 1-18.

Thomas, B. (1997). Fighting spirit. Macmillan. London. UK.

Vereijken, B., van Emmerik, R.E.A., Whiting, H.T.A, & Newell, K.M. (1992). Free(z)ing degrees of freedom in skill acquisition. Journal of Motor Behavior, 24, 133-142.

Wegner, D.M., & Giuliano, T. (1980). Arousal-induced attention to self. Journal of Personality and Social Psychology, 38, 719-726.

Wegner, D.M., Schneider, D.J., Carter, S.R., & White, T.L. (1987). Paradoxical effects of thought suppression. Journal of Personality and Social Psychology, 53, 5-13.

Weinberg, R.S., & Gould, D. (1995). Foundation of sport and exercise psychology. Champaign, IL: Human Kinetics.

Wertz, S. K. (1986). Is "choking" an action? Journal of Philosophy of Sport, 8, 95 107.

White, J. (1993). Yikes it's golfers' yips. Physician and Sports medicine, 21, 6, 13-14.

Wine, J.D. (1971). Test anxiety and the direction of attention. Psychological Bulletin, 76, 92-104.

Woodman, T., & Hardy, L. (2001). Stress and Anxiety. In R. Singer, H.A., Hausenblas, & Janelle, C.M. (Eds.), Handbook of research on sport psychology, 2nd ed. (pp. 290-318). New York: Wiley.

Wulf, G., HoB, M., & Prinz, W. (1998). Instructions for motor learning: Differential effects of internal versus external focus of attention. Journal of Motor Behaviour, 30, 169-179.

Wulf, G. Lauterbach, B., & Toole, T. (1999). The learning advantage of an external focus of attention in golf. Research Quarterly for Exercise and Sport, 70, (2), 120-126.

Wulf, G., McConnel, N., Gartner, M., & Schwarz, A. (2002). Enhancing the learning of sport skills through external-focus feedback. Journal of Motor Behaviour, 34, (2), 171-182.

Wulf, G. McNevin, N.H., Fuchs, T., Ritter, F., & Toole, T. (2000). Attentional focus in complex skill learning. Research Quarterly for Exercise and Sport, 71, (3), 229-239.

Wulf, G. McNevin, N.H., & Shea, C.H. (2001). The automaticity of complex skills learning as a function of attentional focus. The Quarterly Journal of Experimental Psychology, 54, (4), 1143-1154.

Wulf, G. & Prinz, W. (2001). Directing attention to movement effects enhances learning: A review. Psychological Bulletin and Review, 8 (4), 648-660.

Wulf, G., Shea, C., & Park, J. (2001). Attention and motor performance: Preferences for and advantages of an external focus. Research Quarterly for Exercise and Sport, 72, (4), 335-344.

Wulf, G., & Weigelt, C. (1997). Instructions about principles in learning a complex motor skill: To tell or not to tell... Research Quarterly for Exercise and Sport, 68, (4), 362-367.

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.

Zijlstra, F. R. H. (1993). Efficiency in work behaviour: A design approach for modern tools. Delft: Delft University Press.

Appendix 1

Flow Diagram of Thesis

Flow Diagram of Ph.D. Thesis

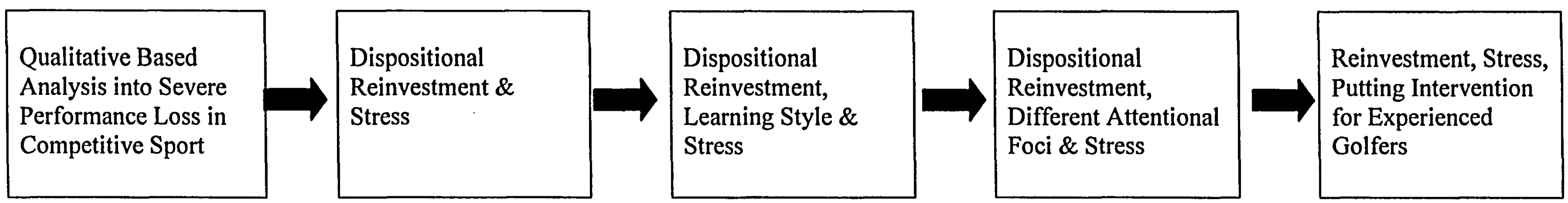
Study One	Study Two	Study Three	Study Four	Study Five

Time Line for Studies

2000	2001	2002	2003	2004

Time Taken to Collect Data

16 weeks	3 weeks	6 weeks	4 weeks	10 weeks



Appendix 2

Informed Consent for Study 1

Informed Consent Form

This study involves exploring your apparent severe loss of performance during competition. The aim of the study is to attempt to identify your personal experience, prior to, during and after your severe loss of performance. This semi-structured interview will last approximately one hour and will include five sections which are as follows:

(1) Interviewer's general details (2) Your general details (3) A detailed description of your most severe performance loss during competition (4) other negative experiences/discrepancies you have experienced during performance(s) (5) Summary questions and final comments.

If you feel comfortable with the interview procedure outlined above and are happy to participate, then please sign below. If you have any questions relating to this procedure please don't hesitate to ask.

I have read the description of the interview procedure and consent to participate in the study.

Name: ………………………………….. (please print)

Name: ………………………………….. (please sign)

Date: ……………………

Many Thanks!

Ben Chell

Appendix 3

A Survey on Individual Sporting Experiences

A Survey on Individual Sporting Experiences

Name: .... Age: ....

Tel: .... E-mail: ....

Main Sport(s): .... Years of Involvement: ....

Level competed at (i.e. Novice, recreational, local league, college, county, nationally, internationally): ....

1) Have you ever experienced times when you consistently perform with excellence in practice but poorly in a competitive environment?

Yes / No (please circle accordingly)

2) On a scale of 1 to 10 how well do you perform in competition (1 = Very Poor; 10 = Very Well)?

1 2 3 4 5 6 7 8 9 10 (please circle accordingly)

3) Have you ever experienced a loss of performance when competing, if so on a scale of 1 to 10 how severe do you perceive this experience to be (1 = not severe - 10 = Very Severe)?

1 2 3 4 5 6 7 8 9 10 (please circle accordingly)

4) If you have experienced a loss of performance in your sporting career please give a brief account of this experience below including the perceived cause(s), and how you felt before and during this experience (excluding physical injury)?

....

....

....

....

....

5) Are you prepared to be interviewed on your sporting experience(s)?

Yes / No (Please Circle Accordingly)

Appendix 4

Interview Guide for Study 1

Interview Guide

Introduction – Section (1):

- Explain nature of the interviews, get participants to sign consent form.
- Do you have any objections to my tape-recording this interview?
- All information will be kept strictly confidential – tapes will be erased when the relevant information has been transcribed.
- No names will be used when writing up this study for my thesis to **ensure** complete confidentiality.
- Interview duration – approximately 1 hour.
- The purpose of this study is to gain an insight in to severe performance loss of individuals during competition.
- The interview format comprises 5 sections: a) interviewer's general details, b) interviewee's general details, c) Interviewee's description of most severe loss during competition, d) other negative experiences/discrepancies during performance(s), e) Summary and questions.

Interview format
Section (2):- Interviewee's general details

The following were asked:

- How long have you played your sport?
- How old are you?
- At what standard are / were you competing?
- Are you currently still competing?
- Please give me some general background information on your involvement in your sport.

Section (3):- Interviewee's description of most severe loss during competition

The following was asked:

- Please describe to me your most severe experience when you felt you could not perform to your usual skill level.

Section (4):- Other negative experiences / discrepancies during competition (including other sports)

The following was asked:

- Please describe to me any other occurrence(s) when you experienced a severe loss of performance and felt you could no longer compete to your usual skill level (including other sports).

Section (5):- Summary questions and final comments

- The interviewer conveyed a brief summary of the interview content.
- The interviewee was given the opportunity to explain any aspects that were misinterpreted by the interviewer, and add any further comment if necessary.

Interviewee 8 - Golf

Name: .... Age: ....

Years of Involvement: .... Level competed at: ....

Please describe to me your most severe experience when you felt you could not perform to your usual skill level.

Right, it was erm... a couple of years ago it was qualifying for the club championships. It wasn't the pressure so much that I needed to qualify because I'd already qualified. It was just like a big medal event. Erm...but the reason it became so important to me was because of the fact that I was on a really good score, the course record was on. Through the first 9 or 10 holes you don't think much about it, you just think it's another round of golf until the pressure starts building and building as your score gets better and better. You start to think too much about what is going to happen at the end, rather than thinking hole by hole. So you are like, all you can think of, it probably happens in a lot of sporting events when you are in the lead or something, all you can think of is the fact that if I do this, this and this by the end I will have done it, where as you should always think more like, take things one hole at a time. I got through to the 16th. Hole, erm...just made a birdie and the 16th and 17th , they run parallel to each other. They are quite short holes, and there's a lot of water involved and out of bounds. So there are a lot of players dropping balls, and taking a lot of time on those 2 holes. So at the 16th I made a birdie to go 6 under, the course record at the time was 5 under.

So, at this point you were becoming more and more aware of the course record?

Yes. The problem came at the 17th tee, we had to wait a long time for the group in front to play. Erm...you always find that the more time you have to think the more scenarios go through your head. Shall I take this club, that club, shall I knock it down with that, shall I just hit an iron. I went from one club back to another. You know, the more you think about it the more you just want to get on with it. When you are in that scenario you just want to finish and get it over as quickly as possible. It's not, I would have said, an enjoyable situation to be in till it's actually finished, then you can look back on it and enjoy it. Because of the sort of pressure and stress that are involved in it, it has happened quite a few times in various events that I have been in, you don't actually enjoy it at the time. You are scared in a way that, but when you look back on it you think oh that was a great day, fulfilling day. So erm...we were waiting a long time on the tee and I don't know if your... how much you know about golf, but....I have this problem, I've always had this problem with what they call shanking, and erm...I eventually decided to take a 4 iron off the tee, it's a par 4 with water on the left and out of bounds on the right. So you know it's quite a tight hole and I ended up with the worst swing ever I could have ever put on it. I just wanted to try and guide it down the hole and erm..... it just went straight right, straight out of bounds. Then the first thing that comes into your head is I've blown it. I've blown the course record. You don't think, Oh right, it's not gone down there, I can still make a six, I can still make a good score up the last. All is that came into my head, caz I'd been thinking about it up the last previous 3 or 4 holes, I think ya, I've got a good chance here and suddenly in a flash it was gone, you know what I mean? From having a good chance, and just seeing that ball go like that in an instant, everything goes.

What impact do you think waiting to play between the 16th and 17th had on your performance?

I think this is quite, I think out of all the sports I have played golf has to be the most frustrating sport. It's not like a fluid game where you can just get on with it, you don't have to think. The more you have to think the worse it gets because you get so many negative thoughts in your mind. If you could just get on with it, like football, I play football as well, the pressure doesn't get to you because you are playing all the time and you just get involved in it and you don't have the time to think. But there's too much thinking in golf, you think about all, I mean it's a four hour round, four / four and a half-hour round. How much of that time do you spend hitting that ball? Very small amount of time, I would say three/three and a half-hours of that time is spent thinking about that next shot.

And that's what you were doing in this particular time period between the 16th and 17th?

Yes, yes.

Can you elaborate on some of the things you were thinking at this time?

I remember thinking well, I've got 2 choices here I either, because with my driver I can…I've got a shot that I know that it's always going to be going the same way. I can fade the ball with my driver to a certain degree, yes. Sometimes it doesn't work and it goes...it just stays straight and doesn't come back. Other times it does it a little bit too much but I know that 80% of the time it will go where I want it to. So I was thinking of that shot, just to start it out into the water and fading it back into the fairway, yes. It's a dodge shot because you are aiming it at a hazard, yes, or aiming it down the middle of the fairway. A 4 iron is probably easier to hit, less can go wrong, so I was weighing up those 2 options.

Can you elaborate on how you finally made your decision on which club to take?

Sure….the more you are waiting the more your brain gets a little bit more muddled. If I had to make the same choice now I would probably take the other choice, but maybe that's because of what happened. If I'd have done the same with a driver and knocked that out of bounds I would probably take the other club, but since then I have always taken a driver on that hole because of the memories of what happened. So there is a lot of…sort of picturing the shot, trying to work out what to do with each club and when I took that club there was no sort of definite decision of, Oh that's the club I want. I was always thinking about the other club as well. I was apprehensive and I thought right! I stood there first of all waiting for the people in front of us. Then I thought just knock the driver down there, then I thought no, no, no, no, its probably best to take the 4 iron…no, no, no drive, no 4 iron and I probably wasn't 100% committed to the shot I wanted to play.

You mentioned negative thoughts; can you describe to me some of the negative thought you were having at this time?

Yes, erm….when you are playing a shot like that, I suppose, if its just a practice round, the fairway seems really wide, but that's just stressful situations, pressure situations everything seems to come in like that (interviewee uses his hands to assimilate the narrowing effect of the fairway when under pressure) and all I could see on this particular occasion was a very narrow strip of fairway. Erm… and you are thinking of what could go wrong rather than what could go right. You can't…. Its difficult to picture the shot you want to play, erm…because all you are thinking, there is no sort of provision down the fairway everything else comes into play.

Could you elaborate on why, during this occasion the fairway in your mind appeared to narrow?

I think you can get too protective of your scores sometime in those sorts of situations, instead of thinking, just make 2 pars and you have beaten the course record; whereas a birdie and a par would beat the record by 2. You know, you get a bit negative; you get a little bit protective. I think when you start to get protective of your score that's when things can go wrong. Do you know what I mean? I changed my game, I was really sort of positive about the way I was going about it during the first 16 holes, caz the 16th a short par 4, so I took a driver out and just knocked it on the green, yes. Then, suddenly my game plan changed and like, you know? I think when you start playing, you know? If you play the first 16 holes positively, then you should carry on through the whole…. and because I had to think about it, I had to sort of change my whole game plan and reassess exactly where I was and what score I had. At this point I thought 2 pars does it, whereas if I had walked straight up to the 17th pumped, because I'd just got a birdie and thought, come on let's go. So I walked off the 16th 6 under. If I had to take the shot straight away, it might have been a different scenario. But when I had time to think about things and reassess what I'd done, or what I was doing in regards to my score, the adrenaline had left me from the last hole and fear had come into the game.

Did the fear and negative thoughts affect you during the first 16 holes?

Erm…not really, not really.

Where would your self-confidence have been on a scale of 1-10, 10 being very self-confident; 1 being not at all self-confident in performing well on the first 16 holes?

I would say about an 8, quite high.

So you were high in self-confidence and low in anxiety during the first 16 holes?

Yes, well, I would say low in anxiety, but it's building up. At the start, low in anxiety, and the more I went through if you're marking out of 10, say, about 1 through to 5 through that stage of the round.

Could you elaborate on why you think that was?

It's sort of the realisation of what you are doing and the fact that you are steadily building a good score and sort of, at any stage it might go wrong. But it wasn't until I walked onto the 17th and had to think about it, it probably rose from about 5 to 8.

This is your anxiety?

Yes.

So the realization was that you could break the course record...

Yes, caz 16 and 17, 17 especially is a hole where a lot can go wrong, you've got a very tight area to aim at, whereas on 14 or 15 you know if you hit a bad shot you can get away with it. If you hit a bad shot on 17 you are either in the water or out of bounds.

Could you expand on how this increase in anxiety affected you?

Erm...mentally your brain gets scrambled, I think that is probably the term we use, and when your brain gets scrambled there are too many thoughts.

Could you elaborate on how the anxiety affected your focus?

I think when I become anxious like that everything becomes a little bit more rushed, you don't take your time you just want to get that shot out of the way, and then walk to the next one, you know what I mean? Your pre-shot routine goes a little bit out of the window, or if it does stay there it becomes more rushed.

Could you expand on your self-confidence whilst you were waiting on the 17th?

I was feeling anxious so self-confidence wasn't quite as high. Erm.... as I said I wasn't 100% committed to the club that I was going to use, so you know, there was a loss of self-confidence in the 5 or 10 minute period while we were waiting. When I went off the 16th confidence was quite high, and then that 5 minute waiting period, it just...just, I mean on your scale 1-10 the self-confidence on the 16th was here and the anxiety was there and then it just went like that (interviewee assimilates with his hand that self-confidence and anxiety became inverse). All that I could think about was the course record...the other guys were chatting away, and I tried to join in but I couldn't concentrate on what they were saying. I was thinking about what was going on in front of me.

You said earlier that you took a 4 iron and you'd decided that was the club you were going to take although you weren't sure and your words were... "I just tried to guide it down the middle of the hole" can you elaborate on this please?

Well, it's a shot I don't know really, you just try, you lift you head quickly because you want to see where it is going, you just try and push it down there and its not your natural swing, yes! Erm...I think my brain was so scrambled, all I was thinking about was knocking it down there and seeing where it had gone. The technique just went completely out of the window.

So after you had hit the 4 iron what happened after that?

Well it went out of bounds so I had to play another ball off the tee, erm...so I decided to take the driver this time and I hit it into the water. From that point on it was like a lost time you know what I mean? It was just like you couldn't really remember what the hell was going on, it was just like the brain was so scrambled I wanted to get the hole over as quickly as possible. So I've hit one out of bounds and playing three off the tee. I've hit another one into the water, so now I'm playing my fifth shot to the green with a wedge. Once again, technique completely out the window, shanked that one out of bounds again (nervous laughter), so I'm now playing 7, came up short of the hole, erm...chipped on and 2 putted for a 10 (laughs). So I went from 6 under to level parr in the space of one hole (laughs). You wanted to hear about severe performance loss (laughs).

Could you just describe to me in detail the rest of the shots on that hole?

Erm... I wasn't concentrating on any of the shots I played on that hole, all I was thinking about was the first shot I played on the 17th ...thinking - why did I do that, why didn't I take this club instead of that one?

So you were still thinking about the previous bad shot?

Yes, oh yes, yes, yes. And like you weren't concentrating on the shots that you were playing at all, you couldn't get it out of your head of what you'd done, it was so stupid.

How did that make you feel?

Well! You go from like ecstatic to deflated in the space...and because it's such a short time period, you know what I mean? If its something like football and you lose a goal you can get it back, do that in a round of golf and there's no way of getting it back. You know you can't recover from that, from a 10...ha, or even a 6 or a 7.

Could you expand on how you felt during these shots that you were playing; the first shot that went out of bounds, the second that went in to the water and the third, which you again chipped out of bounds?

Erm...yes, I was probably more anxious standing on the tee, than I was actually playing the shots. The reason that I got a severe performance loss for the rest of the hole was my loss of concentration. The fact that I was thinking of what I'd done, on the first shot. I just wasn't concentrating on the shots. I just wanted to get them out of the way and finish the hole, get off and get on with finishing the round.

You put in your survey that you felt physically sick, could you elaborate on this for me please?

You just feel gutted from what you had just lost in the matter of a minute, err...it was the fact that you've blown the course record, erm...you've lost your chance of winning that competition, erm...you've lost the chance of getting your handicap cut. I would have probably been cut to almost scratch, being as I was 6 under. All those factors, mainly the course record...

You were aware of these factors whilst playing?

Yes, yes, it's too much going on, these things are going round in your head and taking priority over the shot that you are trying to play. So, obviously the quality of the performance significantly decreases because you are not actually concentrating on what you are doing, you are off somewhere else.

How many players were in your group?

2 others.

Were there any spectators?

No.

So it was just the 3 of you?

Yes.

Were other people aware of your performance that may have been playing or waiting to play certain holes?

I don't think.... I think there were a few people aware of my score err…but they were all playing there own game. No one was coming out and watching, everyone was playing their own game. So the only people that were really aware and watching were the 2 people I was playing with. One of them was the guy that I was talking about earlier, one of my mates that plays off+1, erm…,and Steve, he plays off about 15/16. So I mean, actually the funny thing is, and that came into it as well, was the fact that the guy I was playing with, held the course record of 67, 5 under, and I was one shot better at that point. Erm…1 know he was willing me on to do it but you know, at the same time he probably didn't want to lose it, so that was probably going round my head as well.

Okay, the people that you were playing with, did they affect you at all?

Yes, I mean especially the better of the players I was with. I don't think the other guy was even aware of what score I was on because he was quite a new player and didn't really realise the significance; whereas the better player did. He knew exactly what was going on, exactly what score I was on and we'd played a lot of golf together, me and this other guy, and you know he wouldn't have wished that on me and I wouldn't have wished that on him. For him, it was quite hard as well, to watch me doing that. Erm..., you know; you'd think he'd be glad that I wasn't now going to beat the course record. I think he was genuinely gutted for me as well, so...

Could you elaborate on how that made you feel?

Yes, I mean at the start of the match, I mean I'd been playing well up until then and for weeks before that, but you never expect to be at that score. If someone said to me on the first tee you are going to be 6 under after 16, you'd go, "No, I don't think so". So you are out there to score well you're not sort of targeting a particular score. So my expectations were quite high for playing well, but I wasn't expecting to beat that particular score at that particular time. As the round went on and you are 2 or 3 under, you start looking toward the other holes, thinking there are some really good birdie opportunities out there. There are some holes when you've just got to make your parr and you know, it just went to plan, and you thought well, if I can make birdie down 12, it's a parr 5 and a birdie down 14, which is also a parr 5 then I will be 5 under. Then just make parr at 13 and 15 which are parr 3's and that all went to plan, and then brought the driver out at 16 and knocked it on the green for 6 under, and it like, well, everything is going to plan.

Sure. In-between 16 and 17 you had this wait, where did your expectations lie at this point?

All I was looking to do was just to parr it, and was still expected to do it. It's always the hardest, its always hard to cross that finishing line, you know what I mean? That's the hardest part, whether your playing golf or another sport, it's actually like finishing it off, finishing the whole thing off and completing the game. So I was expected to do it but I knew that there were dangers out there that could spoil it. But at that time I still expected to be 6 under after 18.

Ho did these expectations make you feel physically?

After what I'd done I didn't feel relaxed, because of the mental side of it your swing just goes completely to pot, it's like, you are tense. That's the thing that when you shank the ball, once you've done it once, it's very difficult not to do it again. It's_one of those faults where you hit one, and I've done this before where I've played a whole round where I'm standing over the ball knowing that I'm going to do it again and there's nothing I can do about it.

So it's like pre-emptive?

Oh yes. The second time when I shanked it out of bounds and I was standing there and I knew I was going to do it, or I was pretty sure I was going to do it. Erm...and I rushed it and off it went. So yes, I think it is the fact that you tense up and grip the club tightly and you don't actually go through with the shot you just try and push at it, guide it.

So it's almost a completely different stoke from what you would normally do?

Yes, yes.

Erm...did you manage to gain your previous form for the last hole?

I boggied the last just because you know, the expectations had gone, everything had gone. It didn't really matter anymore, it didn't really matter what I scored on the last hole. I didn't...you know, the concentration had gone, there was, you know, what had happened to me on the 17th there was nothing more to play for on the 18th. I just played it out and made boggie. I mean if I'd have parred it I would have still been under my handicap, as I was playing off 1, but I wasn't even thinking about that. My expectations were so high before hand nothing could make up for it, or even partly make up for what I'd just done. So everything was still going round in my head, plus the fact I would have to walk in and like people who knew I was on a good score would wonder why, or how the hell I'd finished 1 over parr after being, when they saw me, 4 or 5 under. And like that's what I was thinking about!

So you were also aware at this point of what people might have been thinking about you?

Yes, yes.

Could you expand on this awareness of others for me please?

I just think in general I'm quite a self-conscious person and always wondering what people might be thinking about me. Erm... I mean you think you are strong enough to get through something like that, you don't think you can ever do something like that;

you can't work out what has happened. And all you are thinking of is, if this can happen once it can happen again. Erm...

So on a scale of 1-10 where would you say your self-consciousness lay prior to this performance loss, 1 being very low and 10 being very high in self-consciousness?

Erm...Well, I'm quite a self-conscious person anyway so it would never be sort of really low, but sort of a 3 or 4. Mind you, erm...you are always self-conscious even if you perform well and if I had managed to get through I would be self-conscious finding out what people thought of what I'd done either way; but it's a good feeling, a good self-conscious feeling. Whereas when you've blown it, all you want to do is get out the clubhouse, get in the car and drive home. You're pissed off; you don't really want people to know what you have done. I mean it's difficult because people really wouldn't know what to say in a situation like that. I wouldn't know what to say.

What about waiting on the 17th?

Erm...it was more or less 9 or 10 (referring to levels of self-consciousness) when I was on the 17^{th}.

How important is golf to you?

I'm obsessive about it! I used to play, I used to have a job where I worked in the evenings and because I had that free time during the day I would play golf a lot of the time. Say 4 or 5 times a week, but because I played so much, you know if you play any sport too much you lose the enthusiasm. Because I now have to work in the day I don't get time to play as much, at the moment I'm not too worried about it because it's not as obsessive as it used to be. Erm...

Were you obsessed with golf when you experienced this performance loss?

Oh yes, definitely; I was highly motivated to succeed. Whereas, compared to last weekend when I shot level parr and I couldn't work out why I couldn't get into it, I was like playing well, had a good score going but it felt like I didn't really care what happened, I just couldn't get involved in the game. If I'd have really concentrated I would have been 2 or 3 under, but I just, because that obsession had gone, you know, it didn't really matter as much. So I've noticed that in the last year there are more important things to me now than just scoring.

Could you elaborate on this decrease in obsession for the game and how it has affected you performance?

Erm... It varies really because you don't feel the pressure as much, but in the same light, like last weekend, you can't get into it as well, you can't get into it. So sometimes the pressure helps you sometimes it doesn't. As long as it's going all right the pressure helps you to concentrate, as soon as things start to go wrong the pressure debilitates your performance.

You mentioned earlier certain changes in the physical aspect of your stroke can you elaborate on that for me?

It's difficult to remember because you can't really remember what you have done. Erm...You are trying to block out what you have just done, but it's difficult. You are more like...rather than having a relaxed fluid swing, you are pushing at it. It's like a nervy swing its not a full swing, it's more of a mechanical swing, it's not fluid.

When you say, "guided" can you explain that in more detail?

Yes, erm...You are just trying to push at it and look up as soon as you've hit it, to see where it has gone...hoping, yes, yes, hoping that it has gone in the right direction. So your heads up, you've got a mechanical swing and it's the complete opposite to what you should be doing.

Okay, did this experience ever affect subsequent performances?

Erm...I think, to a certain degree you learn from what you have done. Erm...From the previous scenario that you've been in and it's happened on the odd occasion but not to the same degree. If it has happened I probably got away with it. Once you've got away with it you realise what you have done, you realise, my god I've just tried to hit the same shot that I tried to hit 'that time'. Fortunately I've got away with it, as you concentrate you don't do that again. But you know it could happen again.

Does that worry you at all?

Yes, yes, of course.

Every time you play?

No, occasionally! It's not very often that I'm in that situation to be honest.

What kind of situation would you need to be in to elicit this concern about past experiences?

It would have to be quite a big competition; it would have to be a good score going or a very close match. It could have been a very tight finish to this year's club championships and I made, to a certain degree, the same mistake, I lost my concentration on the last hole. I'm 2 shots ahead and I've pulled it into the heavy rough. At this point I'm feeling the same way as I felt that other time. Even though I have a 2 shot cushion, it could quite easily happen again, caz. It was in long rough and possibly I wouldn't have found the ball, but fortunately I did. All you could do was punch it out onto the fairway, which was about 15 yards...at this point I've played 2 and he's played 1. I still know that if I can knock it onto the green and 2 putt he's still got to make birdie to beat me or to tie. But I ended up making 6 and he ended up making a 4. Erm...So that made us level, but for some reason it didn't really...I knew that all I needed to do was make a 4 up the last. I thought I had blown it, but I hadn't you know, I was still in there, and it went to play off. Erm...But it made me even more determined to win for some reason, that time. I played very well over the next 3 holes and because I was holder of the dam thing, I did want to lose it, I just wasn't going to lose it. Erm...So some times you see pressure manifests itself in different ways. Okay it was a slight performance loss on the last hole but my confidence was still there to play well.

Because it wasn't like I'd, you know, I'd just hit one bad shot really and it wasn't that I was really pressured when I hit it, I just lost concentration. I knew it was because I didn't concentrate. I didn't feel under pressure because I was 2 in the lead. Then I played the next 3 holes quite well.

Could you elaborate the times when you questioned you ability to perform well?

Erm.........When I was on the 17th and 6 under I suddenly started to question my ability. I stood on the tee and knew that I wasn't going to play a very good shot. Erm...And yes, it has happened on other occasions, it's mainly the shank thing. You get that in your head, once you get that in your head...you do it once then over and over again. And all that you can think of when you are standing there is it's going to go over there, it not going to go straight it's going to go right.

How did that make you feel!

If it's another fault then it's easier to rectify caz, it's a one off. But this particular fault that I do get now and again ....it's not just me, it's the same with a lot of people. Once they've hit one they hit another then another and all they can think of is hitting that shot.

When does this normally occur?

Erm...there are various ways in which it happens and one of them is tensing up and, err.... trying to push at the ball rather than follow through the ball. Erm...So yes, it does happen frequently and I shouldn't be doing that really, not at my standard. Yes, it is quite frequent, when it happens.

Any other situations where you feel you experienced a severe performance loss in golf or any other sports?

No, I don't think so, I mean, especially physical sports I think the adrenaline builds up so much that I don't think you really get the fear. Erm...Whereas, all I'll say with golf is that like I said before, you are waiting so long, or there's so much time between each shot, probably to much time to think. There are too many scenarios that can go on in your head. It's not like a split decision, an instant decision that you have to make like in a game of football. You don't have time to think in football, whereas there is too much more time to think in golf. I think golf is quite a unique sport in that way. Erm...There are sports where you have to wait a long time, maybe snooker. But really if you're sitting down you are not in control of the situation, if you're sitting down when the other player is building a break, you are not in control of that situation you have to wait while he's building a break. You're reliant too much on the other person, whereas in golf it's an individual sport. Most of the time you are not playing against another person you are playing against the course, or you are playing against a lot of people, but not directly one to one like snooker. But you are in control of the situation and you have a lot of time to think about it and, or, it takes the right sort of person to be able to deal with that. All these top pro's, you know, they can blank everything out you know, and they will concentrate, you have to concentrate for 4.5 hours, it a long time. Although its not a physical sport, as such, it's not like you have to be amazingly fit to play, but you have to be amazingly fit in there (interviewee points to his head), the brain. Because you're only playing for about half an hour, actual shot making, the rest of the time it's a mental game. They reckon the game is sort of 70/80% mental and only 20% skill.

You mentioned 'fear' earlier could you expand on this feeling?

I feared failure on that day on the 17^{th}, and that fear was a fear of failure.

From where did this fear transpire?

Erm…I don't know, you come so far in the round that there is always that fear of failure. I mean you aren't in total control sometimes of what you are doing and erm…… you know that there are dangers out there, and you know the possible scenarios that can happen. One of these scenarios is hitting it down the middle; another scenario is hitting it out of bounds. The more you stand there the more you think about the possible scenarios that lead to failure, than the possible scenarios that lead to success. Erm…In a way you are hoping that shot you play will lead to success, but you are fearing the shot that you play leads to failure. So, I don't know, I think the fear of failure does play on your mind and results in a loss in performance.

Okay, do you want to make any other comments or ask any questions?

Just that if I could mention that the guy I was playing with was a factor in this, being one a friend, and two a rival. Well, not a rival, but someone I've competed against before. There were only 2 of us in the club at that standard and there was always rivalry between us so it was very disappointing to do that in front of him, and I was aware of that when things started to go wrong.

Thank you for your time.

Reinvestment Scale

Name : ……………………….. Age : …………………..

The following statements describe characteristic of certain individuals. Read each statement and circle the answer (i.e. true / false; yes / no) that appropriately characterises you. There are no right or wrong answers. Do not spend too much time on any one statement.

1. I'm always trying to figure myself out.	True / False
2. I am concerned about my style of doing things.	True / False
3. I remember things that upset me or make me angry for a long time afterwards.	True / False
4. I reflect about myself a lot.	True / False
5. I get 'worked up' just thinking about things that have upset me in the past.	True / False
6. I'm constantly examining my motives.	True / False
7. I'm concerned about the way I present myself.	True / False
8. I often find myself thinking over and over about things that have made me angry.	True / False
9. I sometimes have the feeling of somewhere watching myself.	True / False
10. I think of ways of getting back at people who have made me angry long after the event has happened.	True / False
11. I'm self-conscious about the way I look.	True / False
12. I never forget people who upset me, even about small things.	True / False
13. I'm alert to changes in my mood.	True / False
14. One of the last things I do before leaving my house is look in the mirror.	True / False
15. When I am reminded of my past failures, I feel as if they are happening all over again.	True / False
16. Do you have trouble making up your mind?	Yes / No
17. I usually worry about making a good impression.	True / False
18. I'm aware of the way my mind works when I work through a problem.	True / False
19. I'm concern about what others think of me.	True / False
20. I worry less about the future than any one I know.	True / False

Modified Anxiety Rating Scale

Name : ....

Directions: A number of statements which athletes have used to describe their feelings before performing. Read each statement and then circle the appropriate number on the (vertical) scale from 1 to 7 to indicate how you are feeling right now before performing. Then circle the appropriate number on the (horizontal) scale from 1 to 7 to indicate whether you perceive your feelings to be detrimental or helpful to your performance. There are no right or wrong answers. Do not spend too much time on any one statement.

I feel nervous, my body feels tight and/or my stomach tense:

1.	Not at all	Very detrimental to performance	Very helpful to performance
2.	A little bit		
3.	Somewhat		
4.	Moderately so	1 2 3 4 5 6 7	
5.	Quite a bit		
6.	Very much so		
7.	Intensely so		

I feel concerned about performing poorly and that others will be disappointed with my performance:

1.	Not at all	Very detrimental to performance	Very helpful to performance
2.	A little bit		
3.	Somewhat		
4.	Moderately so	1 2 3 4 5 6 7	
5.	Quite a bit		
6.	Very much so		
7.	Intensely so		

I feel secure, mentally relaxed and confident of coming through under pressure:

1.	Not at all	Very detrimental to performance	Very helpful to performance
2.	A little bit		
3.	Somewhat		
4.	Moderately so	1 2 3 4 5 6 7	
5.	Quite a bit		
6.	Very much so		
7.	Intensely so		

Appendix 8

The Modified Competitive State Anxiety Inventory-2

The Modified Competitive State Anxiety Inventory-2

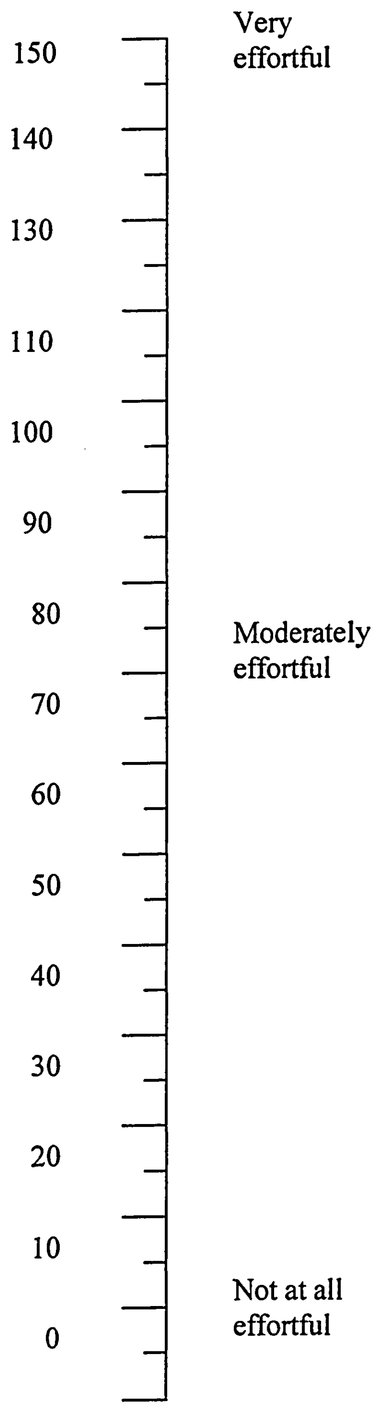
	SECTION 1				SECTION 2						
	Not at all	Some-what	Moderately so	Very much so	Very negative		Unimportant				Very positive
I am concerned about this competition	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel nervous	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel at ease	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I have self doubts	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel jittery	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel comfortable	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I am concerned that I may not do as well in this competition as I could	1	2	3	4	-3	-2	-1	0	+1	+2	+3
My body feels tense	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel self-confident	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I am concerned about losing	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel tense in my stomach	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel secure	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I am concerned about choking under pressure	1	2	3	4	-3	-2	-1	0	+1	+2	+3
My body feels relaxed	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I am confident I can meet the challenge	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I am concerned about performing poorly	1	2	3	4	-3	-2	-1	0	+1	+2	+3
My heart is racing	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I'm confident about performing well	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I'm worried about reaching my goal	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel my stomach sinking	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I feel mentally relaxed	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I'm concerned that others will be disappointed with my performance	1	2	3	4	-3	-2	-1	0	+1	+2	+3
My hands are clammy	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I'm confident because I mentally picture myself reaching my goal	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I'm concerned I won't be able to concentrate	1	2	3	4	-3	-2	-1	0	+1	+2	+3
My body feels tight	1	2	3	4	-3	-2	-1	0	+1	+2	+3
I'm confident at coming through under pressure	1	2	3	4	-3	-2	-1	0	+1	+2	+3

Appendix 9

The Mental Effort Scale

Rating scale for mental effort

Please rate the mental effort you have just invested in executing each putting stroke.



Appendix 10

The Movement Imagery Questionnaire – Revised Version

The Movement Imagery Questionnaire – Revised Version

1. Starting Position: Stand with your feet and legs together and your arms at your sides.

Action: Raise your right knee as high as possible so that you are standing on your left leg with your right leg flexed (bent) at the knee. Now lower your right leg so that you are again standing on two feet. Perform these actions slowly.

Mental Task: Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating: ____________

2. Starting Position: Stand with your feet slightly apart and your hands at your sides.

Action: Bend down low and then jump straight up in the air as high as possible with both arms extended above your head. Land with your feet apart and lower your arms to your sides.

Mental Task: Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.

Rating: ____________

3. Starting Position: Extend the arm of your nondominant hand straight out to your side so that it is parallel to the ground, palm down.

Action: Move your arm forward until it is directly in front of your body (still parallel to the ground). Keep your arm extended during the movement and make the movement slowly.

Mental Task: Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating: ____________

4. Starting Position: Stand with your feet slightly apart and your arms fully extended above your head.

Action: Slowly bend forward at the waist and try and touch your toes with your fingertips (or if possible, touch the floor with your fingertips or hands). Now return to the starting position, standing erect with your arms extended above your head.

Mental Task: Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.

Rating: ____________

5. Starting Position: Stand with your feet slightly apart and your hands at your sides.

Action: Bend down low and then jump straight up in the air as high as possible with both arms extended above your head. Land with your feet apart and lower your arms to your sides.

Mental Task: Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating: ____________

6. Starting Position: Stand with your feet and legs together and your arms at your sides.

Action: Raise your right knee as high as possible so that you are standing on your left leg with your right leg flexed (bent) at the knee. Now lower your right leg so that you are again standing on two feet. Perform these actions slowly.

Mental Task: Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.

Rating: ____________

7. Starting Position: Stand with your feet slightly apart and your arms fully extended above your head.

Action: Slowly bend forward at the waist and try and touch your toes with your fingertips (or if possible, touch the floor with your fingertips or hands). Now return to the starting position, standing erect with your arms extended above your head.

Mental Task: Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating: ____________

8. Starting Position: Extend the arm of your nondominant hand straight out to your side so that it is parallel to the ground, palm down.

Action: Move your arm forward until it is directly in front of your body (still parallel to the ground). Keep your arm extended during the movement and make the movement slowly.

Mental Task: Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.

Rating: ____________

INSTRUCTIONS

This questionnaire concerns two ways of *mentally* performing movements which are used by some people more than by others, and are more applicable to some types of movements than others. The first is attempting to form a visual image or picture of a movement in your mind. The second is attempting to feel what performing a movement is like without actually doing the movement. You are requested to do both of these mental tasks for a variety of movements in this questionnaire, and then rate how easy/difficult you found the tasks to be. The ratings that you give are not designed to assess the goodness or badness of the way you perform these mental tasks. They are attempts to discover the capacity individuals show for performing these tasks for different movements. There are no right or wrong ratings or some ratings that are better than others.

Each of the following statements describes a particular action or movement. Read each statement carefully and then actually perform the movement as described. Only perform the movement a single time. Return to the starting position for the movement just as if you were going to perform the action a second time. Then depending on which of the following you are asked to do, either (1) form as clear and vivid a visual image as possible of the movement just performed, or (2) attempt to feel yourself making the movement just performed without actually doing it.

After you have completed the mental task required, rate the ease/difficulty with which you were able to do the task. Take your rating from the following scale. Be as accurate as possible and take as long as you feel necessary to arrive at the proper rating for each movement. You may choose the same rating for any number of movements "seen" or "felt" and it is not necessary to utilize the entire length of the scale.

RATING SCALES

Visual Imagery Scale

7	6	5	4	3	2	1
Very easy to see	Easy to see	Somewhat easy to see	Neutral (not easy nor hard)	Somewhat hard to see	Hard to see	Very hard to see

Kinesthetic Imagery Scale

7	6	5	4	3	2	1
Very easy to feel	Easy to feel	Somewhat easy to feel	Neutral (not easy nor hard)	Somewhat hard to feel	Hard to feel	Very hard to feel

Condition Criteria

Participant information - Supplement A.

Prior to each putt please would you consider your ideal putting movement, focus on performing the ideal movement. The following information has been obtained from a reputable coaching source, please read through the points and focus on them for each putt.

During Pre-Putting Routine and Putting Execution:

Performance cues (Back swing phase)

1. Focus on how far the right elbow and wrists rotate backwards, and how far your shoulders rock to the right in order for the putter-head to achieve the correct back swing distance (opposite for left handers). Focus on keeping these distances consistent for each putt.

Performance cues (Contact phase)

2. Focus on your wrists being over the ball at point of contact.

Performance cues (Follow-through phase)

3. Focus on how far the left elbow and wrists rotate forward, and how far your shoulders rock to the left in order for the putter-head to achieve the correct follow-through distance (opposite for left handers). Focus on keeping these distances consistent for each putt.

Participant information - Supplement B.

Prior to each putt I would like you to consider the ideal path of the ball in relation to the desired outcome (e.g. straight and accurate). Imagine a successful putt in terms of the direction and destination of the golf ball in isolation of your putting stroke.

Participant information - Supplement C.

During the entire 30 putts of this condition I would like you to call out random letters every 1.5secs. to the click of a metronome. It is important that you continue to generate letters throughout the putting task regardless of your performance. I would also like you to give priority to the randomness of the letters generated.

Competition Brief

The purpose of this study is to analyse different attentional foci on individual putting techniques, in relation to accuracy. You will be in competition with all 12 of the golfers involved in this study. The aim of the competition is simply to hole as many putts as possible using a specific attentional focus. It is important that you continue to use the specified focus, regardless of your performance. During the competition phase you are required to complete 20 putts in each of the 3 foci conditions. Your score from each condition will be added together to give an overall competition score. Continue to use your pre-putting routine if you have one (e.g. practice putt(s)), however, it is important that you incorporate the specific focus during your routine. You will receive 1 point if you hole a putt, however, 1 point will be deducted if you miss a putt. You will be required to hole missed putts at the end of each set of ten trials. For each additional stroke 1 point will be deducted. Missed putts will be marked and removed if an obstruction is caused. After the competition you will be placed into a league table. The league table will be sent to you showing you how you performed in relation to the other participants in the study. A video recording will also be made so that an analysis can be made of your putting technique by a golf professional. The participant that receives the highest score will receive a £50 prize. Prior the 20 trials you will be required to fill out a simple questionnaire. Similarly, at the end of each condition you will be required to give a mental effort rating score. Finally, after 20 trials you will be briefly interviewed on your experiences.

Good Luck!

Appendix 13

Social Validation Interview Guide – Study 4

Social Validation Interview Guide

1. How did you feel during the performance - were you able to use the strategy provided throughout the putting task?

2. What kind of things did you think about during the putting strategy?

3. Did you experience any distracting thoughts?

4. How did the strategy provided affect your performance?

5. Did you experience any specific problems with the putting strategy?

6. Were you satisfied with the results of your performance?

7. How much effort did you invest in actually doing the putting task - in which aspect of the task did you expend most effort?

Appendix 14

Intervention Brief – Study 5

Intervention Brief - Participant Information

Phase 1.

For this phase of the study please would you employ the following information in the decision-making phase and execution phase of each putt. You will be asked to complete 50 putts using the following instructions:

Decision-Making Phase of Each Putt. During this phase I would like you to see in your mind's eye the correct direction, speed and destination of each putt prior to execution. When you image the correct direction, speed and destination of each putt it is important that you employ an external perspective (seeing your self perform on a television screen) rather than an internal perspective (seeing yourself perform through your own eyes). To help you with this imagery process you will be shown a two-minute video (after every 20 putts) of a golf professional putting. For each putt you will then be asked to imagine that you are watching yourself, as an observer, execute the perfect putt on the television screen as you did with the golf professional in the video clip. Do not spend too much time evaluating each putt; try and keep the time-frame consistent so you get into a routine.

Execution Phase of Each Putt. **Immediately** after you have imaged the correct direction, speed and destination of each putt please start to shout out random letters in sync with the sound of the metronome every 1.5 seconds. Please **prioritize** the randomness of the letters that you generate. You may stop generating random letters after striking each putt.

Please do not practice these strategies at any other time throughout the duration of the experiment.

Phase 2.

For this phase of the study please would you employ the following information in the decision-making phase and execution phase of each putt. You will be asked to complete a total of 75 putts using the following instructions; 50 putts today and 25 putts on another occasion:

Decision-Making Phase of Each Putt. Identical to the previous phase I would like you to see in your mind's eye the correct direction, speed and destination of each putt prior to execution. When you image the correct direction, speed and destination of each putt it is important that you employ an external perspective (seeing your self perform on a television screen) rather than an internal perspective (seeing yourself perform through your own eyes). To help you with this imagery process you will be shown a two-minute video (after every 20 putts) of a golf professional putting. For each putt you will then be asked to imagine that you are watching yourself, as an observer, execute the perfect putt on the television screen as you did with the golf professional in the video clip. Do not spend too much time evaluating each putt; try and keep the time-frame consistent so you get into a routine.

Execution Phase of Each Putt. **Immediately** after you have imaged the correct direction, speed and destination of each putt please start to shout out random letters, this time independent of the metronome every 1.5 seconds. Please continue to **prioritize** the randomness of the letters that you generate. You may stop generating random letters after striking each putt.

Please do not practice these strategies at any other time throughout the duration of the experiment.

Phase 3.

For this phase of the study please would you employ the following information in the decision-making phase and execution phase of each putt. You will be asked to complete a total of 75 putts using the following instructions:

Decision-Making Phase of Each Putt. Identical to the previous phase I would like you to see in your mind's eye the correct direction, speed and destination of each putt prior to execution. When you image the correct direction, speed and destination of each putt it is important that you employ an external perspective (seeing your self perform on a television screen) rather than an internal perspective (seeing yourself perform through your own eyes). To help you with this imagery process you will be shown a two-minute video (after every 20 putts) of a golf professional putting. For each putt you will then be asked to imagine that you are watching yourself, as an observer, execute the perfect putt on the television screen as you did with the golf professional in the video clip. Do not spend too much time evaluating each putt; try and keep the time-frame consistent so you get into a routine.

Execution Phase of Each Putt. **Immediately** after you have imaged the correct direction, speed and destination of each putt please start generating random letters non-verbally (in your own head) every 1.5 seconds. Please continue to **prioritize** the randomness of the letters that you generate. You may stop generating random letters after striking each putt. In this phase you are required to hole out each putt. Please repeat the above processes when doing this.

Please do not practice these strategies at any other time throughout the duration of the experiment.

Appendix 15

Competition Brief (Phase 1 & 2) – Study 5

Competition Brief - Phase 1

The purpose of this study is to analyse individual putting techniques, in relation to accuracy. You will be in a two-phase competition against two other golfers. The aim of the competition is simply to hole as many putts as possible. During this phase (1) of the competition you will be required to complete 200 putts. You will receive 1 point if you hole a putt; 1 point will be deducted if you miss a putt. You will be required to hole missed putts. For each additional stroke 1 point will be deducted. Missed putts will be marked and removed if an obstruction is caused. After completing the second phase of the competition you will be placed into a league table. The league table will be sent to you indicating your performance in relation to the other two golfers in the study. The golfer with the highest score at the end of the competition will be awarded £50. Finally, following Europe's success in the 'Ryder Cup' the BBC is currently producing a documentary entitled 'Putting on the Pressure'. As part of the documentary the university has been contacted in relation to the sport science support that they are providing for the members of the English Golf Union (EGU). The BBC is also interested in using footage from the cutting edge golf research that is currently being conducted through the university. Hence, footage from this experiment may be incorporated into the documentary, which is due to be broadcast in January 2005.

Good Luck!

Competition Brief - Phase 2

The purpose of this study is to analyse individual putting techniques, in relation to accuracy. You will be in a two-phase competition against two other golfers. The aim of the competition is simply to hole as many putts as possible. It is important that you use the specified focus that you have been taught, regardless of your performance during this competition. During this phase (2) of the competition you will be required to complete 200 putts. You will receive 1 point if you hole a putt; 1 point will be deducted if you miss a putt. You will be required to hole missed putts. For each additional stroke 1 point will be deducted. Missed putts will be marked and removed if an obstruction is caused. After competing the second phase of the competition you will be placed into a league table. The league table will be sent to you indicating your performance in relation to the other two golfers in the study. The golfer with the highest score at the end of the competition will be awarded £50. Finally, following Europe's success in the 'Ryder Cup' the BBC is currently producing a documentary entitled 'Putting on the Pressure'. As part of the documentary the university has been contacted in relation to the sport science support that they are providing for the members of the English Golf Union (EGU). The BBC is also interested in using footage from the cutting edge golf research that is currently being conducted through the university. Hence, footage from this experiment may be incorporated into the documentary, which is due to be broadcast in January 2005.

Good Luck!

Appendix 16

Social Validation Interview Guide / Questionnaire – Study 5

Social Validation Interview Guide / Questionnaire

Please complete the following questionnaire giving reasons for your answers and providing as much information about your experience as possible. Please read the question carefully and then circle the number on the 1-7 (1= poor; 7=good) Likert scale that corresponds with your response.

1. Were you able to use the two-phase putting strategy consistently throughout the task?

1 2 3 4 5 6 7

- Decision Making Phase: ....
....
....
....
- Execution Phase: ....
....
....
....

2. What kind of things did you think about during the two-phase putting strategy?

- Decision Making Phase: ....
....
....
....
- Execution Phase: ....
....
....
....

3. Are you able to recall the putts you holed and missed?

1 2 3 4 5 6 7

....
....
....
....

4. How did the two-phase putting strategy provided, affect your performance?

- Decision Making Phase: ....
....
....
....
- Execution Phase: ....
....
....
....

5. Did you experience any specific problems with the two-phase putting strategy?

- Decision Making Phase: ....
....
....
....
- Execution Phase: ....
....
....
....

6. What were your general beliefs about your performance? ....
....
....
....

7. Did you find the two-phase putting strategy positive or negative?

- +

1 2 3 4 5 6 7

- Decision Making Phase: ....
....
....
....
- Execution Phase: ....
....
....
....

8. Would you feel confident in using this strategy during competition?

1 2 3 4 5 6 7

....
....
....

9. How smooth did your putting stroke feel?

1 2 3 4 5 6 7

....
....
....

10. Did your experience differ between phase 1 and 2 of the competition, if so in what way? ....
....
....
....

Thank You!

Study 2

Low and High Reinvestment: Soccer Performance Analysis

Within-Subjects Factors

STRESS	Dependent Variable
1	LOW STRESS
2	HIGH STRESS

Between-Subjects Factors

	Value Label	N
1.00	LOW REINVESTMENT	7
2.00	HIGH REINVESTMENT	7

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power
STRESS	30.04	1	30.04	.57	.478	.572	.110
STRESS * REINVEST	2006.04	1	2006.04	14.80	.008		
Error (STRESS)	315.2	12	52.54				

Computed using alpha = .05

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power
REINVEST	631.75	1	631.75	.13	.731		
Error	29245.50	12	4874.25				

Computed using alpha = .05

Study 2

Low and High Reinvestment: Anxiety Rating Scale Analysis

Stress Manipulation Check - Somatic Anxiety Intensity

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	LSSOMINT	1.6429	14	.92878	.24823
	HSSOMINT	2.9286	14	1.14114	.30498

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	LSSOMINT - HSSOMINT	-1.286	1.68379	.4500	-2.2579	-.3135	-2.9	13	.013

Stress Manipulation Check - Cognitive Anxiety Intensity

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	LSCOGINT	1.7857	14	1.18831	.31759
	HSCOGINT	2.9286	14	1.20667	.32250

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	LSCOGINT - HSCOGINT	-1.1429	1.87523	.50118	-2.2256	-.0601	-2.28	13	.040

Somatic Anxiety (Intensity)

Within-Subjects Factors

STRESS	Dependent Variable
1	LOW STRESS
2	HIGH STRESS

Between-Subjects Factors

	Value Label	N
1.00	LOW REINVESTMENT	7
2.00	HIGH REINVESTMENT	7

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power
STRESS	11.57	1	11.57	5.17	.063	5.17	.480
STRESS * REINVEST	3.57	1	3.57	15.00	.008	15.00	.894
Error (STRESS)	13.43	12	2.24				

Computed using alpha = .05

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power
REINVEST	.57	1	.57	.53	.493	.533	.106
Error	6.43	12	1.06				

Computed using alpha = .05

Low and High Reinvestment: Anxiety Rating Scale Analysis

Cognitive Anxiety (Intensity)

Within-Subjects Factors

STRESS	Dependent Variable
1	LOW STRESS
2	HIGH STRESS

Between-Subjects Factors

	Value Label	N
1.00	LOW REINVESTMENT	7
2.00	HIGH REINVESTMENT	7

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power
STRESS	6.04	1	6.04	2.38	.174	2.380	.257
STRESS * REINVEST	4.32	1	4.32	5.28	.062	3.261	.486
Error (STRESS)	15.21	12	2.54				

Computed using alpha = .05

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power
REINVEST	.89	1	.89	1.60	.253	1.596	.187
Error	3.36	12	.56				

Computed using alpha = .05

Low and High Reinvestment: Anxiety Rating Scale Analysis

Self-Confidence (Intensity)

Within-Subjects Factors

STRESS	Dependent Variable
1	LOW STRESS
2	HIGH STRESS

Between-Subjects Factors

	Value Label	N
1.00	LOW REINVESTMENT	7
2.00	HIGH REINVESTMENT	7

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power
STRESS	17.29	1	17.29	16.69	.006	16.69	.922
STRESS * REINVEST	9.14	1	9.14	16.34	.007	16.34	.917
Error (STRESS)	6.21	12	1.04				

Computed using alpha = .05

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power
REINVEST	5.14	1	5.14	1.89	.219	1.886	.213
Error	16.36	12	2.73				

Computed using alpha = .05

Low and High Reinvestment: Anxiety Rating Scale Analysis

Somatic Anxiety (Direction)

Within-Subjects Factors

STRESS	Dependent Variable
1	LOW STRESS
2	HIGH STRESS

Between-Subjects Factors

	Value Label	N
1.00	LOW REINVESTMENT	7
2.00	HIGH REINVESTMENT	7

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power
STRESS	10.32	1	10.32	9.63	.021	9.633	.735
STRESS * REINVEST	2.89	1	2.89	9.35	.022	9.346	.722
Error (STRESS)	6.43	12	1.07				

Computed using alpha = .05

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power
REINVEST	2.89	1	2.89	.70	.435	.698	.120
Error	24.86	12	4.14				

Computed using alpha = .05

Low and High Reinvestment: Anxiety Rating Scale Analysis

Cognitive Anxiety (Direction)

Within-Subjects Factors

STRESS	Dependent Variable
1	LOW STRESS
2	HIGH STRESS

Between-Subjects Factors

	Value Label	N
1.00	LOW REINVESTMENT	7
2.00	HIGH REINVESTMENT	7

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power
STRESS	.04	1	.04	.01	.909	.014	.051
STRESS * REINVEST	.89	1	.89	1.23	.310	1.230	.156
Error (STRESS)	15.21	12	2.54				

Computed using alpha = .05

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power
REINVEST	10.32	1	10.32	3.66	.104	3.658	.364
Error	16.93	12	2.82				

Computed using alpha = .05

Low and High Reinvestment: Anxiety Rating Scale Analysis

Self-Confidence (Direction)

Within-Subjects Factors

STRESS	Dependent Variable
1	LOW STRESS
2	HIGH STRESS

Between-Subjects Factors

	Value Label	N
1.00	LOW REINVESTMENT	7
2.00	HIGH REINVESTMENT	7

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power
STRESS	8.04	1	8.04	10.23	.019	10.227	.759
STRESS * REINVEST	4.32	1	4.32	18.15	.005	18.150	.940
Error (STRESS)	4.71	12	.79				

Computed using alpha = .05

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power
REINVEST	2.89	1	2.89	1.03	.349	1.030	.140
Error	16.86	12	2.81				

Computed using alpha = .05

Study 3

Pretest Phase: Reinvestment

REINVESTMENT	Dependent Variable
1	LOW REINVESTMENT
2	HIGH REINVESTMENT

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.225	1	4.225	.102	.751
Within Groups	1576.750	38	41.493		
Total	1580.975	39			

Study 3

Retention Phase: Reinvestment x Learning x Time Analysis

Within-Subjects Factors

TIME	Dependent Variable
1	PRETEST
2	LAST 20 - LEARNING
3	RENTION

Between-Subjects Factors

		Value Label	N
LEARNING	1.00	PROCESS	20
	2.00	HOLISTIC	20
REINVESTMENT	1.00	LOW	20
	2.00	HIGH	20

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
TIME	3618.350	2	1809.175	84.097	.000
TIME * LEARNING	24.950	2	12.475	.580	.563
TIME * REINVEST	22.050	2	11.025	.512	.601
TIME * LEARNING * REINVEST	19.717	2	9.858	.458	.634
Error (TIME)	1548.933	72	21.513		

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	321057.075	1	321057.075	8466.406	.000
LEARNING	81.675	1	81.675	2.154	.151
REINVEST	1.875	1	1.875	.049	.825
LEARNING * REINVEST	35.208	1	35.208	.928	.342
Error	1365.167	36	37.921		

Study 3

Low Reinvestment: Basketball Performance Analysis

Within-Subjects Factors

STRESS	Dependent Variable
1	LOW STRESS
2	HIGH STRESS

Between-Subjects Factors

LOW REINVESTMENT	Value Label	N
1.00	PROCESS	10
2.00	HOLISTIC	10

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Eta Squared	Noncent. Parameter	Observed Power
STRESS	78.400	1	78.400	2.116	.163	.105	2.116	.281
STRESS * LEARNING	57.600	1	57.600	1.554	.228	.079	1.554	.219
Error (STRESS)	667.000	18	37.056					

Computed using alpha = .05

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Noncent. Parameter	Observed Power
Intercept	119028.100	1	119028.100	2849.077	.000	.994	2849.077	1.000
LEARNING	16.900	1	16.900	.405	.533	.022	.405	.093
Error	752.000	18	41.778					

Computed using alpha = .05

Study 3

Low Reinvestment: Anxiety Rating Scale Analysis

Somatic Anxiety (Intensity)

Within-Subjects Factors

STRESS	Dependent Variable
1	LOW STRESS
2	HIGH STRESS

Between-Subjects Factors

LOW REINVESTMENT	Value Label	N
1.00	PROCESS	10
2.00	HOLISTIC	10

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Noncent. Parameter	Observed Power
STRESS	3.025	1	3.025	12.236	.003	.405	12.236	.911
STRESS * LEARNING	2.500E-02	1	2.500E-02	.101	.754	.006	.101	.060
	2.500E-02	1.000	2.500E-02	.101	.754	.006	.101	.060
Error (STRESS)	4.450	18	.247					

Computed using alpha = .05

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Noncent. Parameter	Observed Power
Intercept	198.025	1	198.025	347.751	.000	.951	347.751	1.000
LEARNING	1.225	1	1.225	2.151	.160	.107	2.151	.284
Error	10.250	18	.569					

Computed using alpha = .05

Low Reinvestment: Anxiety Rating Scale Analysis

Cognitive Anxiety (Intensity)

Within-Subjects Factors

STRESS	Dependent Variable
1	LOW STRESS
2	HIGH STRESS

Between-Subjects Factors

LOW REINVESTMENT	Value Label	N
1.00	PROCESS	10
2.00	HOLISTIC	10

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Eta Squared	Noncent. Parameter	Observed Power
STRESS	3.025	1	3.025	22.224	.000	.553	22.224	.994
STRESS * LEARNING	2.500E-02	1	2.500E-02	.184	.673	.010	.184	.069
Error(STRESS)	2.450	18	.136					

Computed using alpha = .05

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Eta Squared	Noncent. Parameter	Observed Power
Intercept	156.025	1	156.025	218.556	.000	.924	218.556	1.000
LEARNING	.625	1	.625	.875	.362	.046	.875	.144
Error	12.850	18	.714					

Computed using alpha = .05

Low Reinvestment: Anxiety Rating Scale Analysis

Self-Confidence Anxiety (Intensity)

Within-Subjects Factors

STRESS	Dependent Variable
1	LOW STRESS
2	HIGH STRESS

Between-Subjects Factors

LOW REINVESTMENT	Value Label	N
1.00	PROCESS	10
2.00	HOLISTIC	10

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Noncent. Parameter	Observed Power
STRESS	2.025	1	2.025	2.710	.117	.131	2.710	.344
STRESS * LEARNING	2.500E-02	1	2.500E-02	.033	.857	.002	.033	.053
Error(STRESS)	13.450	18	.747					

Computed using alpha = .05

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Noncent. Parameter	Observed Power
Intercept	855.625	1	855.625	738.669	.000	.976	738.669	1.000
LEARNING	3.025	1	3.025	2.612	.123	.127	2.612	.334
Error	20.850	18	1.158					

Computed using alpha = .05

Study 3

High Reinvestment: Basketball Performance Analysis

Within-Subjects Factors

STRESS	Dependent Variable
1	LOW STRESS
2	HIGH STRESS

Between-Subjects Factors

HIGH REINVESTMENT	Value Label	N
1.00	PROCESS	10
2.00	HOLISTIC	10

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Eta Squared	Noncent. Parameter	Observed Power
STRESS	36.100	1	36.100	.659	.428	.035	.659	.120
STRESS * LEARNING	422.500	1	422.500	7.710	.012	.300	7.710	.747
Error(STRESS)	986.400	18	54.800					

Computed using alpha = .05

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Noncent. Parameter	Observed Power
Intercept	108993.600	1	108993.600	1692.155	.000	.989	1692.155	1.000
LEARNING	10.000	1	10.000	.155	.698	.009	.155	.066
Error	1159.400	18	64.411					

Computed using alpha = .05

Study 3

High Reinvestment: Anxiety Rating Scale Analysis

Somatic Anxiety (Intensity)

Within-Subjects Factors

STRESS	Dependent Variable
1	LOW STRESS
2	HIGH STRESS

Between-Subjects Factors

HIGH REINVESTMENT	Value Label	N
1.00	PROCESS	10
2.00	HOLISTIC	10

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Noncent. Parameter	Observed Power
STRESS	65.025	1	65.025	170.869	.000	.905	170.869	1.000
STRESS * LEARNING	.625	1	.625	1.642	.216	.084	1.642	.229
Error(STRESS)	6.850	18	.381					

Computed using alpha = .05

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Noncent. Parameter	Observed Power
Intercept	600.625	1	600.625	928.004	.000	.981	928.004	1.000
LEARNING	.225	1	.225	.348	.563	.019	.348	.086
Error	11.650	18	.647					

Computed using alpha = .05

High Reinvestment: Anxiety Rating Scale Analysis

Cognitive Anxiety (Intensity)

Within-Subjects Factors

STRESS	Dependent Variable
1	LOW STRESS
2	HIGH STRESS

Between-Subjects Factors

HIGH REINVESTMENT	Value Label	N
1.00	PROCESS	10
2.00	HOLISTIC	10

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Noncent. Parameter	Observed Power
STRESS	65.025	1	65.025	60.803	.000	.772	60.803	1.000
STRESS * LEARNING	.225	1	.225	.210	.652	.012	.210	.072
Error(STRESS)	19.250	18	1.069					

Computed using alpha = .05

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Noncent. Parameter	Observed Power
Intercept	555.025	1	555.025	529.997	.000	.967	529.997	1.000
LEARNING	.625	1	.625	.597	.450	.032	.597	.113
Error	18.850	18	1.047					

Computed using alpha = .05

High Reinvestment: Anxiety Rating Scale Analysis

Self-Confidence (Intensity)

Within-Subjects Factors

STRESS	Dependent Variable
1	LOW STRESS
2	HIGH STRESS

Between-Subjects Factors

HIGH REINVESTMENT	Value Label	N
1.00	PROCESS	10
2.00	HOLISTIC	10

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Noncent. Parameter	Observed Power
STRESS	18.225	1	18.225	29.688	.000	.623	29.688	.999
STRESS * LEARNING	13.225	1	13.225	21.543	.000	.545	21.543	.992
Error(STRESS)	11.050	18	.614					

Computed using alpha = .05

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Noncent. Parameter	Observed Power
Intercept	585.225	1	585.225	275.400	.000	.939	275.400	1.000
LEARNING	3.025	1	3.025	1.424	.248	.073	1.424	.204
Error	38.250	18	2.125					

Computed using alpha = .05

Appendix 19

Statistical Analysis for Study 4

Study 4

Golf Performance Analysis

Within-Subjects Factors

FOCI	Dependent Variable
1	BASELINE
2	INTERNAL
3	EXTERNAL
4	RLG

Descriptive Statistics

	Mean	Std. Deviation	N
BASELINE	15.92	1.240	12
INTERNAL	12.58	1.311	12
EXTERNAL	14.17	2.167	12
RLG	15.08	1.084	12

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
FOCI	Sphericity Assumed	73.396	3	24.465	13.602	.000
	Greenhouse-Geisser	73.396	1.916	38.312	13.602	.000
	Huynh-Feldt	73.396	2.310	31.766	13.602	.000
	Lower-bound	73.396	1.000	73.396	13.602	.004
Error(FOCI)	Sphericity Assumed	59.354	33	1.799		
	Greenhouse-Geisser	59.354	21.073	2.817		
	Huynh-Feldt	59.354	25.415	2.335		
	Lower-bound	59.354	11.000	5.396		

a Computed using alpha = .05

Anxiety Rating Scale Analysis

Somatic Anxiety (Intensity)

Within-Subjects Factors

SOM	Dependent Variable
1	BASELINE
2	INTERNAL
3	EXTERNAL
4	RLG

Descriptive Statistics

	Mean	Std. Deviation	N
BASELINE	17.1667	3.24271	12
INTERNAL	22.8333	3.95045	12
EXTERNAL	22.5833	5.94610	12
RLG	24.3333	6.61037	12

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
SOM	Sphericity Assumed	354.563	3	118.188	7.398	.001
	Greenhouse-Geisser	354.563	2.213	160.252	7.398	.002
	Huynh-Feldt	354.563	2.794	126.911	7.398	.001
	Lower-bound	354.563	1.000	354.563	7.398	.020
Error(SOM	Sphericity Assumed	527.188	33	15.975		
	Greenhouse-Geisser	527.188	24.338	21.661		
	Huynh-Feldt	527.188	30.732	17.155		
	Lower-bound	527.188	11.000	47.926		

a Computed using alpha = .05

Anxiety Rating Scale Analysis

Cognitive Anxiety (Intensity)

Within-Subjects Factors

COG	Dependent Variable
1	BASELINE
2	INTERNAL
3	EXTERNAL
4	RLG

Descriptive Statistics

	Mean	Std. Deviation	N
BASELINE	16.8333	4.15240	12
INTERNAL	23.3333	2.34844	12
EXTERNAL	23.0833	3.50216	12
RLG	25.5000	4.10100	12

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
COG	Sphericity Assumed	501.062	3	167.021	28.094	.000
	Greenhouse-Geisser	501.062	2.654	188.812	28.094	.000
	Huynh-Feldt	501.062	3.000	167.021	28.094	.000
	Lower-bound	501.062	1.000	501.062	28.094	.000
Error(COG	Sphericity Assumed	196.187	33	5.945		
	Greenhouse-Geisser	196.187	29.191	6.721		
	Huynh-Feldt	196.187	33.000	5.945		
	Lower-bound	196.187	11.000	17.835		

a Computed using alpha = .05

Anxiety Rating Scale Analysis

Self-confidence (Intensity)

Within-Subjects Factors

CONF	Dependent Variable
1	BASELINE
2	INTERNAL
3	EXTERNAL
4	RLG

Descriptive Statistics

	Mean	Std. Deviation	N
BASELINE	23.50	4.700	12
INTERNAL	20.42	4.870	12
EXTERNAL	20.58	5.017	12
RLG	17.17	4.970	12

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
CONF	Sphericity Assumed	241.167	3	80.389	9.297	.000
	Greenhouse-Geisser	241.167	2.187	110.284	9.297	.001
	Huynh-Feldt	241.167	2.751	87.679	9.297	.000
	Lower-bound	241.167	1.000	241.167	9.297	.011
Error(CONF)	Sphericity Assumed	285.333	33	8.646		
	Greenhouse-Geisser	285.333	24.055	11.862		
	Huynh-Feldt	285.333	30.256	9.431		
	Lower-bound	285.333	11.000	25.939		

a Computed using alpha = .05

Anxiety Rating Scale Analysis

Somatic Anxiety (Direction)

Within-Subjects Factors

FOCI	Dependent Variable
1	BASELINE
2	INTERNAL
3	EXTERNAL
4	RLG

Descriptive Statistics

	Mean	Std. Deviation	N
BASELINE	3.0833	6.48717	12
INTERNAL	-4.2500	9.00631	12
EXTERNAL	-5.2500	9.11667	12
RLG	-6.5000	10.05892	12

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
FOCI	Sphericity Assumed	668.063	3	222.688	18.409	.000
	Greenhouse-Geisser	668.063	1.871	357.031	18.409	.000
	Huynh-Feldt	668.063	2.241	298.165	18.409	.000
	Lower-bound	668.063	1.000	668.063	18.409	.001
Error(FOCI	Sphericity Assumed	399.188	33	12.097		
	Greenhouse-Geisser	399.188	20.583	19.394		
	Huynh-Feldt	399.188	24.646	16.197		
	Lower-bound	399.188	11.000	36.290		

a Computed using alpha = .05

Anxiety Rating Scale Analysis

Cognitive Anxiety (Direction)

Within-Subjects Factors

FOCI	Dependent Variable
1	BASELINE
2	INTERNAL
3	EXTERNAL
4	RLG

Descriptive Statistics

	Mean	Std. Deviation	N
BASELINE	2.4167	7.07696	12
INTERNAL	-3.7500	6.96909	12
EXTERNAL	-4.9167	7.46456	12
RLG	-7.7500	10.51514	12

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
FOCI	Sphericity Assumed	661.667	3	220.556	16.473	.000
	Greenhouse-Geisser	661.667	2.347	281.877	16.473	.000
	Huynh-Feldt	661.667	3.000	220.556	16.473	.000
	Lower-bound	661.667	1.000	661.667	16.473	.002
Error(FOCI	Sphericity Assumed	441.833	33	13.389		
	Greenhouse-Geisser	441.833	25.821	17.111		
	Huynh-Feldt	441.833	33.000	13.389		
	Lower-bound	441.833	11.000	40.167		

a Computed using alpha = .05

Anxiety Rating Scale Analysis

Self-confidence (Direction)

Within-Subjects Factors

FOCI	Dependent Variable
1	BASELINE
2	INTERNAL
3	EXTERNAL
4	RLG

Descriptive Statistics

	Mean	Std. Deviation	N
BASELINE	4.6667	8.21676	12
INTERNAL	2.5833	8.39327	12
EXTERNAL	2.5000	10.04083	12
RLG	-4.5833	12.39837	12

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
FOCI	Sphericity Assumed	588.417	3	196.139	7.587	.001
	Greenhouse-Geisser	588.417	1.891	311.208	7.587	.004
	Huynh-Feldt	588.417	2.271	259.076	7.587	.002
	Lower-bound	588.417	1.000	588.417	7.587	.019
Error(FOCI	Sphericity Assumed	853.083	33	25.851		
	Greenhouse-Geisser	853.083	20.798	41.017		
	Huynh-Feldt	853.083	24.983	34.146		
	Lower-bound	853.083	11.000	77.553		

a Computed using alpha = .05