EFFECT OF SHOT TYPE, TASK DIFFICULTY AND RESEARCH ENVIRONMENT ON CONSISTENCY OF PRE-PERFORMANCE ROUTINES IN GOLF: PSYCHO-PHYSIOLOGICAL BASES AND IMPLICATIONS.

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DECLARATION

I, Stewart Thomas Cotterill, declare that this thesis, submitted in partial fulfilment of the requirements for the award of Doctor of Philosophy, in the Moray House School of Education, University of Edinburgh, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for degree or any other professional qualifications at any other academic institution.

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ABSTRACT

Golfers have been encouraged to develop consistent pre-performance routines (PPRs) in order to enhance their performance. However, the theoretical underpinning of these recommendations is unclear. Issues relating to the overall function(s) of the PPR, psychological components; routine usage across different shot types; and the impact of task difficulty on routine execution have yet to be explored in detail. The general purpose of this thesis was to quantify differences in the duration / composition of PPRs across shot types and task difficulty while developing a greater understanding of the psychological skills utilised and the function of the PPRs

To achieve this general purpose four studies were completed. Study one (n=6, age M = 22.5yrs) explored the behavioural and temporal consistency of the PPRs utilised by the participants within shot type and across three different environmental conditions (competition, practice, and simulated). PPR behaviours were classified according to four categories (head, club, posture, still). The results revealed that the participants were very consistent in their routines and no significant differences were identified between environmental conditions.

In Study two (n= 6, age M= 22.5years) the extent to which participants utilised different routines for different shots (putter, driver, wedge) as well as the impact of task difficulty on routine duration were explored. Significantly different routines were used for the three shot types. However, with the exception of one component for one participant, there were no significant differences between the conditions of task difficulty (easy Vs hard Vs very hard) .

In Study three (n=6, Age M= 23.7yrs) heart-rate deceleration (HR-D) characteristics for each participant prior to shot execution were explored for good versus poor shots as an indicator of attentional focus. There were clear differences between good and poor performance in the duration of the inter-beat intervals (IBIs).

The specific purpose of Study four was to explore the psychological strategies utilised by golfers during their PPRs and the function of the PPRs. A number of key psychological skills were identified including: imagery, self-talk, relaxation techniques, trigger-words, concentration/focusing strategies, and achieving a 'flow state'. The evidence suggested that the function of PPRs is to focus attention on the task.

The findings of all four studies informed the development of practical guidelines for the future use and development of PPRs in golf.

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Chapter One

INTRODUCTION

1.1. BACKGROUND AND NEED FOR THIS STUDY

In order to perform effectively sports performers are required to execute a complex set of skills in a perfect or at the very least a near perfect way. For the sports performer, achieving a psychological state appropriate for executing their well-learnt skills is crucial. The ability to self-regulate arousal levels, expectations, confidence and attentional focus amongst other factors may be as critical as carrying out the execution of the skill itself (Singer, 2002). Sporting competition at the highest level requires a great amount of precision in movement execution demonstrated repeatedly over many occasions, against a variety of opponents, and in various environments.

Jackson and Baker (2001) suggested that self-paced skills such as the basketball free throw, the football penalty kick and rugby goal kick have relatively few, if any variables for the performer to consider. Jackson and Baker further suggested that these few variables can become a problem for elite performers in that the cognitive demands are low and as a result the performer might become distracted by negative self-talk or other task-irrelevant stimuli that could disrupt performance.

A method to deal with these potential distractions suggested by Boutcher (1990, 1992) and Lobmeyer and Wasserman (1986) is to develop a consistent pre-performance routine. However, even at this basic stage there is a fundamental question that requires attention. Do sports performers execute skills successfully because they use a consistent pre-performance routine, or do performers use consistent routines because they have performed successfully and look to recreate the conditions for success? In essence is it a cause or effect relationship between consistent pre-performance preparation and performance? Are the components of these routines important because of the function they fulfil in preparing the athlete, or is the routine as a whole important because it is perceived to mirror preparation for other good performances? Answers to these questions can further guide the development of appropriate pre-performance routines.

Current coaching practices relating to pre-performance routines are underpinned by the implicit assumption that increasing routine consistency will lead to improved performance (Jackson, 2003). However, these coaching practices are not based on consensus of opinion regarding the role that these routines actually fulfil. Over the last twenty years various rationales have been offered with respect to the main roles of pre-performance routines including influencing the performer's ability to deal with distractions (Boutcher and Crews, 1987; Weinberg, 1988; Gould and Udry, 1994; Maynard, 1998), focusing attention (Boutcher, 1992; Harle and Vickers, 2001), acting as a trigger (Boutcher and Crews, 1987; Moran, 1996), enhancing ability to focus and the recall of physiological and psychological states (Marlow et al, 1998), and reducing the 'unravelling of automaticity' (Beilock and Carr, 2001; Beilock, Carr, MacMahon and Starks, 2002).

There is very little support outside of anecdotal evidence to underpin these suggestions. Much of what has been suggested is based upon the observed outcomes of the routines, and their major characteristics. Unfortunately very few of the recommendations are based on research data reflecting the underlying physiological and psychological processes that occur during this pre-performance phase. Furthermore, there are very few examples of researchers asking the sports performer what is going on, what strategies they use, and how they believe the routine aids their performance.

The aim of this thesis is to explore in detail, the nature and function of the pre-performance routines utilised by elite golfers and to address the ecological validity issues that have arisen from the use of a range of research and experimental designs in the study of the routines. The effect of task difficulty on the consistency of temporal and behavioural characteristics of the routines will also be explored as well as the effect of shot type on the structure and consistency of the routines. The underlying psychological processes that occur whilst the routine is being executed and the psychological strategies and skills that are utilised by the golfer during the execution of their pre-performance routines will be investigated.

Two major outcomes are anticipated. The first is, an understanding of the structure, function, and importance of pre-performance routines in golf performance, in particular, the impact of research paradigms upon the ecological validity of the data collected; how consistent golfers are behaviourally and temporally within the routine and across shot types; examining the psychophysiological indicators of the underlying psychological processes; the function of the pre-performance routines from the perspective of the golfer; and the psychological strategies they utilise during this pre-performance period.

The second is a basis for developing new guidelines for the development and execution of effective pre-performance routines for individual golfers.

1.2. RESEARCH AND HYPOTHESES QUESTIONS

The following research questions were designed to focus the research project:

- *Question one* - Are there significant temporal and behavioural differences between the pre-performance routines utilised by elite golfers in practice, competition, and simulated environments?

  Hypothesis one: There are significant differences between the routines within subject when comparing the competitive and practice environments, and between the simulated and practice environments, but not between the competitive and simulated environments.

- *Question two* - Does task difficulty impact upon the components of, or consistency of pre-performance routines in golf?

  Hypothesis two: Increases in the difficulty of the task will lead to significant differences in the routine duration and the characteristics of the composite behavioural characteristics.

- *Question three* - Are there differences in the pre-performance routines utilised by golfers based on their club / shot selection?

  Hypothesis three: There will be no difference either behaviourally or temporally between the pre-performance routines utilised by elite golfers for different classifications of shot type.

- *Question four* – Are there significant differences in behavioural and heart rate deceleration characteristics when comparing good and poor shots?

  Hypothesis four: There will be no significant differences between the behavioural components of the routines utilised for good and poor shots, but there would be significant differences between the related heart-rate deceleration characteristics for the routines when comparing good and poor performance.

- *Question five* - What psychological strategies are utilised by elite golfers during the execution of their pre-performance routines? In particular, do the participants perceive there to be differences in the strategies used and approach adopted for good and poor performances.

    a. Do they engage in task-relevant priming / readying thoughts to prepare for action?

    b. Are the same strategies used for the same type of shot and level of performance?

c. Are there differences between successful and unsuccessful shots / performances?

1.3. Overview of Thesis

Chapter 2 provides an overview of the literature relating to pre-performance routines, considering the limitations and design issues with prior research, and progressing to explore the nature of the routines, the role they fulfil and importantly how to measure them in order to allow comparisons.

Chapter s 3, 4, 5, and 6 outline the methodological approach utilised to answer the research questions through each of the four studies, specifically providing details on the participants, procedures and analysis of the collected data. Each chapter also presents relevant results, providing the data to answer the research questions stated previously. Each of these four study-focused chapters then explore the implications of the results presented, discussing in detail the implications of the results for each study, and progressing to a general discussion about the implications of this data in developing our understanding of the nature, function and structure of pre-performance routines.

Chapter 7 concludes the thesis with the major implications of the research findings and presents practical guidelines for the development and implementation of pre-performance routines. Future directions for research exploring pre-performance routines in sport are also discussed.

Chapter Two

LITERATURE REVIEW

2.1. INTRODUCTION

The goal of any serious sports performer is the consistent, flawless and automatic execution of skills in competition resulting in peak performance (Singer, 2002). In golf at elite level, peak performance is associated with golfers having a narrow focus of attention, immersion in the present, feelings of confidence and effective control (Cohn, 1991); characteristics which have been reported in a variety of other sport and challenge settings (e.g. Csikzentmihalyi 1990; Gould, Eklund and Jackson, 1992).

Csikzentmihalyi (1990) used the collective term 'flow' to group the characteristics of peak performance. Flow was specifically identified as "an optimal and positive psychological state attained through deep concentration on the task in hand and involving total absorption" (Csikzentmihalyi, 1975, p.25). He suggested eight specific characteristics of flow including: clear goals and feedback; balance between challenges and skills; action and awareness merged; concentration on the task; a sense of potential control; loss of self-consciousness; an altered sense of time; and, autotelic (self-rewarding) experience; with the most important characteristics being concentration on the task in hand and the merging of action and awareness. Csikszentmihalyi (1990) also suggested that the key factor, which determined whether performers entered this 'flow' state, was attentional focus and not skill level. Gould, Eklund and Jackson (1992), in their report on Olympic Wrestlers, also concluded that optimal performance states " have a characteristic that is referred to variously as concentration, the ability to focus, a special state of involvement, the zone, flow state, ideal performance state, awareness and / or absorption in the task in hand. In this state of mind, the athlete is totally absorbed in task-relevant concerns" (p.377).

As a result, coaches, performers, and sports psychologists have been committed over the past 25 years to developing systematic and consistent strategies to allow the performer or team to achieve this peak performance state.

A number of approaches have been developed in order to attempt to achieve consistent and highly effective performance including Singer's (1988) 5-step approach and Murphy's (1994) 4-point model. The 5 steps proposed by Singer were readying, imaging, focusing attention, executing and evaluating. Lidor and Tenenbaum (1993) implemented this 5-step model with basketball players and found the most important stage to be the readying stage, the preparation to perform. They reported that the greater the preparation time the greater the success rate. Murphy's (1994) model was dubbed the 'performance management model'. The steps he advocated were: practice, preparation, performance and analysis to create the 'flow state'.

2.2. PRE-PERFORMANCE ROUTINES

Lidor and Tenenbaum (1993) advocated the use of a structured routine prior to performance, which they believed is an extremely important behavioural technique to help performers to attain a high level of achievement in sport. Murphy also recommended that a mental routine should be developed for every shot to develop consistent performance, recommending mental routines as a way to focus attention on the performance in hand.

Boutcher (1990) and Lobmeyer and Wasserman (1986) suggested that a method for maintaining high levels of performance in the face of potential distractions is to develop a consistent pre-performance routine (PPR). Crampton (1989) suggested that a pre-shot routine was an “ordered collection of thoughts and behaviours that is aimed at achieving the necessary mind set, concentrational focus and physical readiness for each shot” (p.9). Moran (1996) further defined pre-performance routines (PPRs) as a “sequence of task-relevant thoughts and actions which an athlete engages in systematically prior to his or her performance of a specific sports skill” (p.177).These two definitions of this pre-performance behaviour raise issues relating to inconsistencies in the literature regarding the terminology used to describe this behavioural phenomenon that occurs prior to performance. In reviewing the literature authors have tended to refer to either PPRs (McCann, Lavallee and Lavallee 2001; Singer, 2002; Holder, 2003; Marlow et al, 1998; Jackson and Baker, 2001; Jackson, 2001 and 2003; Moran, 1996, 2004) or pre-shot routines (Harle and Vickers, 2001; Shaw, 2002; Douglas and Fox, 2002; Crews and Boutcher, 1987; Cohn, Rotella and Lloyd, 1990). All of the references to pre-shot routines occur in studies where performance was described in terms of shots (either basketball or golf). As a result, pre-shot routines can be classified as a more sport / activity specific description of a PPR. In the literature there is also reference to a ‘mental preparation routine’. However the definition of this routine “systematic, routinised patterns of physical actions and pre-planned sequences of thoughts and arousal related cues” (Gould and Udry, 1994, p.483) again refers to the same phenomenon described by Moran (1996) whilst defining PPRs.

Although the use of PPRs is more readily implemented with closed skills (such as a golf shot, basketball free throw, long jump, hockey penalty flick), they are also useful with some open skill sports. PPR research in sport to date has explored golf (Fairweather and Potgeiter, 1993; Boutcher and Crews, 1987; Cohn, Rotella and Lloyd, 1990; Kirschenbaum and Bale, 1980; McCann, Lavallee, and Lavallee, 2001; Rotella and Bunter, 1981; Yancey, 1977; Shaw, 2002); Tennis (Moore, 1986); Basketball (Lidor and Tenenbaum, 1993; Southard and Miracle, 1993; Lobmeyer and Wasserman, 1986; Harle and Vickers, 2001; Wrisberg and Penn, 1992); Football (Vealey, 1986); Bowling (Kirschenbaum, 1987); Gymnastics (Mahoney and Avener, 1977); Wrestling (Gould et al, 1981); Skiing and Skating (Orlick, 1986); Diving (Highlen and Bennett, 1983); Water Polo (Marlow, Bull, Heath and Shambrook, 1998); Rugby Union (Jackson and Baker, 2001; Jackson, 2003); and Track and Field Athletics (Cotterill and Greenlees, 2003).

The popularity of PPRs in golf stems largely from the belief that they enable players to concentrate more effectively. Boutcher (1992) highlighted five main benefits that PPRs provide to golfers. They improve concentration by encouraging the golfer to focus their thoughts on the task-relevant cues, help the golfer overcome a natural tendency to dwell on negatives, allow the golfer to select the appropriate motor schema, prevent ‘warm-up’ decrements and prevent the golfer from devoting excessive attention to the mechanics of their automatic skill.

2.3. THEORETICAL UNDERPINNING OF ATTENTION AND CONCENTRSTION

A number of theories have been suggested in an attempt to explain how people focus their attention or concentrate. A key point here would be to clarify what is meant by focusing, attention and concentration. Although often used interchangeably there are differences. Matlin's (2002, p.51) definition of attention as 'a concentration of mental effort' reinforces this interrelation. At least three major dimensions of attention have been identified in cognitive psychology literature including: concentration; a skill in selective perception; and mental time-sharing ability. A fourth dimension of vigilance has also been suggested (Eysenck, 2001). With concentration specifically defined as the ability to 'focus one's attention on the task at hand and thereby not to be disturbed or affected by irrelevant external and internal stimuli' (Schmid, Peper and Wilson 2001, p.333), understanding the mechanisms through which we focus our attention or select a focus for our attention is of particular importance.

2.3.1. Early selection theories

Early theories attempting to explain the mechanism through which we 'select' to pay attention to a particular stimuli in preference over other stimuli revolved around our capacity to process information. The early selection model of attention proposed by Broadbent (1957) suggested that although we receive vast amounts of sensory information there is only a very limited capacity perceptual channel that can only process a single stimulus at a time. A 'bottleneck' or filter was envisaged to exist at the point where these stimuli met the perceptual channel. One stimuli was selected here for further processing at the expense of all others (see Figure. 2.1.). However, dichotic listening studies such s Moray (1959) and Treisman (1960) proved that this is not the case, in particular if a participants name occurred in a non attended channel it would force its way into the participants attentional space. The lack of flexibility of this theory also presents problems (Eysenck, 2001). An alternative to Broadbent's model was Treisman's (1964) Attenuated Filter Model which suggested a filter that attenuates or reduces the signal strength in the unattended channel(s), and a cognitive 'dictionary' that determines the semantic importance of stimuli (see Figure 2.3.2.).

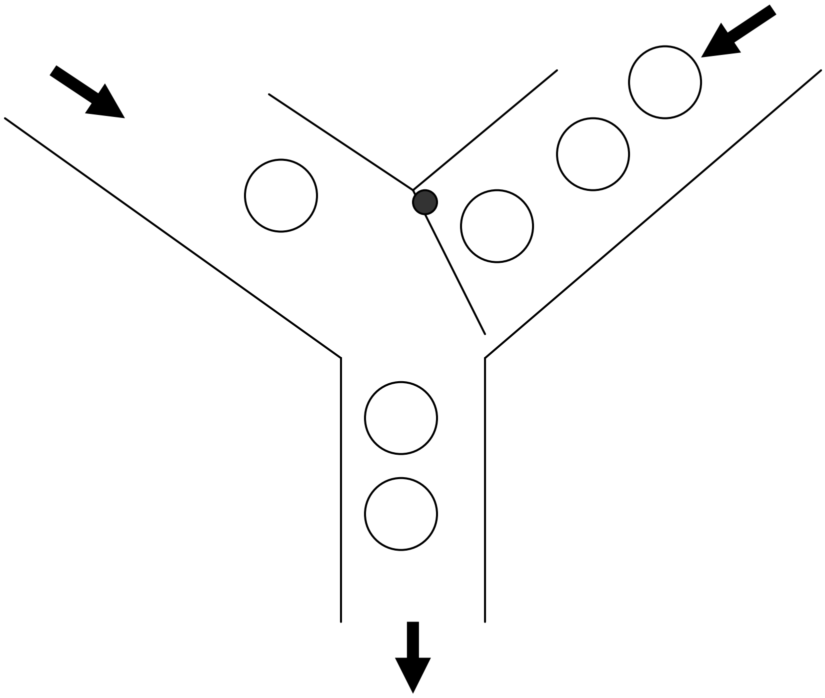


Figure 2.1. The early selection model of attention (from Broadbent (1957).

According to Treisman (1964) stimulus processing proceeds systematically, starting with analysis based on physical cues then moving onto analyses based on meaning. If there is insufficient processing capacity to allow for full stimulus analysis, then some of the later analyses are omitted with 'unattended' stimuli. All sensory information is received by the cognitive dictionary that uses principles of activation and thresholds, in a manner similar to the spread of activation.

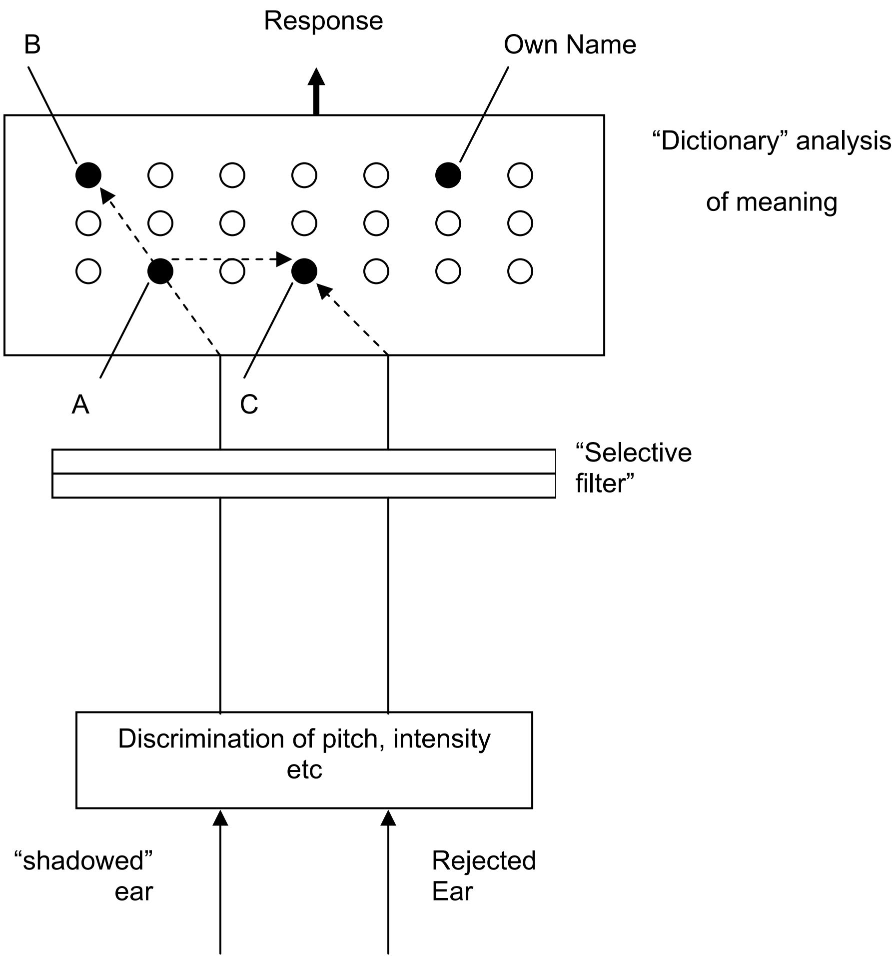


Figure 2.2. Treisman's model of selective attention (from Treisman 1960).

2.3.2. Late selection theories

An alternative to Early selection approaches was the late selection model proposed by Deutsch and Deutsch (1963). This model retained the idea of an all or nothing filter but changed its location. This filter was relocation to after the recognition stage of processing. As a result participant would receive and process all received signals, then just before responding a signal is selected based upon its importance. This model was further refined by Norman (1968). Incoming stimuli is cross-referenced with the contents of long-term memory and this determines importance (see figure 2.3). In this model the only function of the filter is to provide a focus of attention for further processing. Researchers such as MacKay (1973) and Marcel (1983) settled in favour of late selection over early selection, however another theoretical approach focusing on capacity began to gain prevalence (Kellogg, 1995) which questioned the use of filter theories as they failed to capture the full complexity of human attention.

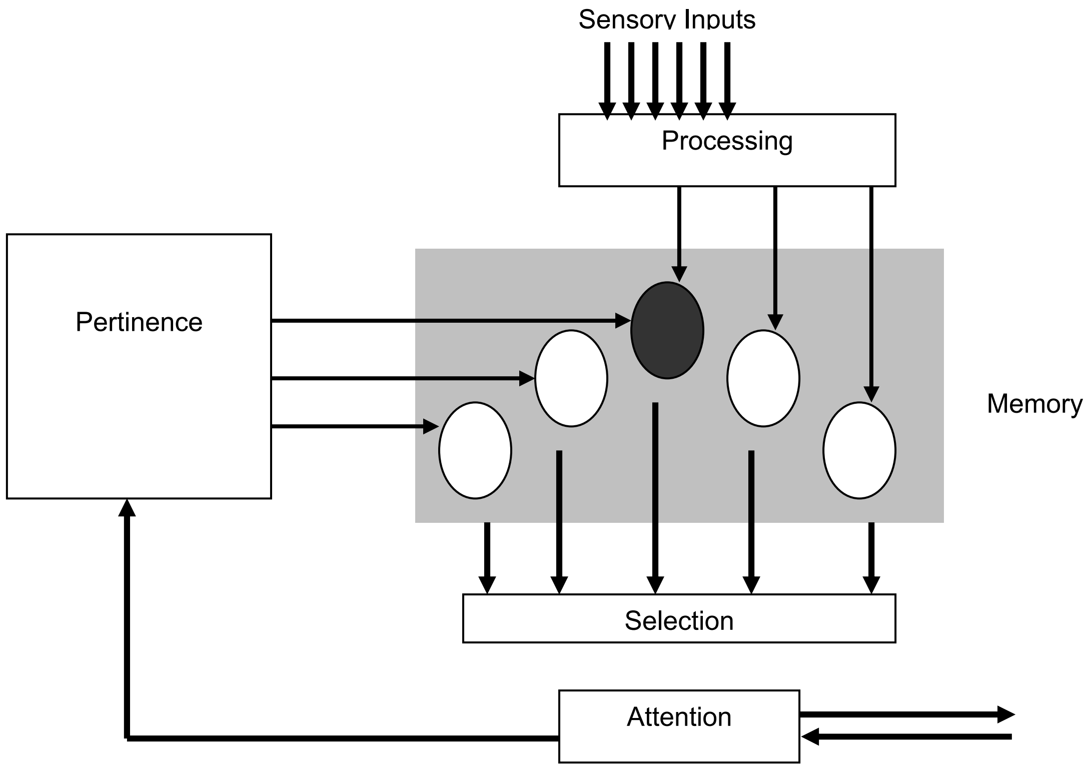


Figure 2.3. The late selection model of attention (from Norman, 1968)

2.3.3. Single capacity theory

Kahneman (1973) proposed that attention is limited in overall capacity and our ability to carry out simultaneous tasks depends in part on how much capacity a task requires. This capacity approach identified attention as mental effort (Kellogg, 1995), the more capacity a task requires, the more mental effort a person exerts. In Kahneman's model an individual has the greatest amount of available capacity when they are moderately physiologically aroused, high or low arousal decreases capacity.

Factors such as enduring dispositions, momentary intentions, and evaluation of current demands on capacity were seen to shape allocation policy. Accordingly, if an individual is too distracted or has insufficienrt available capacity because of fatigue or stress then performance decrements would occur (Kellogg, 1995). In proposing this model Kahneman (1973) saw this limited pool of capacity as an addition instead of a replacement for the bottleneck idea of the filter theories (see figure 2.4.).

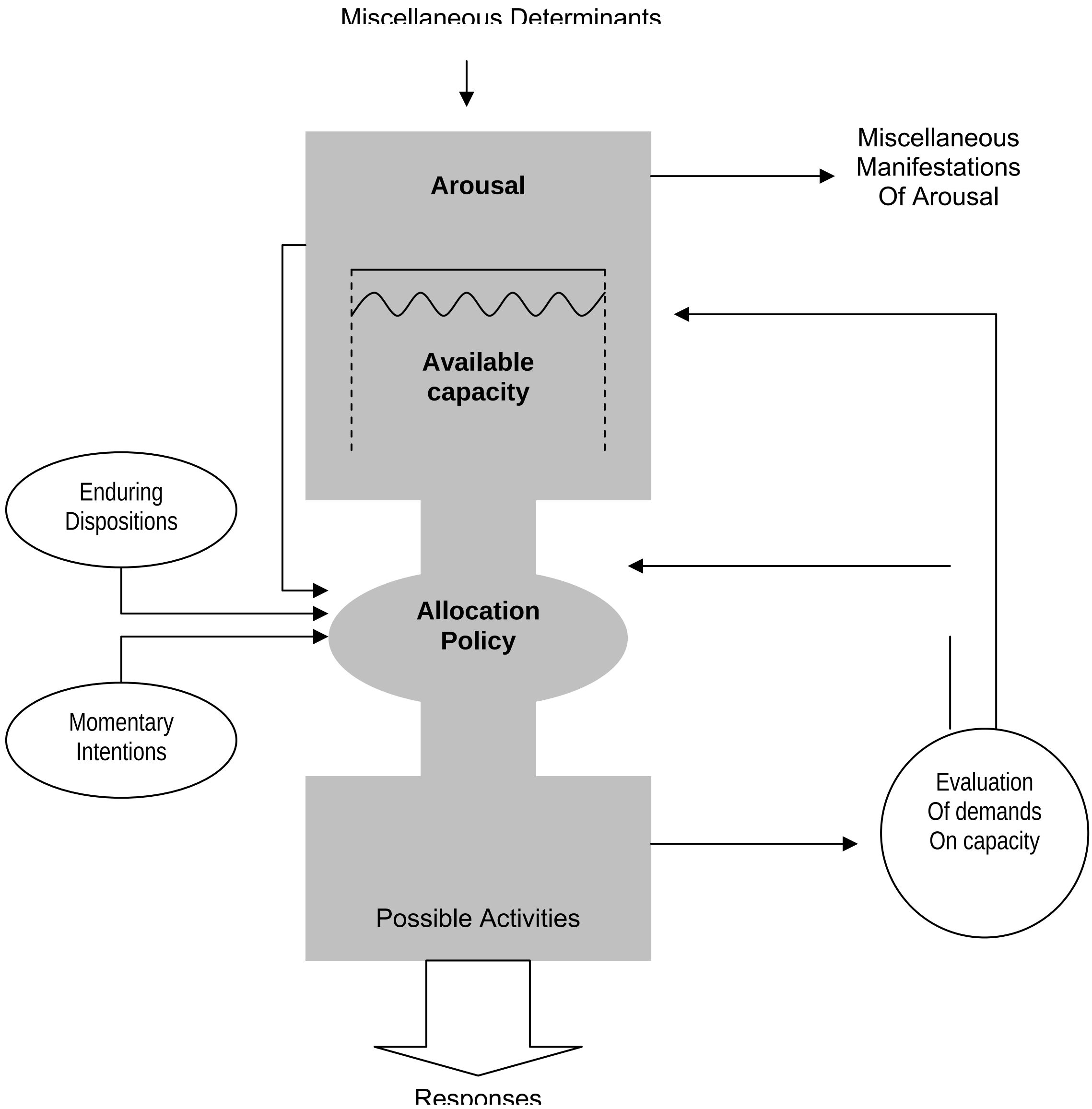


Figure 2.4. Single Capacity Theory (from Kahneman, 1973).

2.3.4. Multiple Resources theories

Navon and Gopher (1979) suggested that finer distinctions within attention needed to be drawn than those offered by Kahneman (1973). Multiple resource theories seek to explain how two simultaneous tasks will interfere with each other depending on the capacity required for each. Wickens (1980) suggested three dimensions of resources: Auditory versus visual perceptual modalities; perceptual-cognitive resources; verbal versus spatial processing codes. The auditory versus visual perceptual modalities focused on structural interference, perceptual-cognitive resources related to resources consumed by the tasks such as reading or mental calculations, and response resources consumed by speaking or moving the hand. The verbal versus spatial processing codes focused on speech to illustrate verbal codes and pictures / diagrams to illustrate spatial codes. An alternative multiple resource theory (Friedman and Polson, 1981; Polson and Friedman, 1988) identified the left and right hemispheres as independent resource types. They argued that the identification of specific neurological components corresponding to resources can better predict task interference than Wicken’s (1980) dimensions. These capacity theories, whilst not perfect do recognise the mental effort and selective aspects of attention.

2.3.5. Focusing Visual Attention

Kinchla (1992) noted that visual attention can be overt, where we specifically direct our eyes to one object instead of another, and covert, where we are attending to an object in peripheral vision.

Visual attention has been likened to a spotlight that shines onto a portion of the visual field (Posner, 1980). The focus then corresponds with the illuminated area.

LaBerge, Brown, Carter, Bash and Hartley (1991) suggested that the size of the spotlight beam contracts as the load on attentional capacity increases.

Attentional shifts from one area of the visual field to another have also been investigated. Interestingly, Kinchla (1992) suggested in summarising the research in this area that attention does not shift from one area to another in an all-or-nothing manner. Instead, attention begins to build up gradually at the cued location. Indeed, Kinchla stated that 'in terms of the spot light metaphor, it is as if the spotlight went off at one point and then gradually came on again at the target location'(p.726).

Treisman's (1964) Attenuated filter theory has undergone a number of evolutionary changes to offer a space-based theory of attention called Feature Integration Theory.

2.3.6. Feature Integration theory

Treisman (1992) distinguished between the features of objects and the object themselves. This feature integration theory assumed that there is rapid initial parallel processing in which the visual features of objects in the environment are processed together, there is then a serial process in which features are combined to form objects, the serial process is slower than the intial parallel process, features can be combined by focused attending to the location of the object, they can be influenced by stored knowledge, and in the absence of focused attention or relevant stored knowledge features from different objects will be combined randomly. Treisman and Sato (1990) further suggested that the degree of similarity between the target and the distractors influences visual search time. One of the weaknesses of Treisman's FIT is that it neglects mechanisms for top-down control over early pre-attentive processing.

2.3.7. Guided Search Theory

Suggested by Wolfe (1998) Guided search theory offers a refinement of Feature integration theory. In this theory the initial processing of basic features produces an activation map in which each item in the visual display has its own level of activation. Attention is then directed towards objects based upon their level of activation. However, Wolfe (1998) raised issues relating theories to the real world ‘in the real world, distractors are very heterogeneous. Stimuli exist in many scales in a single view. Items are probably defined by conjunctions of many features and as a result Wolfe (1998) suggested that “a truly satisfying model of visual search will need to account for a range of real-world visual behaviour” (p.56).

2.3.8. Object-based Theories of Attention

A contemporary alternative to space-based theories of attention are object-based approaches to selection. Duncan and Humphreys (1989, 1992) developed an object-based theory called Attentional engagement Theory. The first stage produces a detailed representation of visual input, including codes for meaning and as a result this is a theory of late selection. Segmentation of the visual field structures the representation in terms of object-based units. Selection controls access of the input to a visual short-term memory (VSTM), where it serves as the focus for further action. Objects compete for access to the VSTM on the basis of activation levels. Selection is also influenced by perceptual grouping effects. Similar units tend to lose or gain activation together. Searching for a target surrounded by distractors is easier when the distrators are similar to each other.

It has been suggested that selection may actually operate within both space and object-based frames of references (Tipper and Weaver, 1998).

It is clear from the development of these theoretical approaches to understanding attention that there are a number of influencing factors. Factors such as physiological arousal, skill level, importance of the features in the visual field, and required capacity for a task need to be considered in order to be able to focus attention effectively.

2.4. FUNCTIONALITY OF PRE-PERFORMANCE ROUTINES

Numerous ideas have been developed to explain the role that PPRs satisfy. It has been suggested that they prescribe an attentional focus (Boutcher, 1992; Harle and Vickers, 2001); reduce the impact of distractions (Boutcher and Crews, 1987; Weinberg, 1988); act as a trigger for well learnt movement patterns (Boutcher and Crews, 1987; Moran, 1996); divert attention from task irrelevant thoughts to task relevant thoughts (Gould and Udry, 1994; Maynard, 1998); improve concentration and enhance the recall of physiological and psychological states (Marlow et al, 1998); help performers achieve behavioural and temporal consistency in their performance (Wrisberg and Penn, 1992); or prevent performers focusing on the mechanics of their skills and the resulting unravelling of automaticity (Beilock and Carr, 2001; Beilock, Carr, MacMahon and Starks, 2002). It has been suggested that the main purpose of a performance routine is to “put oneself in an optimal emotional, high self-expectant, confident, and focused state immediately prior to execution, and to remain that way during the act” (Singer, 2002, p.6). Shaw (2002) also hypothesised that the value of PPRs may be that they pre-sensitise the movement system to the appropriate perception-action coupling between the environment and the player.

However, as yet no definitive position has been achieved to explain the function of PPRs. Indeed the majority of the suggestions offered to date regarding the functionality of PPRs are simply ideas or notions put forward by researchers and practitioners alike. Applied recommendations such as those put forward by Boutcher (1990), although appealing, appear fundamentally flawed, based on a causal inference from correlational data (Jackson and Baker, 2001). Further examination of the role that PPRs satisfy is required before effective application strategies can be developed.

2.5. APPLIED RECOMMENDATIONS

Whatever their mechanism or primary thrust however, current thinking is that effective pre-performance routines should possess certain key characteristics if they are, in turn, to 'generate' peak performance. In this regard Crews and Boutcher's (1987) study of elite golfers highlighted that consistency of the timing and behavioural characteristics were key to the eventual impact of the routine itself. Indeed Crews and Boutcher (1987) advocated that the timing of the routines was essential with expert players taking longer to execute their routine at both putting and full swing shots. Extending this contention, Boutcher (1990) recommended that performers should assess the consistency of their PPRs by time analysis. Crampton (1989) suggested that; "elite golfers appeared to do the same things in the same order and with the same timing" (p.9). Douglas and Fox (2002) argued further that professional golfers drill themselves to perform a pre-shot routine regardless of the situation, contending that this factor may actually distinguish the very best and highly competent professional golfers. However, these applied recommendations do not appear to recognise the factors that impact upon the golfer. Indeed suggesting that the same preparation is required for similar actions and activities, although appealing from a preparation perspective, intuitively does not account for the variables the golfer needs to address in order to perform. Without understanding the functions that PPRs actually fulfil in the execution of high levels of performance the suggestion of routine guidelines based on observed differences between good and bad performance and their precursors is unacceptable. In order to prescribe effective pre-performance behavioural and psychological routines there is a need to understand how these routines influence the performer and the impact they have on skill execution.

2.6. LIMITATIONS IN PREVIOUS RESEARCH DESIGNS

Previous research that has manipulated performance based upon the use or absence of routines appears to have been flawed. Specific issues relating to the ecological validity of this work needs to be addressed. In particular, concerns relating to the ecological validity of the research environment; the fidelity of the tasks performed; environment type; participants' visual perception perspective; task difficulty issues; with their impact upon behaviours and underlying psychological processes need to be addressed.

2.6.1. Ecological validity

In order to develop an understanding of the psychological processes underlying the pre-performance rituals, behaviours and routines of elite performers in their chosen sports it is essential for researchers to observe the performer in the competitive environment (Morris and Summers, 2004). Being able to observe the performer in this ‘real’ environment would not only enhance a researchers understanding of the performers responses to the environment, but also lead to understanding factors that directly and indirectly influence the performers’ responses.

It is often impractical to observe performers in a real competition due to the nature of competition itself. However, it is essential to make the research settings as realistic as possible. Ideally allowing important features influencing behaviour such as perception, decision-making, and effector organisation to remain unaffected by the imposition of experimental constraints, and attempt to maximise ecological validity.

The issue of ecological validity is a key factor in applied sports research and crucial to understanding the psychological strategies utilised by performers prior to and during competitive sport. Davids (1988) suggested that ecological validity is a “transient phenomenon characterised by informed and systematic attempts to analyse actual behaviour within specific environmental contexts, utilising unobtrusive, realistic, and reliable methods of investigation” (p.127). Davids suggested further that the more exact the replication of actual behaviour patterns in controlled and specific settings, the greater the credibility in the application of the accrued data. For the researcher interested in exploring pre-performance behaviour the ability to exactly replicate ‘real’ competitive situations in experimental conditions is difficult to achieve.

Davids (1988) recommended that the use of new technology and novel approaches in the study of sports behaviours could potentially be used to address this issue of ecological validity. This suggestion was supported by Paull and Case (1994) who proposed that the development of an interactive video simulation for sports skills analysis may provide such ecological validity for sports research, also potentially decreasing the experimenter's intrusion which can detract from the reality of the environment for the sports performer.

2.6.1.1. Ecological validity in pre-performance behaviour research

Research to date exploring the use of PPRs generally (Southard and Amos, 1996; Marlow, Bull, Heath, and Shambrook, 1998; Harle and Vickers, 2001) and specifically in golf (Boutcher and Crews, 1987; Cohn, Rotella and Lloyd, 1990; McCann, Lavallee and Lavallee, 2001; Douglas and Fox, 2002) has focused on the processes involved, generally exploring factors that could impact upon the consistency of behavioural routines and the relationship between consistency and performance. Douglas and Fox (2002) used members of the Ladies European Tour (LET) to complete a putting task. The task was set up on the eighth green of Gleneagles short course. The task involved three putts to three different holes. The participants were faced with one right to left six foot putt, one left to right six foot putt and one double breaking forty five foot putt. The actual putting task involved six consecutive putts to each hole (18 holes) under two conditions: practice and competition (competing with other subjects for personal reward). Boutcher and Crews (1987) used six male and six female University golfers. Subjects were required to complete 18 putts at a local golf course, putting six times from three different differences (4, 12 and 20 feet). Southard and Amos (1996) explored PPRs using seven elite sports performers taken from golf, basketball or tennis. Participants were required to complete either 15 free throws, 15 putts or 15 tennis serves. Data collection took place in a gymnasium, with the putting taking place on an artificial putting matt 2.5m x 0.5m.

Cohn, Rotella, and Lloyd (1990) made only 13 observations per participant across a range of shots during a round of golf. McCann, Lavallee, and Lavallee (2001) assessing the effect of pre-shot routines on the golf wedge shot required their 68 participants to play the ball into a 10m (radius) target area from distance varying from 40m to 60m. All of these studies incorporated ecologically flawed methodologies when comparing the tasks to the real golfing conditions of matchplay.

Each of these highlighted studies required the participants to perform a task that in some cases was loosely similar to the real experience, often in dissimilar environmental conditions. As a result the ecological validity of these studies could be questioned.

Indeed nearly all of these studies failed to either address or explain the impact of task constraints on the routine (performance related and environmentally related aspects of the task) on PPRs, or, the dynamic nature of sport, in particular golf where the same shot or type of shot is very rarely played twice. The limited, repetitive nature of these tasks could have caused the observed results, therefore making the findings different from, and therefore not applicable to the ‘real’ environment. This could ultimately result in significant differences between the experimental and competitive environments.

2.6.2. Fidelity

Starkes and Lindley (1994) suggested that the fidelity of the environment is a crucial factor in determining the effectiveness and ecological validity of the research environment when compared to the competitive environment. Starkes and Lindley defined fidelity as the "extent to which the simulation mimics the real-work task" (p.221). Lintern, Sheppard, Parker, Yates, and Nolan (1989) proposed three distinctly different components of fidelity. Physical fidelity (the look of the task), which differs from functional equivalence (whether the simulated task feels like the real task), which in turn differs from psychological fidelity (how much the performer perceives the simulated environment to be realistic). Lintern et al. (1989) further suggested that researchers needed to strive for physical fidelity, functional equivalence and psychological fidelity in order to make the simulated environment as ecologically valid as possible.

Of these three components of fidelity in previous studies, it could be suggested that the functional equivalence have been at best a poor imitation of the real task. By getting participants to repeat the same aspect of their game e.g. putts (Douglas and Fox, 2002; Boutcher and Crews, 1987) they are not completing a task with the same dynamic demands. The physical and psychological fidelity of the tasks have also changed, players do not play the same shot continually in the competitive environment. Therefore it is reasonable to assume that the participant would not feel that the experimental situation was sufficiently similar to competition. This could lead to different task, environmental and psychological demands which could ultimately change the temporal and behavioural characteristics of the PPRs utilised by golfers, and ultimately change the psychological strategies adopted. As a result, without confidence in the ecological validity of the research setting, changes in the functional equivalence, physical and psychological fidelity of the task could severely limit the researchers ability to unravel the physical, psychological and behavioural mysteries of the PPR.

Specific requirements for an experimental paradigm exploring sports performance behaviour were outlined by Paull, Case and Grove (1997, p.534). Their identified requirements included:

(1) Environments reproducing the perceptual information cues available in the usual performance situation;
(2) Dynamic displays of the action typical of the skill domain, including information about any alternative situations (uncertainty) that can arise;
(3) Realistic motor response actions that have, through practice, become coupled in a performer's memory to his / her perceptual system;
(4) The ability to manipulate perceptual and probabilistic cues in the display with the expectancy that this will create changes in the subject's responses;
(5) The recording of control, timing, and response data without interfering with subjects' execution of their usual actions for the skill.

Through using these guidelines Paul, Case and Grove suggested that if a researcher fulfilled these requirements they could be confident that any subsequently recorded data reflected how a person behaves in the operative situation.

2.6.3. Environment type

The potential difference between experimental and competitive environments has been highlighted by Jackson and Baker (2001) who adopted a case study approach to exploring PPRs focusing on an individual elite rugby goal kicker. They utilised data collected from the club ground and data from international matches. In the controlled experimental situation the kicking positions were marked on the pitch using plastic cones. Jackson and Baker found that the participant's concentration times tended to be shorter for kicks taken in the competitive environment than in the controlled experimental environment. The results also indicated significant differences in the physical preparation time mean standard deviation between the experimental conditions (1.82s) and the competitive conditions (1.02s). Given that both the concentration time and physical preparation times were different, this raises the question of whether the player is still utilising the same strategies to prepare for the kick.

2.6.4. Visual perception

Perception involves detecting and interpreting changes in various forms of energy flowing through the environment such as light rays, sound waves, and neural activation (Bruce, Green and Georgeson, 1996). The environmental changes which can be perceived from these energy flows over space and time are used to support the goal-directed actions of the athlete (Williams, Davids, and Williams, 1999). As a result it could be suggested that changes in the nature of the environment could directly influence the behaviour of the performer.

There are two major approaches which seek to rationalise the link between visual perception and action, indirect and direct perception. Indirect perception theorists (Bruner, 1957; Neisser, 1967; Gregory, 1980) argue that perception involves the formation of an internal representation suggesting that memory, in the form of stored knowledge of the world, is of central importance to perception (Eysenck, 2001).

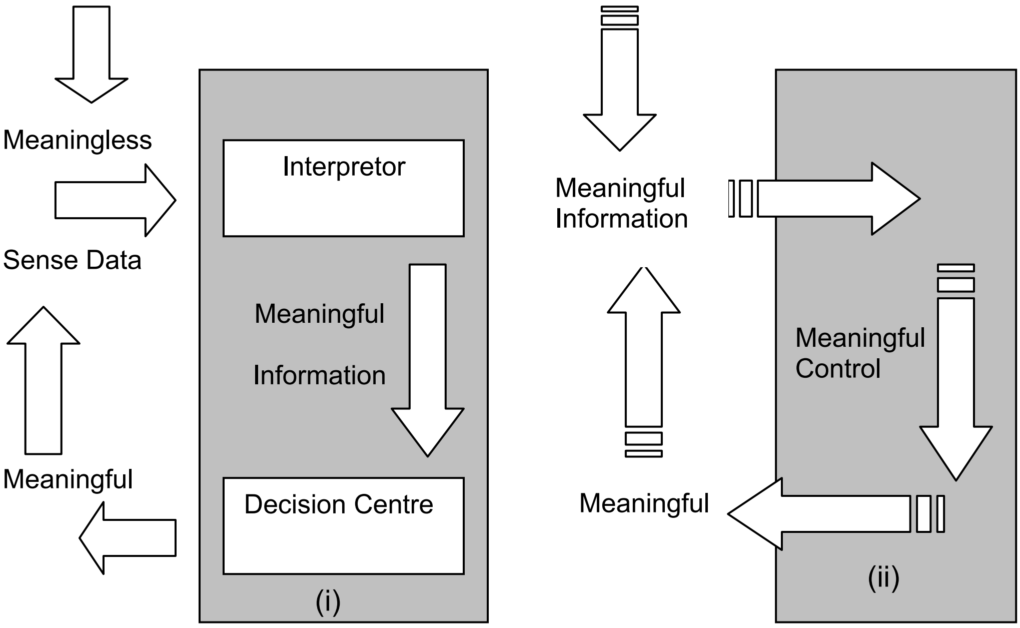


Figure 2.5. Indirect (i) and direct (ii) conceptions of the relationship between perception and action (Meijer, 1988).

The indirect perception theorists believe that there is a need to understand the interrelationships of perception processing at different cognitive levels.
Direct perception deals with visual perception by emphasising optical flow patterns.

Gibson (1979) suggested that the optical array specified at the eye contains abundant information over space and time that allows the actor to directly and unambiguously perceive the layout and properties of events within the environment. This visual information is crucial in the execution of golf shots.

In essence indirect perception emphasises top-down processes where meaning is added by the organism whilst direct perception emphasises bottom-up processes with sensory sources of information already carrying meaning (See figure 2.1.).

The relative importance and salience of top-down and bottom-up processes depends on a range of factors. Eysenck (2001) suggested that visual perception may be determined primarily by bottom-up processes when the viewing conditions are good, but involves top-down processes as the viewing conditions deteriorate because of very brief presentation times or lack of stimulus clarity. Indeed in the development of these two conceptual approaches to perception Gibson focused on visual perception under optimal viewing conditions, whereas constructivist theorists (Bruner, 1957; Neisser, 1967; Gregory, 1980) often used suboptimal viewing conditions. Eysenck (2001) suggested that these two approaches, instead of providing alternative views of visual perception, actually look at different aspects. Indirect theorists have focused on perception for recognition, whereas direct theorists have emphasised perception for action (Milner and Goodale, 1998). As a result, it's this direct, ecological approach to visual perception that appears to explain better the link between perception and action (Williams, Davids, and Williams, 1999). The accuracy and relevance of the information received from the experimental environment could result ultimately in a different set of responding actions.

2.6.4.1. Environmental simulation

The effective replication of the competitive environment is key to maximising the ecologically valid nature of pre-performance behaviour research. A potential remedy to the problem of ecological validity in sport is to conduct performance-related research in a realistic competitive simulated environment.

Task simulators are used increasingly in different domains for training and research (Diechmann, 2000). Environmental simulators have been used extensively in a number of professions to facilitate training and 'real' experiences. Significant users of simulators historically have included the medical professions (Gaba, Howard, Fish, Smith and Sowb, 2001); engineering (Kamath, 2005); the military (Childs, 1997); and the aviation industry (Lee, 2005). Schultheis and Mourant (2001) explored the use of computer-based simulation for driving tasks and suggested that they offered the opportunity to deliver real-life scenarios for the assessment of driving capacity. They also argued that simulators allowed an individual to 'experience' the driving scenario maximising the potential for the transfer of learning to an individuals 'real' environment. Indeed in computer simulation it is possible that drivers may experience a sense of 'immersion' and perform with the same level of risk-taking as when driving in the real world (Nash, Edwards, Thompson, and Bartfield, 2000).

Plumert, Kearney, and Cremer (2004) used a high fidelity, interactive bicycle simulator to study gap choices and crossing behaviour, which they reported allowed children to be presented with the same kinds of challenges as they confront in the real environment. In developing simulators for research Paull, Case, and Grove (1997) suggested that the use of full-sized images of actual dimensions is necessary to the virtual research paradigm. Perceptual cues from eye kinesthesis are then consistent with features of the display, which, it is hypothesised, should result in the relevant actions observed in real competition environments.

In the last few years, the golfing community has experienced a proliferation of ‘real play’ computer-based simulators. These simulators offer the golfer the opportunity to play a realistic simulation of a golf course of their choice, using their own clubs and golf balls. Golf simulators such as the one marketed by SmartGolf UK (see Figure 2.2.) appear to have a number of distinct advantages over other methods of observing golf performance outside of competition (putting green, driving range and laboratory setting). First, they visually recreate an accurate view of the shot facing the player on the course. This allows the task demands to mirror more completely a real competition. Second, players are able to play with their own clubs, which is consistent with the real environment. Third, due to the nature of the simulator, participants are required to undertake similar thought processes as in real competition situations e.g. club selection, round construction, competition against other players. All of these reinforce the ecological validity of the psychological and task-related factors impacting on the players, making the routines and behaviours observed as realistic as possible within the simulated environment.

The basic tenet of an ecologically valid research paradigm is that subjects should execute the skilled performance with minimum interference from the system (Paull, Case and Grove, 1997). Previously, this issue has presented particular problems in the use of computer and video simulated environments in sports related research.

However, the new generation of golf simulators appears to have overcome this specific limitation by allowing participants the space to perform normally.

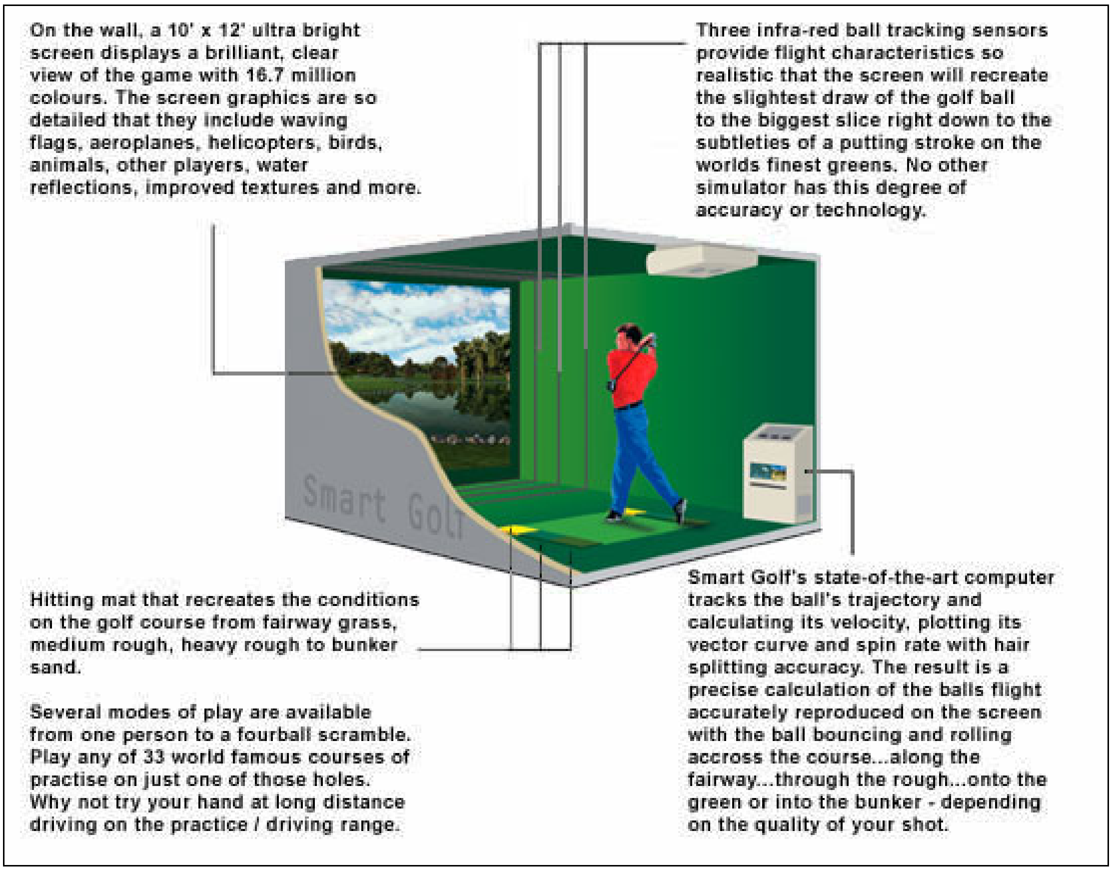


Figure 2. 6. Smart Golf ‘real play’ golf simulator. Reproduced from http://www.smartgolfeurope.com/

2.6.5. Task difficulty

Jackson and Baker (2001) further highlighted the impact that task difficulty could have on PPRs. They looked at the effects of task difficulty and the use of psychological skills on the consistency of PPRs in rugby kicking. By varying location and distance to manipulate the task difficulty they found that the duration of concentration times and physical preparation times increased as task difficulty increased. However, the number of steps taken and glances to the posts remained constant. Therefore, it was the temporal duration of each behaviour that changed. These findings conflict with those of Crews and Boutcher's (1987) who found that elite golfers had highly consistent routine times suggesting that the component parts of PPRs remain the same. The time duration between each behavioural action however changes in relation to task difficulty. Therefore in light of these potential differences the impact of task difficulty and task type on PPRs needs to be further investigated. Much prior research exploring PPRs has not allowed for the impact of task difficulty on the psychological processes utilised by the performer. Instead, only the behavioural and temporal characteristics of the experimental tasks have been described. Indeed it is easy to argue that if a participant is required to complete the same task time after time without greatly varying task difficulty the psychological processes and strategies utilised will remain constant resulting in temporal and behavioural consistency. This cannot however then lead to the assumption that all situations will require the same temporal and behavioural characteristics of routines.

2.7. UNDERLYING PSYCHOLOGICAL PROCESSES

Previous research exploring PPRs in sport has not to date comprehensively explored in depth the psychological processes that occur during the routine stage prior to the execution of the required movement, even though the importance of a positive affective state pre-competition has been identified (Hardy, Jones and Gould, 1996). Indeed it could be argued that inappropriate mental states can lead to task-irrelevant thoughts, loss of attention, and inappropriate physical states which can result in poor performance (Boutcher, 1990). Previous researchers in the area have suggested a number of potential psychological processes, which include the utilisation of imagery (Hall, Rodgers and Barr, 1990) and distracting the attentional focus from irrelevant thoughts to task relevant thoughts (Maynard, 1998). It has also been suggested that the PPRs specifically improve both concentration and performance (Harle and Vickers, 2001), and enhance the recall of physiological and psychological states (Marlow, 1998). Indeed Jackson and Baker (2001) suggested that "it seems logical that routine times would be longer whenever other coping strategies, such as applied relaxation (Ost, 1988), attentional cueing (Hill and Borden, 1995) or thought stopping (Zinsser, Bunker and Williams, 1998) are incorporated into a pre-performance routine" (p.50). Shaw (2002), in his case study of a professional golfer, reported that the professional golfer had experienced some attentional benefits arising from the use of a PPR. Specifically, the golfer reported that “the new routine had made him more focused for each shot and therefore, less distracted by irrelevancies” (p.117). However, although a number of psychological processes have been suggested to accompany the pre-performance routine, to date only Jackson and Baker (2001) have explored these processes in detail despite the potential benefits that a greater understanding of these processes would have for the performer, coach and sport psychologist. Jackson and Baker in their case study of an elite rugby kicker found that the player utilised a range of psychological strategies including specific mental cues, thought stopping, inverse simulation, visualisation and relaxation techniques, but interestingly these differed from attempt to attempt. Indeed the authors concluded that the most important determinant of kicking performance in the competitive environment was the successful application of specific psychological strategies rather than the temporal consistency of the PPR. As a result it would make sense to focus more on the underlying psychological processes and psychological strategies used than on the temporal consistency of pre-performance behaviours.

2.8. CONDUCTING RESEARCH INTO PREPERFORMANCE ROUTINES

There are a number of research approaches that have been utilised to explore pre-performance behaviours, techniques and strategies in sport. Specifically, research has focused on recording the duration, order and instances of certain categories of behaviours, measured attention-related events using psychophysiology, and explored the psychological techniques and strategies utilised by players through direct interviews (Shaw, 2002).

2.8.1. Behavioural / temporal description

In order to study PPRs meaningfully the researcher must decide how to quantify them (Wrisberg and Pein, 1992). Previous measures exploring pre-performance behaviour in golf have focused on measuring the frequency, duration and consistency of the participants' behaviours prior to, during, and after ball strike. For example, Boutcher and Zinsser (1990) in their study exploring cardiac deceleration in elite and beginning golfers during putting, specifically looked at the number of practice swings and the number of glances at the hole of participants. A similar approach was adopted also by Douglas and Fox (2002), who took three measures of the routines: First, the length of time in seconds between the time the player grounded the putter head behind the ball and time the ball was struck; Second, the number of practise swings during that period; and thirdly, the number of glances at the hole during that period. Crews and Boutcher (1986) who used a modified version of events recording (Siedentop, 1983), included a number of discrete behavioural actions (practise swings, waggle and glances at the target or hole) occurring pre and post shot, the number of actions, their order, and certain time aspects.

2.8.2. Psychophysiological exploration of underlying processes

The mind-set of the performer appears to be the most important factor in understanding the function of the PPRs (Jackson and Baker, 2001). The ability to understand the cortical activity and related psychological processes during mental preparation for sports performance appears to be key to understanding the nature of the PPRs used immediately prior to sports performance.

The relationship between attention and performance has been investigated in numerous studies, often by using indirect measurements such as self-report questionnaires or reflective logs. An alternative to the use of self-report measures for studying attentional processes during an event can be provided by psychophysiological methods (Hassmen and Kolvula, 2001). Psychophysiology can be defined as “the scientific study of cognitive, emotional and behavioural phenomena as related to and revealed through physiological principles and events” (Cassioppo and Tassinary, 1990, p.ix). This approach was supported by Lawton et al (1998) who advocated the use of psychophysiological measures as an effective way of observing, and measuring mental processes during real-time performance. Lawton suggested further that this measure could then be related to the underlying nervous system processes being utilised by the performer during the pre-performance period.

This particular approach to measuring psychological processes is particularly useful as it can “provide an objective and relatively non-invasive method of examining the complex processes involved in sports performance as they take place” (Collins, 2002, p.17). The approach is promising in that it can provide an unobtrusive, objective and real-time measurement of mental processes associated with sports performance (Hung, 2002). The psychophysiological methods most suited to the study of mental processes during ‘real-time’ performance are the use of heart rate changes and electroencephalography. Singer (2002) suggested that on the basis of the psychophysiological evidence to date, which has been obtained primarily in aiming sports, outstanding athletes and performances could be distinguished from other athletes and performances in the pre-performance state. Therefore the comparison of psychophysiological data for good versus poor performance could potentially highlight differences in the psychological processes utilised in each case.

2.8.2.1. Cardiac deceleration

Cardiac deceleration is a measure of the duration of time between a specific, reoccurring point of the cardiac cycle and the next corresponding point (see Figure 2.3.). Lacey and Lacey (1966) proposed that decreases in cardiac activity prior to performance facilitate attentional processes. This was due to decreased feedback to the brain associated with a decrease in cardiac activity. Janelle et al. (1999) suggested that when the act requires an internal attentional focus, heart rate acceleration results in greater cortical activity. Landers, Petruzzello, Slazar et al. (1991) reported that there tends to be a decrease in heart rate during the preparation and concentration phase related to performing a motor skill.

Boutcher and Zinsser (1990) in their study of university golfers suggested that “greater heart rate deceleration (HRD) may be associated with more efficient attentional focus” (p.37).

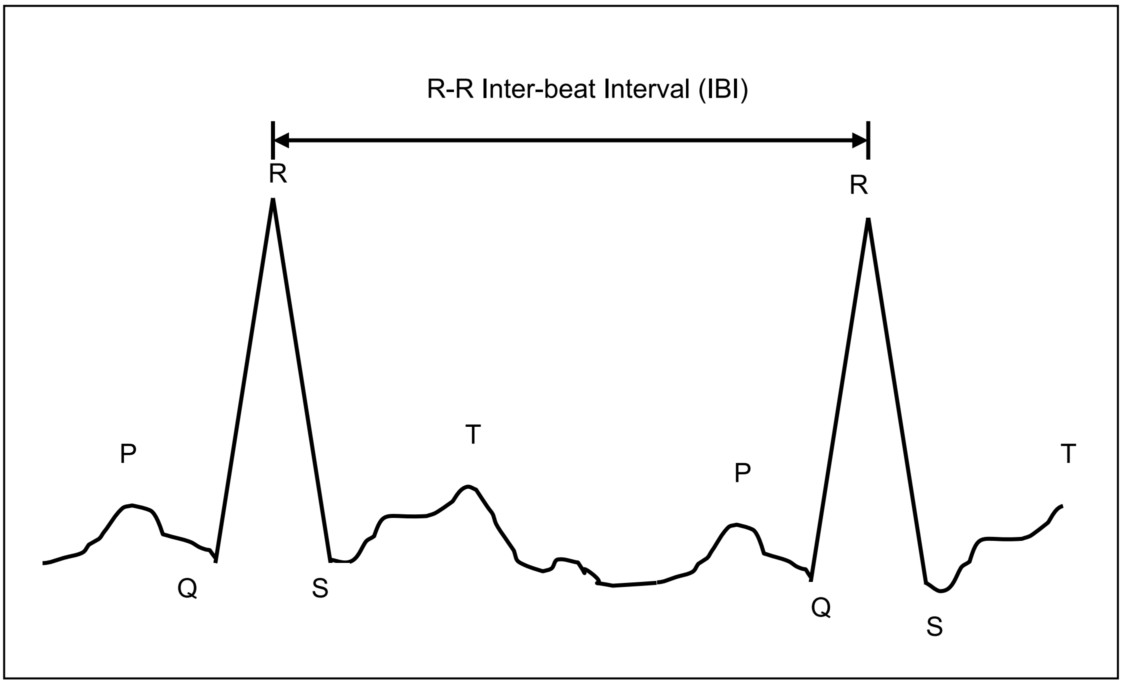


Figure 2.7. Demonstrates the point-to-point measurement that is taken when recording the R – R inter-beat interval (IBI) which is measured in milliseconds.

Radlo et al. (2002) in their study exploring elite darts players found that participants using an external focus strategy showed a steady decrease in heart rate immediately prior to dart throwing. Dart throwers engaged in an internal attentional focus showed a slight decrease in heart rate until the last heart beat epoch before initiating the toss. Boutcher and Zinssers' study of university golfers measured the inter-beat intervals (IBI's) between heartbeats immediately prior to, during and post completing a putting task. Their results showed that this IBI increased significantly in length prior to performance indicating a decrease in heart rate. The overall conclusions indicated that there was a greater cardiac deceleration associated with superior putting performance. They suggested that future work should explore both heart rate and electroencephalography patterns in golf, specifically focusing on their relationship.

Coles (1984) believed that HRD mainly reflects motor readiness. Radlo et al (2002) also reported that when each performer's four best and worst throws were analysed in conjunction with heart rate, the results showed that a significant HRD was associated with the best shots. Additionally, the worst shots were associated with a significant increase in heart rate.

2.8.2.2. Electroencephalography

Electroencephalography (EEG) uses electrodes attached to the scalp to record the changes in electrical potential, which accompany peripheral nerve activity in the brain. This measure is then used as an indicator of neural function. The main frequency bands of interest when recording scalp potentials relating to sport are alpha and beta. Alpha activity is characterised by high-amplitude low-frequency (8-13Hz) waveforms in EEG. Alpha activity is important in its ability to reflect attentional processes. Beta activity has been identified as low amplitude high frequency (14-30Hz) rhythms. Examples of both alpha and beta wave forms are shown in Figure 2.4. Active processing in the cortex is characterised by increases in beta activity, which leads to a decrease in alpha band activity, sometimes referred to as alpha blocking (Collins, Powell and Davies, 1991).

Lawton et al (1998) concluded that there is a fairly widespread decrease in cerebral activity when preparing immediately to perform motor tasks. Specific cortex areas of interest are the occipital, pariatal and temporal lobes of the brain.

Salazar et al. (1990) reported that when four best and worst archery shots were compared, increases in alpha activity in the left hemisphere were related to poorer performance.

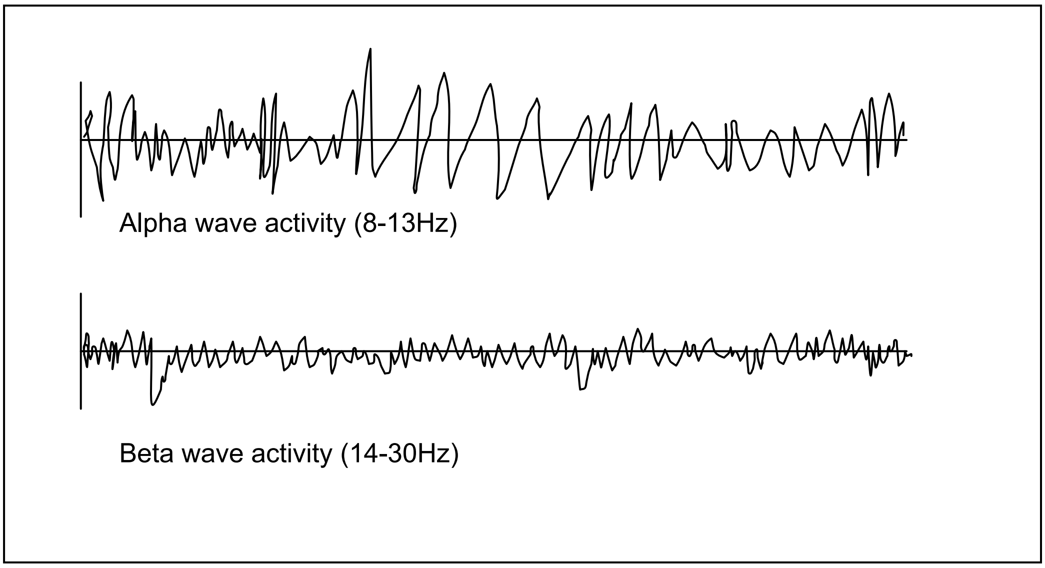


Figure 2.8. Visual representation of alpha and beta wave forms in EEG.

Crews and Landers (1993) reported that alpha activity in the right hemisphere rather than the left hemisphere of the temporal cortex was related to performance. They concluded that the golf putt requires the use of both hands while other reported events (archer, pistol shooting) involve only one hand to initiate action and would explain conflicts with other published studies.

Crews, Lutz, Nilsson and Marriott (1998) in their study exploring psychophysiological indicators during the golf putting suggested that EEG measures of automatic, successful performance confirm that low levels of activity exist in various areas of the brain immediately prior to initiating the stroke during the golf putt. These results appeared to reinforce previous findings (Crews and Landers, 1993; Hatfield, Landers, and Ray, 1984) that suggested that increased alpha activity was related to reduced error, and a quieting of the left hemisphere appears important for successful performance.

Various recent studies have explored the alpha power characteristics exhibited by sports performers in various environments. Janelle, Hillman, Apparies, et al. (2000) reported that expert marksmen exhibited a significant increase in left hemisphere alpha power (a more relaxed state) compared with the right hemisphere, as well as asymmetrical patterns of alpha and beta activity in both hemispheres. Landers et al. (1994) reported that the amounts of alpha activity across both hemispheres at the beginning of learning were relatively low. However, as the participants become more skilled, an increase in alpha activity was evident in the left hemisphere while activity in the right hemisphere remained constant. All of these studies suggest a link between alpha power, particularly in the left hemisphere, and the pre-performance state. However to date there are no studies of how performers can achieve this superior attentional state characterised by alpha synchronisation prior to performance.

While attention concerns the selection of input to the organism, intention refers to the selection of output (O’Connor, 1981). The perception of objects requires attention to external space with the consequent peripheral feedback, control of action depends on the implementation of internal plans and can be a feed forward process (Hoff and Arbib, 1992). This implies the organism is looking ahead towards a new state, the representation of which steers the transformation until its completion (Jeannerod, 1994). The intention mode of behaviour probably uses feed-forward control, based on centrally stored instructions, to monitor the relationship between the actual and predicted trajectories (Loze et al, 1999). When a task being performed is well known to the individual and is performed in a predictable environment there is a change from attentional control to intentional control. Prior to performance there is a shift from the external environment to the internal environment. In essence there is a shift from attention to external sensory stimulus to an intentional state. This intentional state refers to the selection of motor output prior to skill execution based on an internal representation of the skill and the appropriate action(s) necessary for a successful performance (Jeannerod, 1994). This shift to intention is reflected in EEG. Alpha power has been shown to reflect the level of visual attention to external stimuli. Due to the decrease in processing of external sensory information there is an increase in alpha frequency and power in the occipital and parietal cortex. In target sports this shift from attention to intention is generally acknowledged as occurring 2.5 seconds prior to trigger release. This shift however, is individualistic and dependent on task difficulty. Loze, Collins and Holmes (2001) in a study with elite shooters examined the pre-shot occipital EEG alpha-power activity of elite air-pistol shooters. Specifically they selected the best and worst 5 shots for each shooter based on four indicators of shot quality, which were either outcome based or rated by experts. Loze et al found that pre-shot alpha power increased through epochs 1 to 3 prior to best shots, but decreased prior to worst shots. They also found that alpha power was also significantly greater during the final pre-shot epochs of the best shots. This implies that prior to best performance in closed skill tasks there is an increase in occipital alpha power immediately prior to performance. This indicates that achieving this state is essential to achieving optimal performance levels. Comparing the preparatory stages of good and poor performance in golf could offer an insight into exactly what the optimal cognitive state prior to performance is and possibly how the performer can achieve the required psychological state prior to performance.

In order to be able to distinguish between the psychophysiological data collected for both good and poor shots in golf there is a need to be able to measure / rate performance on the task that the participants perform. The majority of previous studies looking to distinguish between good and poor performance have focused on self-report measures, subjective ratings, and measurable outcomes of performance. Crews and Landers (1993) in measuring a putting task used the distance the putt finished from the hole as an indicator of performance ranging from 0cm to a maximum of 61cm measured from the closest rim of the hole. Loze, Collins and Holmes (2001) in their study of elite air-pistol shooting utilised a combination of the score achieved, a sport psychologist rating each shot, participants (post shot) rating of their own performance, and a fourth criterion analysing the technique of the performer using video analysis post hoc. This mixture of subjective and objective measures of performance appears to be a good way to discriminate between good and poor performance attempts.

To appreciate the importance of the PPR in golf performance it is essential to understand the psychological processes that occur during this preparatory period. Specifically being able to contrast the processes present in preparation for good performance and poor performance will provide an insight into the ideal preparation characteristics for golfing performance. Previous research has not comprehensively explored the psychological components of the pre-performance period in any great detail, particularly in relation to distinguishing between the processes of good and poor performance.

2.8.3. Qualitative analysis of pre-performance psychological strategies

In recent years the use of qualitative approaches to research has gained increasing popularity in sport psychology research. Martens (1987) and Horn (1992) both questioned the methods of orthodox science as the most appropriate way of understanding human behaviour. They both proposed a heuristic paradigm where the researcher has a central position in the research process. This heuristic paradigm stresses the importance of studying the whole subjective experience of individuals by examining the way people perceive, create and interpret their world.

Within this qualitative research framework a number of varied qualitative methodologies have been used to inform the research process. Of the many available qualitative approaches, phenomenology merits particular attention due to its focus on the participant’s experience.

2.8.3.1. Phenomenology

Phenomenology is a research philosophy that was initiated by Edmund Husserl (1900-1970) at the beginning of the twentieth century.

In general terms, phenomenological research aims to clarify situations, experiences, and behaviours of persons in everyday life (Giorgi and Giorgi, 2003). Instead of attempting to reduce a phenomenon to a convenient number of identifiable variables and control the context in which the phenomenon will be studied, phenomenological research is designed to remain as faithful as possible to the phenomenon and to the context in which it appears in the world. This means that to study a particular phenomenon, a situation is sought in which individuals have first-hand experiences that they can describe as they actually took place in their life (Giorgi and Giorgi, 2003). The use of phenomenology in sport psychology research has increased in recent years with authors including Poczwardowski and Conroy (2002); and Nicholls, Holt and Polman (2005) utilising the approach. Poczwardowski and Conroy used a phenomenological approach to explore the coping responses of elite athletes and performing artists whilst, Nicholls, Holt, and Polman (2005) used the approach to explore golfers coping effectiveness in competition.

2.8.3.2. Interpretive phenomenological analysis

Interpretive (or inductive) phenomenological analysis (IPA) is an approach developed by Smith (1996), which focuses on interpreting experiences of interviewees and representing a view of the world from the interviewees' perspectives. Specifically Smith (1996) outlined IPA as:

> "The aim of IPA is to explore the participant's view of the world and to adopt, as far as is possible, an insider's perspective (Conrad, 1987) of the phenomenon under study. At the same time, IPA also recognises that the research exercise is a dynamic process. While one attempts to get close to the participant's personal world, one cannot do this directly or completely. Access is both dependent on, and complicated by, the researcher's own conceptions which are required in order to make sense of that other personal world through a process of interpretative activity" (p.264).

IPA is phenomenological in that there is an exploration of the individual's personal perception or account of an event or state as opposed to attempting to produce an objective record of the event or state itself. At the same time, while trying to get close to the participant's personal world, IPA considers that you cannot do this directly or completely. Access is dependent on the researcher's own conceptions which are required to make sense of that other personal world through a process of interpretive activity.

The majority of work that has been conducted using IPA has used semi-structured interviews, which enables the participant to provide a fuller, richer account than would be possible with a standard quantitative instrument and allows the researcher flexibility in probing interesting areas that emerge.

2.9. SUMMARY

The use of effective and relatively consistent PPRs to maximise performance is a strategy implemented at all levels of sport. Indeed there are clear rationales articulated in the literature (Csikzentmihalyi, 1990; Lidor and Tenenbaum, 1993; Murphy, 1994; Singer, 1988) for the importance of the pre-performance period in allowing performers to execute their performance effectively.

Many sport psychology researchers and practitioners have advocated the use of a 'structured routine prior to performance' to maximise the effectiveness of this pre-performance time period (Boutcher, 1990; Crampton, 1989; Lidor and Tenenbaum, 1993; Lobmeyer and Wasserman, 1986). Indeed, there is much published research that has described the observed characteristics of these routines in order to prescribe the development and enhancement of their successful application.

However, to date there has been no real concerted attempt to understand the nature and function of PPRs. A number of potential functions for PPRs have been hypothesised (enhance attentional focus; reduce the impact of distractions; act as a trigger; focus attention on task relevant thoughts; improve concentration and enhance recall; help performers achieve consistency; and reduce the unravelling of automaticity), but no real definitive function has been identified. Without understanding the function / role that PPRs fulfil it is difficult to identify effective practical guidelines for golfers to enhance their overall performance effectiveness and consistency.

The applied recommendations that have been published for the training and development of PPRs have been based mainly on observations that have occurred in unrealistic research conditions. Recommendations in previous empirical sources have been applied to enhance the consistency of the behavioural and temporal characteristics of the routines. These recommendations have not accounted for the influence of other situation specific variables such as task difficulty, specific task-related performance requirements or differences in technical aspects of performance (e.g. shot type / club type) and their impact upon the development and execution of the PPR. As a result these guidelines appear to advocate a relatively inflexible template for the execution of PPRs regardless of the situation, task, or environment.

A number of researchers in the field have adopted an approach that has proven to be too simplistic. Questions can be raised regarding the ecological validity and fidelity of many research designs. The impact of environment type and its subsequent influence on visual perception have also been overlooked. Also, the issue of task difficulty and its impact of PPRs has been addressed only briefly (Jackson and Baker, 2001; Cotterill and Greenlees, 2003), and has not been explored in golf. Finally, the development of an understanding of the underlying psychological processes and strategies utilised by golfers during execution of PPRs have been neglected. Jackson and Baker (2001) in their case study of an elite rugby kicker reported that different strategies were employed at different times. Thus there is no consensus regarding guidelines for the development and execution of the PPRs. The understanding of these psychological processes and strategies appears to be a crucial factor in understanding the real function and effectiveness of the PPR.

Chapter 3

STUDY ONE

3.1. Method

3.1.1. Aim

The aim of Study One was to investigate the PPRs utilised by golfers in three specific conditions; competition, practice and a simulated ‘real play’ environment. It was hypothesised that there would be significant differences between the routines within subject when comparing the competitive and practice environments, and between the simulated and practice environments, but not between the competitive and simulated environments. An initial pilot study was conducted to test the experimental design, equipment and data analysis procedures. Following this pilot study, slight modifications were made to the experimental design before the main study was conducted (for further details of pilot study one please refer to Appendix A).

3.1.2. Participants

The participants in this study were six elite male golfers (age M = 22.5yrs, SD = 3.3 years; handicap M = +1, SD = 1; years playing M = 8.63, = SD = 5.21). The golfers were recruited through personal contact, and were required to play golf in three distinct environments. The participants completed testing sessions at a putting green, golf course and in a ‘full swing’ golf simulator during match-play enabling comparisons across environment type.

The participants were required to perform a range of golf shots in three different conditions: practice (putting green), in a simulated environment (golf simulator) and during competition (on the golf course). Each subject completed 30 putts of varying difficulty on the local Open Golf putting green. Participants were further required to play four rounds on a golf simulator (SmartGolf) using a simulation of the Belfry course (Birmingham, UK). Finally, participants played four rounds on a local links course under matchplay conditions. All three conditions involved the participants playing in pairs in an attempt to standardise the competitive requirements of the task. On the putting green participants were randomly assigned start positions and then positions for subsequent shots, which offered different distance, direction and topographic requirements for each shot played. In the golf simulator the next shot was determined by the effectiveness of the previous shot allowing for a variable manipulation of distance, direction and topography for the following shot by the computer programme. Finally, in the competitive condition, the task difficulty of the next shot was again determined by the requirements of the particular hole and performance on prior shots.

3.1.3. Golf simulator

The simulated environmental condition was created using a full swing golf simulator marketed and supplied by Smart Golf Europe [TM]. As the product title implied this type of simulator allows the golfer to execute a full swing and to hit the ball at a screen that displays a projected picture of a golf course hole including the tee, fairway, hazards, and green with a pin and flag (see Figure 3.1.). The golfers played a simulated round of golf at a specifically selected golf course.

Figure 3.1. 3-D layout of the Smart Golf simulator. Reproduced from http://www.smartgolfeurope.com/html/simulator.htm.

The simulator itself is housed in a box with a 3.05m x 3.66m screen at one end and an overall depth of 5.49m. As the player strikes the ball it passes across the simulator's dual tracking system which scans more than two million infrared beams per second. The ball's movement, direction, velocity and displacement across these infrared beams is relayed to the computer, which tracks the ball's trajectory and calculates its velocity, plotting its vector curve and spin rate (see Figure 3.2.). Once this data is processed a virtual ball is created in the virtual on screen environment with these calculated characteristics. The shot then continues in the virtual environment until its conclusion. The image on the screen is projected from above the golfer's head via an industry standard data projector. The simulator also provides different texture surfaces for the player to attempt their shot depending on the surface on the course. The range of surfaces includes the fairway, green, rough, long grass and sand. All of these features are available to both left and right-handed players.

The simulator also estimates the distance and the direction for each shot, which is then displayed on screen. The scores for the holes are also recorded. For each shot a visual path trajectory line or a visual image of the flight of the golf ball from impact until the ball is stationary can be provided. The visual display created by the simulator provides a visually accurate two-dimensional representation of the golfing environment of the course being played (see Figures 3.3. and 3.4.).

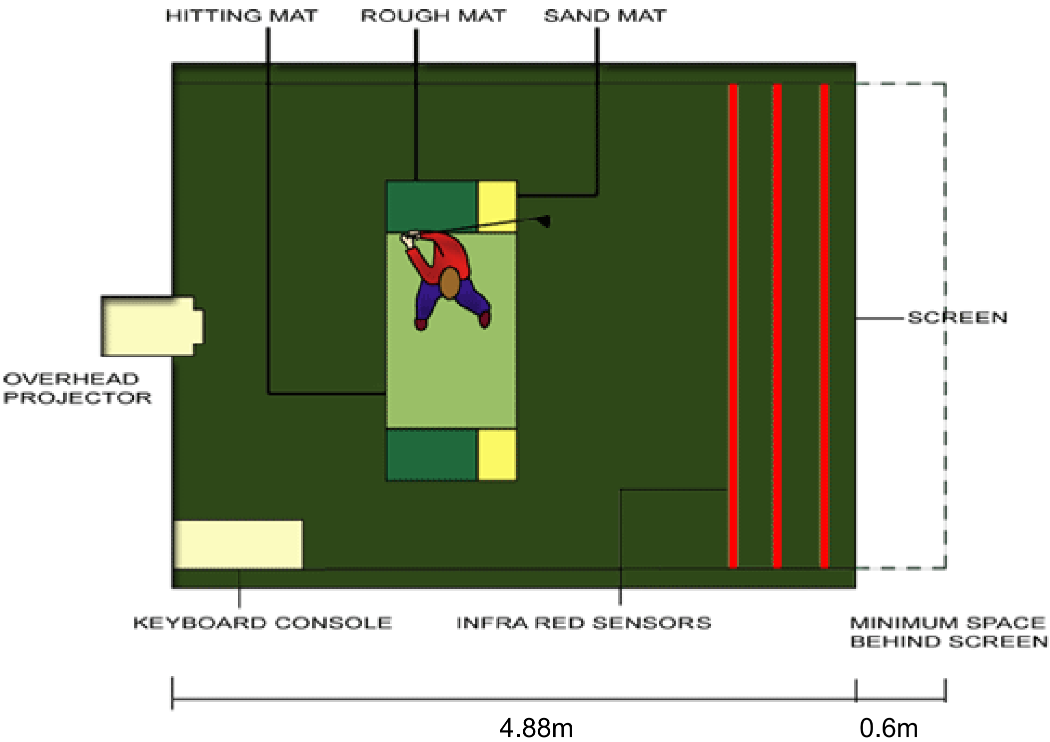


Figure 3.2. Plan layout of the simulator including infrared sensors and playing surfaces (http://www.smartgolfeurope.com/html/spaceallocation.htm).

Figure 3.3. Normal screen shot with feedback and different views (http://www.smartgolfeurope.com/html/graphics.htm).

Real Virtual

Figure 3.4. Real verses virtual views of a particular hole available to play on the simulator (http://www.smartgolfeurope.com/html/graphics.htm).

3.1.4. Procedure

In order to meaningfully assess the consistency of the PPRs in this study it was important to develop a robust system with which to objectively quantify them

(Wrisberg and Penn, 1992). Previous measures exploring pre-performance behaviour in golf have focused on measuring the frequency, duration and consistency of the participants' behaviours prior to, during, and after, ball strike.

A similar robust approach to measuring pre-performance behaviour to that demonstrated in previous studies (Crews and Boutcher, 1986; Boutcher and Zinesser, 1990; Douglas and Fox, 2002) was adopted for the purpose of this study. Firstly, the duration of the PPRs was recorded. This was identified as the period of time between the player grounding the club behind the ball for the first time, and the time that the ball was struck. Then, during the same period of time all discrete behavioural actions (glances at the hole / target, changes in foot position, swaying, limb movement, practice swings, raising the club) were recorded. These were classified into four distinct behavioural categories: 'head', 'posture', 'club', or 'still', with corresponding defining behaviours and descriptions as shown in Table 3.1.

A digital video camera was used to record each participant's PPRs for each shot in each of the three environmental conditions. Specifically, a Sony DCR TRV950, with a digital zoom of 150x, a maximum shutter speed 1/10000s, 3.6mm – 43.2mm zoom lens, 246,000 pixel display format, and a IEEE 1394 Firewire / i.LINK connection. This facilitated analysis of both the temporal and behavioural components of the routines using Dart Trainer ProSuite behaviour analysis software.

Characteristic	Behaviour	Description
Head	Glance	Initiated by head movement towards the target. Ended when the focus returns to the ball and the head is stationary
Posture	Postural Adjustment	Any movement of the lower body whilst the feet remain fixed. E.g. knee bend
	Stepping	Change in foot position
Club	Raised	Initiated when the club is raised off the ground behind the ball. Ended when the club is re-grounded behind the ball.
	Practice Swing	Initiated when the club is drawn back from the ball. Ended when the club returns to its start position behind the ball
Still	No Movement	The time between when the player becomes still (no movement) and when ball strike is initiated

Table 3.1. Definitions of the categories of behavioural characteristics observed during the pre-performance routines.

A sampling rate of 50 images/sec allowed a precision of +/- 0.02s. The dart trainer software allowed a frame-by-frame analysis of the routines with a frame-counter and marker option to identify the start and finish of the routines and behavioural components of the routines.

Participants' were informed of the general nature of the study prior to agreeing to participate. Specifically they received the instructions 'this study seeks to explore how golfers prepare for their next shot. Video data will be collected whilst you play your normal game to assess whether you do different things for different shots'. The environment was engineered to be competitive (playing in pairs) to generate a task performance related focus. Consent was gained from participants for the collection of data and their participation in the study.

3.1.5. Data analysis

A within participant approach was adopted due to individual differences between participants. It was observed that the individuals differed in the component parts of the routines in variable ways. Consequently a within participant design was adopted to allow meaningful analysis of the routines across environments.

For each environmental condition, the behavioural and temporal characteristics of the routines were analysed for each participant. This resulted in a behavioural template for the routines and mean temporal durations for the whole routine and the discrete behavioural components. These data were then normalised by converting the duration of the behaviour in seconds to a percentage of the overall duration of the routine recorded. This allowed for comparisons across each of the environment types (practice, competition and simulated) within participants to detect significant differences in the behavioural and temporal characteristics of the pre-performance routines for specific shot types.

An initial one-way between groups analysis of variance (ANOVA) was conducted to compare the overall duration of the PPRs across the environment types within participant.

A further one-way, within-participant multivariate analysis of variance (MANOVA) was conducted to investigate whether any significant differences existed in the temporal characteristics of the behavioural categories within the routines and across the three experimental conditions for the four dependent variables: ‘head’, ‘club’, ‘posture’ and ‘still’. The independent variable was the environmental condition (course, practice and simulator). Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity. There were no serious violations of these criteria. If significant differences were identified follow-up uni-variate tests were to be conducted.

3.2. RESULTS

3.2.1. Overall duration of pre-performance routines across environment type

The data here highlights the mean overall duration of the PPRs for all six participants across the three environment types. Table 3.2.1. Shows these mean value and standard deviation values across environment types.

	Environment type		
Participant	Practice	Simulator	Course
1	7.45 (0.58)	7.09 (0.29)	7.36 (0.45)
2	15.67 (0.45)	15.76 (0.35)	16.15 (0.27)
3	10.12 (0.87)	9.42 (0.50)	10.30 (0.28)
4	7.80 (0.37)	7.48 (0.58)	8.07 (0.58)
5	5.62 (0.43)	5.44 (0.38)	5.43 (0.38)
6	7.52 (0.29)	7.42 (0.57)	7.52 (0.37)

Table 3.2.1. Mean overall duration (and standard deviation) of pre-performance routines across environment type.

The results of the one-way between groups ANOVA conducted within participant displayed in table 3.2.2 clearly show that for five out of the six participants although the total duration for the PPRs across environment types differ they are not statistically significantly different. The only participant who demonstrated significant differences was participant three. Subsequent post hoc (Tukey) tests identified that it was only between the simulator and course environments that these significant differences occurred.

Participant	Sum of Squares	DF	Mean Sq	F	Sig	Sig Tukey Post hoc results
1	.670	2	.335	1.384	.272	
	5.084	21	.242			
2	1.025	2	.512	3.383	.053	
	3.181	21	.151			
3	3.518	2	1.759	4.207	.029	Simulator-Course*
	8.780	21	.418			
4	1.376	2	.688	2.148	.142	
	6.725	21	.320			
5	.191	2	.095	.342	.714	
	5.845	21	.278			
6	.128	2	.064	.314	.734	
	4.286	21	.204			

*significant at the .05 level, for each participant row 1 is within data and row 2 is between data.

Table 3.2.2. One-way between environments ANOVA and significant post hoc tests for all 6 participants.

3.2. 2. Differences in pre-performance routines across environment type

Initial data are presented on a subject-by-subject basis. Figures 3.2.1. to 3.2.18. present a visual representation of the PPRs for the putt across environment type. This allows for an effective initial comparison regarding the components of the routines and their durations. The three categories of behaviours are designated by the number 1, 2, and 3 on the left-hand side of the Figures. ‘Head’ is denoted by a 1; ‘club’ by a

2; and ‘posture’ by a 3. The fourth behavioural component identified as the ‘still’ period is represented by the gap between the behavioural characteristic furthest to the right and the end of the routine. The numbers along the bottom axis represent a timeline in seconds from the start of the routine to ball strike at the end of the routine. Table 3.2.3. displays the averaged data for all participants across environments for all identified categories of behaviour characteristics.

A summary of the one-way MANOVA data for all six participants presented in Tables 3.2.4. and 3.2.5.

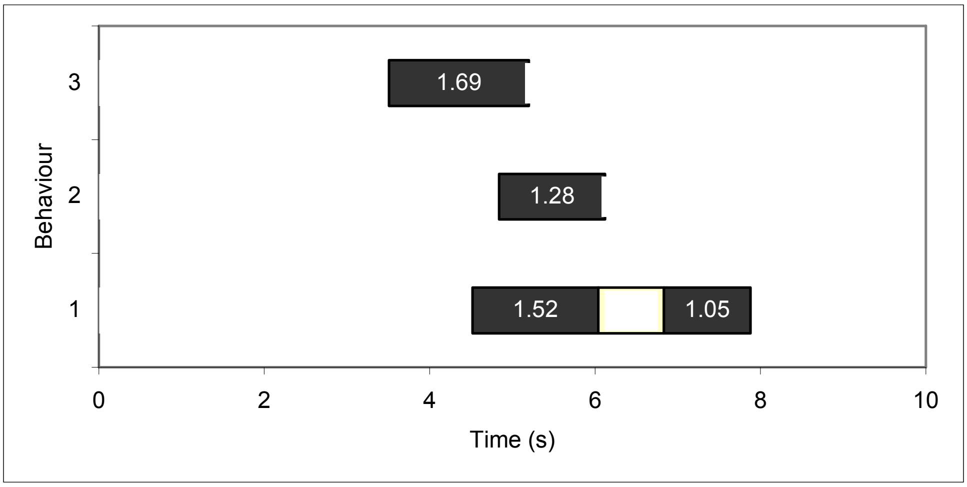


Fig 3.2.1. Participant one – putter (practice)

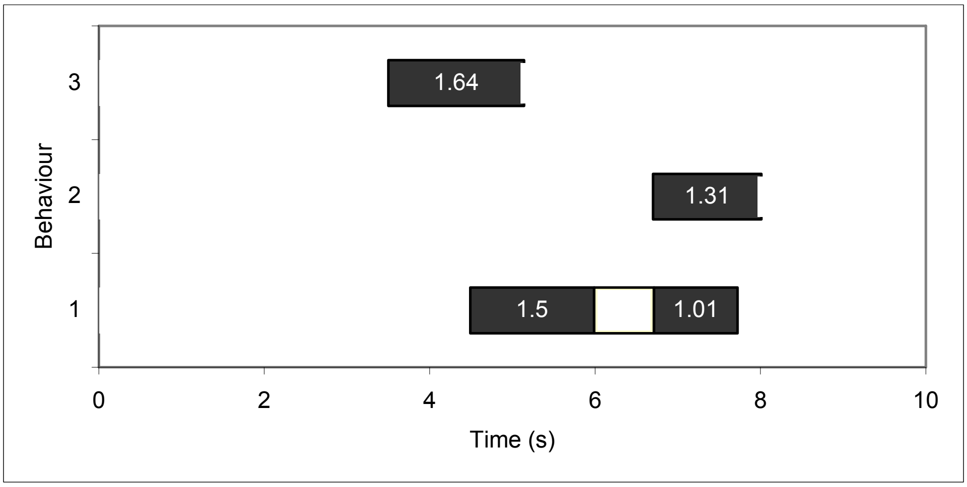


Fig 3.2.2. Participant one – putter (simulator)

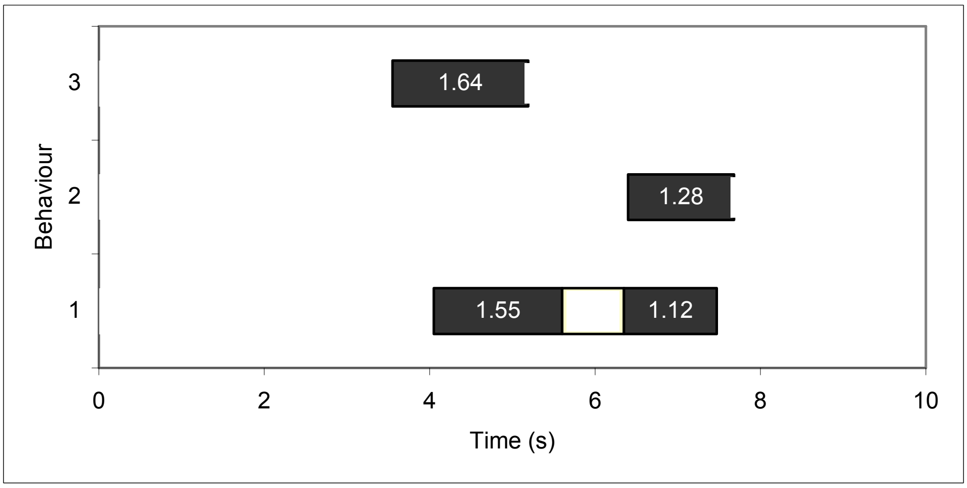


Fig 3.2.3. Participant one – putter (course)

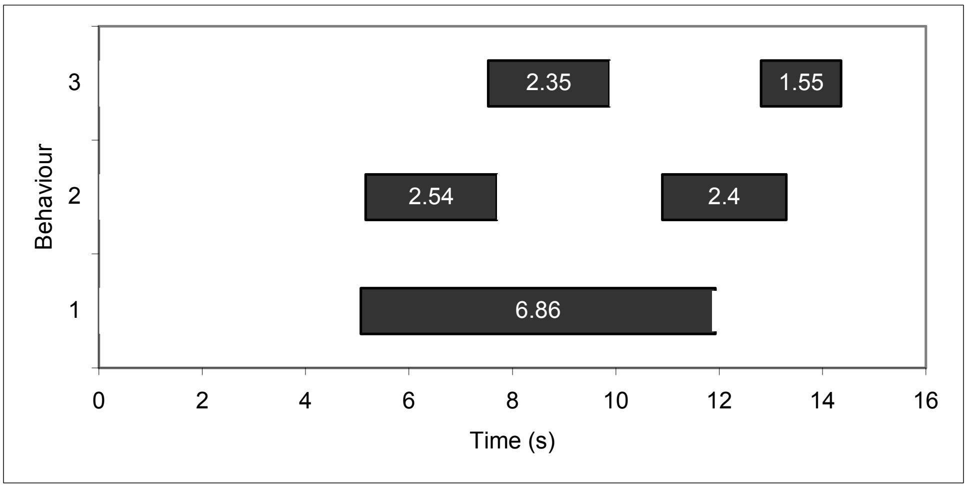


Fig 3.2.4. Participant two – putter (practice)

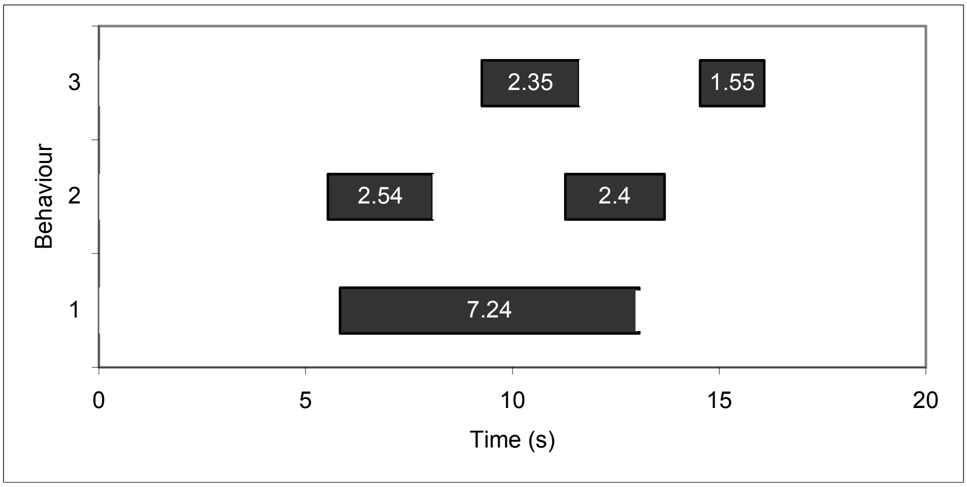


Fig 3.2.5. Participant two – putter (simulator)

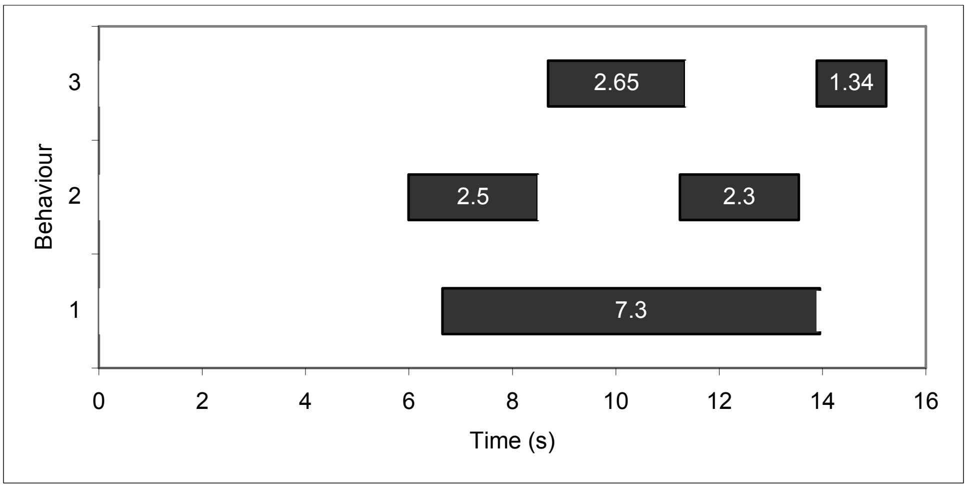


Fig 3.2.6. Participant two – putter (course)

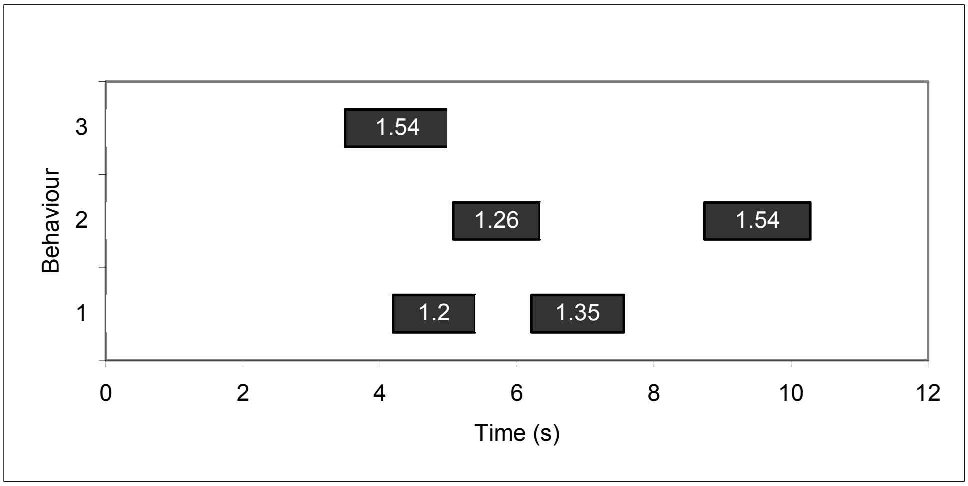


Fig 3.2.7. Participant three – putter (practice)

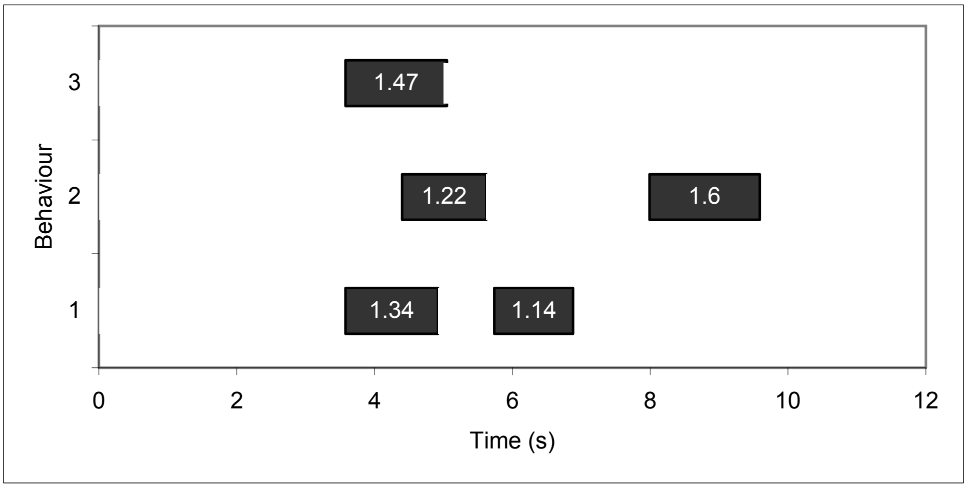


Fig 3.2.8. Participant three – putter (simulator)

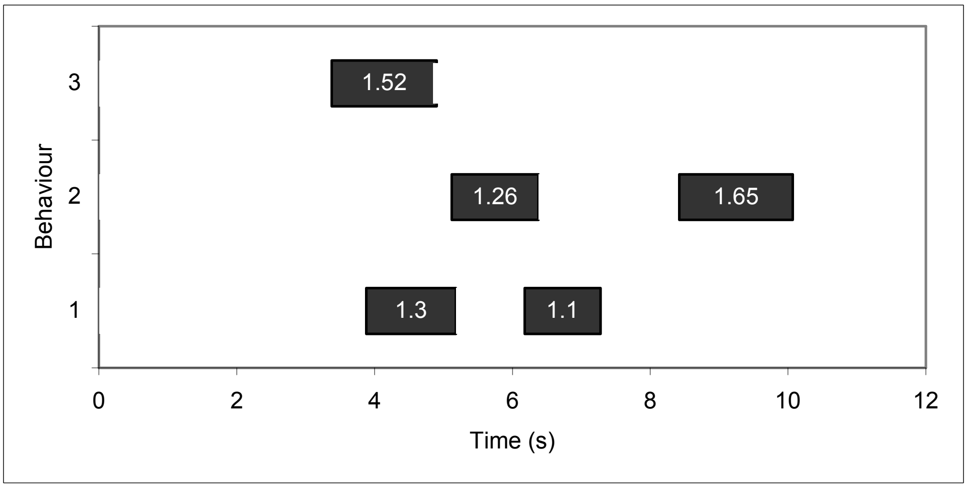


Fig 3.2.9. Participant three – putter (course)

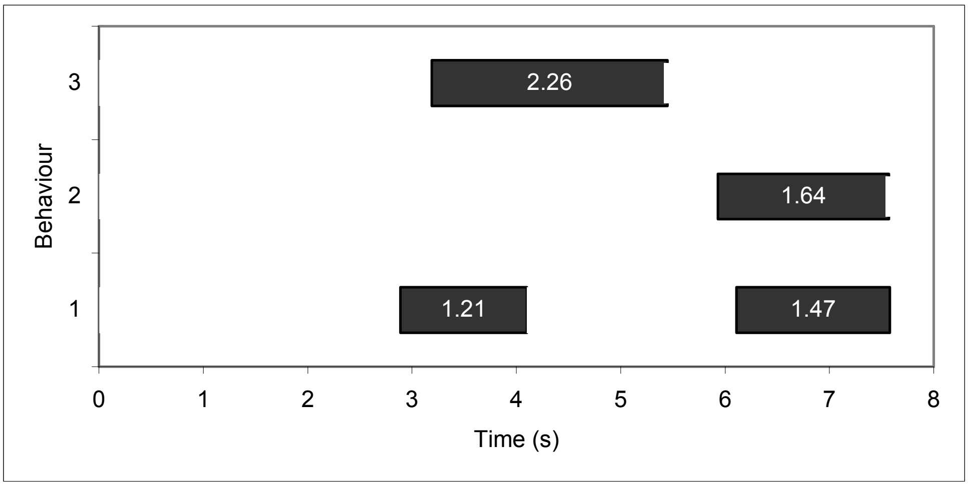


Fig 3.2.10. Participant four – putter (practice)

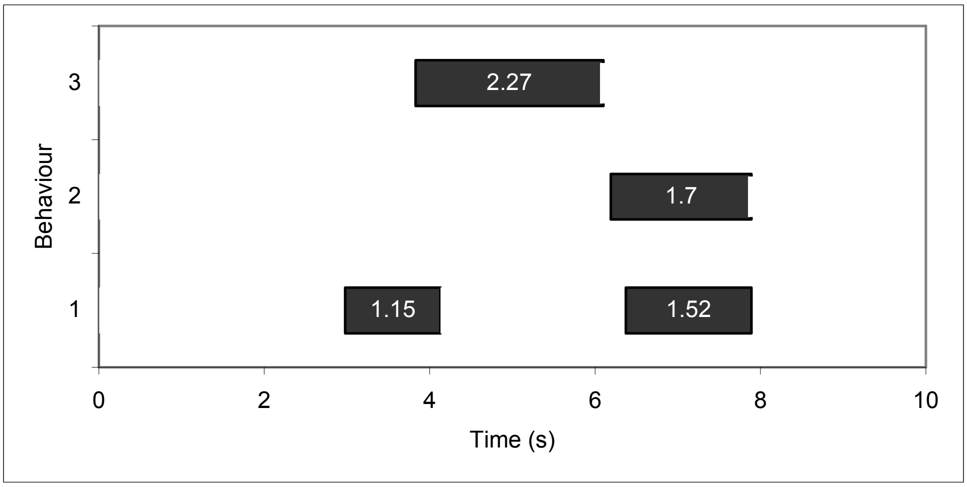


Fig 3.2.11. Participant four – putter (simulator)

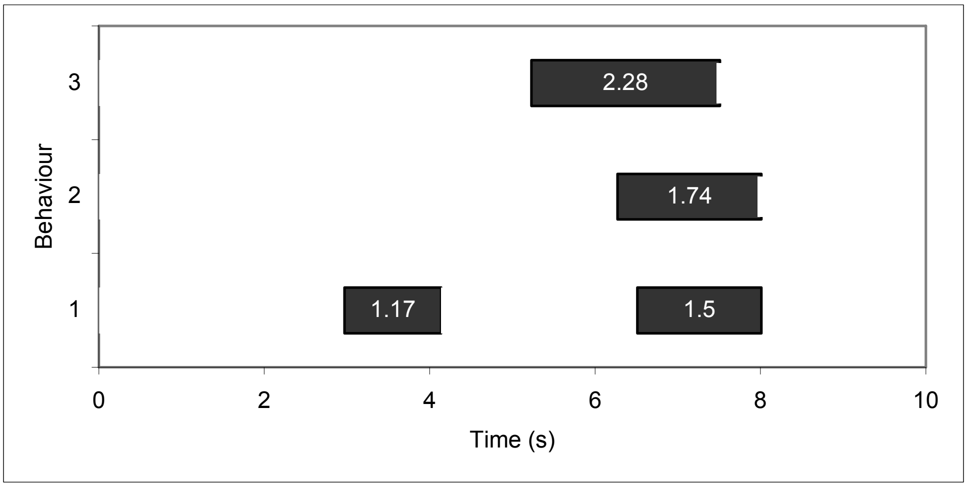


Fig 3.2.12. Participant four – putter (course)

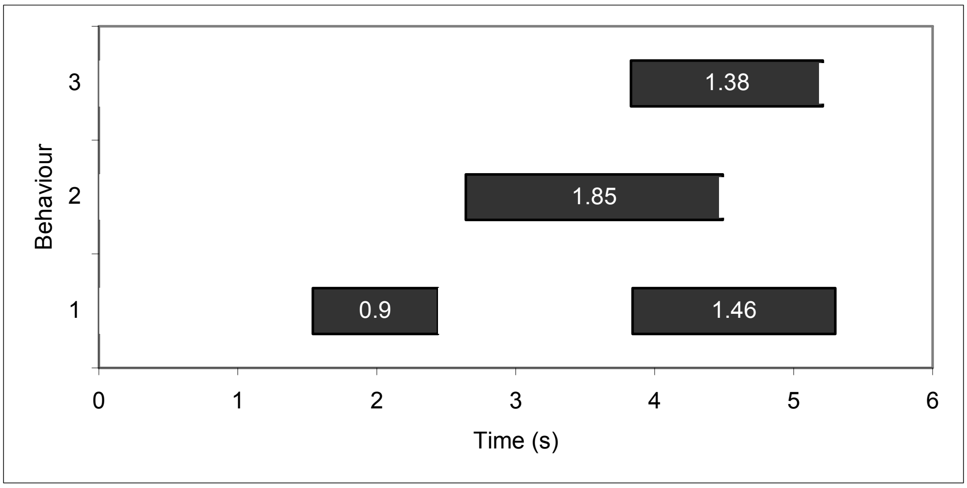


Fig 3.2.13. Participant five – putter (practice)

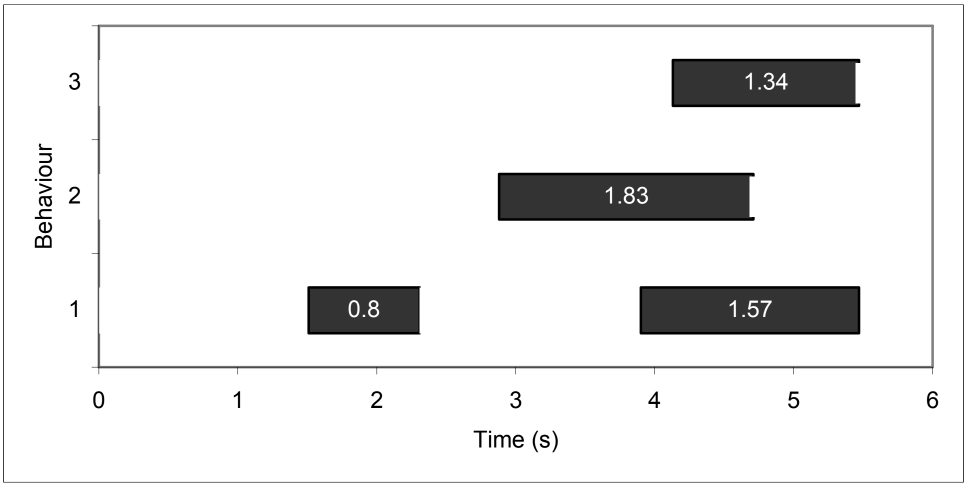


Fig 3.2.14. Participant five – putter (simulator)

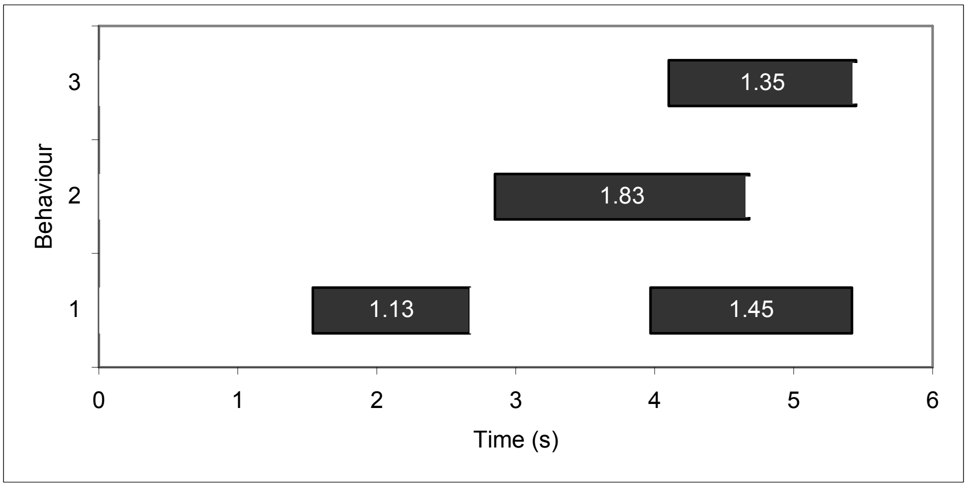


Fig 3.2.15. Participant five – putter (course)

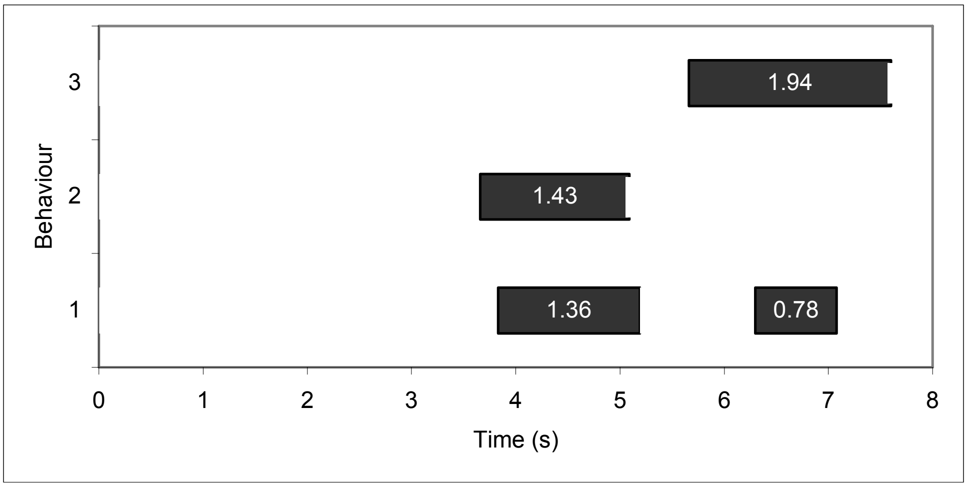


Fig 3.2.16. Participant six – putter (practice)

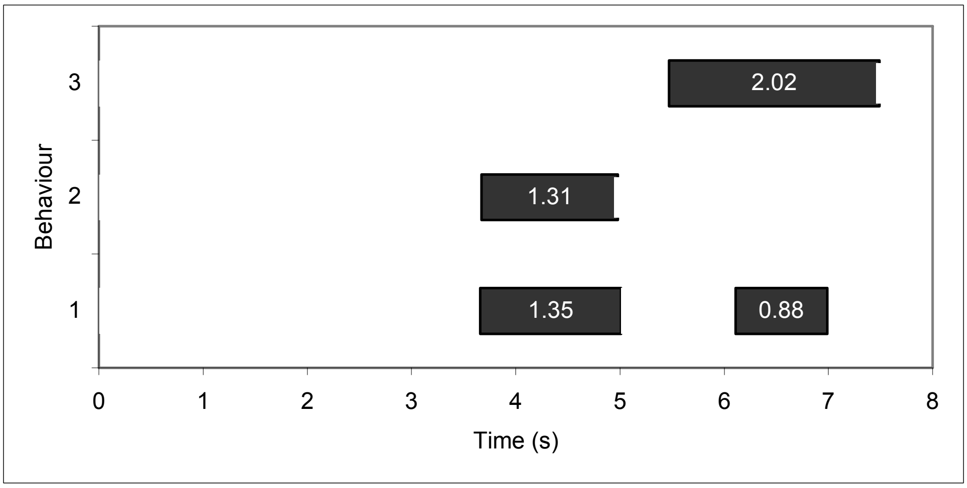


Fig 3.2.17. Participant six – putter (simulator)

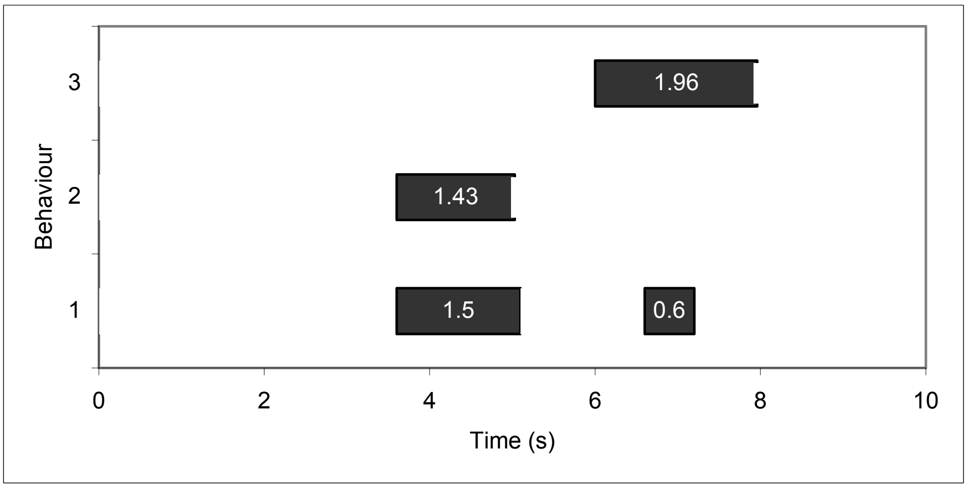


Fig 3.2.18. Participant six – putter (course)

Participant	Condition	Behavioural characteristics							
		Head		Club		Posture		Still	
		M (SD)	%	M (SD)	%	M (SD)	%	M (SD)	%
1	Practice	2.58 (0.19)	36	1.28 (0.07)	18	1.69 (0.12)	23	3.51 (0.16)	49
	SIM	2.51 (0.28)	38	1.31 (0.14)	20	1.64 (0.16)	24	3.49 (0.35)	50
	Course	2.56 (0.30)	36	1.23 (0.19)	17	1.64 (0.27)	23	3.55 (0.35)	50
2	Practice	7.17 (0.30)	46	4.98 (0.34)	31	3.92 (0.19)	253	2.38 (0.23)	16
	SIM	7.14 (0.22)	44	4.95 (0.26)	28	3.93 (0.30)	23	2.27 (0.21)	14
	Course	7.30 (0.27)	45	4.90 (0.26)	30	4.02 (0.23)	25	2.39 (0.27)	15
3	Practice	2.33 (0.26)	23	2.80 (0.18)	27	1.53 (0.17)	15	3.48 (0.23)	34
	SIM	2.48 (0.19)	26	2.83 (0.24)	30	1.47 (0.12)	15	3.51 (0.15)	37
	Course	2.47 (0.36)	25	2.91 (0.40)	30	1.56 (0.27)	15	3.42 (0.27)	35
4	Practice	2.33 (0.26)	34	1.70 (0.19)	22	2.27(0.23)	29	2.98 (0.13)	38
	SIM	2.69 (0.29)	36	1.61 (0.14)	21	2.26 (0.15)	30	2.89 (0.14)	37
	Course	2.48 (0.36)	37	1.74 (0.31)	24	2.28 (0.30)	31	2.97 (0.30)	41
5	Practice	2.67 (0.26)	45	1.70 (0.19)	32	2.27 (0.23)	24	1.51 (0.22)	27
	SIM	2.38 (0.19)	42	1.64 (0.17)	33	2.26 (0.20)	24	1.54 (0.20)	26
	Course	2.67 (0.27)	41	1.74 (0.33)	29	2.28 (0.30)	22	1.54 (0.28)	25
6	Practice	2.13 (0.19)	28	1.43 (0.14)	19	1.94 (0.15)	26	1.82 (0.17)	24
	SIM	2.23 (0.14)	30	1.30 (0.09)	17	2.01 (0.11)	27	1.84 (0.11)	25
	Course	2.12 (0.27)	29	1.42 (0.27)	20	1.92 (0.25)	27	1.84 (0.27)	25

M – mean ,SD – standard deviation, % - percentage of the overall routine duration, SIM – simulator.

Table 3.2.3. Mean (and standard deviation) participant scores across environment type and normalised (%) data.

The Mahalanobis distances used to test multivariate normality (Tabachnick and Fidell, 2001) for all six participants presented in were all acceptably below the critical value of chi-squared for four dependent variables of 18.47. (see appendix B for MANOVA assumption testing data).

Participant		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
1	Pillai's Trace	.998	9082.00	4	72	.000	.998
	Wilks' Lambda	.002	9082.00	4	72	.000	.998
2	Pillai's Trace	.999	30119.79	4	72	.000	.999
	Wilks' Lambda	.001	30119.79	4	72	.000	.999
3	Pillai's Trace	.998	10127.20	4	72	.000	.998
	Wilks' Lambda	.002	10127.20	4	72	.000	.998
4	Pillai's Trace	.999	12160.08	4	72	.000	0.999
	Wilks' Lambda	.001	12160.08	4	72	.000	.999
5	Pillai's Trace	.995	3952.72	4	72	.000	.995
	Wilks' Lambda	.005	3952.72	4	72	.000	.995
6	Pillai's Trace	.998	8257.95	4	72	.000	.998
	Wilks' Lambda	.002	8257.95	4	72	.000	.998

Table 3.2.4. Intercept data from the multivariate tests for all six participants

Participant		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
1	Pillai's Trace	.078	.743	8	146	.65	.039
	Wilks' Lambda	.923	.737	8	144	.659	.039
2	Pillai's Trace	.153	1.515	8	146	.157	.077
	Wilks' Lambda	.851	1.513	8	144	.158	.078
3	Pillai's Trace	.155	1.536	8	146	.150	.078
	Wilks' Lambda	.851	1.516	8	144	.157	.078
4	Pillai's Trace	.078	.74	8	146	.658	.039
	Wilks' Lambda	.923	.74	8	144	.657	.039
5	Pillai's Trace	.091	.87	8	146	.543	.046
	Wilks' Lambda	.909	.88	8	144	.537	.046
6	Pillai's Trace	.167	1.67	8	146	.111	.084
	Wilks' Lambda	.883	1.72	8	144	.099	.087

Table 3.2.5. Condition data from the multivariate tests for all six participants

The results for the MANOVA tests for differences within participant displayed in Tables 3.2.4. and 3.2.5. did not identify statistically significant differences between the duration of the behavioural components of the PPRs across the three conditions for any of the studies six participants. There was also not a statistically significant difference if the more robust Pillai's Trace was adopted to test for multivariate differences.

3.2. 3. Overview of study one results

All six participants were very consistent putting across environments. Behaviourally each participant was doing the same things in the same order prior to ball strike within environment type. Indeed, when comparing each participant behaviourally for the putt across environmental conditions they appeared to do the same things in the same order prior to ball strike.

The mean and SD data in Table 3.2.3. displayed differences in the overall mean duration of the routines and behavioural responses utilised by each of the participants across each of the experimental conditions. There were slight differences between the normalised values within participant across environment type for the major categories of behaviours. However, when these differences were tested statistically (Tables 3.2.4., 3.2.5.) no significant differences were identified (participant one Λ=0.92 p=0.66; participant two Λ=0.85 p=0.16; participant three Λ=0.85 p=0.16; participant four Λ=0.92 p=0.66; participant five Λ=0.91 p=0.54; participant six Λ=0.88 p=0.10) for any of the six participants between the three environmental conditions of competition, practise and the golf simulator.

3.3. DISCUSSION

The aim of Study one was to investigate the PPRs utilised by golfers in three specific conditions; competition, practice and a simulated ‘real play’ environment. It was hypothesised that there would be significant differences between the routines within subject when comparing the competitive and practice environments, and between the simulated and practice environments, but not between the competitive and simulated environments.

The first component of interest was the consistency of the PPRs utilised by participants in terms of the behavioural and temporal characteristics within shot type. The question being addressed essentially, was ‘were the participants doing the same things in the same order prior to shot execution?’. The second key area for this study was comparing these routines across environmental conditions to see whether significant differences existed.

3.3.1. Temporal and behavioural consistency within shot.

The results across all six participants clearly display a high level of consistency within the shot for the major categories of behavioural components (club, head, posture, still) of the routines. Each participant is clearly doing the same things in the same order prior to the execution of the shot (Figures 3.2.1. – 3.2.18.).

All six participants appear to have developed a consistent behavioural approach to the execution of the putt. However, these data provide information about the consistency of behaviours within participants but do not provide information relating to whether the participants were aware of their very consistent pre-performance behaviour or whether the development of this sequence of behaviours has been a conscious process, or simply a reflection of an unconscious behavioural response to the demands of the task. While the level of cognition involved in the process of developing the consistent pre-shot behaviour requires further exploration, it is clear that these behaviours are important, or at least perceived to be important, component of each participant's preparation to perform.

All of the participants in this study demonstrate similar overall duration of these behavioural routines and the duration of the specific components. Although there were variations, the standard deviation from the mean was low. It seems clear then that when the task demands are constant, the temporal characteristics of the routines are, in general, almost constant.

This supports Wrisberg and Pein (1992) who suggested that the greater the level of the performer the more consistent they appear to be regarding the amount of time they take to execute their routine. It is interesting to note however that Wrisberg and Penn's study explored the success of basketball free throws in an inter-collegiate basketball game. As such, task demands (e.g., distance, direction, height, force required) always remained constant. The only aspects that differed from attempt to attempt were the score, time in the game etc. Therefore, in golf research one would expect to observe a similar outcome for tasks that are governed by consistent physical constraints. Indeed, Boutcher and Crews (1987), Boutcher and Zinsser (1990), Crews and Boutcher (1986) all adopted research designs that limited the physical constraints of the task, and all reported similar consistent temporal characteristics. If however different physical constraints were applied to each specific shot and task difficulty levels were manipulated (as exists in the real golfing environment) it may be that the duration of the routines would significantly differ depending on the complexity of the task that is to be executed (distance, topography, conditions etc).

Southard and Amos (1996) in comparing the mean duration of pre-performance behaviour within participant for three different activities (golf putt, basketball free throw, and tennis serve) observed relatively similar overall durations for the tennis serve and the basketball free throw, but a much greater mean duration for the golf putt. This is further evidence that in golf there are a greater number of variables that need to be considered for performance execution and possibly a greater degree of accuracy is also required. If this suggestion holds true one would expect to see a greater overall duration for a very precise target-orientated shot (e.g. the putt) when compared to a shot requiring a reduced level of accuracy (e.g., teeing off with the driver). Expressing it another way, when there is less room for error the participants take longer to execute the routine. At this stage it is unclear whether this would be due to the use of different psychological skills during the routine or through an extension of the existing skills utilised.

A possible factor that could influence the consistency of pre-performance behaviour of the participants in this study was the use of a digital video camera (camcorder) to collect the PPR data. The use of a video camera in analysing participants' PPRs has been shown by Lewis and Linder (1997) to have an impact upon a participant's level of self-awareness. Masters (1992) further suggested that this could result in an increase in the duration of a self-paced task like a golf shot.

3.3.2. Differences between environmental conditions within shot type.

The participants in this study generally had very consistent pre-performance behaviours across all three environmental conditions. This is underlined by the lack of significant differences in the overall duration of routines across shot types. For each shot type across the three conditions the participants appeared to exhibit the same behaviours in the same order prior to shot execution. Therefore participants' behaviours prior to performance of the relevant shot did not change from condition to condition.

Despite the consistency in pre-performance behaviours and their sequencing, the overall durations of the behaviours differed. The overall duration of the pre-performance behavioural routines for all participants was greater in the competition condition than in the simulated and practice conditions. One factor contributing to the non-significant increase in the overall routine time for the competition condition could be the increased number of variables which need to be taken into account when playing in the 'real' environment than in the golf simulator. In the simulator condition, the wind, rain, temperature and dampness of the course are all controlled thereby reducing the number of variables to be considered prior to executing the correct performance response for that particular situation. As a result, this reduction in variables needing attention can reduce the decision making time required. Indeed, a similar response was reported by Jackson and Baker (2001) when comparing concentration times for rugby kicking performance in practice and competition conditions. In the practice condition, due to the constant nature of the environment participants would have ‘stored’ the relevant environmental information then merely modify this stored information to play other similar shots in the same environment.

Normalising the duration of the components of pre-performance behaviour as a percentage of the overall duration of the routine revealed additional interesting findings (Table 3.2.3.). This normalisation allowed for the comparison of routines across the different environmental conditions. Differences in the mean duration of the routines in each condition would have made temporal comparisons of the behavioural components of the routines difficult. The data in this study indicated that the behavioural characteristics of the routines and their relative duration were not significantly different across the three conditions.

This outcome was predicted for the simulated condition but not for the practice condition where it was hypothesised that there would be significant differences in the composition of the routines due to ecological differences between that condition and playing in the ‘real’ environment. One potential explanation for the practice condition not demonstrating significant differences when compared to the real condition could have been the way the practice task was structured in this experiment. Chapter two identified limitations in the design of practice conditions for collecting data on pre-performance routines in golf. The current study was designed to make the practice condition as close to the real thing regarding task constraints (competition, random variation, manipulation of task difficulty). Which may have resulted in an increase in the ecological validity of this condition.

The results of this study question the benefits of consistent pre-performance behaviour identified by Shaw (2002) in the direct-perception approach. Williams, Davids, and Williams (1999) had proposed that rather than employing a store of schematic representations, golfers respond directly to information in the environment. Gibson (1966) further argued that the requirements of performance in terms of muscle force, angles and kinematic information are ‘picked up’ directly from the environment. Shaw (2002) suggested that the PPR might pre-sensitise the movement system to the appropriate perception-action coupling between the environment and the player. If this were the case one would expect significant differences when comparing golf course routines to simulator and practice routines due to the differences in depth and positional information relating to the target and environment. However, this was not the case.

The findings of this study do offer support to Davids (1988) and Paull et al.’s (1997) suggested that use of new technologies and simulated environments as a potential alternative to the researcher that still maximises ecological validity. Paull et al. (1997) reported the video-based simulation system used in their research appeared to overcome many of the ecological validity difficulties previously seen in applied sports research. At a lower technology level, these findings also advocate the use of relevant controlled practice conditions (Lintern et al., 1989) if the realistic nature of the task demands can be maximised.

The future use of environmental simulation systems in sport behaviour research could offer the researcher the opportunity to maximise the fidelity and therefore ecological validity of their experimental designs whilst further allowing them to control for a significant level of variables impacting upon the participants' behaviours, allowing the researcher to understand more fully the behaviours of elite sports performers.

In an ideal world, golf performance research would occur in the 'real' environment. However, because this is often not practical or possible both simulation and practice environments appear to offer ecologically valid alternatives. The key here appears to be the researcher's ability to replicate the task requirements, demands, difficulty and variability (Davids, 1988). The potential use of computer-simulated environments offers an encouraging research environment due to its controllable nature.
Although Paull et al (1997) identified the crucial requirement of any simulated system using full-sized images and actual distances, ensuring that perceptual cues from eye kinesthesis are consistent with features of the display. Crucially the use of a simulator can provide high levels of fidelity, that is that the environment is a true representation of the actual skill environment.

The psychological fidelity of both practice and simulated environments may require further attention. Participants do not appear to demonstrate significantly different behavioural characteristics across environment types, but this does not mean that they are utilising the same strategies of psychological skills across the different conditions.

Chapter 4

STUDY TWO

4.1. METHOD

4.1.1. Aim

There were two main aims of Study Two. The first was to explore the impact that task difficulty has on the behavioural and temporal consistency of PPRs. It was hypothesised that increases in the difficulty of the task would lead to significant differences in the routine duration and the characteristics of the composite behavioural characteristics. The second was to ascertain whether golfers utilise different PPRs for different shot types. It was hypothesised that there were no significant differences between the routines used for the different types of shots used by the participants (specifically putting, driving and using the wedge). Pilot study two (Appendix B) was conducted to test the experimental design and procedures.

4.1.2. Participants

The participants were the same six elite golfers who took part in study one (age M = 22.5yrs, SD = 3.3years; handicap M = +1, SD = 1; years playing M = 8.63 SD = 5.21). Each participant was recruited through personal contact.

4.1.3. Procedure

The participants were required to play four rounds at the Belfry course (Birmingham, UK) on the Smart Golf simulator (See 3.1.3.). Before each shot participants were required to indicate the difficulty level of their shot. Self-ratings of task difficulty were used to differentiate between the three classifications of task difficulty (‘easy’, ‘hard’ and ‘very hard’). PPRs were recorded via a digital video camera which allowed subsequent analysis of the temporal and behavioural characteristics of the routines (see section 3.1.4. for a more detailed review of this procedure).

4.1.4. Task difficulty measures

Before every shot each participant was required to indicate the club chosen, the distance the ball should travel and indicate their perception of task difficulty. Each player was asked to rate on a 10-point Likert scale their perception of task difficulty relating to the pending shot, selecting a representative number from this scale ranging from 1 (very easy) to 10 (almost impossible). Participants were briefed, clarifying that perceptions of task difficulty should include the identification of a desired outcome for the shot and should consider factors such as distance, topography, precision requirements, match-play situation and personal strengths. Task difficulty on the simulator was randomly altered during match-play, according to the hole and play progression.

For the purpose of this study, a very easy shot was classified as one that the participant was confident of executing and achieving the specified desired outcome nine times out of ten and a very difficult shot was classified as one that the participant felt they could only achieve the specified desired outcome once in ten attempts. The points in-between on the scale represented an increasing scale of certainty regarding the execution of the desired shot (See Figure 4.1.).

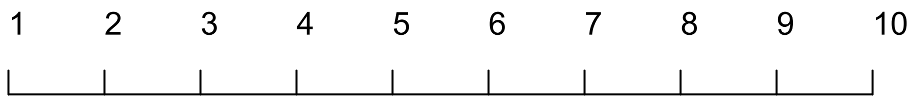


Figure 4.1. Self-rating task difficulty Likert scale.

4.1.5. Data analysis

The analysis for study two was split into three stages. Firstly the temporal and behavioural differences of each shot type within participant was explored. A subsequent analysis then assessed the differences between routines of participants for different shot types. The final stage explored differences between 10 easy, 10 hard and 10 very hard shots.

An initial one-way between groups analysis of variance (ANOVA) was conducted to investigate whether there were significant differences in total PPR duration across the three shot types. Subsequent Tukey post-hoc tests were conducted if the ANOVA highlighted significant differences, to ascertain between which shots the significant differences occurred.

A one-way, within-participant multi-variate analysis of variance (MANOVA) was conducted to investigate whether any significant differences existed between the duration of the behavioural categories within the routines and across the three shot types. Four dependent variables were used: the temporal duration of the head, club, posture and still behavioural components of the routines. The independent variable was the club type (driver, putter and wedge). Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity. No serious violations were indicated by the tests. Follow-up univariate tests were utilised to ascertain specifically where significant differences occurred. Post hoc pair-wise comparisons were conducted; specifically independent samples t-tests, with Bonferroni corrected alpha levels using separate error terms. Alpha levels were set at 0.00417. Finally, the 10 shots rated as very easy, 10 shots rated as hard, and 10 shots rated as very hard for each participant were compared.

For each participant the mean total duration of the routine and mean duration of each of the four behavioural characteristic categories (head, club, posture, and still) were calculated. This was achieved by calculating the mean values for the 10 selected shots in each category (easy, hard and very hard). In order to normalise these data for comparisons across task difficulty level the duration of each behavioural category for each level of task difficulty was converted into a percentage of the mean total duration, allowing for comparisons across task difficulty levels.

A one-way, within-participant MANOVA was conducted to investigate whether any significant differences existed between the duration of the behavioural categories within the routines across the three levels of task difficulty. The four dependent variables were the durations of: head, club, posture and still. The independent variable in this instance was the task difficulty level (easy, hard and very hard). Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity with no serious violations noted. If significant differences were identified follow-up univariate tests were to be conducted.

4.2. RESULTS

The data were analysed to determine two specific aspects of PPRs utilised in golfing performance. Firstly, the PPRs across three different shot types were compared to ascertain whether significant differences existed between the overall duration; and between the behavioural routines utilised for different categories of shot. The second aspect of the participants' PPRs explored in this study focused on whether task difficulty levels impacted upon participants' consistency and overall execution of their PPRs as suggested by Jackson and Baker (2001).

4.2.1. Overall duration of pre-performance routines across shot types

The data here highlights the mean overall duration of the PPRs for all six participants across the three environment types. Table 4.2.1. Shows these mean value and standard deviation values across environment types.

	Shot type		
Participant	Putter	Wedge	Driver
1	6.78 (0.48)	6.27 (0.34)	7.20 (0.36)
2	15.95 (0.34)	8.47 (0.41)	9.72 (0.83)
3	9.48 (0.70)	9.40 (0.56)	8.42 (0.73)
4	7.47 (0.56)	8.70 (0.63)	7.28 (0.51)
5	5.51 (0.49)	6.18 (0.45)	5.75 (0.51)
6	7.49 (0.60)	7.26 (0.42)	5.37 (0.35)

Table 4.2.1. Mean overall duration (and standard deviation) of pre-performance routines across shot types.

Subsequent statistical analysis of the overall duration data presented in table 4.2.2. highlights some significant differences far all participants between shot types. Subsequent post hoc analysis shows that participant three highlighted significant differences for all 3 shot combinations; participants two, four, and six demonstrated significant differences for 2 shot combinations; and participants one and five demonstrated significant differences for 1 shot combination.

Participant	Sum of Squares	DF	Mean Sq	F	Sig	Sig Tukey Post hoc results
1	3.411	2	1.705	9.333	.001	Wedge-Driver*
	3.832	21	.183			
2	259.69	2	129.844	340.344	.001	Putter-Driver*
	8.012	21	.382			Wedge-Driver*
3	5.691	2	2.849	5.580	.011	Putter-Driver*
	10.722	21	.511			Puter-wedge* Driver-wedge*
4	9.767	2	4.884	13.128	.001	Wedge-Putter*
	7.812	21	.372			Wedge-Driver*
5	1.793	2	.896	3.502	.049	Putter-Wedge*
	5.376	21	.256			
6	19.94	2	9.967	39.336	.001	Putter-Driver*
	5.32	21	.253			Wedge-Drivr*

*significant at the .05 level, for each participant row 1 is within data and row 2 is between data.

Table 4.2.2. One-way between shot types ANOVA and significant post hoc tests for all 6 participants.

Figures 4.2.1. to 4.2.18. demonstrate the behavioural component parts of the pre-performance routines, representing their mean duration and temporal location within the routine and in relation to other behavioural components of the routines. The graphs for the three different shot types (putter, driver and wedge) within participant are all presented on the same page to allow an initial visual comparison of the routines. Tables' 4.2.3. and 4.2.4. display the results of the multivariate tests for all six participants. Follow-up pairwise posthoc univariate t-test values, alpha levels and effect sizes are presented in Table 4.2.3.

Task difficulty data is presented in Table 4.2.6., displaying mean duration and standard deviation data for the four identified behavioural components of the routines (still, head, club and posture) across the three levels of task difficulty (easy, hard and very hard).

4.2.2. Differences in pre-performance routines across shot type.

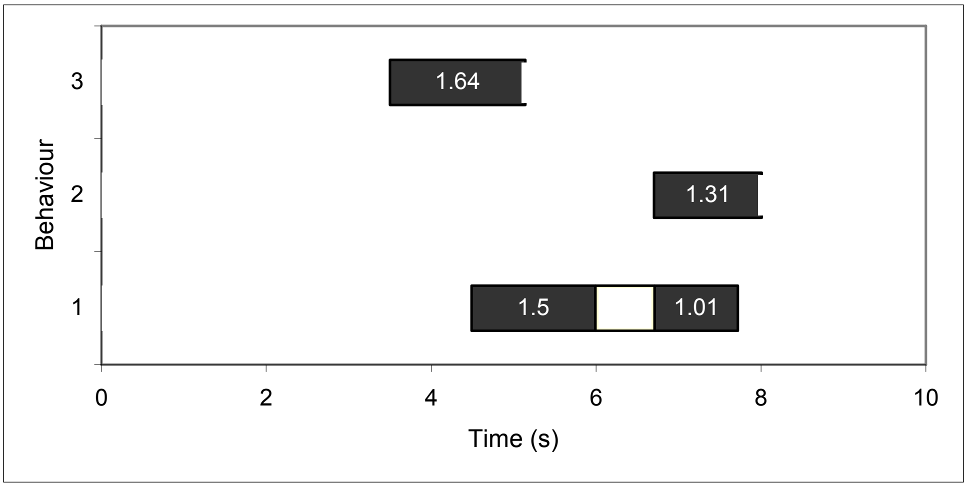


Fig 4.2.1. Participant one – putter (simulator)

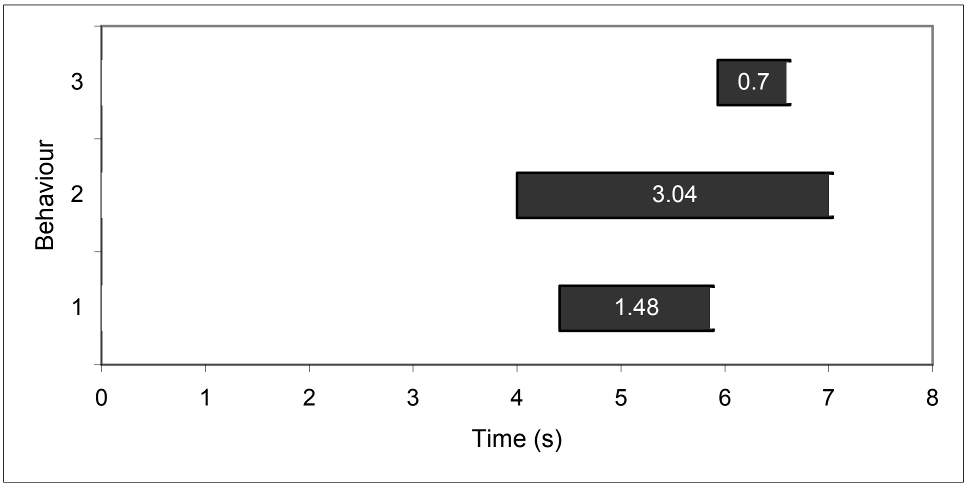


Fig 4.2.2. Participant one – wedge (simulator)

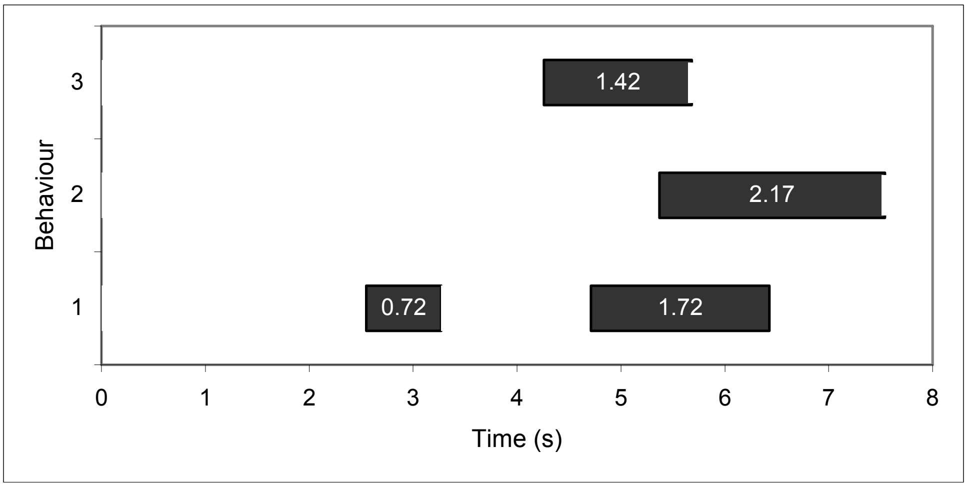


Fig 4.2.3. Participant one – driver (simulator)

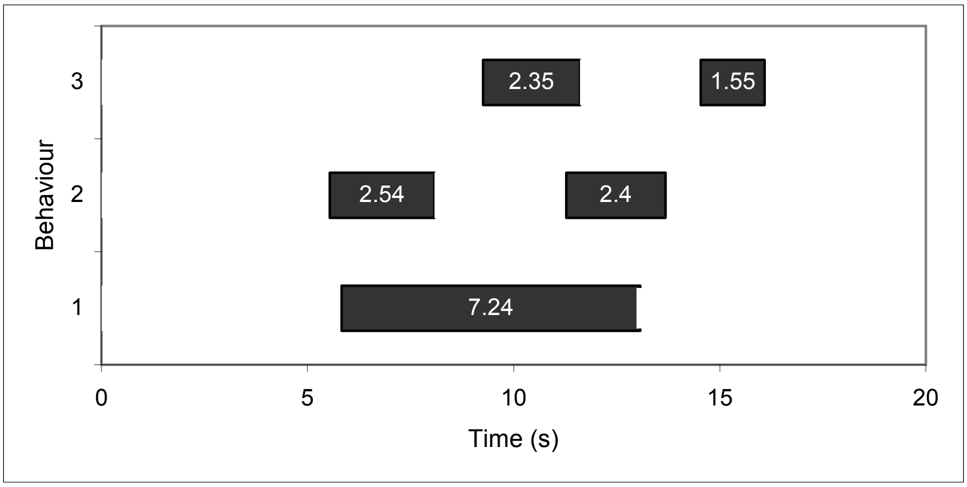


Fig 4.2.4. Participant two – putter (simulator)

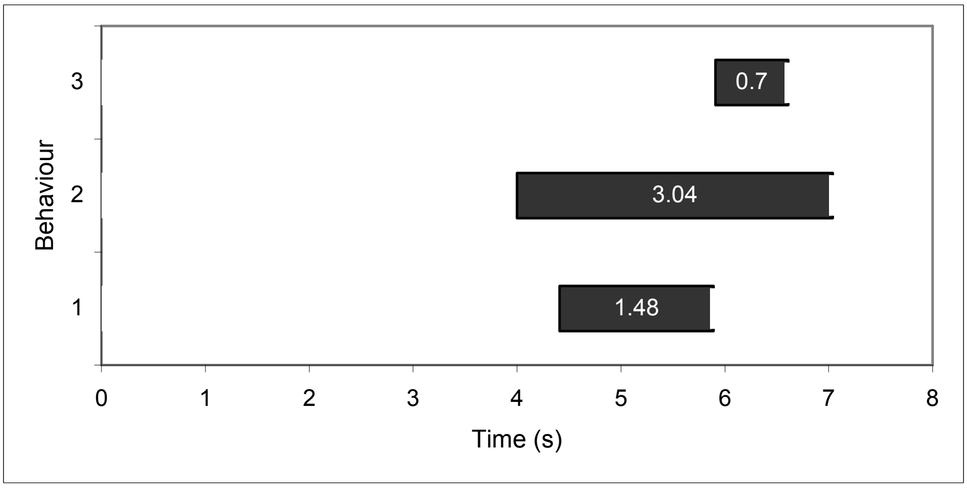


Fig 4.2.5. Participant two – wedge (simulator)

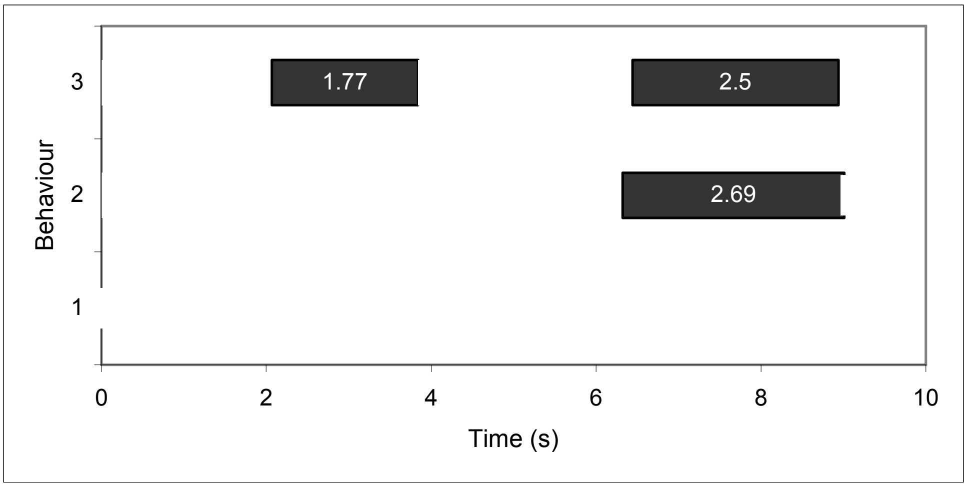


Fig 4.2.6. Participant two – driver (simulator)

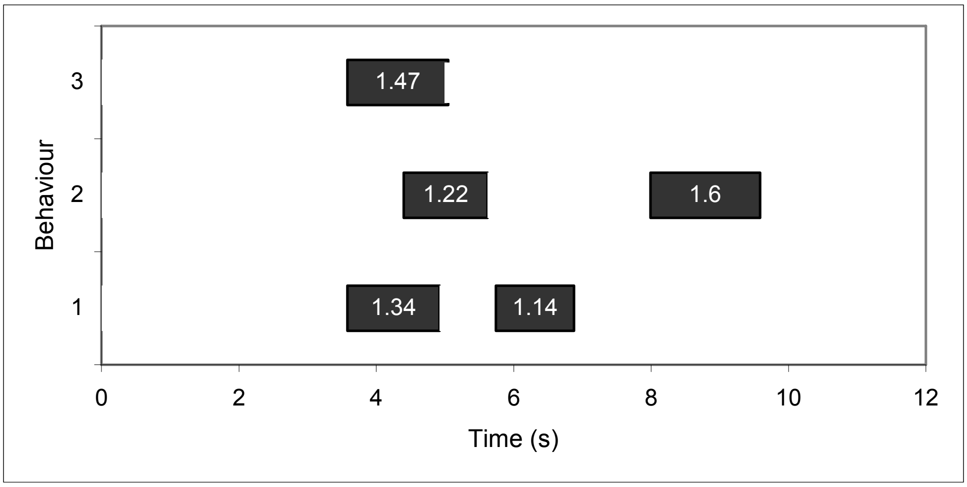


Fig 4.2.7. Participant three – putter (simulator)

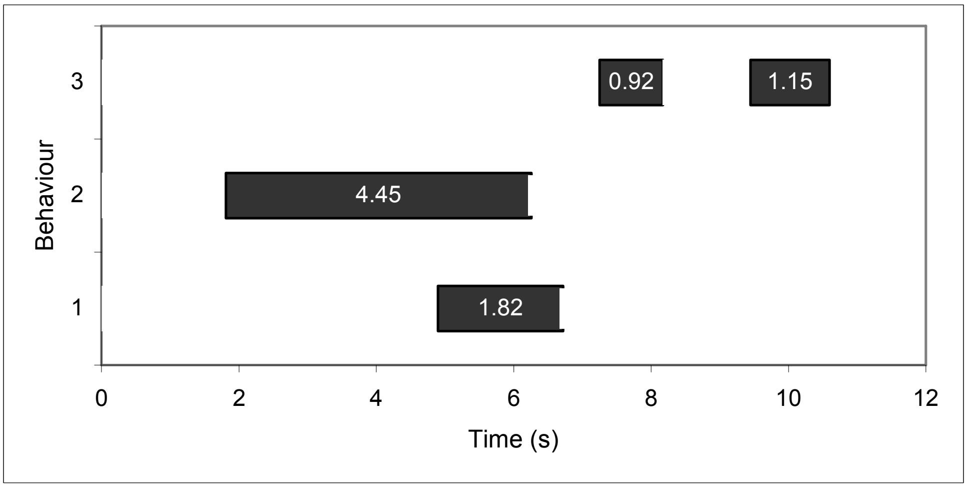


Fig 4.2.8. Participant three – wedge (simulator)

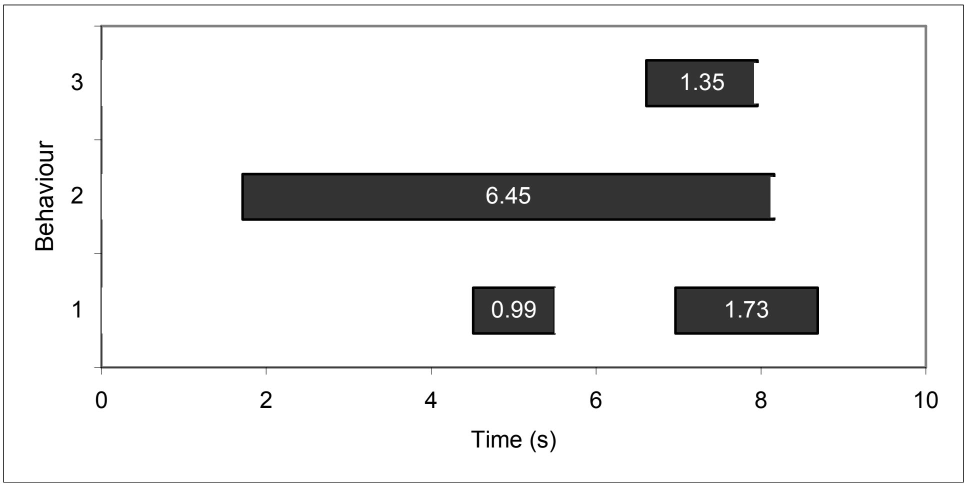


Fig 4.2.9. Participant three – driver (simulator)

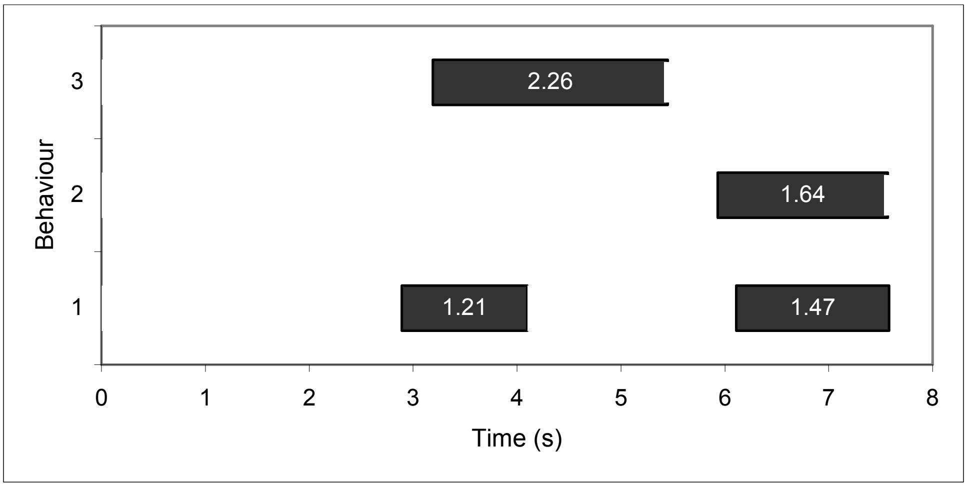


Fig 4.2.10. Participant four – putter (simulator)

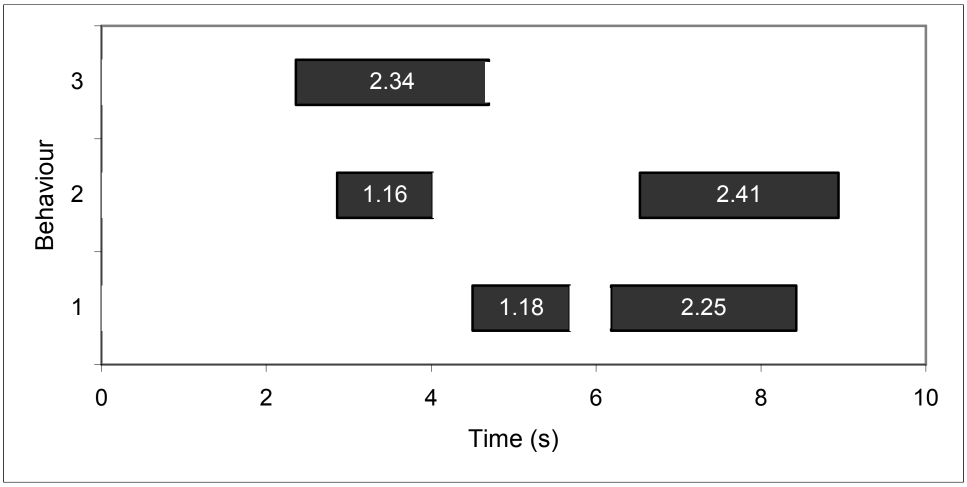


Fig 4.2.11. Participant four – wedge (simulator)

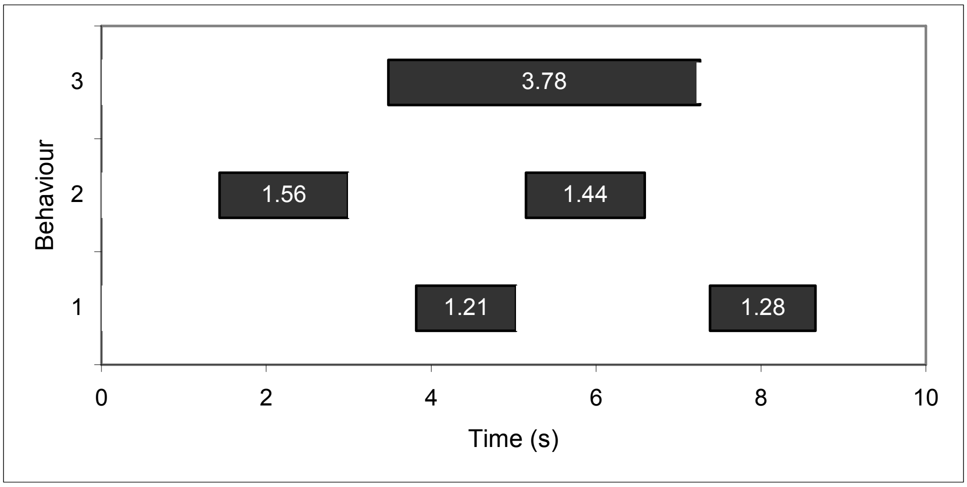


Fig 4.2.12. Participant four – driver (simulator)

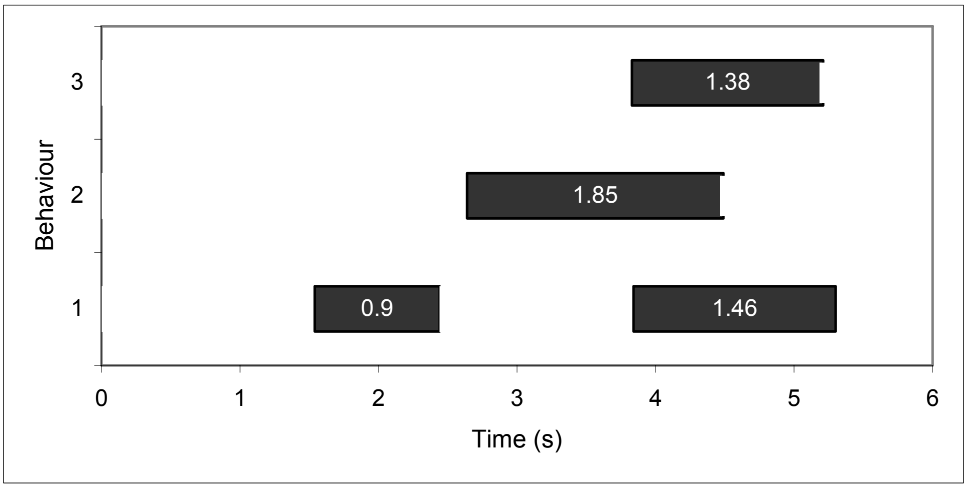


Fig 4.2.13. Participant five – putter (simulator)

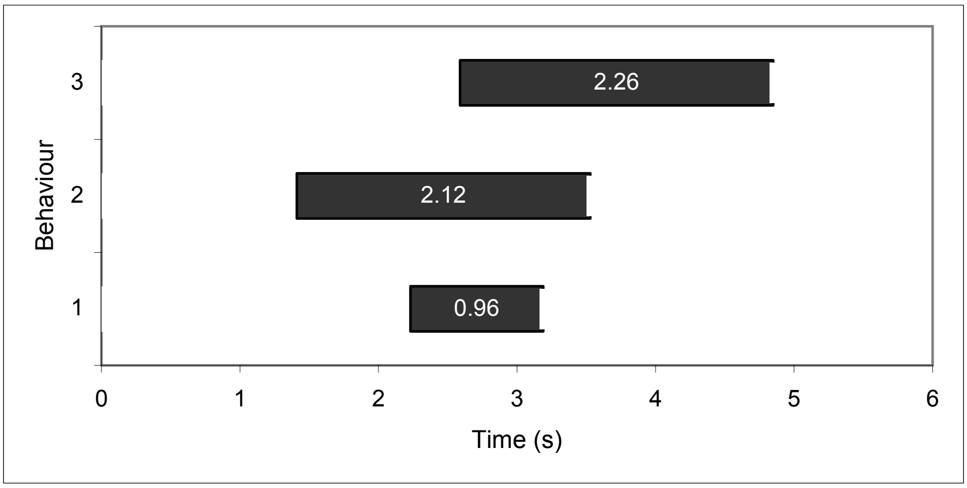


Fig 4.2.14. Participant five – driver (simulator)

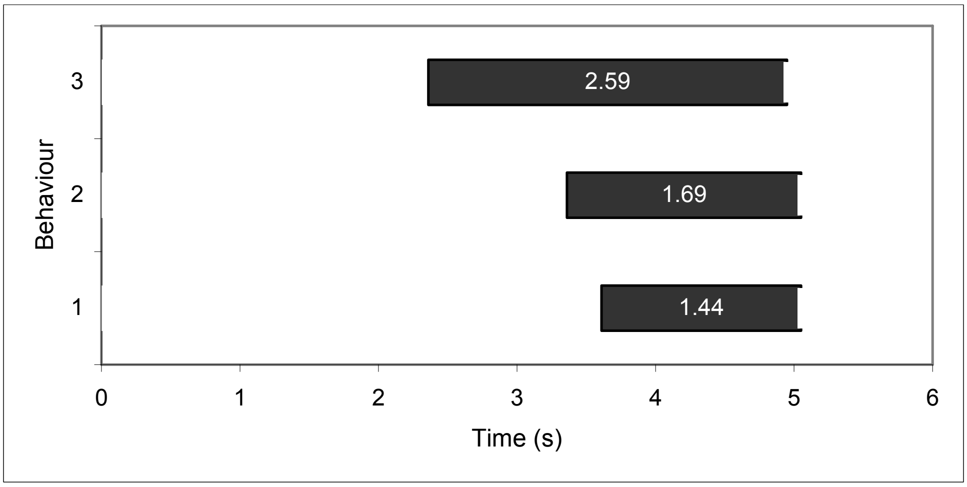


Fig 4.2.15. Participant five – wedge (simulator)

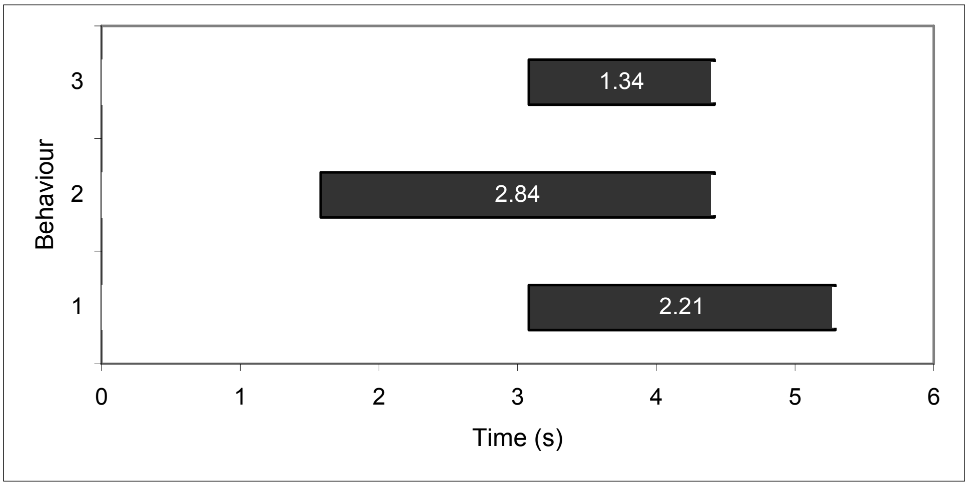


Fig 4.2.16. Participant six – driver (simulator)

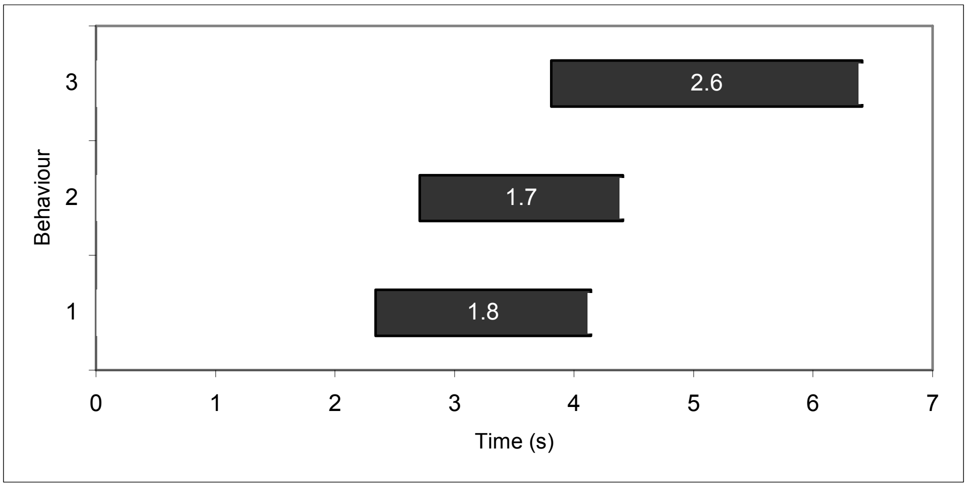


Fig 4.2.17. Participant six – wedge (simulator)

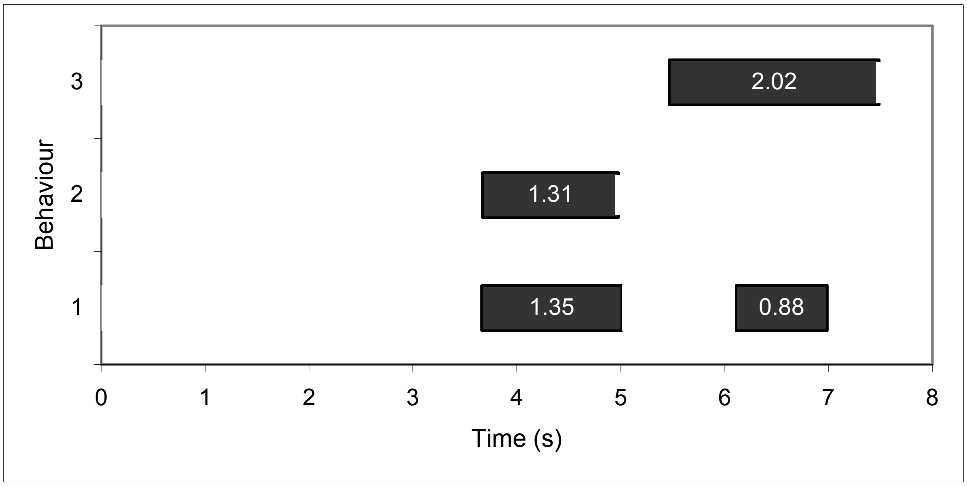


Fig 4.2.18. Participant six – putter (simulator

Mahalanobis distances for all participants were below the critical value for chi-squared of 18 (MANOVA assumption testing data is available in appendix D).

The results of the one-way within participant MANOVAs displayed in Tables 4.2.3. and 4.2.4. indicate significant differences in the behavioural characteristics of the routines utilised by the participants across the three shot types. As a result of the significant differences identified in the one-way MANOVAs, post hoc univariate pair-wise tests were conducted to explore in greater detail exactly where significant differences existed. A summary of this data is presented in Table 4.2.5. Due to the high number of post hoc t-tests required within participant to explore the specific significant pair-wise relationships a Bonferroni correction reduced the alpha level applied to 0.00417.

Participant		Value	F	Hypothesis df	Error df	Sig.	Partial Eta²
1	Pillai's Trace	.999	14335.897(a)	4.000	72.000	.000	.999
	Wilks' Lambda	.001	14335.897(a)	4.000	72.000	.000	.999
2	Pillai's Trace	.997	5174.251(a)	4.000	69.000	.000	.997
	Wilks' Lambda	.003	5174.251(a)	4.000	69.000	.000	.997
3	Pillai's Trace	.999	20878.797(a)	4.000	69.000	.000	.999
	Wilks' Lambda	.001	20878.797(a)	4.000	69.000	.000	.999
4	Pillai's Trace	.999	15982.457(a)	4.000	69.000	.000	.999
	Wilks' Lambda	.001	15982.457(a)	4.000	69.000	.000	.999
5	Pillai's Trace	.998	7842.634(a)	4.000	69.000	.000	.998
	Wilks' Lambda	.002	7842.634(a)	4.000	69.000	.000	.998
6	Pillai's Trace	.999	13266.539(a)	4.000	69.000	.000	.999
	Wilks' Lambda	.001	13266.539(a)	4.000	69.000	.000	.999

Table 4.2.3. Multivariate intercept data for all six participants across shot type.

Participant		Value	F	Hypothesis df	Error df	Sig.	Partial Eta²
1	Pillai's Trace	1.927	478.915	8.000	146.000	.000	.963
	Wilks' Lambda	.001	681.229	8.000	144.000	.000	.974
2	Pillai's Trace	1.929	475.481	8.000	140.000	.000	.965
	Wilks' Lambda	.000	800.398	8.000	138.000	.000	.979
3	Pillai's Trace	1.938	544.703	8.000	140.000	.000	.969
	Wilks' Lambda	.001	656.714	8.000	138.000	.000	.974
4	Pillai's Trace	1.884	285.118	8.000	140.000	.000	.942
	Wilks' Lambda	.003	312.328	8.000	138.000	.000	.948
5	Pillai's Trace	1.773	136.785	8.000	140.000	.000	.887
	Wilks' Lambda	.008	175.854	8.000	138.000	.000	.911
6	Pillai's Trace	1.002	17.577	8.000	140.000	.000	.501
	Wilks' Lambda	.034	76.648	8.000	138.000	.000	.816

Table 4.2.4. Multivariate condition data for all six participants across shot type.

The post hoc tests comparing the behavioural components of the PPRs for all six participants clearly demonstrated significant differences across all of the dependent variables (head, club, posture and still) when testing them in a pair-wise fashion (wedge v driver; wedge v putter; driver v putter). Participants one, two, four and five demonstrated significant differences for eleven out of the twelve pair-wise tests with participant three demonstrating significant differences on ten of the twelve tests, and participant six demonstrating significant differences on nine of the tests.

The effect sizes (eta²) for each of these analyses that proved to be significant were also large when compared with Cohen's (1988) guidelines for interpreting eta squared (.01 = small effect; .06 = moderate effect; .14 = large effect. Ranging from 0.40 to 0.99 for participant one; 0.60 to 0.99 for participant two; 0.31 to 0.99 for participant three; 0.38 to 0.98 for participant four, 0.43 to 0.96 for participant five; and 0.49 to 0.97 for participant six.

		Head	Club	Posture	Still
1	W v D	$t = 16.17$ $p < 0.00417$ $\text{eta}^2 = 0.92$	$t = 47.91$ $p < 0.00417$ $\text{eta}^2 = 0.99$	$t = 18.48$ $p < 0.00417$ $\text{eta}^2 = 0.93$	$t = 13.90$ $p < 0.00417$ $\text{eta}^2 = 0.88$
	W v P	$t = 16.46$ $p < 0.00417$ $\text{eta}^2 = 0.92$	$t = 36.52$ $p < 0.00417$ $\text{eta}^2 = 0.98$	$t = 25.67$ $p < 0.00417$ $\text{eta}^2 = 0.96$	$t = 24.27$ $p < 0.00417$ $\text{eta}^2 = 0.96$
	D v P	$t = 1.08$ $p = 0.291$ $\text{eta}^2 = 0.05$	$t = 73.33$ $p < 0.00417$ $\text{eta}^2 = 0.99$	$t = 4.01$ $p = 0.001$ $\text{eta}^2 = 0.40$	$t = 30.18$ $p < 0.00417$ $\text{eta}^2 = 0.97$
2	W v D	$t = 35.08$ $p < 0.00417$ $\text{eta}^2 = 0.98$	$t = 2.73$ $p = 0.012$ $\text{eta}^2 = 0.24$	$t = 37.18$ $p < 0.00417$ $\text{eta}^2 = 0.98$	$t = 6.60$ $p < 0.00417$ $\text{eta}^2 = 0.65$
	W v P	$t = 47.42$ $p < 0.00417$ $\text{eta}^2 = 0.99$	$t = 17.1$ $p < 0.00417$ $\text{eta}^2 = 0.92$	$t = 17.78$ $p < 0.00417$ $\text{eta}^2 = 0.92$	$t = 14.48$ $p < 0.00417$ $\text{eta}^2 = 0.90$
	D v P	$t = 30.72$ $p < 0.00417$ $\text{eta}^2 = 0.99$	$t = 16.03$ $p < 0.00417$ $\text{eta}^2 = 0.91$	$t = 5.98$ $p < 0.00417$ $\text{eta}^2 = 0.60$	$t = 9.82$ $p < 0.00417$ $\text{eta}^2 = 0.80$
3	W v D	$t = 15.90$ $p < 0.00417$ $\text{eta}^2 = 0.91$	$t = 39.81$ $p < 0.00417$ $\text{eta}^2 = 0.98$	$t = 15.61$ $p < 0.00417$ $\text{eta}^2 = 0.91$	$t = 2.03$ $p = 0.54$ $\text{eta}^2 = 0.15$
	W v P	$t = 13.59$ $p < 0.00417$ $\text{eta}^2 = 0.89$	$t = 29.53$ $p < 0.00417$ $\text{eta}^2 = 0.97$	$t = 14.25$ $p < 0.00417$ $\text{eta}^2 = 0.90$	$t = 41.02$ $p < 0.00417$ $\text{eta}^2 = 0.99$
	D v P	$t = 3.31$ $p < 0.00417$ $\text{eta}^2 = 0.31$	$t = 67.22$ $p < 0.00417$ $\text{eta}^2 = 0.99$	$t = 3.88$ $p = 0.01$ $\text{eta}^2 = 0.38$	$t = 43.89$ $p < 0.00417$ $\text{eta}^2 = 0.99$
4	W v D	$t = 7.13$ $p < 0.00417$ $\text{eta}^2 = 0.68$	$t = 7.79$ $p < 0.00417$ $\text{eta}^2 = 0.72$	$t = 18.35$ $p < 0.00417$ $\text{eta}^2 = 0.93$	$t = 15.78$ $p < 0.00417$ $\text{eta}^2 = 0.91$
	W v P	$t = 11.80$ $p < 0.00417$ $\text{eta}^2 = 0.85$	$t = 30.28$ $p < 0.00417$ $\text{eta}^2 = 0.97$	$t = 2.11$ $p\ 0.045$ $\text{eta}^2 = 0.17$	$t = 9.26$ $p < 0.00417$ $\text{eta}^2 = 0.78$
	D v P	$t = 3.82$ $p < 0.00417$ $\text{eta}^2 = 0.38$	$t = 25.0$ $p < 0.00417$ $\text{eta}^2 = 0.96$	$t = 36.96$ $p < 0.00417$ $\text{eta}^2 = 0.98$	$t = 32.65$ $p < 0.00417$ $\text{eta}^2 = 0.98$
5	W v D	$t = 10.97$ $p < 0.00417$ $\text{eta}^2 = 0.83$	$t = 9.26$ $p < 0.00417$ $\text{eta}^2 = 0.78$	$t = 5.72$ $p < 0.00417$ $\text{eta}^2 = 0.58$	$t = 16.14$ $p < 0.00417$ $\text{eta}^2 = 0.92$
	W v P	$t = 25.87$ $p < 0.00417$ $\text{eta}^2 = 0.96$	$t = 4.25$ $p < 0.00417$ $\text{eta}^2 = 0.43$	$t = 22.11$ $p < 0.00417$ $\text{eta}^2 = 0.95$	$t = 14.41$ $p < 0.00417$ $\text{eta}^2 = 0.90$
	D v P	$t = 24.98$ $p < 0.00417$ $\text{eta}^2 = 0.96$	$t = 5.48$ $p < 0.00417$ $\text{eta}^2 = 0.56$	$t = 19.68$ $p < 0.00417$ $\text{eta}^2 = 0.94$	$t = 2.55$ $p = 0.17$ $\text{eta}^2 = 0.21$
6	W v D	$t = 0.974$ $p =0.34$ $\text{eta}^2 = 0.04$	$t = 23.19$ $p < 0.00417$ $\text{eta}^2 = 0.95$	$t = 12.49$ $p < 0.00417$ $\text{eta}^2 = 0.87$	$t = 6.21$ $p < 0.00417$ $\text{eta}^2 = 0.62$
	W v P	$t = 1.03$ $p = 0.315$ $\text{eta}^2 = 0.04$	$t = 16.77$ $p < 0.00417$ $\text{eta}^2 = 0.92$	$t = 4.79$ $p < 0.00417$ $\text{eta}^2 = 0.49$	$t = 0.787$ $p < 0.00417$ $\text{eta}^2 = 0.03$
	D v P	$t = 0.117$ $p = 0.907$ $\text{eta}^2 = 0.001$	$t = 29.12$ $p < 0.00417$ $\text{eta}^2 = 0.97$	$t = 17.36$ $p < 0.00417$ $\text{eta}^2 = 0.93$	$t = 6.80$ $p < 0.00417$ $\text{eta}^2 = 0.66$

(df for all t values = 24, W – Wedge, P – Putter; D – Driver).

Table 4.2.5. Summary table of t values, alpha levels and eta^2 effect sizes for pairwise posthoc univariate tests.

P	TD	Putter				Driver				Wedge			
		Head	Club	Posture	Still	Head	Club	Posture	Still	Head	Club	Posture	Still
1	E	2.36 (0.34)	1.26 (0.14)	1.57 (0.17)	3.21 (0.53)	2.42 (0.24)	2.16 (0.13)	1.34 (0.14)	1.50 (0.16)	1.41 (0.07)	2.97 (0.12)	0.76 (0.10)	2.35 (0.11)
	H	2.45 (0.11)	1.30 (0.06)	1.61 (0.05)	3.49 (0.08)		2.16 (0.07)	1.39 (0.05)	1.58 (0.04)	1.48 (0.05)	3.03 (0.06)	0.72 (0.06)	2.36 (0.04)
	VH	2.53 (0.30)	1.29 (0.10)	1.62 (0.10)	3.44 (0.14)		2.25 (0.15)	1.34 (0.09)	1.60 (0.09)	1.43 (0.10)	3.03 (0.08)	0.78 (0.09)	2.41 (0.06)
2	E	7.25 (0.20)	7.25 (0.20)	4.76 (0.28)	3.96 (0.23)	--	2.61 (0.10)	4.24 (0.16)	1.19 (0.38)	2.57 (0.17)	2.44 (0.12)	1.65 (0.09)	0.79 (0.11)
	H	7.03 (0.20)	4.55 (0.10)	3.80 (0.15)	2.17 (0.10)	--	2.66 (0.06)	4.27 (0.09)	1.33 (0.04)	2.59 (0.12)	2.43 (0.06)	1.63 (0.07)	0.81 (0.06)
	VH	7.12 (0.20)	4.52 (0.45)	3.80 (0.15)	2.15 (0.24)	--	2.66 (0.13)	4.29 (0.12)	1.28 (0.09)	2.50 (0.16)	2.47 (0.09)	1.65 (0.13)	0.88 (0.06)
3	E	2.53 (0.37)	1.20 (0.12)	1.38 (0.14)	3.50 (0.16)	2.71 (0.42)	6.46 (0.14)	1.31 (0.12)	1.63 (0.14)	1.72 (0.10)	4.40 (0.18)	1.98 (0.15)	1.72 (0.07)
	H	2.58 (0.59)	1.25 (0.08)	1.43 (0.08)	3.50 (0.07)	2.60 (0.63)	6.44 (0.10)	1.39 (0.07)	1.70 (0.10)	1.80 (0.07)	4.4 (0.07)	2.09 (0.13)	1.78 (0.07)
	VH	2.55 (0.75)	1.20 (0.08)	1.42 (0.07)	3.52 (0.07)	2.46 (0.81)		1.38 (0.05)	1.66 (0.11)	1.77 (0.12)	4.53 (0.19)	2.07 (0.10)	1.73 (0.09)
4	E	2.25 (0.14)	1.61 (0.13)	2.27 (0.13)	2.88 (0.19)	2.99 (0.11)	2.89 (0.08)	3.74 (0.11)	1.43 (0.11)	3.50 (0.10)	3.69 (0.14)	2.27 (0.10)	2.40 (0.13)
	H	2.78 (0.06)	1.60 (0.08)	2.23 (0.08)	2.83 (0.06)	2.99 (0.07)	2.96 (0.08)	3.73 (0.05)	1.41 (0.08)	3.48 (0.07)	3.63 (0.07)	2.33 (0.07)	2.42 (0.08
	VH	2.66 (0.07)	1.57 (0.05)	2.28 0.06)	2.76 (0.09)	2.91 (0.12)	3.01 (0.12)	3.74 (0.14)	1.42 (0.12)	3.48 (0.12)	3.64 (0.11)	2.38 (0.11)	2.30 (0.12)
5	E	2.39 (0.10)	1.94 (0.32)	1.37 (0.07)	1.53 (0.15)	2.24 (0.36)	2.18 (0.28)	2.25 (0.09)	1.39 (0.12)	1.39 (0.11)	1.69 (0.14)	2.54 (0.12)	2.34 (0.16)
	H	2.34 (0.07)	1.87 (0.05)	1.36 (0.05)	1.50 (0.08)	2.15 (0.09)	2.12 (0.05)	2.25 (0.09)	1.48 (0.30)	1.46 (0.08)	1.67 (0.06)	2.60 (0.07)	2.40 (0.07)
	VH	2.36 (0.11)	1.80 (0.18)	1.35 (0.14)	1.44 (0.06)	2.34 (0.11)	2.16 (0.11)	2.22 (0.14)	1.44 (0.15)	1.44 (0.11)	1.69 (0.12)	2.59 (0.14)	2.36 (0.16)
6	E	2.25 (0.09)	1.28 (0.09)	2.07 (0.15)	1.84 (0.09)	2.84 (0.19)	2.20 (0.12)	1.32 (0.10)	1.52 (0.13)	2.25 (0.14)	1.73 (0.09)	1.87 (0.10)	1.87 (0.12)
	H	2.30 (0.12)	1.30 (0.08)	2.08 (0.11)	1.87 (0.09)	2.22 (0.11)	2.88 (0.09)	1.19 (0.38)	1.55 (0.11)	2.24 (0.07)	1.75 (0.05)	1.81 (0.09)	1.85 (0.05)
	VH	2.24 (0.08	1.33 (0.06)	2.07 (0.12)	1.86 (0.08)	2.16 (0.09)	2.84 (0.09)	1.31 (0.08)	1.58 (0.10)	2.13 (0.11)	1.70 (0.08)	1.84 (0.08)	1.87 (0.10)

P – participant , TD – task difficulty level, E – easy, H – hard, VH – very hard.

Table 4.2.6. The mean duration (and standard deviation) of the behavioural components of pre-performance routines across task difficulty types on the golf simulator.

4.2.3. Impact of task difficulty on pre-performance routines.

The one-way MANOVA's conducted to ascertain whether any significant differences existed within participants across task difficulty levels generally failed to find significant differences. Participants one, three, four, five and six did not have any significant differences across the four dependent variables for the three levels of task difficulty. Indeed neither the Wilks' Lambda multivariate test nor the more robust Pillai's Trace provided a significant effect (see Tables 4.2.7. and 4.2.8., for further details).

Participant		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
1	Pillai's Trace	.999	5871.472(a)	4.000	24.000	.000	.999
	Wilks' Lambda	.001	5871.472(a)	4.000	24.000	.000	.999
2	Pillai's Trace	.999	11348.344(a)	4.000	24.000	.000	.999
	Wilks' Lambda	.001	11348.344(a)	4.000	24.000	.000	.999
3	Pillai's Trace	.999	9557.929(a)	4.000	24.000	.000	.999
	Wilks' Lambda	.001	9557.929(a)	4.000	24.000	.000	.999
4	Pillai's Trace	.999	9095.004(a)	4.000	24.000	.000	.999
	Wilks' Lambda	.001	9095.004(a)	4.000	24.000	.000	.999
5	Pillai's Trace	.999	10286.720(a)	4.000	24.000	.000	.999
	Wilks' Lambda	.001	10286.720(a)	4.000	24.000	.000	.999
6	Pillai's Trace	1.000	14104.560(a)	4.000	24.000	.000	1.000
	Wilks' Lambda	.000	14104.560(a)	4.000	24.000	.000	1.000

Table 4.2.7. Multivariate test intercept data across task difficulty levels.

Only participant two demonstrated significant differences on the duration of behavioural components of their PPRs across task difficulty levels: $F(3,48) = 3.40$, $p < 0.00417$, Wilks' Lambda = .407, $eta^2 = .362$. Post hoc univariate pair-wise t-tests demonstrated a significant effect only on the still dependent variable across the task difficulty levels. This difference was apparent at the new alpha level of 0.00417 following a Bonferroni adjustment due to the twelve post hoc univariate tests conducted. A significant difference existed between the easy and hard conditions: $t(9) = 5.35$, $p < .00417$; between the easy and very hard conditions: $t(9) = 12.42$, $p < .00417$; and between the hard and very hard conditions: $t(9) = 27.62$, $p < .00417$. A summary of participant two univariate statistics is available in Table 4.2.9.

Participant		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
1	Pillai's Trace	.212	.742	8.000	50.000	.654	.106
	Wilks' Lambda	.796	.724(a)	8.000	48.000	.670	.108
2	Pillai's Trace	.609	2.738	8.000	50.000	.014	.305
	Wilks' Lambda	.407	3.404(a)	8.000	48.000	.004	.362
3	Pillai's Trace	.129	.430	8.000	50.000	.897	.064
	Wilks' Lambda	.874	.418(a)	8.000	48.000	.904	.065
4	Pillai's Trace	.405	1.587	8.000	50.000	.153	.203
	Wilks' Lambda	.618	1.629(a)	8.000	48.000	.141	.214
5	Pillai's Trace	.227	.799	8.000	50.000	.607	.113
	Wilks' Lambda	.783	.779(a)	8.000	48.000	.623	.115
6	Pillai's Trace	.176	.604	8.000	50.000	.770	.088
	Wilks' Lambda	.831	.580(a)	8.000	48.000	.789	.088

Table 4.2.8. Multivariate test task difficulty data across task difficulty levels.

	Head	Club	Posture	Still
E v H	T = 2.99 P = 0.015 Eta² = 0.50	T = 2.62 P = 0.028 Eta² = 0.43	T = 1.75 P = 0.114 Eta² = 0.25	T = 5.35 P = < 0.00417 Eta² = 0.76
H v VH	T = 1.02 P = 0.336 Eta² = 0.10	T = 0.72 P = 0.49 Eta² = 0.05	T = 0.34 P = 0.974 Eta² = 0.01	T = 27.62 P = < 0.00417 Eta² = 0.99
E v VH	T = 1.23 P = 0.25 Eta² = 0.14	T = 1.06 P = 0.319 Eta² = 0.11	T = 2.21 P = 0.054 Eta² = 0.35	T = 12.42 P = < 0.00417 Eta² = 0.93

(df for all t values = / E – Easy; H – Hard; VH – Very Hard).

Table 4.2.9. Summary table of t values, alpha levels and eta² effect sizes for pair-wise posthoc univariate tests for participant two across task difficulty levels.

4.2.4. Overview of study two results

There is a clear difference demonstrated within all six participants when comparing the PPRs utilised when using the driver, putter, and wedge. All participants demonstrated clear significant differences across all behavioural characteristics of their routes. In some cases the duration changes, in others the sequence or inclusion of specific behavioural components in the routines altered. The temporal characteristics of these behaviours also differed on an individual basis and as a component of the overall routines.

The results exploring the impact of task difficulty on the structure and duration of the PPRs of the six participants did not reach such a unanimous result. Five out of six of the participants did not demonstrate significant differences between the overall duration of the components of their PPRs. Only participant two demonstrated a significant difference, which interestingly was only apparent on the still dependent variable. These significant differences did however exist across all three of the pair-wise t-tests (easy v hard, hard v very hard, and easy v very hard).

4.3. DISCUSSION

The second study sought to explore two further variables, to those identified in study one, that could impact upon the nature of the PPRs utilised by the participants. First, exploring whether differences existed both behaviourally and temporally between shot using different types of club (putter, driver, and wedge). The second part of this study explored whether task difficulty (easy, hard, very hard) impacted upon the structure, duration and execution of the PPRs within participant.

4.3.1. Comparisons across different shot types

Participants were analysed and compared across three major types of shot (putter, driver and wedge). All six participants utilised distinctly different behavioural routines for each of the three shot types previously identified. Visual comparison of the behavioural components of the routines within participant and across shot type presented in Figures 4.2.1. – 4.2.18. clearly show differences in the structure of the routines. Some participants utilised different behaviours for the different shots, whilst other participants used the same behaviours but in a different sequence.

Temporally, the overall duration of the routines across shot type and the duration of the discrete behavioural components across shot type proved to be significantly different for all six participants. Post hoc tests demonstrated significant differences within participant for most behavioural characteristics for all participants (see Table 4.2.4.).

One very interesting finding from this study was the increase in the duration of the 'still' period across shot types with an increase from the driver, to the wedge to the putter. In all cases the participants had a longer still period for the task requiring greater accuracy (i.e. the golf putt) when compared to the still period of shots requiring a reduced degree of accuracy (the drive). This suggests that the psychological strategies utilised by the players in this phase of the routine could differ depending on the accuracy / control requirements of the shot to be played.

These findings suggest doubts in the simplicity of previous studies exploring the nature of PPRs in golf. Indeed, these data indicated that the characteristics of the routines (both behavioural and temporal) differ according to the type of shot, reflecting different task demands. As a result, the focus on temporal consistency advocated by earlier studies appears to be at best too simplistic and at worst potentially detrimental to performance. Possibly the future direction of work exploring and developing PPRs should focus on the role they fulfil and the key components or behaviours that need to be included and not necessarily how long they components take to execute.

4.3.2. Impact of task difficulty on pre-performance routines.

The duration of behavioural components across task difficulty levels only differed significantly for participant two ($F_{3,48} = 3.40$, $p < .00417$, Wilks' Lambada = .407, $eta^2 = .362$). This suggests that, in the main, task difficulty did not have a significant impact upon the duration of the behavioural components of the routine. However, the standard deviation data for each component across task difficulty levels indicated the possibility that there is a decrease in the variability for ‘hard’ or ‘very hard’ shots when compared to easy shots. This indicates that the participants were more consistent when they perceived shots as hard. This is reinforced by the goal setting literature, which suggests that the most effective goals are challenging, but attainable (Burton and Naylor, 2002). Participants were less consistent when performing tasks they classified as easy or tasks there classified as very hard.

These results contradict Jackson and Bakers’ (2001) suggestion that task difficulty impacts upon the duration of the routine. One possible explanation for this is the environment in which the data were collected for this study. Although the findings in Study one indicated that a simulated environment is a viable one in which to observe pre-performance behaviour it does remove the effect of a number of specific variables, which can impact upon the time required to place the corresponding shot. Indeed actually playing out of the rough or playing out from behind a tree is a different experience to playing these hazards on the simulator where more factors need to be considered such as wind speed and direction, moisture, topography etc. As a result a shot categorised as difficult on the simulator may not be the same as a shot characterised as difficult on the golf course. Jackson and Baker (2001) further identified specific characteristics that impacted upon the time taken by the participant to make the decision or concentrate prior to shot execution. They proposed that it was the concentration time that increased with increasing difficulty prior to the execution of the rugby penalty kick, and that “partial correlation coefficients indicated that the times were more strongly related to the distance than to the lateral angle” (p.60). As a result, the impact of task difficulty on performance should be further investigated in the real competitive environment to fully understand the impact these specific factors have on the execution of the PPRs.

The results in this study cast serious doubt on previous recommendations that golfers should strive towards temporal and behavioural consistency for all shot types in all situations (Boutcher and Crews, 1987; Crampton, 1990; Cohn, Rotella, and Lloyd, 1990; Wrisberg and Pein, 1992). The results presented here clearly identified behaviourally and temporally distinct routines for each participant when different shot types were compared (putter, driver and wedge). The results showed that the participants in this study are very consistent within shot, but not between shot types.

The variability data for the duration of the behaviours across task difficulty levels (very easy, hard and very hard) does offer some partial support to Jackson and Baker's (2001) work exploring the impact of task difficulty on performance. The participants demonstrated greater within shot consistency for tasks they rated a hard than in tasks rated as either very easily or very hard. It appears then, that performer perceptions of task difficulty could impact upon the consistency of their preparation for movement initiation.

Another interpretation of these findings could be that participants use different strategies depending on the difficulty of the task presented to them. The elite rugby kicker in Jackson and Bakers' (2001) study identified a range of strategies he utilised interchangeably during the PPR dependent on the psychological constraints the task presented to him. These findings further challenge Rotella's (1995) suggestion that when preparing to play a shot the golf player should allow themselves to go into ‘auto-pilot’.

Exploration of these strategies utilised by performers in sporting situations would serve to enhance our understanding of the psychological processes utilised and how best to develop strategies to enhance them.

It is essential that future research explores the psychological processes that are occurring during the PPR stage prior to execution of the required movement. Although a number of researchers have speculated about the mental processes of the performer during this stage, only Jackson and Baker (2001) have explored this phenomenon. Many authors have offered suggestions including Hall, Rodgers and Barr (1990) in their study of 381 athletes across six sports. They concluded that the athletes utilised imagery more in competition than in training / deliberate practices. Maynard (1998) suggested that PPRs serve to divert attention away from task irrelevant thoughts to task relevant thought. It has also been suggested that PPRs improve concentration and performance (Harle and Vickers, 2001), and enhance the recall of physiological and psychological states (Marlow, 1998). Jackson and Baker (2001) suggested further that "it seems logical that routine times would be longer whenever other coping strategies, such as applied relaxation, attentional cueing or thought stopping are incorporated into a pre-performance routine" (p.50). Shaw (2002), in his case study of a professional golfer, reported that ‘a professional golfer had experienced some attentional benefits arising from the use of a pre-shot routine. Specifically the golfer reported that “the new routine had made him more focused for each shot and therefore, less distracted by irrelevancies" (p.117). Intuitively it makes sense that a greater understanding of these processes would significantly enhance the coach or sport psychologists' ability to develop an effective routine to enhance consistently a player's preparation to perform.

The current study has clarified the impact that task difficulty and shot type have on the structure and temporal characteristics of participant PPRs. The key next step is to seek to contextualise these characteristics with the possible links between behaviour and psychological strategies and skills.

It is important that future work explores PPRs from the perspective of the individual performer. Holder (2003) identified that "the most critical feature of the application of PPRs, as with most, if not all psychological interventions is their individualisation" (p.69). This is supported by the current study which identified very different routines used by each participant. Holder further identified a lack of literature alluding to the psychological consequences of the utilisation of PPRs. This suggestion is reinforced by Shaw (2002) who recommended "future investigations of routines that include mental components are likely to reveal performance-enhancement" (p.113). To date studies of the cognitive strategies utilised during this pre-performance period have been lacking.

This study highlights limitations in previous work exploring the nature of PPRs in the closed skill of the golf shot. Future work needs to focus on the psychological strategies utilised during this pre-performance period by sports performers in an attempt to understand how best to develop this component of performance. Greater understanding would facilitate greater development of the PPR in sport.

Chapter 5

STUDY THREE

5.1. METHOD

5.1.1. Aim

The aim of study three was to explore the nature of psychophysiological indicators of underlying psychological processes during the execution of a PPR. Specifically exploring the nature of PPRs and heart-rate deceleration in shots rated ‘good’ and ‘poor’.

It was hypothesised that there would be no significant differences between the behavioural components of the routines utilised for good and poor shots, but that there would be significant differences between the related heart-rate deceleration (HRD) characteristics for the routines when comparing good and poor performances. This is supported by Radlo et al (2002) who reported similar findings when comparing HRD data for the best and worst shots of elite darts throwers. For a more detailed explanation of heart rate deceleration and its relationship to performance please refer to section 2.7.2.1. in Chapter 2.

Pilot Study 3 was conducted to test the experimental design, equipment, and data analysis procedures. As a result, slight modifications were made to the experimental design (for further details see Appendix F).

5.1.2. Participants

Participants were six right handed highly skilled professional golfers (handicap M= 0.7; Age M= 23.7; years playing golf M= 11). These golfers were all male and were recruited through personal contact.

5.1.3. Procedure

Participants were required to complete 36 putts in an indoor controlled environment. Six specific 'holes' were set up which offered differing distance, direction and topographic requirements. These holes were constructed in a sports hall with indoor cricket strip matting used to imitate the putting surface. A plan of the hole layouts and distances is provided in Figure 5.1. The topography was varied with the use of specific foam inserts under the matting. Participants were randomly assigned an order in which to play these six holes completing the relevant putting task as required. In between each of their putts participants were also required to walk to an indoor driving net to complete a full swing shot to better simulate the breaks experienced between putting episodes and the requirement to change task during match-play. A full swing shot was randomly determined by an independent expert to vary the task demands of the full swing shot. The expert varied the club required for the full swing shot as well as the desired characteristics of the shot (e.g. slice, fade etc). After each set of six holes the participants were afforded a break before returning to the putting tasks. Each time participants returned to the putting task their playing order for the holes was randomly reassigned to reduce the likelihood of participants developing 'over familiarity' with the required task. It was felt that if participants played the same holes in the same order they could pre-plan their shots and possibly modify their PPR as a result. In total, players were required to play each hole six times with the order they played them randomly manipulated for each set of six putts.

After completing each putt the participants were asked to rate their own performance. An independent expert was also required to rate their performance. PPR video data were collected for each putt following the same procedures outlined in studies one and two (see section 3.1.4. for a more detailed explanation). Finally, psychophysiological measures in the form of heart-rate variability data were collected for each participant for the total duration of each PPR to allow comparisons between good and poor performance and comparison with the behavioural components of the PPRs.

Video data were collected via a Canon DM MV550i digital camcorder. This mini DV camcorder included a 440 x digital zoom and a max shutter speed of 1/8000 sec. The lens system included a 2.8mm – 61.6mm zoom lens and a 2.5” colour display with a display format of 112,000 pixels. Data were then transferred via a FireWire link (1 x IEEE 1394 connection type) to computer for analysis via Quintic sports analysis software.

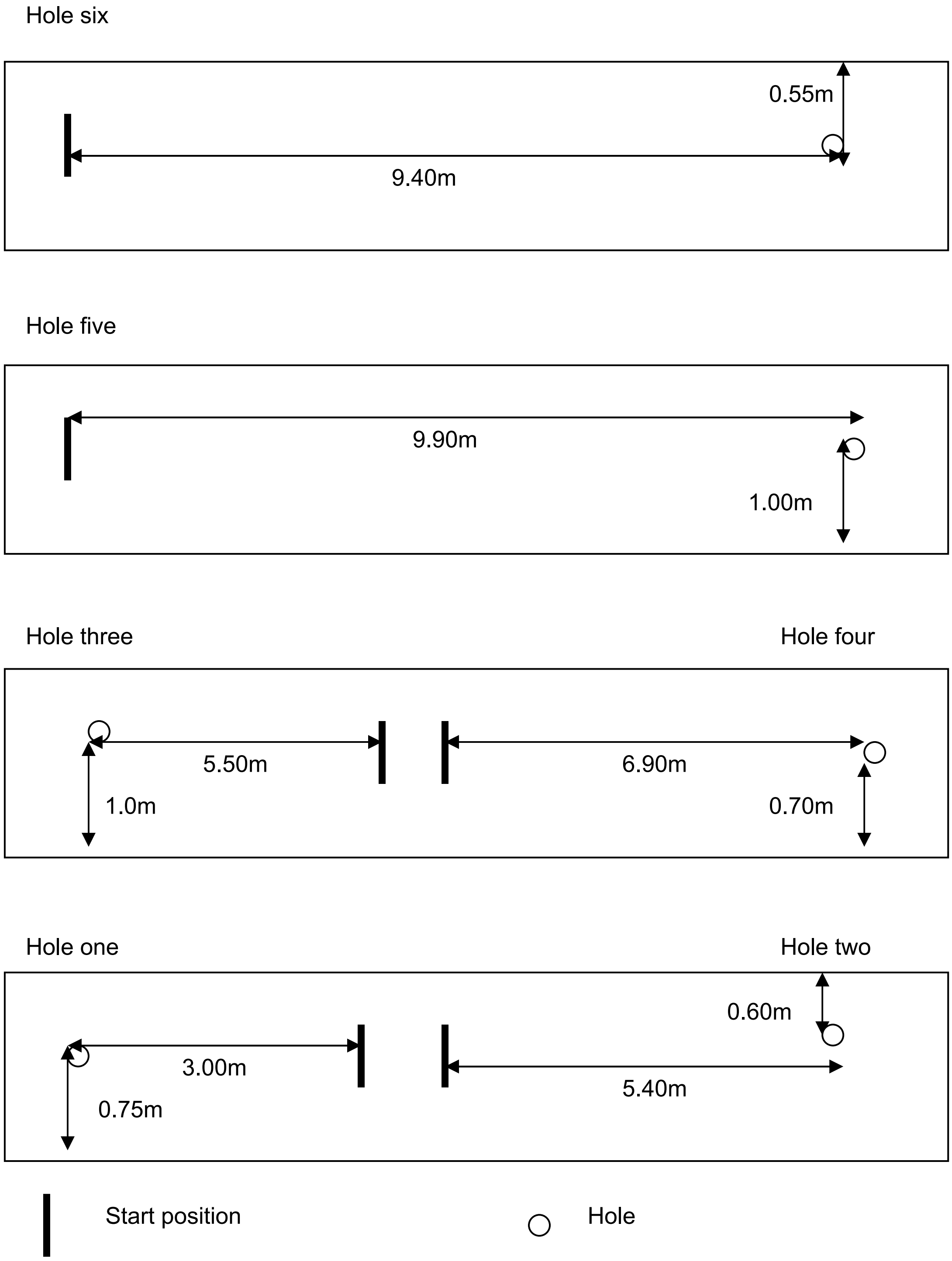


Figure 5.1. Layout of putting tasks

5.1.3.1. Psychophysiological indicators

Participants were required to wear a thoracic strap consisting of two electrodes and a transmitter (Polar Electro Oy, Kemple, Finland) and the data were transmitted directly from a wrist receiver to a PC via an infrared interface. R-R interval data were collected for the whole duration of the pre-shot period and stored for subsequent analysis (Polar precision performance 4.0, Polar Electro Oy, Kemple, Finland). The timer on the video and the stop watch on the HRM were synchronised to enable this analysis.

The Polar S810 HRM was selected due to its capacity to record R-R interval data. Kingsley, Lewis and Merson (2005) sought to ascertain the effectiveness of the Polar S810 HRM by comparing the system to an ambulatory ECG system. Their findings “supported the use of the Polar 810s heart rate monitor as an appropriate device for the measurement of heart rate” (p.43).

Baseline R – R interval data were collected from all participants prior to participation in the study. These baseline data were collected in a laboratory setting with participants sitting in relaxed position. All participants were required to standardise their breathing whilst data was collected. This was achieved by the use of a computer-based metronome programme. This programme sought to standardise the temporal breathing patterns of participants by allowing 2000 ms for inspiration and 3000 ms for expiration.

Participants were required to sit and control their respiration rate for fifteen minutes to achieve a consistent resting heart-rate level. Of this period, ten minutes was allowed to give the participants' heart rates a chance to stabilise. A further five minutes was designated for the recording of the required data. Throughout the data collection process participants viewed the changing colours of the metronome programme on the computer screen but had no indication of their heart rate. This approach was adopted to limit the impact that visual feedback of heart rate could have on the participants' actual heart rate during the resting heart-rate data collection period.

5.1.3.2. Performance indicators

Self report

After completing each putt in all of the six sets, participants were required to independently rate their performance on the putting tasks. Participants rated their performance on a 7-point Likert scale with a score of 1 indicating an 'awful' shot and a score of 7 indicating an 'excellent' shot. These data were then used as one of two measures to indicate the overall perceived quality of the shot (see Figure 5.2.).

Awful			Average			Excellent
1	2	3	4	5	6	7

Figure 5.2. Self-rating performance Likert scale.

Expert rating

Following the completion of each shot by all participants, an independent assessor was required to rate the overall quality of the putts participants executed. The independent assessor rated participant performance on the same seven-point Likert scale (see Figure 5.2.) that was used by the participants to rate their own performance. Participants' performances were again assessed and scored on the Likert scale.

The two scores reflecting the quality of the performance were then combined to produce an overall rating of performance across the range of 2 – 14. From this range, any shot with a score below 7 was categorised as a ‘poor’ shot and any shot with a score above 11 was categorised as a ‘good’ shot. These two classifications of shot were then used for further analysis (Figure 5.3.).

2 3 4 5 6 7 8 9 10 11 12 13 14

Poor Good

Figure 5.3. Shot classification into good and poor shots.

5.1.4. Data analysis

Initial video data were transferred from the camcorder to the Quintic sports analysis software (Quintic Biomechanics 9.03v9a). This allowed the video footage of the PPRs to be analysed on a frame-by-frame basis to ascertain the onset, duration and cessation of the routines and their composite components. The application of frame markers to these events allowed for a reliable calculation of the duration of the routines and the component parts.

The analysis of the collected data for Study three was split into two main parts. The data for each participant was split based upon the performance indicator scores. All putts within participant that scored an overall combined (self and expert rating) score of below eight were categorised as poor shots.

Once the shots for each participant had been split into good and poor shots the corresponding PPRs for each category within participant were analysed. The temporal and behavioural characteristics of the routines were analysed as described previously in section 3.1.4. A one-way, within participant MANOVA was conducted to investigate whether any significant differences existed between the duration of the behavioural categories within the routines and between the two levels of performance for the four dependent variables ‘head’, ‘club’, ‘posture’ and ‘still’. The independent variable was the performance rating (good or poor). Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity. There were no serious violations of these statistical requirements. If significant differences were identified follow-up uni-variate tests were to be conducted.

Heart rate variability data (R-R IBIs) was averaged and mean values were calculated for the corresponding period of time associated with the PPRs. A two-way between groups analysis of variance ANOVA was conducted to compare the IBI durations for good and poor classifications of shots, ascertaining if significant differences existed across performance level.

5.2. RESULTS

5.2.1. Changes in heart-rate deceleration between good and poor performance

The first analysis of Study three related to changes in the heart-rate deceleration indicators of attention across the total duration of the PPR for each participant. Figures 5.2.1. to 5.2.6. show the mean values within participant for each IBI over the total duration of the PPR for both good and poor performance (see 3.3.3.3. ‘performance indicators’ for further information on the differentiation between good and poor performance). The data presented includes the 5 IBI epochs post ball strike and between 17 – 30 epochs prior to ball strike (depending on the overall duration of the participants routines). Results of the two-way between groups ANOVA are presented within participant to ascertain if significant differences exist between the two levels of performance.

The six graphs presented below display mean IBI data for each recorded epoch prior to, during and post ball strike. The data are displayed as mean values for both good and poor categorised shots. The X-axis identifies IBIs in relation to ball strike (0 indicating ball strike, negative numbers representing the period prior to ball strike and positive numbers representing the period post ball strike. The actual mean duration of the IBI is indicated by the value in milliseconds (ms) on the Y-axis.

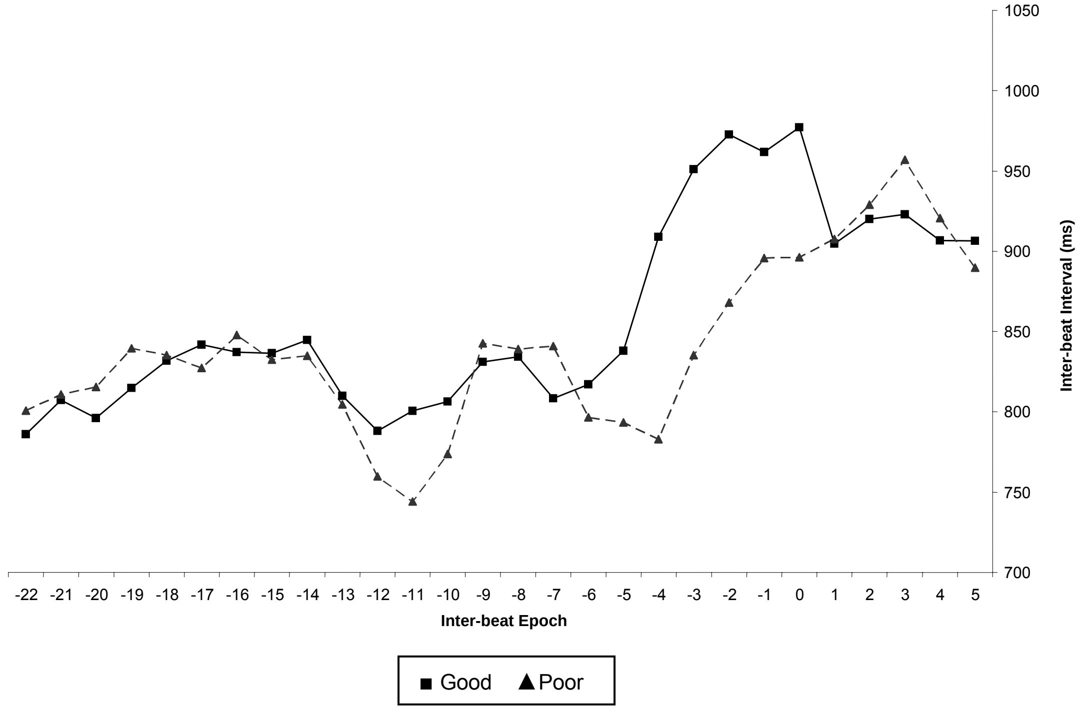


Figure 5.2.1. Mean epoch (0.6s) IBIs for good and poor performance across the total PPR for participant one.

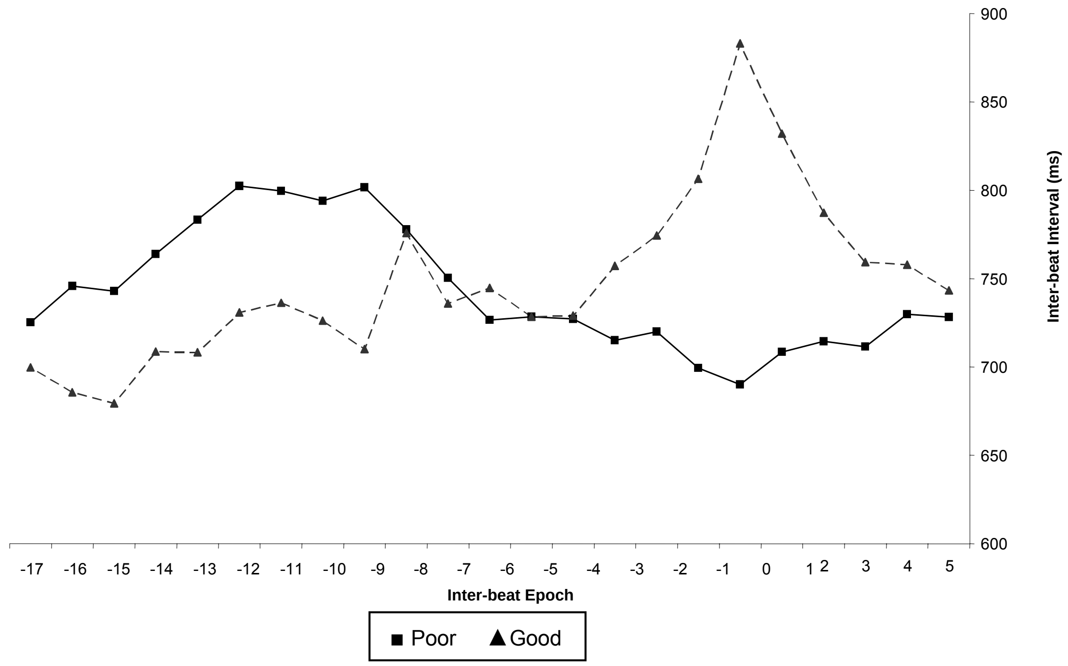


Figure 5.2.2. Mean epoch (0.6s) IBIs for good and poor performance across the total PPR for participant two.

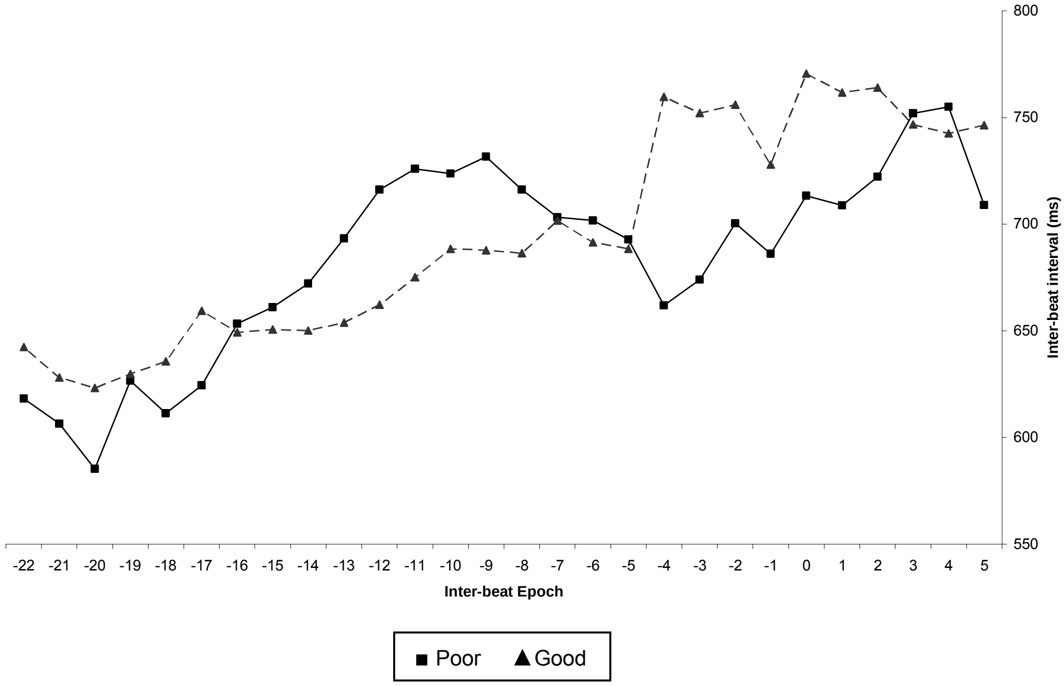


Figure 5.2.3. Mean epoch (0.6s) IBIs for good and poor performance across the total PPR for participant three.

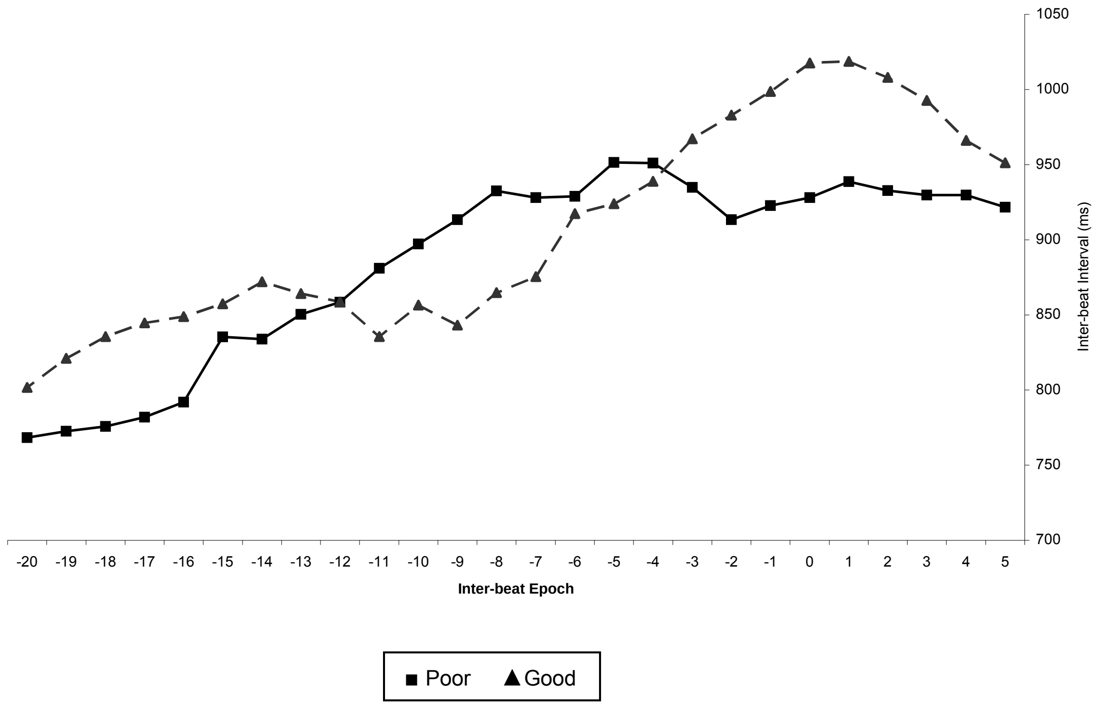


Figure 5.2.4. Mean epoch (0.6s) IBIs for good and poor performance across the total PPR for participant four.

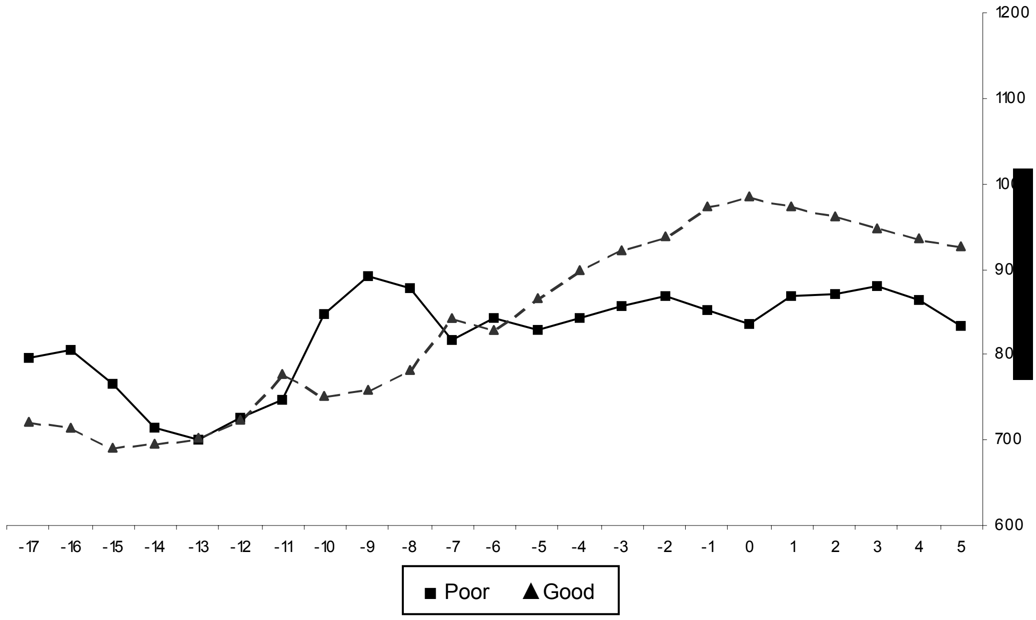


Figure 5.2.5. Mean epoch (0.6s) IBIs for good and poor performance across the total PPR for participant five.

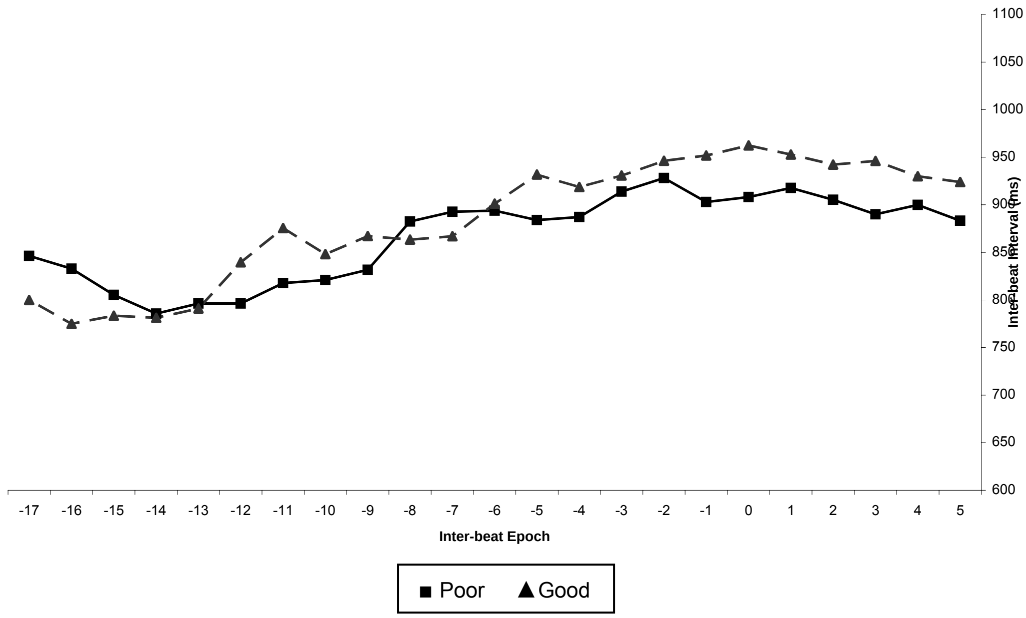


Figure 5.2.6. Mean epoch (0.6s) IBIs for good and poor performance across the total PPR for participant six.

The graphs indicate that all six participants had mean IBI characteristics for those shots defined as good that differed from those defined as poor. However, it needs to be determined whether these differences are statistically significant. It is also interesting to note from these initial data that good performance within participant is not characterised by a consistently longer total duration for IBIs across the whole routine, but only at specific points.

Table.5.2.1. Main effect for shot rating (good Vs poor) for total duration of participant pre-performance routines.

Participant	F Value	DF	Sig.	Partial Eta Squared
1	1.471	(1,14)	0.245	0.95
2	0.006	(1,9)	0.940	0.001
3	0.282	(1,12)	0.605	0.023
4	9.144	(1,10)	0.13	0.478
5	2.956	(1,10)	0.116	0.228
6	3.701	(1,11)	0.083	0.270

There were no statistically significant differences between the two levels (good Vs poor) of performance indicated by the two-way between groups ANOVA (Table 5.2.1.) The main between subject effect for level of performance across all six participants was not significant.

The second aspect of this analysis within Study three focused on the IBIs for a specific component of the PPR, an approach adopted by a number of previous studies including Boutcher and Zinsser (1990), and Hassmén and Koivula (2001). Figures 5.2.7. to

5.2.12. display the mean IBIs for the final four IBIs prior to ball strike, ball strike, and the two IBIs post ball strike for each participant.

5.2.2. Changes in heart-rate deceleration across a seven-epoch period

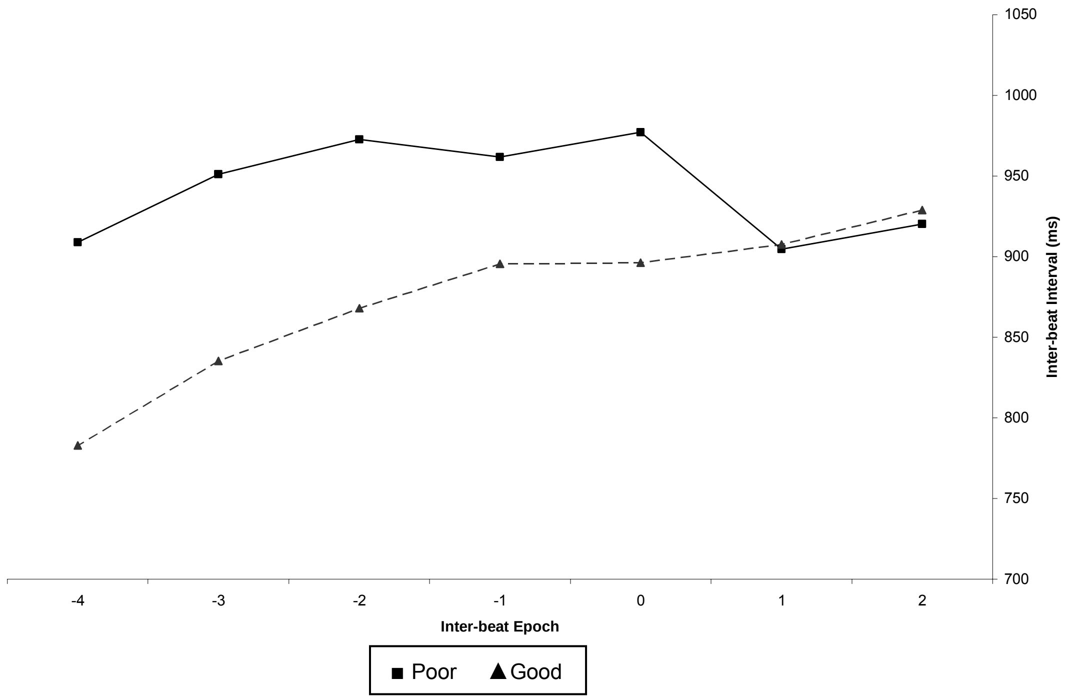


Figure 5.2.7. Mean IBIs for good and poor performance across the final 4 epochs prior to ball strike and 2 epochs post ball strike for participant one.

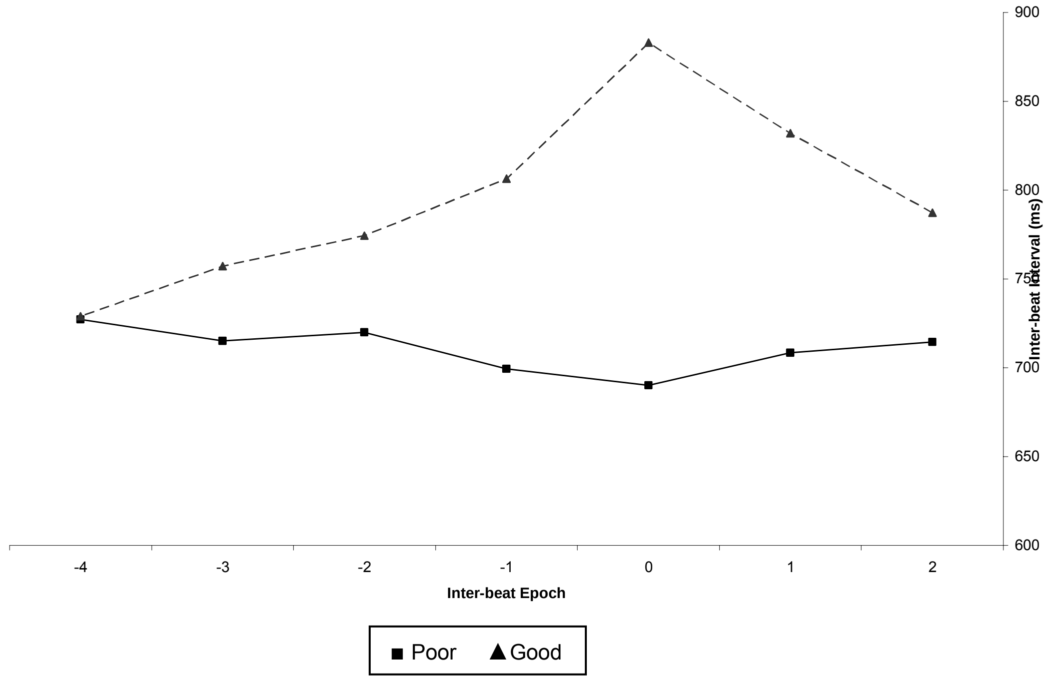


Figure 5.2.8. Mean IBIs for good and poor performance across the final 4 epochs prior to ball strike and 2 epochs post ball strike for participant two.

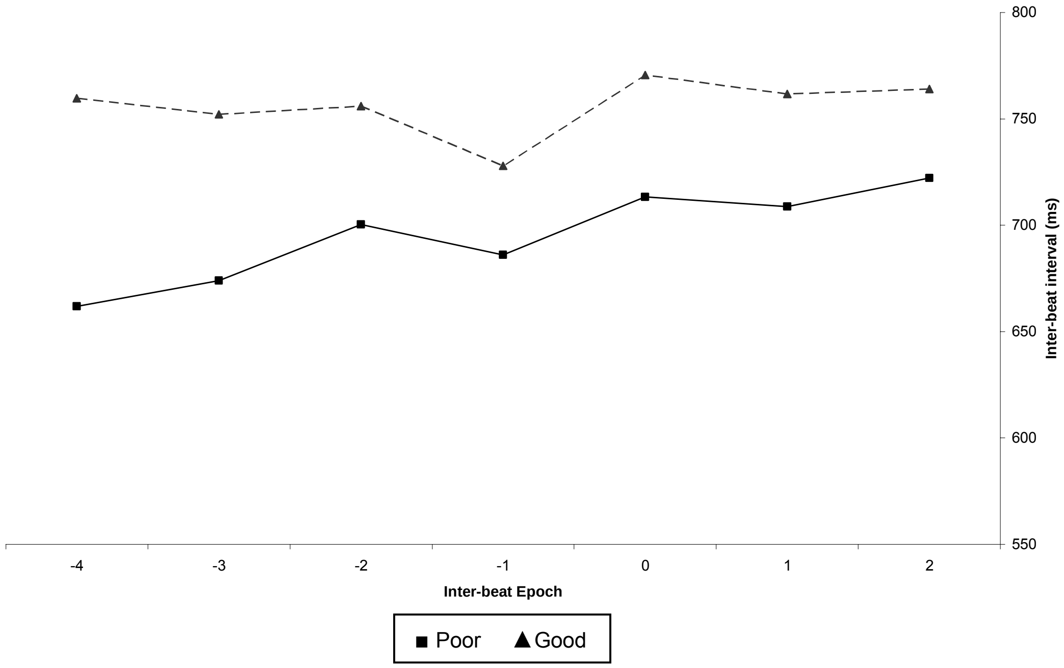


Figure 5.2.9. Mean IBIs for good and poor performance across the final 4 epochs prior to ball strike and 2 epochs post ball strike for participant three.

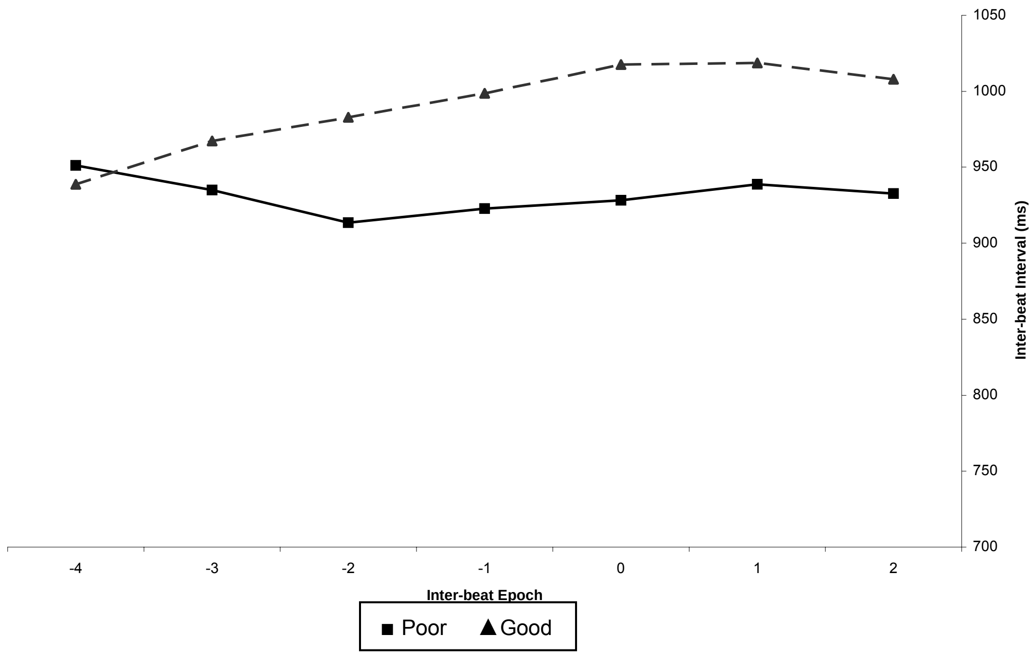


Figure 5.2.10. Mean IBIs for good and poor performance across the final 4 epochs prior to ball strike and 2 epochs post ball strike for participant four.

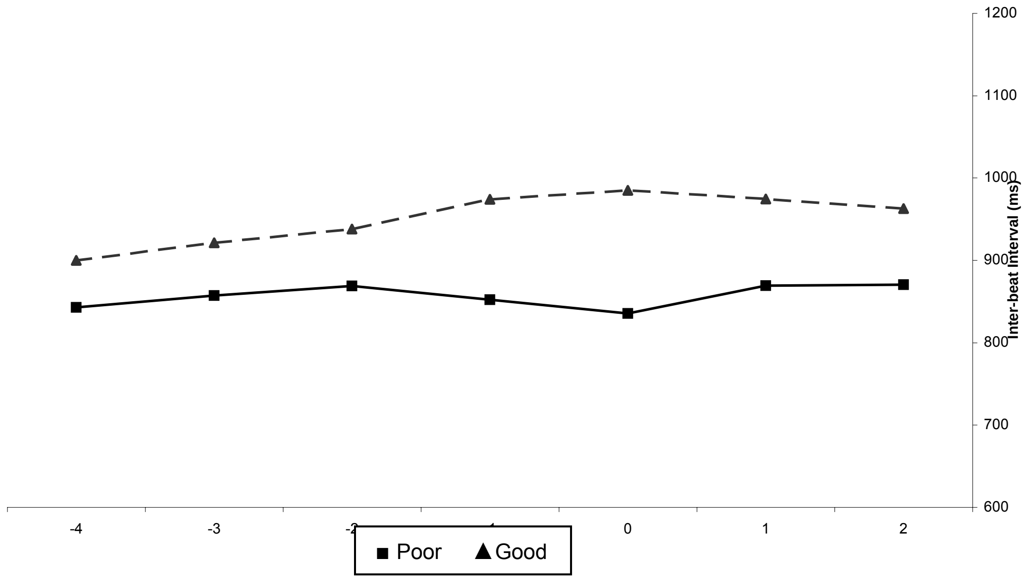


Figure 5.2.11. Mean IBIs for good and poor performance across the final 4 epochs prior to ball strike and 2 epochs post ball strike for participant five.

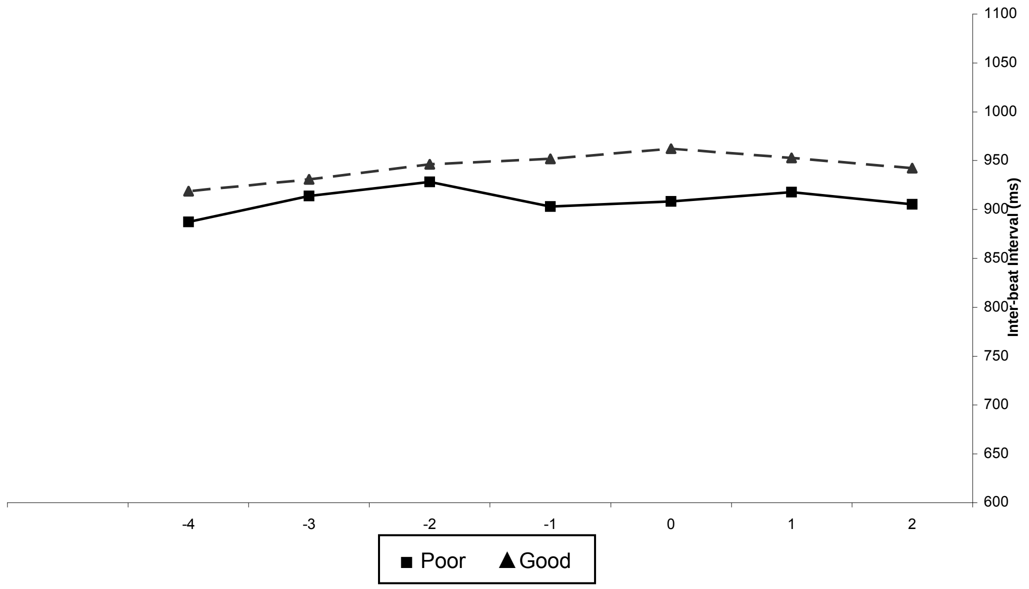


Figure 5.2.12. Mean IBIs for good and poor performance across the final 4 epochs prior to ball strike and 2 epochs post ball strike for participant six.

Again, it is clear from Figures 5.2.7. to 5.2.12. that there are visual differences between the IBI durations when comparing good and poor performance across the specified seven IBIs for all participants. Five out of six of the participants demonstrated at the crucial points prior to ball strike that the IBIs for good performance are consistently higher than those for poor performance.

Table.5.2.2. Main effect for Shot rating (good Vs poor) for the five epochs prior and two epochs post ball strike.

Participant	F Value	DF	Sig.	Partial Eta Squared
1	11.033	(1,14)	0.005	0.441
2	4.966	(1,9)	0.043	0.356
3	11.907	(1,12)	0.005	0.498
4	36.399	(1,10)	0.00	0.784
5	70.947	(1,10)	0.00	0.876
6	27.749	(1,11)	0.00	0.735

The main effect between levels of performance across all six participants for the specified seven IBI time period was significant for all six participants.

Of further interest are the effect sizes for all six participants. When compared with Cohen's (1988) guidelines for interpreting eta squared (.01 = small effect; .06 = moderate effect; .14 = large effect, all six participants demonstrate a large effect size (0.441; 0.356; 0.498; 0.784; 0.876; 0.735).

In the final analysis of Study three the duration of the behavioural components of the pre-performance routines were compared for good Vs poor levels of performance.

Table 5.2.3. Intercept data from the multivariate tests for all six participants

Participant		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
1	Pillai's Trace	.999	3240.876	4.000	11.000	.000	.999
	Wilks' Lambda	.001	3240.876	4.000	11.000	.000	.999
2	Pillai's Trace	1.000	3837.645	4.000	6.000	.000	1.000
	Wilks' Lambda	.000	3837.645	4.000	6.000	.000	1.000
3	Pillai's Trace	.999	2830.084	4.000	7.000	.000	.999
	Wilks' Lambda	.001	2830.084	4.000	7.000	.000	.999
4	Pillai's Trace	.999	1920.490	4.000	7.000	.000	.999
	Wilks' Lambda	.001	1920.496	4.000	7.000	.000	.999
5	Pillai's Trace	.999	2029.147	4.000	7.000	.000	.999
	Wilks' Lambda	.001	2029.147	4.000	7.000	.000	.999
6	Pillai's Trace	1.000	20095.19	4.000	7.000	.000	1.000
	Wilks' Lambda	.000	20095.19	4.000	7.000	.000	1.000

Table 5.2.4. Condition data from the multivariate tests for all six participants

Participant		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
1	Pillai's Trace	.187	.632	4.000	11.000	.650	.187
	Wilks' Lambda	.813	.632	4.000	11.000	.650	.187
2	Pillai's Trace	.285	.599	4.000	6.000	.677	.285
	Wilks' Lambda	.715	.599	4.000	6.000	.677	.285
3	Pillai's Trace	.120	.238	4.000	7.000	.908	.120
	Wilks' Lambda	.880	.238	4.000	7.000	.908	.120
4	Pillai's Trace	.661	3.406	4.000	7.000	.075	.661
	Wilks' Lambda	.339	3.406	4.000	7.000	.075	.661
5	Pillai's Trace	.494	1.710	4.000	7.000	.251	.494
	Wilks' Lambda	.506	1.710	4.000	7.000	.251	.494
6	Pillai's Trace	.189	.408	4.000	7.000	.798	.189
	Wilks' Lambda	.811	.408	4.000	7.000	.798	.189

Mahalanobis distances for all participants were acceptably below the critical value of chi-squared for four dependent variables of 18.47 (MANOVA assumption testing data is available in appendix C). Interestingly, the MANOVAs (see Tables 5.2.3. and 5.2.4.) indicated that no statistically significant differences existed between any of the four behavioural components of the routines within all six participants.

Also, there were no statistically significant differences if the more robust Pillai's Trace was adopted to test for multivariate differences (see Table 5.2.4. for further details of Wilks Lambada (Λ) and Pillai's Trace statistical results for each of the study's participants). These results indicate that the HRD differences identified earlier in this study are not linked to differing structure, composition or execution of the behavioural components of the PPRs. These differences then, must reflect some internal processes related to and impacting upon the successful nature of performance execution.

5.2.3. Overview of Study three results

Although no significant differences were reported between the mean duration of corresponding IBIs when comparing good and poor performance across the whole PPR, significant differences did exist when comparing good and poor performance across a seven IBI range prior to, during, and post ball strike. This suggests that there are key differences prior to ball strike between good and poor performance, this phenomenon could, at least in part, explain why good or poor performance is the end result.

The results of the final component of this study revealed no significant differences between the composition and duration of the PPRs when comparing good and poor performance. Again, this suggests that the differences identified prior to ball strike reflect internal psychological processes that impact upon the effectiveness of shot execution.

5.3. DISCUSSION

The aim of Study three was to explore the psychophysiological indicators of underlying psychological processes during the execution of a PPR. It was hypothesised that there would be no significant differences in the behavioural components of the routines utilised for good and poor shots, but that there would be significant differences between the related heart-rate deceleration characteristics for the routines when comparing good and poor performance.

Two psychophysiological indicators were explored. These indicators were heart-rate deceleration (HRD) across the total duration of the PPR within each participant and; HRD for a specific time period (4 IBIs prior to ball strike, ball strike and two IBIs post ball strike) between good and poor shots within participant; and consistency of the PPRs.

5.3.1. Cardiac deceleration between total routine duration

The main between subject effect for the 2-way between groups ANOVA (Table 5.2.1.) for level of performance across all six participants identified no significant differences for good Vs poor shots. The mean values of IBIs for good and poor performance (Figures 5.2.1. to 5.2.6.) differ for individual epochs over the total duration of the PPR but the effect for the overall routine is not significant. Examination of the curves for good and poor performance offer different profiles for each level of performance. These differing profiles may reflect differing psychological strategies or different temporal application of psychological strategies between the two sets of performance data. Alternatively, this could also reflect a specific profile for good shots with poor shots simply not fitting this profile. Whatever the explanation, the key point here is that the HRD profiles for good Vs poor performance do not demonstrate statistically significant differences over the total duration of the routine. The next step then is to explore the period prior to, during and post ball strike which has been identified in prior studies as a critical period in the execution of successful performance.

5.3.2. Cardiac deceleration between routines prior to during and post ball strike.

Comparison of the seven-epoch period (4 prior to ball strike, ball strike and 2 post ball strike) between good and poor performance (Figures 5.2.7. to 5.2.12.) revealed differences between mean IBI values.

The mean IBIs for good shots across this seven-epoch ball strike period for almost every IBI were longer that the mean values for poor shots. The main between group effect for level of performance for the specified seven IBI time period was significant for all six participants, all of whom also demonstrated large effect sizes.

These differences in HRD between performance levels are similar to the results of related studies. Boutcher and Zinsser (1990) reported significantly slower IBIs when comparing the IBI prior to ball strike, ball strike and the two post ball-strike IBIs for both 4-foot ($t\{14\} = 2.20+$, $p<.05.$), and twelve-foot putts ($t\{14\} = 2.20+$, $p <.05.$) for elite Vs non-elite players. This suggested that increase in HRD is an observable characteristic of good performance. Radlo et al (1992) specifically focused on level of performance, comparing the four best and four worst shots for four epochs prior to dart release, finding that the good shots were significantly different from the bad shots immediately prior to dart release. Carlstedt (2004) also found differences in HRD when comparing games won Vs games lost in a tennis case study. Games won were characterised by higher mean IBIs when compared to games lost indicating greater HRD.

There is then, clear evidence that differences exist between good/successful performance and poor/unsuccessful performance. However, the crucial question is whether or not these differences just reflect differences in pre-performance / performance behaviours, or exclusively reflect differences in internal processes.

5.3.3. Pre-performance routine composition, duration and IBI differences between good and poor performance.

The temporal analysis of the behavioural components of the PPRs comparing good and poor performance using a within participant MANOVA (see Tables 5.2.3. and 5.2.4.) interestingly, identified no statistically significant differences between any of the four behavioural components of the routines within all six participants.

These data indicate that for this study, and these participants in particular, the key difference identified via the HRD data for good and poor performance is not due to differences in the composition and/or the execution of the PPRs. Different behaviours or approaches to the execution of the PPRs comparing good and poor performance could place differing demands on the cardio-vascular system and/or the sympathetic and parasympathetic nervous systems. All of these could impact upon the characteristics of heart-rate and subsequent HRD. As a result, the lack of a significant difference in this data allows other factors that control HRD to be explored.

A very plausible factor that could cause these differences between good and poor performances could be the internal manipulation of HRD. This is supported by the findings of this study which highlighted significant differences in HRD characteristics but no significant differences in behavioural execution of the routines. Indeed researchers including Boutcher and Zinsser (1990), Obrist (1981), and Carlstedt (2004) have concluded that HRD (represented by increased IBIs) reflects attentional processes. Boutcher and Zinsser (1990) suggested that the greater cardiac deceleration of elite golfers compared to beginning golfers may have been "brought about by dissimilarities in attentional focus" (p.45), while Obrist (1981) suggested that HRD may be a result of reduced muscle tension and lower metabolic activity that accompanies a specific attentional focus. Carlstedt (2004) suggested that "heart activity can be viewed as the window into mind-body interactions" (p.118), further concluding that HR, and more importantly variation in HR has been shown to be an important measure of attention and cognitive activity. This is further supported by Sandman et al (1982) who concluded that HR and blood pressure (BP) were the physiological parameters that best differentiated the cognitive-perceptual process.

This link between HR and cognitive activity has been explained on the basis of brain-heart interactions where HRD has been found to release the cortex from the inhibitory control of the baro-receptors, conversely, HR acceleration (HRA) has been shown to stimulate baro-receptor activity and thereby inhibit cortical activity (Carlstedt, 2004). Indeed, HR and BP are thought to inhibit cortical activity, thereby decreasing attention, whereas HRD and lowered BP are thought to facilitate attentional processes (Lacey and Lacey, 1978; Sandman et al, 1982). EEG studies have confirmed this link between HRD and increased cortical alpha activity. Crews and Landers (1993) have further correlated measures of alpha activity with performance, identifying greater power in the left hemisphere as being a differentiating factor between best and worst performance for marksmen and archers. In a case study of a 16-year old tennis player, Carlstedt (2004) found that differences in HRD existed when comparing games won Vs games lost. However, Carlstedt also concluded that no studies had really explored the psychological processes that occurred during the pre-performance and performance periods. Preliminary self-report data presented by Carlstedt suggested that the tennis player was more nervous, less motivated and crucially less attentive during the poor matches. Indeed, an attentional switch from external sport-specific tasks to disruptive (internal) cognitions was reported. This contrasts with the “optimal focusing” (p.135) identified by the participant for the best games.

As a result of these differences in HRD between good performance and poor performance, and the link between HRD and attentional processes, there is a clear need to understand what internal processes are utilised by the golfer during the execution of the PPR and which of these are enduring (always used) and which are transient (more situation specific). Just as importantly, investigation into psychological phenomena present during good and poor performance will allow the development of specific routines to either reproduce or prevent certain situational reactions. The ability to reproduce the internal conditions required to re-create the mental focus achieved during good performance may ultimately provide the answer to the real function of PPRs and unlock the door to the effective implementation of them in the future.

Electroencephalography as a measurement tool of psychological processes, although providing excellent temporal resolution, suffers from the restrictions on movement and ecological validity caused by the required electrodes and cabling. There is also the real issue of current limitations in understanding how cortical electrical activity (location, power, frequency etc) links to specific psychological phenomena. HRD, although less invasive and more applicable to a real sporting context can only provide an indication of attentional differences as measured by changes in IBIs. No real link to specific psychological strategies or techniques can be inferred. The impact of thoughts, feelings, emotions and past experiences on these psychological strategies can also not be measured. The only effective way to achieve this understanding at present is to ask participants about their experiences throughout the performance period. *A*s a result a qualitative approach that advocates the importance of performer thoughts, feelings and experiences is required to further explore the PPR from the perspective of the individual performer.

Chapter 6

STUDY FOUR

6.1. Method

6.1.1. Aim

The aim of study four was to explore the psychological strategies utilised by golfers during the execution of their PPRs, in particular, if the participants perceive there to be differences in the strategies used and approach adopted for highly successful and less successful performances. An initial pilot study was carried out to test the research design and interview structure (Appendix D).

6.1.2. Participants

The participants in this study were six male elite golfers recruited to participate in this study through contact with a national golfing union (handicap M=+1.5; Age M=29; years playing golf M=16.25). All participants were of a similar standard.

6.1.3. Procedure

Each participant was videoed playing a competitive round of golf. Participants completed a full round on the 18-hole par 71 Brickhampton Court Spa course in Gloucestershire playing in pairs with other participants within the study. The video was then edited to produce three distinct sets of video clips. The first contained examples of the pre-performance period for shots involving the putter, the second set of clips for shots involving the driver, and the third set of clips contained examples of shots using the wedge. These video clips were then used to provide specific examples of the behaviours that occurred during this period which were the focus of the study, and to enhance the golfers' recall of the situation and as a result the associated psychological processes and strategies that were utilised at that moment in time. All interviews took place within twenty-four hours of the video data being collected.

The golfers were interviewed individually to gain an understanding of the psychological strategies and processes they felt they used or experienced whilst performing their PPRs. All the interviews were recorded and transcribed verbatim to produce an accurate record of the interviews. The interview transcripts were then returned to the participants to check the accuracy of the transcription process. Interpretive phenomenological analysis was then used to explore the issues and meanings that were apparent from the participant's interviews.

6.1.3.1. Interview structure

The use of interviewing has formed the cornerstone of qualitative data collection in sport psychology (Biddle, et al, 2001). Indeed Smith and Osborn (2003) stated that:

> "although a number of different data collection techniques could be utilised with interpretive phenomenological analysis the best way to collect data has been with the use of semi-structured interviews" (p.55).

Thus, the semi-structured interview approach was adopted for the current study.
The interview schedule that underpinned the interview process was constructed utilising the suggested guidelines published by Smith and Osborn (2003). Smith and Osborn identified the following steps to creating an effective interview schedule:

1. "Having determined the overall area to be tackled in the interview, think about the broad range of issues you want your interview to cover.

2. “Put the topics in the most appropriate sequence”.
3. “Think of appropriate questions related to each area in order to address the issues you are interested in”.
4. “Think about possible probes and prompts, which could follow from the answers that might be given to some of the questions”.

(Smith and Osborn, 2003, p.57-59)

The resulting sequence identified for this study was as follows:

1. How consistent do you feel your pre-performance routines are?

Prompts: time and structure, practice Vs competition.

2. What are you thinking about during each of these stages?

Prompts: golf vs. external, task requirements, psych strategies.

3. What function do you think your pre-performance routine fulfils?

Prompts: physical vs. mental.

4. Do you use any specific mental strategies whilst executing the behavioural components of the routines?

Prompts: attention / distraction links, other strategies.

6.1.4. Data analysis

The data collected via the interview process was analysed with the use of inductive content analysis. Content analysis was used as a tool to “organise the raw interview data into interpretable and meaningful themes and categories" (Scanlan et al., 1989, p.68). The organisation of these data involved two specific steps. First, the raw data had to be assigned tags. These tags of data were then organised into categories from which a structure to the data could be developed. An outline of this process is provided in Figure 6.1.

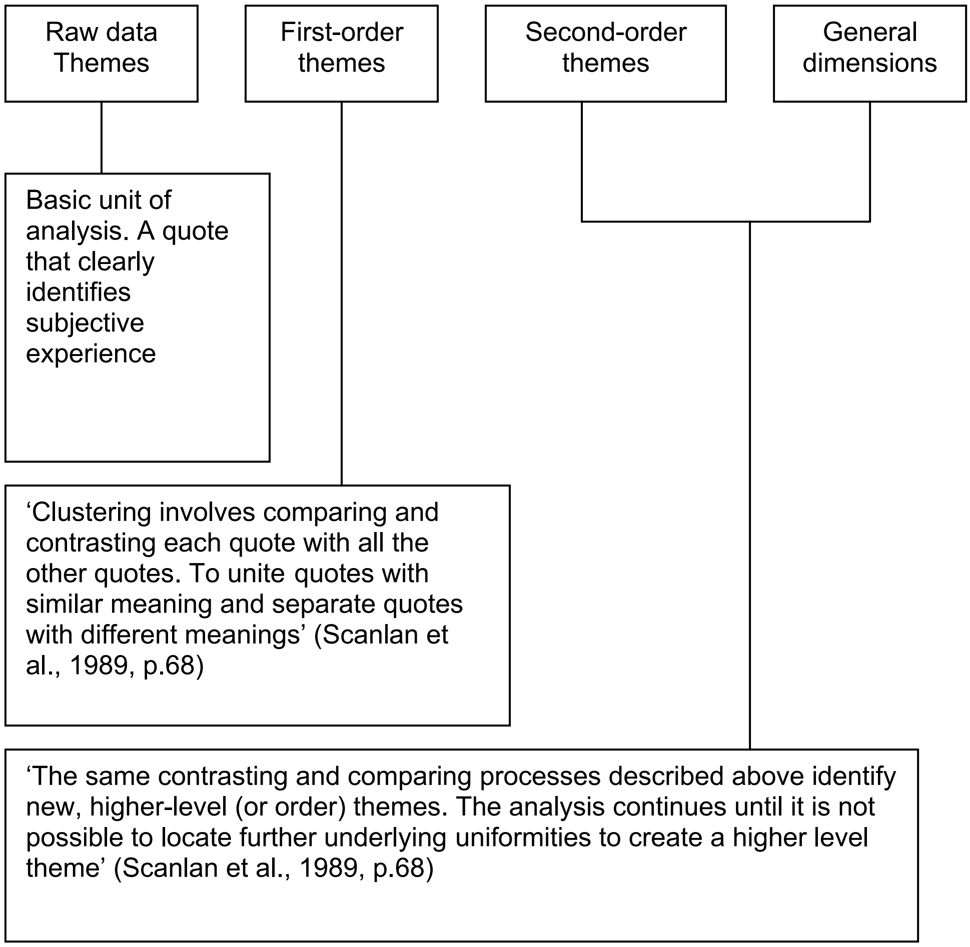


Figure 6.1. The structure and rationale for the process of content analysis (Biddle et al., 2001, p.797).

6.1.4.1. Creating tags

Tags were created that represented the information contained in the interview transcripts. Adopting an open coding strategy (Strauss, 1987) meaningful 'pieces' of information were identified. These ‘pieces’ of information are referred to as meaning units, which were defined by Tesch (1990) as “a segment of text that is comprehensible by itself and contains one idea, episode or piece of information” (p. 116). Each meaning unit was then tagged with a provisional name that described the content. This process also served the function of separating relevant portions of data from their specific context, essentially de-contextualising the information (Cote et al., 1993).

6.1.4.2. Creating categories

The second step of the analysis was to create categories, where tags with similar meanings were gathered together under a label that captured the substance of the topics. These categories then reflected the cluster of tags underneath them in the hierarchy of data (Miles and Huberman, 1984). This step served to re-contextualise the information into distinct categories, which then served as a preliminary organisation system.

From these categories and their relationship to each other a framework for the presentation of the data was created. This framework identified levels of information and its relationship to other categories of the same or a different level. The data were then displayed in a tree diagram format that demonstrated the interrelationships of the data.

6.2. RESULTS AND DISCUSSION

The inductive content analysis of the interview data identified a number of distinct categories that were then re-organised to provide a specific structure. In total, nine first-order categories emerged; allocation of attention, psychological skills, shot selection, routine mental states, routine composition, compulsive behaviours, routine use, top pros and influencing factors.

Twenty second-order categories emerged with links to the first order categories above, with a subsequent thirty-seven third-order categories emerging below. These are detailed in Figures 6.2.1., 6.2.2., and 6.2.3.

The nine first-order categories that emerged (allocation of attention, psychological skills, shot selection, routine mental states, routine composition, compulsive behaviours, routine use, top pros and influencing factors) will be used as the basis for the discussion of study four. Relevant quotes will be utilised to further inform the participant's thoughts, feelings and perceptions regarding their use of PPRs in golf.

Figure 6.2.1. Categories emerging from the analysis of the semi-structured interviews

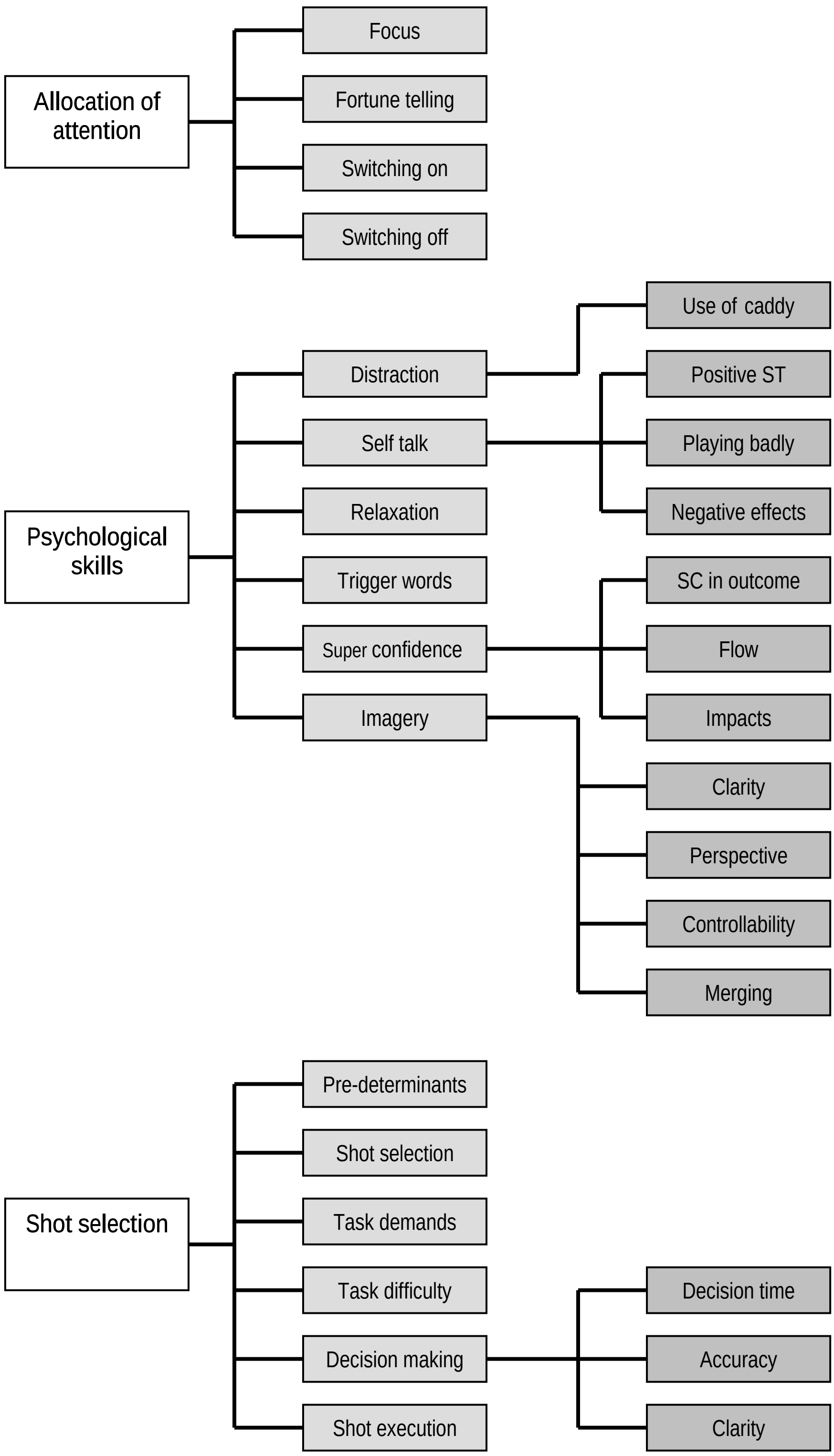


Figure 6.2.2. Further Categories emerging from the analysis of the semi-structured interviews

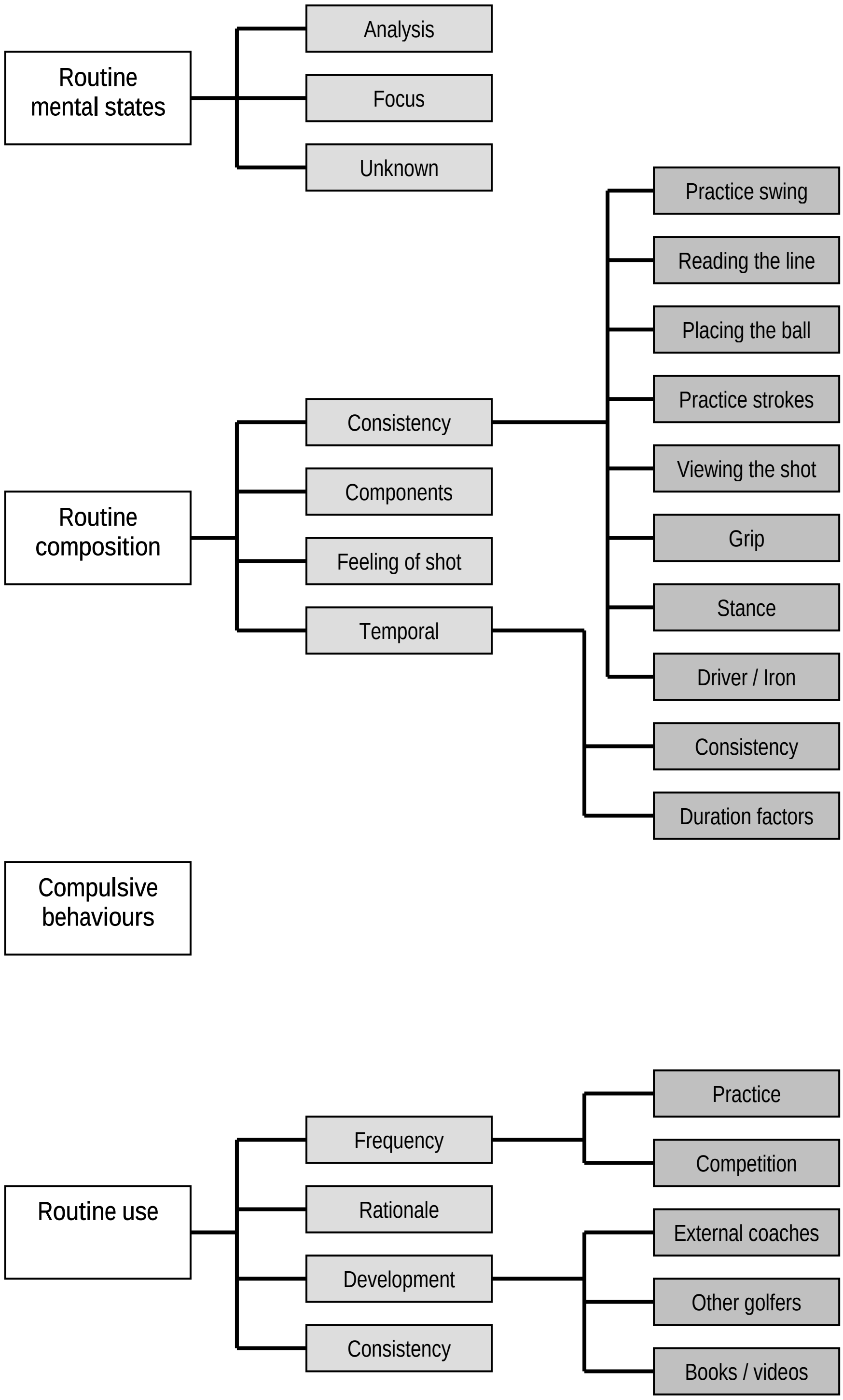
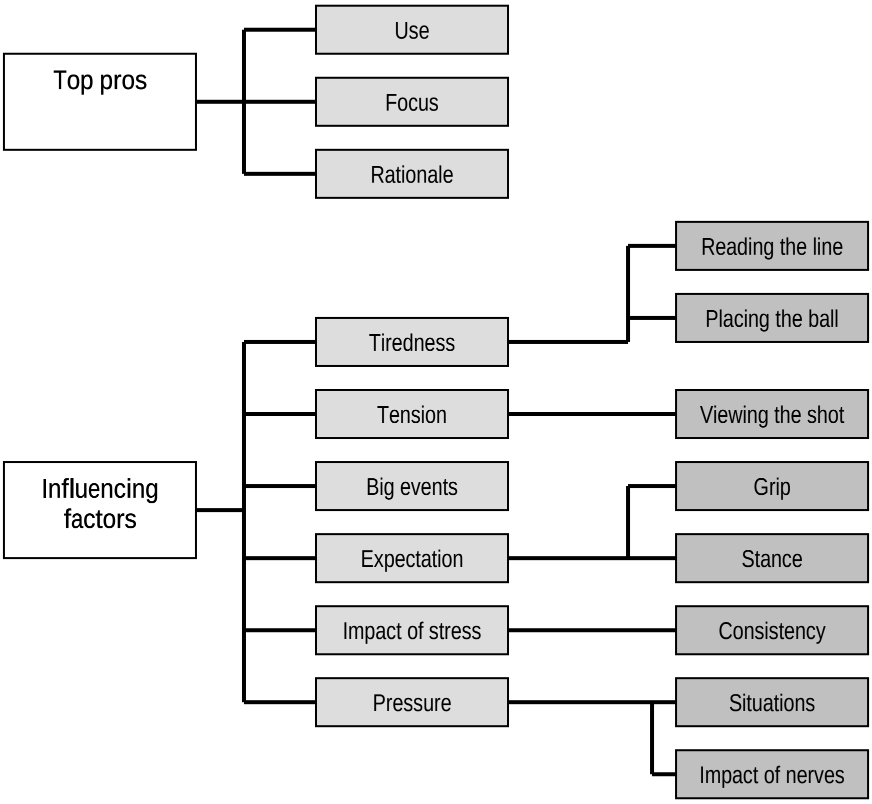


Figure 6.2.3. Final set of categories emerging from the analysis of the semi-structured interviews



The aim of this final study was to explore the key psychological strategies and skills utilised by golfers during the execution of their pre-performance routines, in particular, to explore whether there were perceived differences in the strategies utilised or skills implemented to achieve successful performance.

Nine major categories or topics emerged from the inductive content analysis of the participants' interview transcripts. These nine categories included; allocation of attention, psychological skills, shot selection, routine mental states; routine composition; compulsive behaviours; routine use; top pros and influencing factors.

These categories provided an insight into thoughts, feelings, states and strategies associated with PPR execution. These nine emergent categories have been used as an initial structure for this part of the discussion.

6.2.1. Allocation of attention

The first major category that emerged from the interpretive phenomenological analysis was related to the allocation of attention. Participants' responses indicated that a key issue when playing golf was the question of focus. Further, participants identified two specific components relating to focus, firstly that there was an issue regarding when to 'switch on' and when to 'switch off' for the current shot. Secondly, and linked to the first issue was the notion of staying focused on the present and not dwelling on the past or getting ahead of themselves and engaging in 'fortune telling'.

The issue of developing a focus prior to shot execution appeared to be a key component in the allocation of attention for the participants. When asked what their focus was during the execution of their PPR there appeared to be individually specific approaches cited by the studies participants including:

> On the actual putt itself, its erm the only thing that I am focused on is one on the back swing and two on impact. On the putt I don't hold an image of the hole or the line that I am going to send the ball on in my mind. (P5)
>
> I try to concentrate on not changing my mind, so if I miss the putt, I miss the putt I can't do anything about it, but if I hit a bad putt then that's when I get annoyed with myself more than anything, don't change your mind, stick to your line and hit it, and away you go, if it hits, it hits, if it misses, it misses! (P2)
>
> club comfortable in my hands erm . . . and the main again . . . I suppose the alignment of the club is hugely important. If I feel comfortable with that

> and everything else just seems to fall into place. So again, the actual alignment is my focus. (P1)

Indeed all the participants agreed that having a specific focus was crucial in determining their ability to execute the shot correctly. An incorrect focus was highlighted as having a negative impact on performance. One such example given was the idea of fortune telling or getting ahead of yourself on the course.

> Yeah, when I am concentrating poorly I sometimes start thinking right, when I get to the sixteenth I am going to need to do this, but the sixteenth is still three holes away. (P6)

This idea of not staying in the present was seen as something that was detrimental to performance, and as such should be avoided.

As previously mentioned, an important issue relating to focusing during the round of golf in general, and relating to PPRs in particular, was when to switch on and when to switch off, and more importantly the ability to do it effectively.

> I don't think that I am thinking about my pre-putt routine or the putt until I walk onto that green, definitely not when . . . if I have hit the ball on the green from a hundred and fifty yards I won't be thinking about it then, I won't be thinking about the putt until I can see the contours of the green and you know the way that the grass is lying, you know whether the conditions are damp or dry, it is something, putting, because it is so fine . . . you know like it is not like you are trying to hit a big white target, it is a very small target, I don't think it is something you can really start thinking about until you can see everything around you, you can see all the details. Some people might, some people might be thinking about it from far away but I tend to in between shots distance myself from golf, try thinking about something else, not getting too intense and start losing my concentration, so I try and keep my concentration for the actual moment. (P4)

In the majority of cases participants felt that their 'switching on' cue also signalled the onset of their PPR.

> Yeah! . . . I can be walking down the fairway laughing and joking with my friends then standing behind the putt with everything else blanked out, it's like walking into a room and closing the door. (P3)

The perceived importance to the participants of the PPR as an aid to focusing at least in part supports the stance of numerous authors who advocated this key attentional focusing function of the PPR (Boutcher and Crews, 1987; Boutcher, 1992; Harle and Vickers, 2001; Weinberg, 1988). Each of these authors adopts either a concentration or distraction focus, both of which clearly suggest that a key and possibly fundamental role of PPRs is to provide a specific focus to which attentional resources can be allocated. This is further supported by psychophysiological data which clearly differentiate between level / type of attention and successful / unsuccessful performance.

6.2.2. Psychological skills

A key focus of this study was to gain an insight into the psychological skills utilised by the participants both during the pre-performance period and more specifically during the execution of the PPR. Six main skills emerged from participants as being frequently utilised during the pre-performance period. These were distraction techniques, self-talk, relaxation, trigger words, super confidence / flow and imagery. Interestingly not all of these techniques or skills were utilised by all participants, reinforcing the notion of individual differences in the selection of psychological skills or required outcomes from the implementation of the skills.

The first of these skills, imagery, was clearly identified as a very important psychological skill for all of the participants. Specifically, discussions centred on four aspects of imagery skill usage; clarity; perspective; controllability; and the merging of the real environment and the imagined one. A key finding here, and one that is possibly to be expected, is that all six participants appeared to differ in their specific focus for their imagery, also experiencing differences in perspective, controllability, and the merging of the environment and the image.

> Definitely yeah, when I am behind the ball, all I can see is the ball going towards the hole. Erm . . . I always see ****** . . . I always imagine him taking the putt. Absolutely . . . I have done that for about three or four years now, and every single putt stand behind it, just imagine he is there, putting that ball into the hole, putting it in, and sometimes feel it as well, but actually watch the ball go into the hole, watch it on its whole path into the hole. (P3)

> Erm . . . when I'm . . . say when I line-up a putt I try and very much see it point for point how the ball goes in, with my eyes open, and I try and focus on how I imagine the ball to go in the hole sort of thing. When it comes to my routine when I stare at the hole I don't see it leaving the putter and going all the way I just see the last inch before the hole. (P2)

> No, I actually see it in the environment, and actually . . . whether or not I am actually seeing the ball I . . . there is that vision of seeing the ball in the environment and I'm manipulating it where I want it to go and where I want it to land. (P1)

These findings reinforce the importance of imagery usage during the pre-performance period, supporting Hall, Rodgers and Barr's (1990) assertion that imagery usage prior to performance is crucial. However these findings do contradict Jackson and Baker's (2001) case study data which indicated that the psychological skills utilised by the performer were very transient and dependent on specific task requirements. Here at least there exists evidence that some psychological skills might be utilised more consistently than others. Imagery for all six participants was an enduring psychological skill that they implemented on every occasion and for every shot. It was their individual application of the skills that differed between participants. All participants reported that the use of imagery was a key component of their routines, but they all identified different levels of controllability, vividness of the image, merging of reality and the environment, focus and even perspective.

The second major psychological skill identified as a key component within a number of participants' routines was self-talk (ST). Participants generally were aware of their internal dialogue and the need to control it. Three real responses to ST emerged. The first actively looked to exploit ST's potentially beneficial effects on mood state (Hardy, Hall and Alexander, 2001) and motivation (Theodorakis et al (2000). The second approach looked to manage or deal with negative ST with a range of restructuring techniques. The third and final approach involved 'buying into' the comments in order to promote more extreme responses.

> No, I sometimes say to myself 'you are going to get this one' erm, sometimes gee myself up with a few little positive prompts and phrases, but I don't have a lot of internal dialogue really Like that. I usually find that I play quite well erm, when I am just really just, shall we say, cruising through it really, and just giving myself very simple things. A lot of the time it's just not golf related, I will just be sometimes looking at the view, you know just taking in my surroundings really. Erm, and sometimes I will say to myself 'that's a lovely bit of scenery' or whatever I will sometimes acknowledge that to myself, erm very . . but sometimes it is nothing to do with the actual playing of the game. Or where I am or what I have got to do and things like that. I try not to get too involved. (P1)

> There are times when I really have to gee myself up . . . you know get myself motivated, say things like come on, you know you can do it, or this is it, its time to perform, you need to think like a winner, when the going gets tough . . . that sort of thing! (P5)

However, participants also recognised that the impacts of negative irrational situation evaluations could be catastrophic to their performance.

> . the inner mind telling me I am crap is the one that affects me . . . I don't know, maybe I am contradicting myself a little bit but . . . (P2)

The first approach identified here clearly suggests that the use of ST was to reduce the amount of unrelated thoughts occurring through execution of the task prior to ball strike (Hatzigeogiodis et al (2004). However, this specific application of ST as a deliberate cognitive strategy was not the case for the majority of participants. Indeed the issue here regarding ST which Hackfort and Schwenkmezger (1993) concluded was a "dialogue in which the individual interprets feelings and perceptions, regulates and changes evaluation and convictions and gives oneself instructions and reinforcements" (p.355), is not necessarily that it occurs but rather how aware the participants were of what they are saying and its impact on performance. Essentially, meta-cognition issues relating to ST. The participants perceived that using positive ST alone, or using it to counter negative ST, helped their performance. This is however not necessarily backed up by the research. There is laboratory-based research that advocates this beneficial effect of positive ST (Van Raalte et al, 1995) but the field-based research has proven to be far more ambiguous offering support for the positive effects of both positive and negative ST as well as neutral effect of positive ST. The rationale for the beneficial effects of positive ST, in the literature at least is clear. Essentially that it provides instruction and a source of motivation (Theodorakis et al (2000). This usage to provide instruction could again be linked to the participants need to prescribe a specific attentional focus to reduce the risk of attention being captured by sporadic events or stimuli. What emerged from this study was that deliberate ST was a useful pre-performance tool implemented by some, but not all, of the participants. Negative ST was seen as a hindrance and in some cases strategies were developed to consciously avoid it. This then offers some support to Jackson and Baker's (2001) rugby case study suggestions that some psychological skills are transient in nature.

Linked to the concept of ST, participants were aware of the need for specific, consistent thoughts that could give them a consistent, specific focus during performance, stopping them focusing on specific aspects of their technical execution, and also to deliberately allocate attentional resources.

The use of trigger or rhythm words was a simple technique that was used by the participants in this study to deal with these issues to achieve this.

> I then step in, and set up and one-two, I just think one-two, one-two, the words occupy my mind, while the rhythm is timed for my back swing and forward swing. (P1)

In discussing trigger words with one of the participants, there was no really specific 'constant thought' strategy, which he felt that this at times could hinder his ability to perform.

> Not really! I erm . . . when I am stood over the ball I don't . . . I know that . . . I tell myself off about it really . . . sometimes I can be over the ball for about twenty seconds thinking 'are you going to hit it? Are you going to hit it?' and then that makes it even worse, and I am stood there for even longer . . . this happened recently, and I don't hit it until something inside tells me to hit it. I don't think about 'let's take it away now' it just happens. (P3)

Williams and Leffingwell (2002) suggested that ST as a cognitive self-regulatory strategy might serve to enhance concentration skills. Indeed work by Landin and

Herbert (1999) with tennis players found that players using trigger words attributed their improved performance to enhanced concentration on court. Hardy, Gammage and Hall (2001) also found that athletes used trigger words for such a mastery reason as staying focused. However. Moran (2004) concluded that no published research could answer the question as to whether ST improves athlete concentration, but that ‘positive or instructional self statements could enhance attentional skills by reminding athletes about what to focus on in a given situation’ (p.127).

Achieving a super confidence or flow state was identified as being key regarding how the participants were ultimately going to play. Participants felt if they could achieve their super-confident state then performance would be easy. They would be able to play the ball with maximum certainty and have unwavering confidence regarding the outcome.

> . . . when it is clear as bells I know I am going to hole it, I can see the ball going into the hole with my eyes wide open in the front of my head, I can see the ball going into the hole. And if it is really really clear, then I am confident (P2)

> Err . . . you get the feeling, everybody has it, you get the feeling just like a twelve-footer that is going right to left and you think this is absolutely definitely going in, but I would still go through everything, but while I was going through everything I would be really confident going through everything. (P3)

Also identified by the participants were characteristics associated with this flow state. Achieving a flowing or flow state was identified by all the participants as crucial to their best performances:

> and . . . when I know my body is in the right position I know the putter is going to swing in the right position as well . . . my arms are going to fit perfectly into the swing and everything . . . it flows! (P3)

> I can guarantee you that when I play my best golf I am you know fully focused . . . playing quality, quality golf I couldn't tell you what I was thinking . . . I couldn't . . . I couldn't even remember half the golf shots because I was just there, I was in the 'zone' I hit the shot, I walked on, I hit the putt, I was fully confident and that was it, I could tell you half the thoughts I had when I shot terrible scores but, you know because I am just so conscious of what I am doing and why I am out here sort of thing but, its weird! (P2)

There therefore existed for some participants a desire to try and recreate the factors that contributed to this ideal performance state. Indeed from this perspective it could be argued that the PPR was simply a case of following the same steps to try and recreate the same successful outcome, which in this case was a flow-like state. Indeed there was a realisation that if they could not achieve this performance state then at least by following the same steps they could get as close to it as possible.

> Ok, well if I do the same things as before I am more likely to achieve the same result aren't I? It's a question of process if I reached the right state once I can do it again . . . just follow the same steps . . . do the same things! (P6)

Adopting this perspective, the ultimate goal of the PPR would be to achieve the 'optimal and positive psychological state' as identified by Csikzentmihalyi (1990). The key factor suggested by Csikzentmihalyi which ultimately determined whether performers entered the flow state was attentional focus. As a result the deliberate manipulation of attentional focus appears to be a key strategy used by the participants in trying to achieve this ultimate flow or super-confidence state. Further then, it follows that in using a PPR to manipulate the attentional focus, to achieve this flow state the key or dominant function of the PPR must be related to the allocation of attentional resources to adopt the correct focus.

Specific relaxation techniques were utilised by a couple of participants in this study, but not the majority. The use of these specific relaxation strategies was relatively transient and only utilised to reduce event-related stress. The use of deliberate distraction techniques was also cited by a couple of participants as something they use to stop them dwelling on irrelevant or non-constructive thoughts or issues. In particular the use of the caddy as a source of distraction was highlighted as a crucial tool.

> whenever I play in tournaments I need a caddy, and it's not to carry my bag, its not to give me the club, it's someone to talk to. Because if I'm out there . . . European Pro qualifying I was by myself for two days, I had six hours wait and before I had even teed up on the first I knew I had lost because I had had so much time by myself to worry and to think about what other people think . . . before I had even teed off I had already made excuses in my head about what I was going to tell people about missing the cut, and I couldn't help it, I was trying to tell myself you know 'shut up', and my two playing partners were very very focused, they were not chatty, where as me as a golfer I need someone to talk to, just . . . not that I am nuts or anything like that, but it just takes my mind off it, if I am just by myself all I have got to think of is golf and that . . . I do struggle . . . I appreciate having a caddy with trigger words to take my mind off . . . because I am very much . . . if I am playing with people I can have a giggle with, brilliant, I am generally quite relaxed, but erm, when it comes to tournament golf and my playing partners aren't very chatty, I get really uncomfortable, which is wrong I know I should be comfortable in my game, but, to actually sit there and think about golf for four-and-a-half hours non-stop, is just a nightmare, you can beat yourself up over one golf shot that you hit two-and-a-half hours ago, and it will come back and you know, appear in your head, and it is trying to throw those thoughts out of your head and thinking 'no, I am going to just look at the trees' you know, and it is just so difficult to do. (P2)

The use of disengagement techniques (Giacobbi, Foore, and Weinberg, 2004) was identified as a key coping strategy for the golfer on the course. So the deliberate adoption on this strategy outside of 'routine' time makes complete sense in this study.

Beilock et al. (2002) further advocated the use of disassociation strategies during the PPR that prevented performers focusing on skill execution. The rationale was that attention to specific components of skill execution “may become counter productive as practice builds an increasingly automated performance repertoire” (p.8). Indeed Masters, Polman and Hammond (1993) further suggested that attention to actual performance execution of high-level skills results in their breakdown. So again, achieving the right attentional focus to enable optimal performance appears key.

6.2.3. Shot selection

Shot selection was identified as a key decision-making component of the pre-performance period. Some participants considered this decision making component as an integral part of their PPR, while others classed it as a separate component prior to the initiation of their pre-shot routine. Either way their ability to make a clear decision on the correct club and the way to play the shot were identified as crucial. A number of factors were identified that impacted upon the participants ability to make these decision in a clinical manner. These included the task demands and task difficulty; the actual decision making component; the type of shot to be played; and the pre-determinant characteristics of that shot. With this final point participants felt that if they had played the hole before and played it successfully they already had a template from which to achieve success.

> Yeah, definitely, because you have been there before, if it is say a course that you are a member of, and you play every week, you will probably find that a lot more . . . even so on courses you don’t play you still have those where you sometimes think ‘I know I can hole this’, like when we were doing our putting in the gym there were a couple of holes where I thought

> ‘I just know I am going to walk up to this and it is going to roll across that hole on the floor, and its . . . it did as well, that’s the . . . usually when you get that feeling to usually does just go in. (P4)

The task demands were a crucial component of the shot to be played. Participants acknowledged that there are obvious and easy to see physical characteristics of the shot such as distance etc, but this was also coupled with less obvious physical characteristics that need to be factored in including the wind speed, wind direction and the break of the green. Also, there were the internal components of the demands for the task, which were controlled by the golfer. These specifically include how risky or safe the participant was willing to play the shot in relation to the shot they would of be left with.

> sometimes you could walk up to a forty-footer and you know instantly that it is going to be, you know two, three, four, five inches off the right and it’s easy to just go from there really, erm other times it’s just . . . yeah a definite yeah, it’s the severity and difficulty of the putt that . . . sometimes you know for a fact that the best you are going to be able to do is to get the ball within, say five feet from say forty feet, depending on where you are on the green. (P4)

> So what I sometimes work out is where I would actually like to miss it from, so do I want to leave myself . . . I would rather leave myself . . . rather than worry too much about getting it as close as I can . . . I know it is not going to be possible because the slope, so I am better off say going five feet past the hole than five feet short, or even eight feet past the pole rather than three or four feet short, because at least that is going to leave you an uphill putt, and that is going to be easier coming back than the one that you could leave yourself if you hit it a little bit too cute. (P1)

Key to this is the participants’ ability to make a clear decision regarding the execution of the shot. In the majority of cases this is not a problem, but not being able to make a definite decision the participant feels is correct can then impact upon their performance.

> Yeah, obviously the harder the shot . . . for me its not about reading lines, I have never been A, very good at it and B I can’t . . . make something too

> difficult, if its too difficult . . . I am a simple bloke, but the thing I try and concentrate on is seeing how the ball . . . not seeing the line. . its just, I look at it and think that's just how I imagine the ball to react as it goes across the surface, I use that as my guide. (P4)

> I want to be able to stand there. Look at it, see where the ball is going to go, see how it is going to react and then I can hit that putt confidently. If I can't that's where I struggle, if I can't see a break, or I can't see it straight, then that's where my routine kicks out sort of thing I will try to stick to it, but I am consciously trying to stick to it, and as soon as I consciously try and do something I find it harder, and immediately you start thinking I didn't do that right and start analysing stuff.(P2)

6.2.4. Routine mental states

Three specific aspects of the mental state associated with the routine emerged. Firstly, there was a recognition that when things went well it was very difficult to remember exactly what went well.

> Do you know what, I couldn't tell you what I think . . . again, today, I suppose I had a few things on my mind so It was a little harder to concentrate, on the golf course because, even in my routine I count one-two in my head, this whole one-two thing . . . but when it goes well, I suppose I must be doing the same thing but I can't remember.

This state contrasted well with the rest of the time because there appeared to be a deliberate attempt to control the focus. In particular, two specific responses emerged as to what participants could remember about their mental state. Firstly that a very conscious analytical state emerged:

> Yeah, I think about all of those things . . .very analytical, erm . . . very varied, if it is windy . . . will the wind effect this putt, the line, length of the green, are the greens consistent today, obviously if they have just been cut they will all be consistent, maybe some greens will go quicker than another, erm . . . weather comes into play, if it is raining obviously, if its early in the morning is there dew on the grass, but then by one o'clock it is going to of dried out, things like that. Anything that is going to change the shot. (P3)

Secondly, and linked to the routine very definitely was the mind set of trying to focus on the components of the routine:

> Err that is interesting. . something I have not really, no I don't. . before I take my putt I don't think to myself 'right, I have got to do my routine', because I have done it so many times it just becomes natural, you just don't think of anything else, that's just the order you do things in and it just becomes natural, so I don't . . . yeah so I don't really concentrate . . .the only thing. . you think about the individual elements of it consciously like look at the line, look at the ball stuff like that but it all flows naturally, I don't think, right I have put the ball on the ground and now I have got to go back, its not like a comfort thing that . . . I don't do it so I feel calm about . . . I do it because I want to get the ball in the hole . . . so . . . I am doing everything for a reason. (P4)

The key point is that the best performance appeared to elicit a response similar to amnesia, or that the participants were at least not focusing on what they were doing but were just involved in the skill execution. This differs from the very deliberate states associated with trying to perform well but not achieving the high performance state.

6.2.5. Routine composition

The participants clearly have different routines with different components and different orders of behaviours for different shot types. Indeed the temporal consistency and overall duration of the routines executed by the participants was not something which they deliberately appeared to paid attention. The participants in this study were far more concerned with the behavioural and mental components of their routines and their sequence of execution. General components that were discussed across all six participants included the use of practice swings / strokes, reading the line, placing the ball, viewing the shot, setting the grip, and setting the stance.

> I will walk up, as I walk up to the ball I am looking down the line, stand a putters distance away so I can have a free stroke or two, one stroke, easily one stroke then I will either be looking at the ball or looking at the hole,

> trying really hard to feel . . . feel the ball come off the face, if I hit the ball exactly like that I know how far the ball will go, then as long as that is right . . . step straight into the putt . . . and repeat it. (P3)

> Yeah, It starts with the golf ball, pick up the golf ball, always have the writing facing the hole so I can't see anything on top of the ball. I know some people have lines . . . I don't want to see anything at all . . . that's a distraction. (P1)

> and just getting that club perfect in my hand, because even though I may feel that I am not swinging particularly well, is that I know from past experience that I will swing even worse if I don't feel comfortable with the club in my hand. (P6)

The consistency of the components of the routines was seen as key in the successful execution of the golf shot. Participants were very aware if something was different from their 'normal' routine and as a result felt uncomfortable and ill prepared to execute the shot.

> Erm, I would say that it is to make sure everything is consistent, as well as everything being practical, because I know how important a pre-putt routine is, I suppose consciously I have tried to do the same thing all the time. (P4)

> I would say . . . it has pretty much been the same for five years, so . . . I mean its almost as if I can't help but do it now. I have got the one-two thing that I say in my head 'one-two, one-two, one-two', put the toe of the putter to the ball, stare at the hole until I see the ball going in the hole then make the stroke, that's as simple as I can make it. It's not . . . it's not executed with as much routine as I would like but it is almost as if I can't help but do it, sometimes it's a little bit quicker, sometimes it's a little bit longer the next time, and what-not, but in terms of my routine itself it's pretty. (P2)

Two distinct responses were identified if the routine did not feel right. Participants either aborted the routine and started again, or continued to ball strike even though they knew they did not feel ready. This second response occurred, in the main, in tense situations, often involving a crowd where it was felt that they did not have time to re-start the routine.

The routines in this study differed among participants. This challenges further the approach adopted by such as Boutcher and Crews (1987), and Cohn, Rotella and Lloyd (1990) who enforced uniform PPRs on participants in their studies.

6.2.6. Compulsive behaviours

Participants also mentioned other compulsive behaviours that they thought did not have a beneficial effect like the designated components of their PPRs :

> I clicked once today, I click on the golf course, when a putt is going passed the hole I click . . . as if that is going to make the ball bloody stop, I am sure it stops me shouting obscenities . . . but where that came from I don't know, and you will see quite a few golfers do that, if they think the ball is going past they will click . .why, I don't know! What good does that actually do . . . nothing! (P4)

> I mean . . . I have never . . . today for example I was putting at a white cross and I am sure I might do certain things that I never notice I always do on the golf course, when I am looking around the hole I may do things that I don't notice, but I was just concentrating on the actual putt itself so that was my routine, but maybe there were other bits I haven't noticed that I do when I look at the putt, I think a lot . . . I do tend to swing the putter one-handed looking at the putt, whether that is part of my routine I don't know, maybe that actually gives me the feel for the putt, but when I actually stand near the ball, you will see it on the video camera, it is not part of my routine, but every now and then I'll just stand sideways and just do that . . . and then go into my routine, that's when it is like 'here we go' . . I have never actually thought about it . . . (P2)

This demonstrates an interesting distinction between the compulsive behaviours that are assigned to the PPR that are deemed helpful and other compulsive behaviour that are regarded as not helpful, and possibly detrimental to performance.

6.2.7. Routine use

The development of the PPRs used by the participants in this study appears to contradict some of the hypothesised functions of the PPR. Indeed the development of these routines appears to have been sporadic at best with a range of sources cited as the influences on the routine develop. Obviously in some cases the influence of a coach has been key in the formulation of the routine, but just as prevalent was the use of behavioural components or actions observed in other pro golfers' routines. Just about any source of information was mentioned including golf books, magazines and videos as contributing to the routines.

> Yeah, again throughout golf, and I have been playing sixteen years I have received lots of advice, I have played county and now I am a professional . . . and you get lots and lots of advice and the one thing that has always stuck in my mind through listening to people who can coach and all the coaching I have received over the years is one who said that 'once you have picked your line and you have set-up to the ball you don't change your shot, you can't do any more than that', if you hit a good putt and it misses it's a good putt still. (P2)

> Everything I do I have got from different magazine articles, or people . . ever since I first started to play golf . . . everything is . . . lots of information I have received from magazines, videos, the telly, things you see on the telly, people talking in the clubhouse its all just added together and you know it has all been added together over a few years so, I don't suppose it will ever change. (P4)

A possible concern regarding the hypothesised function of PPRs relating to physical priming (Marlow et al, 1998) and execution was the confession of a number of participants that they did not use their PPRs consistently during practice, but can still execute the shot. This further reinforces the notion that the PPR is actually fulfilling attentional demands during competition as opposed to priming the movement system.

> In all fairness I am pretty slack . . . when I practise my putting I do a lot of putting practise and I am not . . . when I practise I don't do my routine, which is against the book if you like, I am supposed to do my routine . . . and when I am playing badly I will hit a lot of putts and they start going a bit streaky and this and that . . . missing right sort of thing . . . and then I will hole a couple and I will do my routine, then I will carry on . . .

Interestingly, when exploring the participants' perceptions of the underlying rationale for their use of PPRs, a number of similar viewpoints emerged:

> it's almost as if it is a trigger to make me concentrate back on my stroke rather than anything else. (P2)

> erm . . . I would say it gives me a focus so I know what I have got to do in order to execute the shot, without my routine I think I would be all over the place.

> The whole point is definitely to allow me to concentrate, to stop me being distracted by other things going on and to just concentrate on my shot . . . I would say it allows me to step into a room away from everything else and shut the door!

Thus, the participants in this study were very clear as to what they feel is the function of their routine. There is a clear consensus that the routines allow the participants to focus their attention and to provide a specific allocation of attention

6.2.8. Influencing factors

Finally, a number of factors were identified as influencing factors that could impact upon the successful execution of the shot and PPR. These factors include fatigue, tension, playing in big events, expectations (internal and external), stress and pressure.

Fatigue, either physical or mental was identified as a particular influence on the effectiveness of the PPR and shot execution.

> Err . . . I find when I am tired, I usually, I have a tendency to ruin my round over the last few holes, I'll get, I don't know if its mental, maybe I get mentally tired easier than other people but, the last few holes I might get tired and I won't do anything at all I will just get my clubs, out the bag . . . seven iron, walk up to the ball and hit it. So I think definitely, when I get mentally tired and physically tired, especially when . . . the type of weather when it is hot, sometimes you just think 'lets get this round over with' you just don't bother with the pre-shot routines, or you don't even bother looking at as many variables as you should do, so yeah, a shot will speed up! (P4)

> I think everybody knows when they start to feel a little bit tired, or maybe a little cheesed off that they have been out there for that long, erm but the way in which it effects the outcome of the actual shot, I feel for myself is that erm . . I feel the fatigue never effected the swing of the club, but I can definitely remember instances because I obviously have started to get a little bit tired erm, failed to pick things up in the environment that I normally would of done, for instance like the direction of the wind. I have hit shots sometimes where I have hit a lovely shot and the thing is twenty-five yards too big, then I have put the club in my bag and I have just thought 'I can't believe you have just done that and I have actually failed in my analysis and decision making process to of taken into account the direction of the wind. (P5)

Tension was also seen as a limiting factor relating to performance.

> I was so tense, I was only interested in winning really, I couldn't really tell you about the surroundings, they did not seem to impinge at all on my enjoyment, it wouldn't matter if I was for instance playing a municipal course or I was playing Augusta, is that I was . . . I wanted to win. And erm, I think that erm. Definitely for me that caused me to at times get a little bit critical, self critical about my performance, and as I have shall we say matured a bit more and I think to my self, the nature of the game is that you can't win all of the time, so try and take things out of it so I even try and take, like I say even two buzzards, irrespective of whether I am playing well or badly being in a position where you could actually experience that and see them, erm is a reason to be out there, and that makes me feel positive about being out there, erm . . . so that is how I keep myself upbeat whether or not I am playing well or playing badly and erm also most probably leads to the fact that I don't need to affirm positive statements to myself (P1)

> I remember going into the clubhouse then going out and erm to basically get my card and in that time it had basically taken me to get my studs on and then come out there was around one hundred and fifty people stood around the first tee box, and I was immediately thinking Jesus, this is a

> totally different, seemingly, it was a totally different situation, and yeah, its fair to say that I don’t think I have ever hit a golf ball harder off that first tee box, to the extend that the only thing I wanted in my life at that particular time was for the ball to find the fairway. (P6)

Dealing with this negative affect is important, as it is associated with ultimate withdrawal from the activity (Lavallee et al., 2004). Indeed, the ability to cope with pressure situations on the ‘big day’ of competition is regarded as a key determinant of overall success and optimal performance (Dugdale, Eklund and Gordon, 2002).

Linked to the concept of tension were also the notions of stress, and unexpected events, and their impact on performance.

> I would say that the stress and the anxiousness causes me self doubt, self-doubt then causes me not to be able to see things because if I can’t see something I can’t do it full-stop. It is like anything in life, you know, if you can’t see yourself scoring a goal in football, your not going to do it are you! If you see some bird . . . if you think you are going to get a slap round the face you probably will do, if you go in with full confidence you do it and do it well to the best of your ability sort of thing. (P5)

Coping with these situational stressors was of key importance to the participants in this study. Lavallee et al. (2004) identified three general coping strategies that emerged from the limited research in this area. The first general approach identified emerged from work by Gould, Finch and Jackson (1993) who reported the use of psychological skills such as rational thinking or ST, pre-competition mental preparation, the use of relaxation techniques and visualisation. The second emergent strategy was related to the link between pre-competition planning and superior performance. The third and final general strategy was linked to athletes’ situational appraisals (Dugdale et al., 2002), where unexpected stressors were perceived as being the most threatening.

As a result, participants who planned well, utilised specific psychological skills and had a robust strategy to deal with unexpected events, or distracters, were well placed to deal with the identified stress and tension. Therefore the implementation of a pre-planned PPR that includes situational specific and enduring psychological skills, coupled with a deliberate allocation of attention to reduce the tendency for unexpected events to impact upon performance is clearly desirable, and possibly crucial for successful mastery of stressful situations associated with this level of golf performance.

6.2.9. Overview of study four

It was envisaged that the participants in this study would use a range of psychological strategies during the pre-performance period, which would be individually determined and transient. The results and initial discussions, at least in part, support this. There was clear evidence that some psychological skills were employed in a transient nature depending of the specific requirements / demands of the shot to be executed. These skills differed between performers and over time. There was also clear evidence of another group of psychological skills that were enduring and employed in all situations for all shots. Some of these skills differed from participant to participant. Imagery however, was identified as an enduring skill for all six participants. An important finding was that the transient and enduring psychological skills were specific to each individual participant.

The implication for future practice is that the development of PPRs, and in particular the psychological skills employed within the routines, is dependent on the personality, coping resources, and situational appraisals of each individual performer. There is no 'one size fits all' approach. As a result the routine should be built around the enduring psychological skills that the golfer is likely to employ regardless of the situation.

Although numerous functions for the PPR have been suggested across a range of prior research, reports, articles and editorials, it is clear that the predominant function for the PPR that has emerged from this study is their role in controlling the allocation of attentional resources and, as a result, manipulating and controlling each participant's attentional focus. Other suggested functions for the use of the PPR such as; reducing the impact of distractions (Boutcher and Crews, 1987; Weinberg, 1988); acting as a trigger for well learnt movement patterns (Boutcher and Crews, 1987; Moran, 1996); diverting attention to task relevant thoughts (Gould and Udry, 1994; Maynard, 1998); enhancing the recall of physiological and psychological states (Marlow et al, 1998); helping performers achieve behavioural and temporal consistency (Wrisberg and Penn, 1992); and preventing performers focusing on the mechanics of their skills (Beilock and Carr, 2001; Beilock, et al, 2002); in this study at least, occur as a result of this core function. An interesting outcome of this study was the identification of the relatively haphazard development of the PPRs for the participants. It could be argued that this approach has enabled the participants to evolve routines that are effective for them, essentially built around their key performance characteristics and required arousal level and focus. The development of routines sporadically, but effectively, by the participants in this study casts doubt with respect to the effectiveness of the approach adopted by a number of research studies in exploring the use and effectiveness of the PPR. The conditioning of the participants to follow a prescribed set of behavioural and psychological steps artificially administered have been shown to have a positive impact on the execution of a contrived performance, but would these routines be as effective in the real environment? It appears that a routine built around the characteristics and requirements of the individual has a greater propensity than a generic routine to be successful in correctly preparing the golfer to perform. Ultimately by controlling this attentional focus, it allows a transference to an intentional mental state where a feed-forward process can occur, essentially achieving a flow state or entering the zone.

It is obvious then that there is no ‘one size fits all’ approach. While the use of books and magazine articles can be helpful, their focus has been far too prescriptive; focusing on the components one should include as opposed to the individual rationale for the routine and individual characteristics of the way the golfer approaches the game.

The golf pro or golf psychologist then, should look to facilitate the organic development of the PPR based around the individual, then once this development has reached a relatively stable stage to ensure practice makes permanent.

Chapter Seven

CONCLUSION

7.1. RESTATEMENT OF THESIS AIM(S)

The aim of this thesis was to explore the nature and function of the PPRs utilised by elite golfers and to address the ecological validity issues that have arisen from the use of a range of research and experimental designs in the study of the routines. The effect of task difficulty on the consistency of temporal and behavioural characteristics of the routines and the effects of shot type on the structure and consistency of the routines were explored. The underlying psychological processes that occurred whilst the routines were being executed and the psychological strategies and skills that are utilised by golfers during the execution of their pre-performance routines were also investigated.

Two major outcomes of the thesis were sought. The first was a greater understanding of the structure, function, and importance of PPRs in golf performance. The second was to apply the results to recommend practical guidelines for the development and execution of effective PPRs for golfers. The following key findings relate to these outcomes.

7.2. SUMMARY OF KEY FINDINGS

The participants in this study demonstrated very consistent within shot routines. This consistency was demonstrated in both what they did (behaviours) and how long they took (temporal characteristics). This suggests that the golfers had developed and learnt a consistent programme of behaviours that they initiated prior to performance. The second key finding was the lack of significant differences when comparing the components of the PPRs (behavioural and temporal) across environmental conditions. The important implication is that developing, practising or researching PPRs away from the golf course does not result in significantly different routines executed by the golfers.

The third finding was that the participants utilised very different routines for different types of shots. This in turn, presents a significant challenge in the development and teaching of PPRs. The impact of task difficulty for this study did not prove to be significant. This could reflect a decision making process that occurred prior to the execution of the PPR for the current participants. This was in part supported by the findings from the fourth study.

All participants demonstrated a consistent HRD trend prior to ball strike with mean IBIs increasing throughout the routine period. Comparison of good and poor shots over a seven-epoch period (pre, during and post ball strike) identified significant differences and effect sizes indicating that there were measurable differences in HRD between good and poor performance. Subsequent comparisons of the physical routines did not yield significant differences and was evidence that the contributory factor was internal.

The final study highlighted a range of psychological skills employed by the studies' participants during the execution of their PPR. These included enduring and transient psychological skills. It was also clear from the participants that they perceived the main role of the PPR as being an attentional one.

7.3. PRACTICAL GUIDELINES FOR DEVELOPING PRE-PERFORMANCE ROUTINES IN GOLF

Ultimately, the key approach to the development of PPRs should be one of common sense. Each performer needs to be considered as a unique, individual case. The application of a 'one-size fits all' approach that has been suggested in earlier work may elicit a positive impact upon performance and enhance the consistency of skill execution, but this may not achieve the ultimate benefits of a specific, personally tailored PPR.

7.3.1. Behavioural characteristics of the PPR

Of importance in the development of the behavioural characteristics of a PPR is the functionality of the specific components of the routine. There should be a clear rationale for taking a practice swing, or setting the stance, or looking at the flag etc. Relating these behavioural components to the psychological strategies and skills that are incorporated would be particularly advantageous. It is easier to initiate relaxation or arousal reduction with the golfer in a stable position on a stable base than during weight transfer and movement. It also makes sense to use rhythmic strategies such as trigger-words whilst movement, usually club movement, is taking place.

7.3.2. Psychological characteristics of the pre-performance routine

As with the behavioural components of the routine psychological strategies need to be developed with a specific outcome in mind. What does the golfer need in order to execute the shot effectively? Is it reassurance, anxiety / arousal regulation, motivation or instruction, to see their performance etc. Ideally, physical / behavioural and mental / psychological components of the routines should have equal standing in the development of routines. A key point to recognise is that a fundamental function of the PPR is attentional, therefore an active strategy to focus attention is required.

7.3.3. General recommendations

Performers who plan well and utilise specific psychological skills and have a robust strategy to deal with unexpected events, or distracters, are well placed to deal with the situation specific stress and tension that manifest themselves during golf performance. Therefore the implementation of a pre-planned, PPR that includes situational specific and enduring psychological skills, coupled with a deliberate allocation of attention to reduce the tendency for unexpected events to impact upon performance is clearly desirable, and possibly crucial for successful mastery of stressful situations associated with this level of golf performance.

The consequent implication for future practice is clear. The development of PPRs, and in particular the psychological skills employed within the routines, is dependent on the personality, coping resources, and situational appraisals of each individual performer. The routine should be built around the enduring psychological skills that the golfer is likely to employ regardless of the situation.

The use of a guiding template such as Singer's (1988) five-step approach, which is a global learning and performance strategy, may provide the general framework for all golf shots (Figure 7.1.). The first four steps of the approach of readying, imaging, focusing, attention and execution could be the fundamentals of the routine with different behaviours and psychological skills included depending on the shot-type and other situational factors. This empowers the routine as a flexible tool to achieve an outcome as opposed to a rigid set of behaviours. Golfers would develop very specific applications for certain shot types, which although behaviourally and potentially psychologically different still use the same global template.

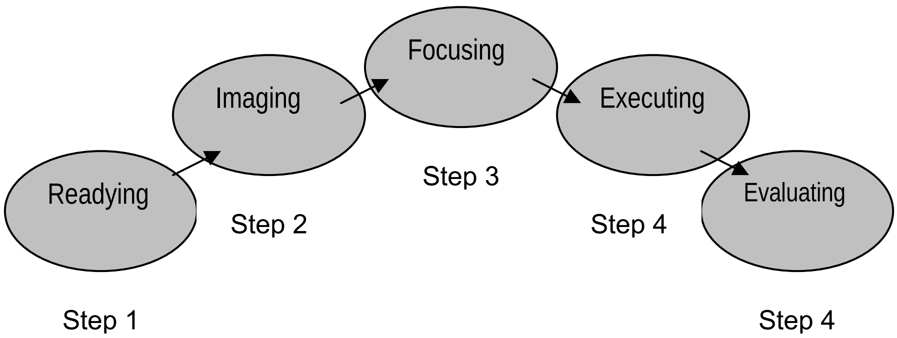


Figure 7.1. Singers (1988) five-step approach

An interesting outcome of this study was the identification of the relatively haphazard development of the PPRs for the participants. It could be argued that this approach has enabled the participants to evolve routines that work for them, essentially built around their key performance characteristics and required mindset. This developmental approach supports the potential strategy outlined above.

An important point regarding the individual nature of these routines is related to the experience and implementation of key psychological skills.

The use of key skills including imagery, relaxation, self-talk and rhythm cues are important components, but they differed in use, ability and application across participants.

The golf pro, golf coach, or golf psychologist should look to facilitate the organic development of the PPR based around the individual, then once this development has reached a relatively stable stage to ensure practice makes permanent.

7.4. FUTURE RESEARCH RECOMMENDATIONS

This thesis has focused exclusively on male participants throughout all four studies. An interesting avenue for further investigation could explore gender differences in the structure, consistency and psychological strategies that compose PPRs in golf. Of further interest would be the exploration of PPR practices in novice and non elite performers. This could explore whether PPRs in these cases fulfil the same performance-based function as with elite performers. Also, the question of the point at which pre-shot skills should be taught needs to be explored.

Outside of golf, these studies have identified differences in PPRs utlised by golfers executing different shot types. In other discrete sporting skills such as a penalty kick in football or basketball free throw the specific environmental conditions do not change. The footballer is always the same distance from the goal and the basketball player is always in the same position for the free throw. The question of whether this impacts upon the dynamics of the routine its execution, or its composite parts, needs to be addressed. Other discrete skills in continuous sports such as a football free-throw or short penalty corner in hockey could also be explored.

Although differences in the duration of the routine components across task difficulty levels were not identified in this thesis there was some indirect evidence of differences in variability across levels of task difficulty. Therefore, a study of how task difficulty affects the duration of the routine components in the real competitive environment is required to assist in understanding the impact of task difficulty on PPR execution and performance in golf.

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APPENDICES

APPENDIX A

PILOT STUDY ONE

INTRODUCTION

In order to develop an understanding of the psychological processes underlying the pre-performance rituals, behaviours and routines of elite performers in their chosen sports it is essential for researchers to observe the performer in the competitive environment (Morris and Summers, 2004). However, previous research exploring the use of pre-performance routines in golf (Boutcher & Crews, 1987; Cohen, Rotella & Lloyd, 1990; McCann, Lavallee & Lavallee, 2001) have failed to account for the ecological validity of the environment participants were required to perform in.

Indeed nearly all of these studies failed to either address or explain the impact of task constraints on the routine (performance related and environmentally related aspects of the task) on pre-performance routines, or, the dynamic nature of sport, in particular golf where the same shot or type of shot is very rarely played twice. The limited, repetitive nature of these tasks could have caused the observed results, therefore making the findings different from, and therefore not applicable to the 'real' environment. This could ultimately result in significant differences between the experimental and competitive environments.

Starkes and Lindley (1994) suggested that the fidelity of the environment is a crucial factor in determining the effectiveness and ecological validity of the research environment when compared to the competitive environment.Lintern et al. (1989) further suggested that researchers needed to strive for physical fidelity, functional equivalence and psychological fidelity in order to make the research environment as ecologically valid as possible.
The potential difference between experimental and competitive environments has been highlighted by Jackson and Baker (2001) who whilst conducting a case study into the pre-performance behaviour of an international rugby goal kicker noted that the routines differed in duration and related psychological strategies based upon the environment.

The aim of this study is to explore whether significant differences exist between the pre-performance routines utilised by golfers in three different environmental conditions: practise, competition and a golf simulator.

METHOD

PARTICIPANTS

The participants in the pilot study were two good standard county male golfers, aged 23 (Handicap –1, 8 years playing) and 25 (Handicap 0, 10 years playing) years respectively. These two participants were recruited through personal contact, and were required to play golf in three distinct conditions, a simulated environment, a practise environment (putting green and driving range) and in a 'real' competition around an 18-hole links golf course. Each subject played 36 holes on a golf simulator (Smartgolf, Links LS Software, 10' x 12' high resolution screen & LCD projection system).

PROCEDURE.

The participants all played 36 holes on a simulation of the Belfry golf course (Birmingham, UK). The simulator design allowed each of the participants to play the holes using their 'normal' game including shot and club selection. Every shot played on all 36 holes was videoed to allow further analysis of the pre-performance routines utilised. Only two specific types of shot were selected in this study for analysis, shots involving the driver and the putter.

Pre-performance routine data was collected using a digital video camera. The video data was then transferred to a PC via a firewire connection to allow further analysis of the routines with the Dart Trainer video analysis package. The video clips for the putter and driver shot pre-performance routines for each participant were transferred to individual files on the PC for each player so that in excess of 20 pre-performance routines for each shot type, for each participant were stored and analysed.

The pre-performance routines were separated into the major defining categories of behavioural characteristics for the routines. A further breakdown of these characteristic categories can be found in table 1. The temporal components of the routines were also analysed.

Characteristic	Behaviour	Description
Head	Glance	Initiated by head movement towards the target. Ended when the focus returns to the ball and the head is stationary
Posture	Postural	Any movement of the lower body whilst the
	Adjustment	feet remain fixed. E.g. knee bend
	Stepping	Change in foot position
Club	Raised	Initiated when the club is raised of the ground behind the ball. Ended when the club is re-grounded behind the ball.
	Practise	*Initiated when the club is drawn back from*
	Swing	*the ball. Ended when the club returns to its*
		start position behind the ball

Table 1. Definitions of the behavioural characteristics monitored during the pre-performance routines

DATA ANALYSIS

The first step involved the identification of the major behavioural components of the routines used by the golfers. The next step using the Dart Trainer software package involved measuring the full temporal duration of the routines and each behavioural component. Once the duration of these components had been measured mean value were calculated for each category of behaviours within participant. This data was then presented in a graphical format to all a visual comparison within shot type across environmental conditions.

A one-way, within participant multi-variate analysis of variance (MANOVA) was conducted to investigate whether any significant differences existed between the duration of the behavioural categories within the routines and across the three experimental environment conditions. Four dependent variables were used: head, club, posture and still. The independent variable was the environmental condition (Course, practise and simulator). Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity with no serious violations noted. If significant differences were identified follow-up uni-variate tests were to be conducted.

RESULTS

Both participants appeared to be very consistent in their pre-performance behaviour and routines. Figures 1, 2, and 3 show a graphical representation of the pre-performance routines utilised by participant one across the three different environmental conditions. Visually, it is clear that the routines for this club (driver) are generally very similar across environment types. The participant appears to be doing the same things, in the same order, with roughly the same temporal components.

Indeed, participant two also exhibits very consistent routine characteristics across the three different environmental conditions. Figures 4, 5, and 6 demonstrate that behaviourally and temporally the routines employed for the same shot type across conditions are very similar.

Fig 1. Participant one - Driver (Simulator)

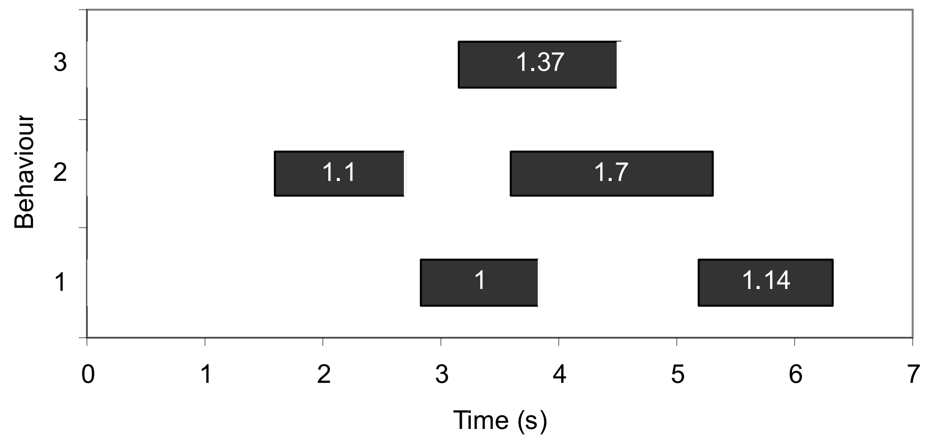


Fig 2. Participant one - Driver (Competition)

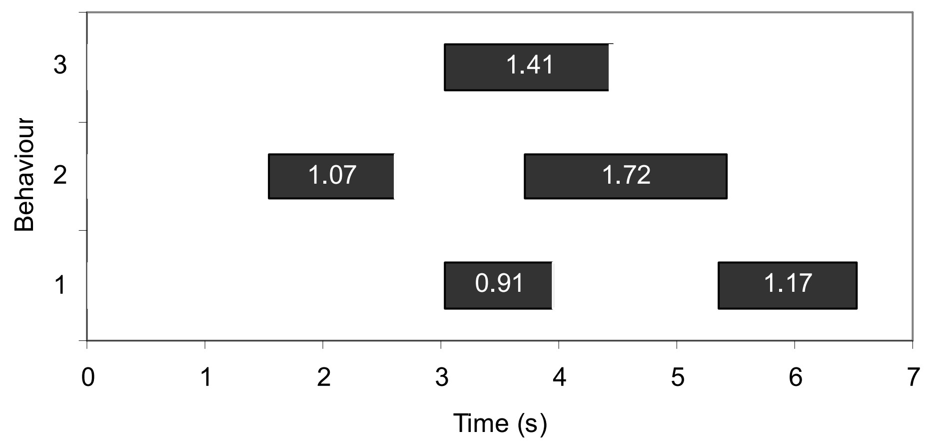


Fig 3. Participant one - Driver (Practise)

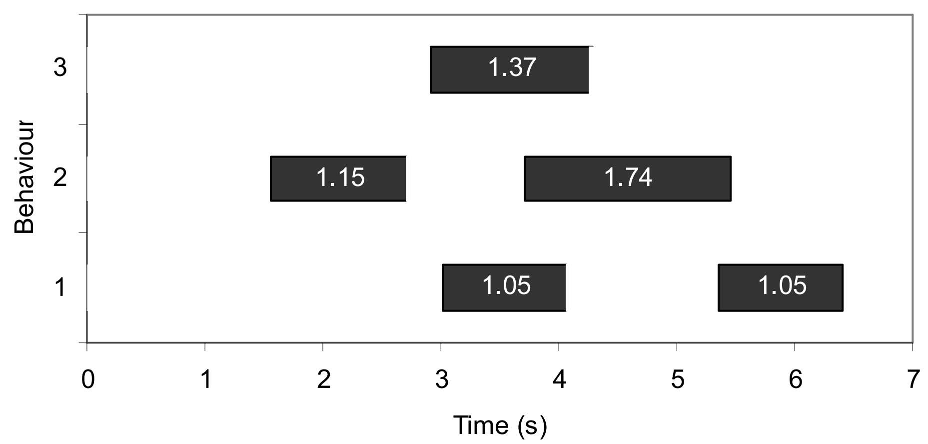


Fig 4. Participant two - Driver (Simulator)

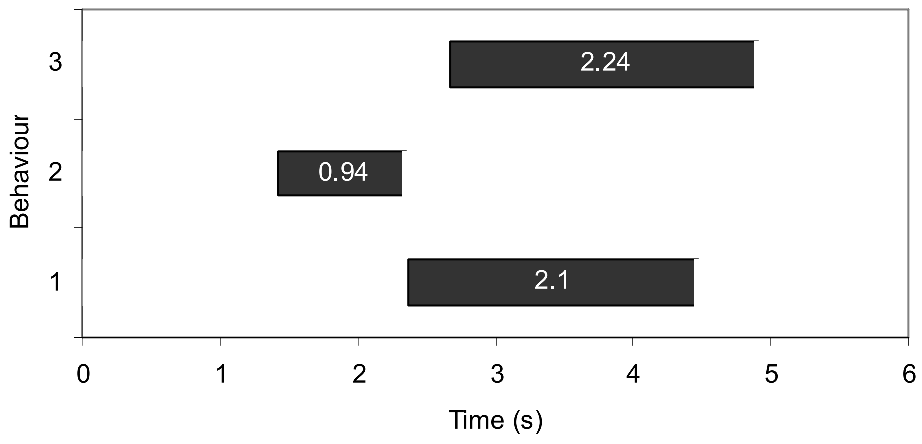


Fig 5. Participant two - Driver (Competition)

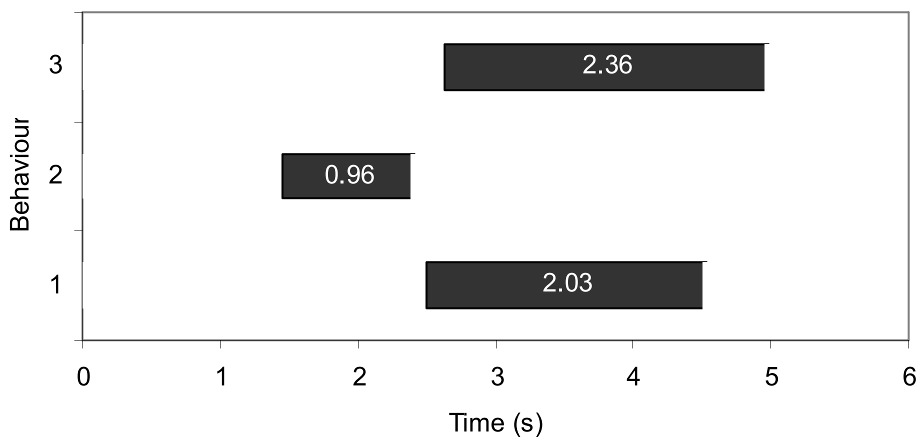
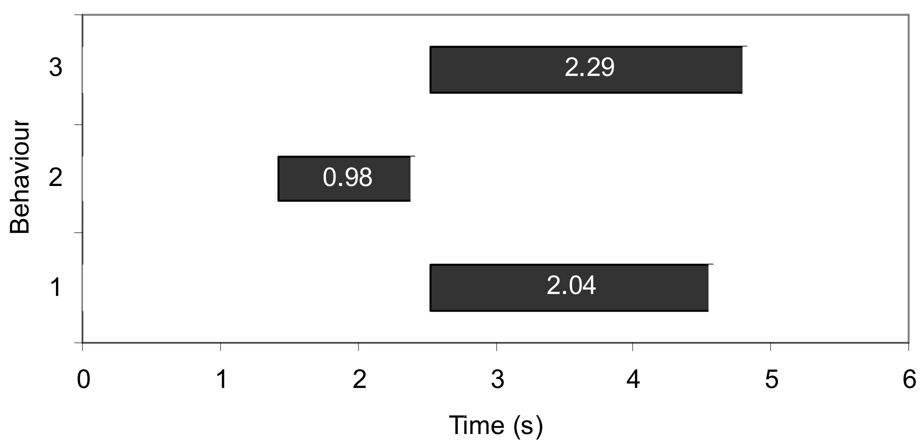


Fig 6. Participant two - Driver (Practise)



	Minimum	Maximum	Mean	Std. Deviation	N
Participant one	.834	14.48	3.933	2.662	60
Participant two	.101	11.042	3.933	2.651	60

Table 1. Mahalanobis distance results for Participants one and two.

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.998	7116.148(a)	4.000	54.000	.000	.998
	Wilks' Lambda	.002	7116.148(a)	4.000	54.000	.000	.998
Env	Pillai's Trace	.063	.447	8.000	110.000	.890	.032
	Wilks' Lambda	.938	.442(a)	8.000	108.000	.893	.032

Table 2. Multivariate Tests for participant one.

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.999	9804.014(a)	4.000	54.000	.000	.999
	Wilks' Lambda	.001	9804.014(a)	4.000	54.000	.000	.999
Env	Pillai's Trace	.124	.912	8.000	110.000	.510	.062
	Wilks' Lambda	.878	.911(a)	8.000	108.000	.510	.063

Table 3. Multivariate Tests for participant two.

The Mahalanobis distance was used to test for multivariate normality (Tabachnick and Fidell, 2001). The Mahalanobis distances of 14.48 for participant one and 11.04 for participant two (Table 1) was acceptably below the critical value of chi-squared for four dependent variables of 18.47.

The MANOVA test for differences within participant one did not identify a statistically significant difference between the duration of the behavioural components of the pre-performance routines across the three environmental conditions: F (3, 108) = 0.442, p=0.893; Wilks' Lambda=.938; partial eta squared =.032.

As with participant one, there was no significant differences across environmental conditions for participant two: F (3, 108) = 0.911, p=0.510; Wilks Lambda=.878; partial eta squared =.063. As a result the dependent variables did not receive further, separate consideration.

DISCUSSION

The results presented for both participants suggest that the type of environment did not have a significant impact upon the structure or duration of the pre-performance routines utilised. Although minor numerical differences existed between the mean duration of the dependent variables (Head, Club, Posture, Still) these differences across environmental conditions did not prove to be significant. These results further suggest that a well-designed, lab-based, research condition can effectively be utilised to study the behavioural and temporal components of a golfers pre-performance routine.

Furthermore, the use of a full swing golf simulator is also advocated by this study as an effective tool with which to explore pre-performance behaviour in golfers.

CONCLUSION

As long as the demands of the shot are structured in such a way that they accurately reflect the task demands of a ‘real’ golf shot, the environment that the golfer is performing the shot in (competition, practise, simulated) does not appear to have a significant impact upon the components and characteristics of the pre-performance routines utilised. Future research should look to strengthen the evidence supporting the use of alternative environments within which to collect data. Follow up work could also explore the impact that these different environmental conditions possible have on the actual execution on the shot to ascertain if significant differences exist during performance execution.

APPENDIX B

STUDY ONE MANOVA ASSUMPTION TESTING DATA

MULTIVARIATE NORMALITY

Mahalanobis distances for all six participants.

Participant	Minimum	Maximum	Mean	Std. Deviation	N
1	.206	15.89	3.95	3.35	78
2	.148	14.851	3.95	2.99	78
3	.480	17.143	3.949	3.3.39	78
4	.133	16.56	3.95	2.92	78
5	.090	12.39	3.95	3.15	78
6	.119	17.43	3.95	3.33	78

MULTIVARIATE OUTLINERS

Participant 1

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	33	33.00	15.88500
		2	13	13.00	13.05234
		3	8	8.00	11.55663
		4	11	11.00	11.27311
		5	15	15.00	11.07881
	Lowest	1	70	70.00	.20593
		2	71	71.00	.28862
		3	45	45.00	.37267
		4	50	50.00	.39476
		5	62	62.00	.40083

Participant 2

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	65	65.00	10.84096
		2	75	75.00	10.81509
		3	56	56.00	10.24706
		4	59	59.00	10.11302
		5	60	60.00	9.61687
	Lowest	1	20	20.00	.15699
		2	70	70.00	.41335
		3	69	69.00	.57522
		4	43	43.00	.57522
		5	36	36.00	.60333

Participant 3

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	47	47.00	17.51025
		2	46	46.00	16.19747
		3	33	33.00	12.11032
		4	40	40.00	10.83557
		5	37	37.00	10.75505
	Lowest	1	53	53.00	.66330
		2	13	13.00	.69631
		3	1	1.00	.86010
		4	74	74.00	.88771
		5	5	5.00	.92373

Participant 4

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	9	9.00	16.55826
		2	4	4.00	11.01625
		3	16	16.00	10.02170
		4	3	3.00	9.90293
		5	13	13.00	8.63083
	Lowest	1	27	27.00	.13312
		2	61	61.00	.44076
		3	35	35.00	.44076
		4	38	38.00	.45769
		5	7	7.00	.48190

Participant 5

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	7	7.00	12.39212
		2	13	13.00	11.51995
		3	4	4.00	11.47704
		4	2	2.00	10.10544
		5	3	3.00	10.06865
	Lowest	1	53	53.00	.08968
		2	27	27.00	.17101
		3	57	57.00	.24690
		4	76	76.00	.26821
		5	28	28.00	.36802

Participant 6

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	12	12.00	15.63744
		2	21	21.00	12.09896
		3	16	16.00	12.05799
		4	25	25.00	11.73049
		5	23	23.00	11.64310
	Lowest	1	53	53.00	.12123
		2	76	76.00	.25091
		3	59	59.00	.26051
		4	57	57.00	.36566
		5	78	78.00	.41731

MULTICOLLINEARITY AND SINGULARITY

Participant 1

		Head	Club	Posture	Still
Head	Pearson Correlation	1	.020	.017	-.163
	Sig. (2-tailed)		.860	.886	.155
	N	78	78	78	78
Club	Pearson Correlation	.020	1	.095	-.170
	Sig. (2-tailed)	.860		.407	.137
	N	78	78	78	78
Posture	Pearson Correlation	.017	.095	1	.225(*)
	Sig. (2-tailed)	.886	.407		.048
	N	78	78	78	78
Still	Pearson Correlation	-.163	-.170	.225(*)	1
	Sig. (2-tailed)	.155	.137	.048	
	N	78	78	78	78

Participant 2

		Head	Club	Posture	Still
Head	Pearson Correlation	1	.168	.110	.105
	Sig. (2-tailed)		.141	.337	.359
	N	78	78	78	78
Club	Pearson Correlation	.168	1	.153	.105
	Sig. (2-tailed)	.141		.181	.360
	N	78	78	78	78
Posture	Pearson Correlation	.110	.153	1	.197
	Sig. (2-tailed)	.337	.181		.085
	N	78	78	78	78
Still	Pearson Correlation	.105	.105	.197	1
	Sig. (2-tailed)	.359	.360	.085	
	N	78	78	78	78

Participant 3

		Head	Club	Posture	Still
Head	Pearson Correlation	1	-.043	.277(*)	.061
	Sig. (2-tailed)		.712	.014	.596
	N	78	78	78	78
Club	Pearson Correlation	-.043	1	-.013	-.295(**)
	Sig. (2-tailed)	.712		.912	.009
	N	78	78	78	78
Posture	Pearson Correlation	.277(*)	-.013	1	.091
	Sig. (2-tailed)	.014	.912		.426
	N	78	78	78	78
Still	Pearson Correlation	.061	-.295(**)	.091	1
	Sig. (2-tailed)	.596	.009	.426	
	N	78	78	78	78

Participant 4

		Head	Club	Posture	Still
Head	Pearson Correlation	1	-.137	-.288(*)	.044
	Sig. (2-tailed)		.231	.011	.701
	N	78	78	78	78
Club	Pearson Correlation	-.137	1	-.259(*)	.078
	Sig. (2-tailed)	.231		.022	.500
	N	78	78	78	78
Posture	Pearson Correlation	-.288(*)	-.259(*)	1	-.087
	Sig. (2-tailed)	.011	.022		.450
	N	78	78	78	78
Still	Pearson Correlation	.044	.078	-.087	1
	Sig. (2-tailed)	.701	.500	.450	
	N	78	78	78	78

Participant 5

		Head	Club	Posture	Still
Head	Pearson Correlation	1	-.185	.123	.097
	Sig. (2-tailed)		.106	.284	.400
	N	78	78	78	78
Club	Pearson Correlation	-.185	1	-.208	.143
	Sig. (2-tailed)	.106		.067	.211
	N	78	78	78	78
Posture	Pearson Correlation	.123	-.208	1	-.059
	Sig. (2-tailed)	.284	.067		.606
	N	78	78	78	78
Still	Pearson Correlation	.097	.143	-.059	1
	Sig. (2-tailed)	.400	.211	.606	
	N	78	78	78	78

Participant 6

		Head	Club	Posture	Still
Head	Pearson Correlation	1	.004	.113	.001
	Sig. (2-tailed)		.972	.323	.993
	N	78	78	78	78
Club	Pearson Correlation	.004	1	-.205	.009
	Sig. (2-tailed)	.972		.072	.938
	N	78	78	78	78
Posture	Pearson Correlation	.113	-.205	1	.016
	Sig. (2-tailed)	.323	.072		.888
	N	78	78	78	78
Still	Pearson Correlation	.001	.009	.016	1
	Sig. (2-tailed)	.993	.938	.888	
	N	78	78	78	78

HOMOGENEITY OF VARIANCE-COVARIANCE MATRICES – Box's Test of Equality of Covariance Matrices

Participant 1

Box's M	68.787
F	3.173
df1	20
df2	20191.262
Sig.	.000

Participant 2

Box's M	47.822
F	2.206
df1	20
df2	20191.262
Sig.	.001

Participant 3

Box's M	67.066
F	3.094
df1	20
df2	20191.262
Sig.	.000

Participant 4

Box's M	40.802
F	1.882
df1	20
df2	20191.262
Sig.	.010

Participant 5

Box's M	10.806
F	.593
df1	10
df2	478.088
Sig.	.820

Participant 6

Box's M	93.207
F	4.299
df1	20
df2	20191.262
Sig.	.000

APPENDIX C

PILOT STUDY TWO

INTRODUCTION

Boutcher (1990), Lobmeyer & Wasserman (1986) suggested that a method for maintaining high levels of performance in the face of potential distractions is to develop a consistent pre-performance routine. Pre-performance routines were defined by Moran (1996) as “a sequence of task-relevant thoughts and actions which an athlete engages in systematically prior to his or her performance of a specific sports skill” (p177).

Crampton (1989) whilst conducting behavioural research in golf observed that elite golfers appeared to do the same things in the same order and with the same timing. In trying to define this consistent pattern of actions. He suggested that their ‘pre-shot routine’ was an ordered collection of thoughts and behaviours that is aimed at achieving the necessary mind set, concentrational focus and physical readiness for each shot. A golfer may utilise several psychological skills combined within a particular physiological strategy for optimal execution of a putt. It has also been suggested that pre-performance routines helped performers achieve behavioural and temporal consistency in their performance (Wrisberg & Penn, 1992).

Crew’s & Boutcher’s (1987) study of elite golfers highlighted an apparent relationship between the consistency of the timing of routines and the consistency of behavioural characteristics. Claiming that a fundamental characteristic of effective pre-performance routines was the consistent duration of the routines. The major criticism of this and other studies that have endeavored to explore the nature of pre-performance routines, is that the tasks subjects have been required to perform have been very limited limited. In each study subjects performed the same tasks time after time in a repetitive manner. Indeed if you explore the prior research in the area further, the majority of studies exploring pre-performance routines have focused almost exclusively on the putt (Fairweather & Potgeiter, 1993; Boutcher & Crews, 1987). Crews & Boutchers’ to their credit did require their subjects to complete a putting task and a swing task. But the data from these two distinct shot types was combined. The other major criticism of pre-performance routine research in golf is that it has focused very exclusively on specifically regulated and repetitive variability’s of task difficulty, if indeed any attention has been paid to the difficulty and variability of the tasks participants have been asked to complete.

The purpose of this pilot study was therefore to explore the extent to which specific temporal and behavioural characteristics of pre-performance routines hold true across a range of different shot types.

The aim then of this pilot study was two fold. Firstly, to explore if differences existed in the nature of pre-performance routines utilised when participants were preparing for two different types of shots. Secondly, to explore the practicalities of using a Smartgolf simulator in pre-performance behaviour research.

METHOD

PARTICIPANTS

The participants were 4 county standard male golfers (County men's first team) with handicaps ranging from +2 to 0 (mean = +1.2). Each subject played 36 holes on a golf simulator (Smartgolf, Links LS Software, 10' x 12' high resolution screen & LCD projection system).

PROCEDURE

The participants all played 36 holes on a simulation of the Belfry golf course (Birmingham, UK). The simulator design allowed each participant to play the holes using their 'normal' game including shot and club selection. Every shot played on all 36 holes was videoed to allow further analysis of the pre-performance routines utilised.

Previous measures to analyse pre-performance routines in golf have focused on the frequency, duration and consistency of behaviours, which combine to form the routine. Boutcher and Zinesser (1990) specifically looked at the number of practice swings and the number of glances at the hole of elite golfers. This approach to analysing the combined behavioural and temporal characteristics of pre-performance routines appears to be an effective method of assessing these routines. As a result, a similar approach was adopted for this study

The temporal characteristics of these behaviour components were also analysed to facilitate inter-shot type comparisons. Only two specific types of shot were selected in this study for analysis, shots involving the driver and the putter.

The video data was collected using a digital video camera. The data was then transferred to a PC via a firewire connection to allow the analysis of the routines with the Dart Trainer video analysis package. The video clips for the putter and driver shot pre-performance routines for each participant were transferred to individual files on the PC for each player so that in excess of 20 pre-performance routines for each shot type, for each participant were stored and analysed.

The pre-performance routines were separated into the major defining behavioural characteristics. A further breakdown of these characteristic categories can be found in table 1. The temporal components of the routine were analysed. Shots using the same club were combined and averaged.

GOLF SIMULATOR

The simulator utilised in this pilot study consists of three infrared ball-tracking sensors, which provide flight characteristics of the ball as it is propelled towards the screen. This data is then used by the systems computer to calculate onward trajectory, direction, and velocity showing the completion of the shot onscreen. The major advantage of this system is that it allows players to use their regular clubs, golf swing, and can hit their own golf balls at the screen.

DATA ANALYSIS

The first step involved the identification of the major behavioural components of the routines used by the golfers. A summary of the major components is provided in table 1. The next step using the Dart Trainer software package involved measuring the full temporal duration of the routines and each behavioural component. Once the duration of these components had been measured all the recorded routines for a particular shot type the mean temporal duration each of the major component categories, for each participant, were calculated. This data was then presented in a graphical format.

Characteristic	Behaviour	Description
Head	Glance	Initiated by head movement towards the target. Ended when the focus returns to the ball and the head is stationary
Posture	***Postural***	***Any movement of the lower body whilst the***
	Adjustment	feet remain fixed. E.g. knee bend
	Stepping	Change in foot position
Club	Raised	Initiated when the club is raised of the ground behind the ball. Ended when the club is re-grounded behind the ball.
	Practise	*Initiated when the club is drawn back from*
	Swing	*the ball. Ended when the club returns to its*
		start position behind the ball

Table 1. Definitions of the behavioural characteristics monitored during the pre-performance routines

RESULTS

The results of this pilot study suggest that the participants utilise different pre-performance routines for different golfing shots. For each participant in this study all putting shots and shots utilising the driver have been combined and averaged. Figures 1- 4 show the instances of movements that comprise the major categories of behavioural components of the combined routines. Specific data is also displayed for the temporal duration of the 'still' period. This still period is characterised as the period of time between suspension of movement at the end of the routine and ball strike.

In the case of all four participants in this study the putting shots have a longer still period when compared within participant to shots utilising the driver. In some cases subjects followed systematically different routines depending on the type of shot they were required to play. These routines within participant were composed of temporally & behaviourally differing characteristics across the two different shot types.

Comparisons between participants also demonstrated that the structure and timing of these pre-performance behavioural routines differ from individual to individual based upon a number of as yet unexplored variables.

PARTICIPANT ONE

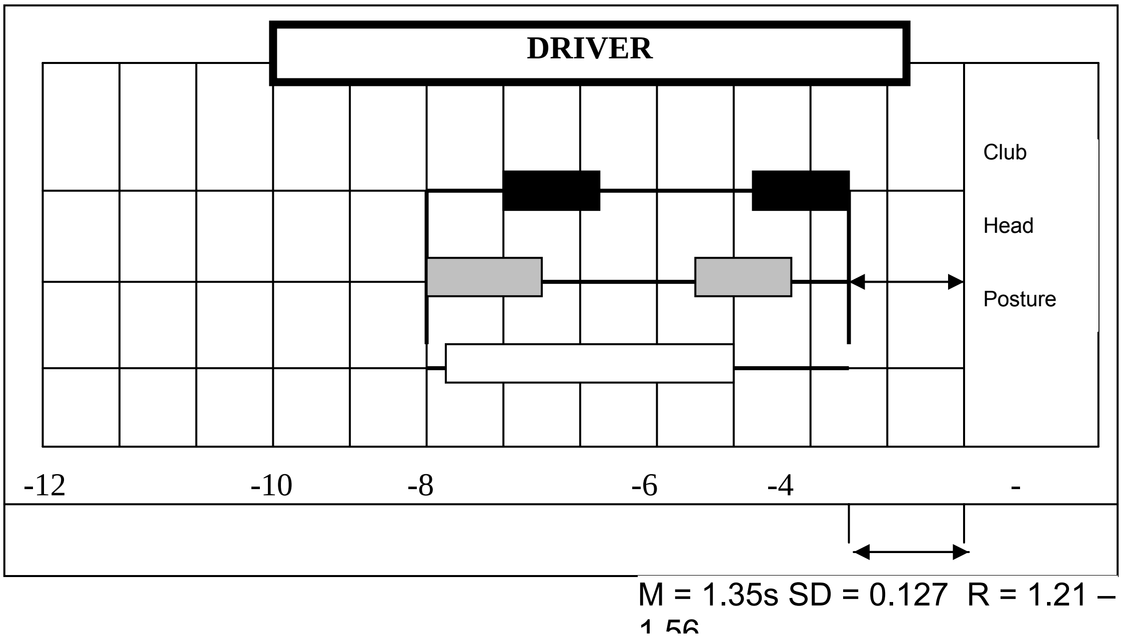


Figure 1. Graphical representation of the temporal and behavioural characteristics of the pre-performance routines utilised by participant one using the driver.

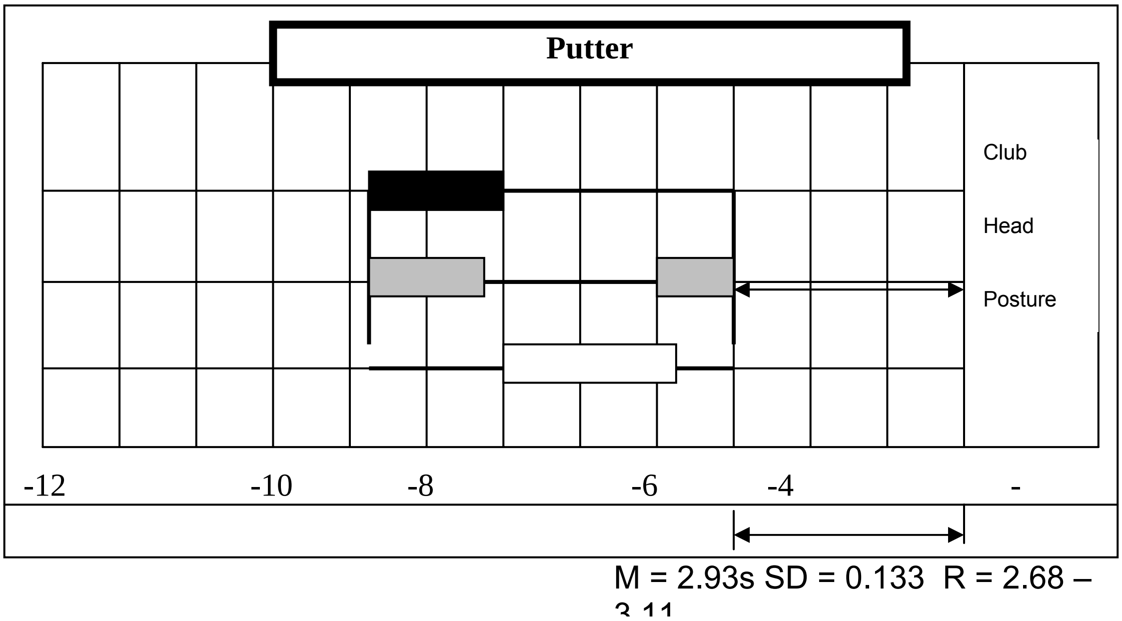


Figure 2. Graphical representation of the temporal and behavioural characteristics of the pre-performance routines utilised by participant one using the putter.

PARTICIPANT TWO

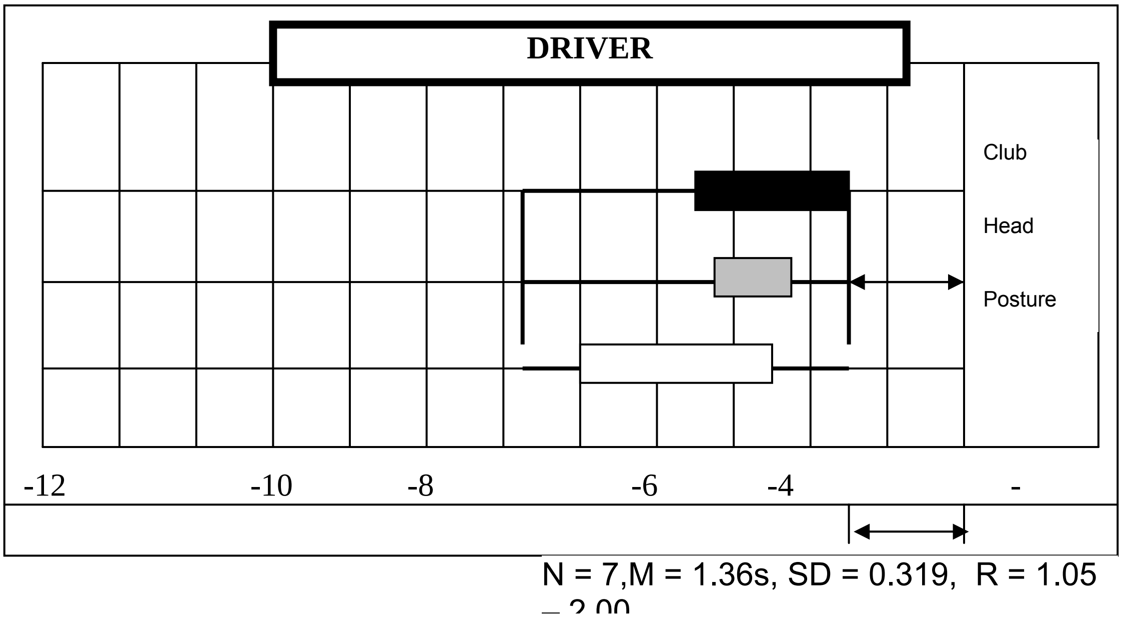


Figure 3. Graphical representation of the temporal and behavioural characteristics of the pre-performance routines utilised by participant two using the driver.

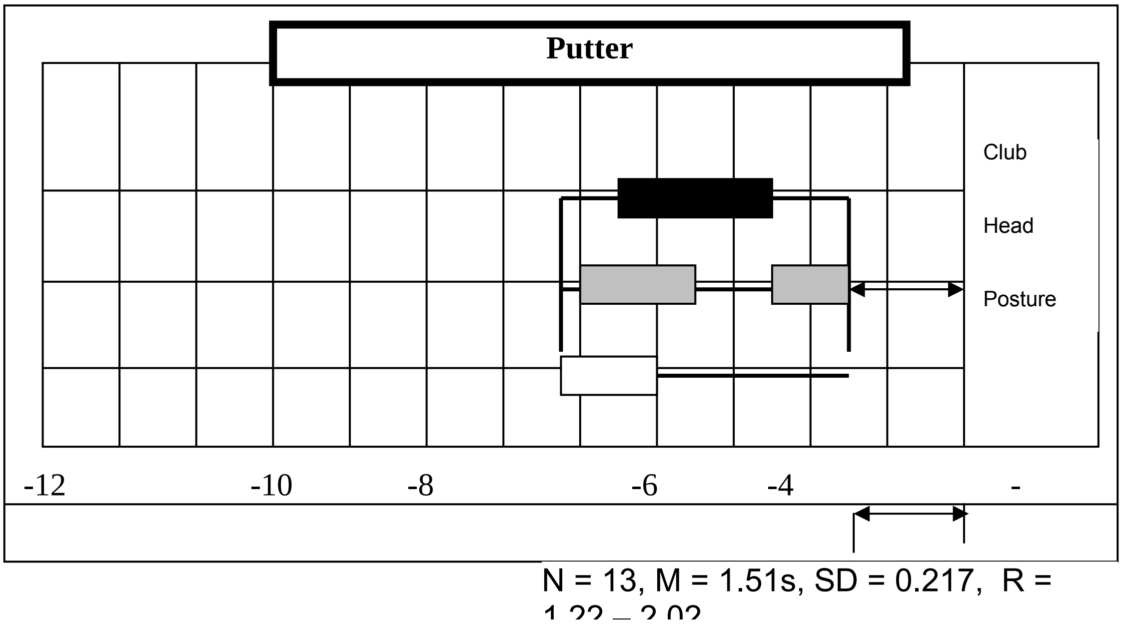
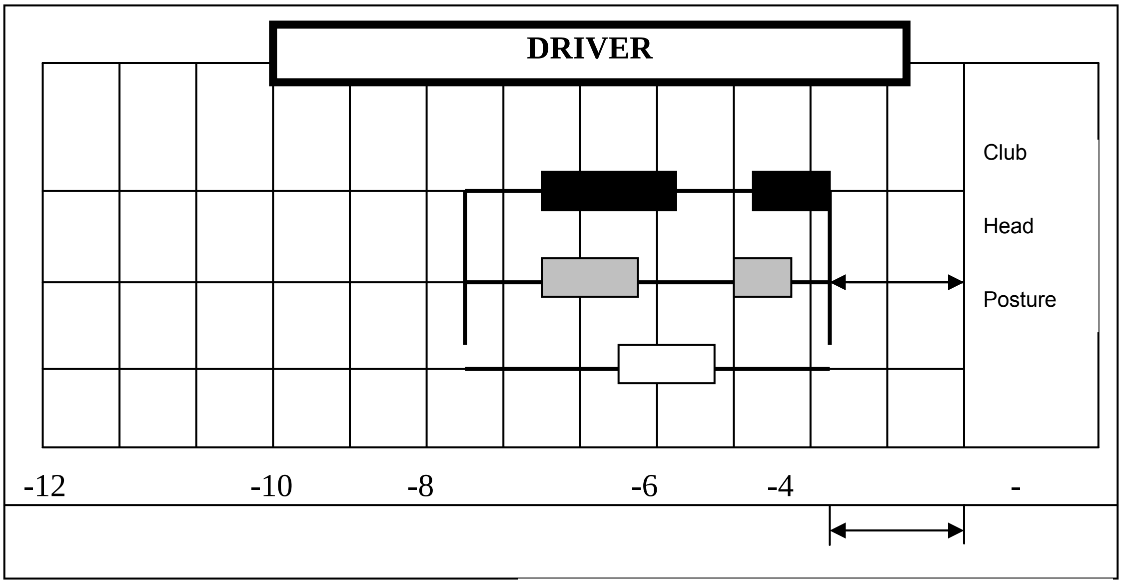


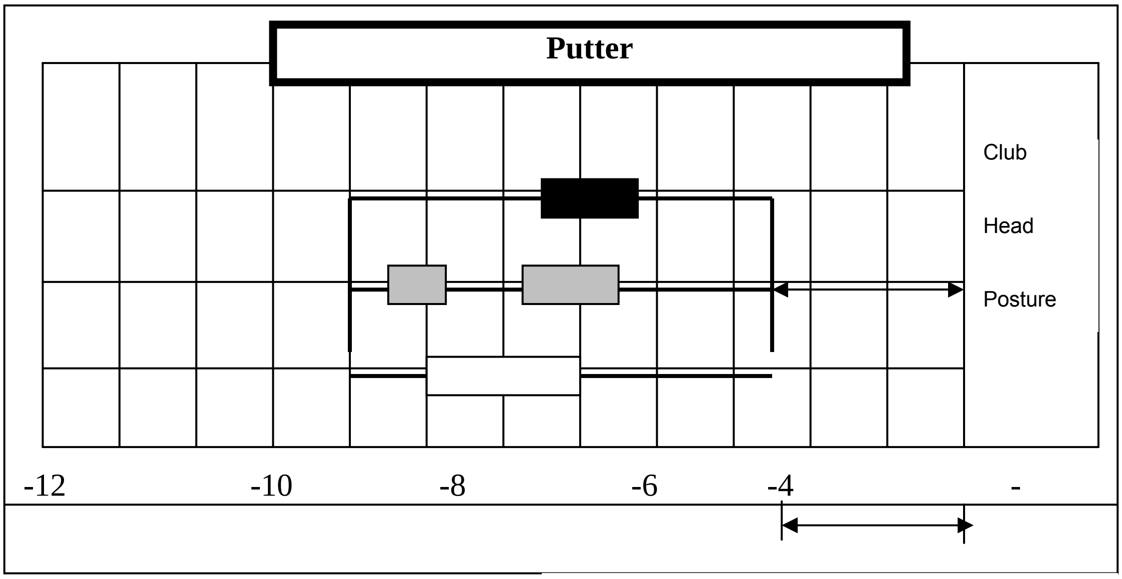
Figure 4. Graphical representation of the temporal and behavioural characteristics of the pre-performance routines utilised by participant two using the putter.

PARTICPANT THREE



N = 10, M = 1.62s, SD = 0.142, R = 1.41 – 1.80

Figure 5. Graphical representation of the temporal and behavioural characteristics of the pre-performance routines utilised by participant three using the driver.



N = 12, M = 2.50s, SD = 0.197, R = 2.30 – 2.89

Figure 6. Graphical representation of the temporal and behavioural characteristics of the pre-performance routines utilised by participant three using the putterer.

PARTICPANT FOUR

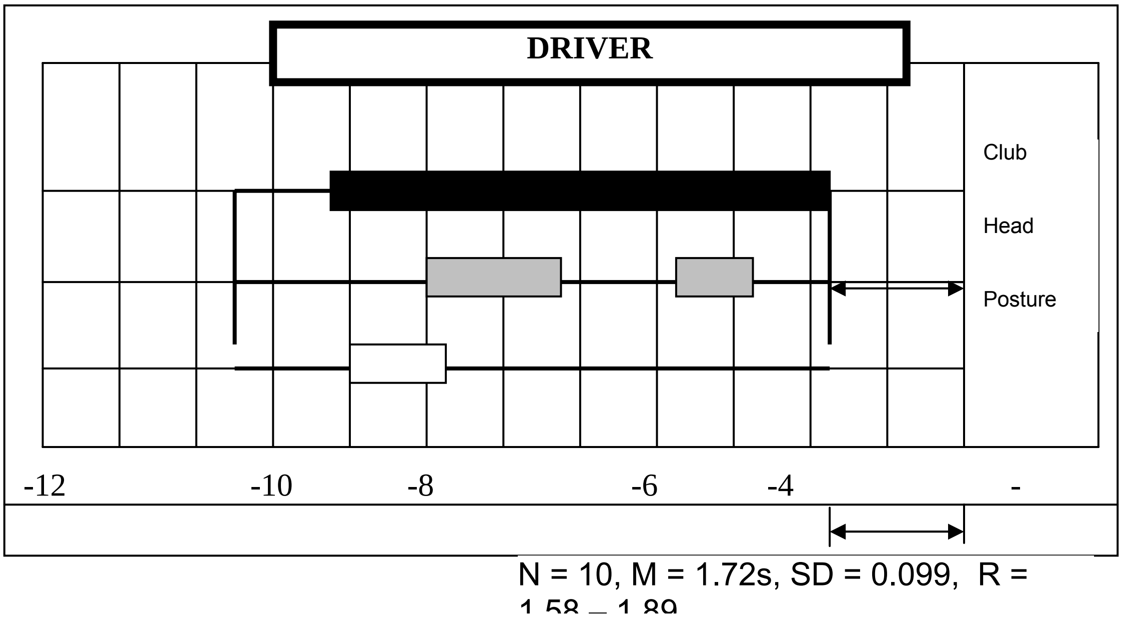
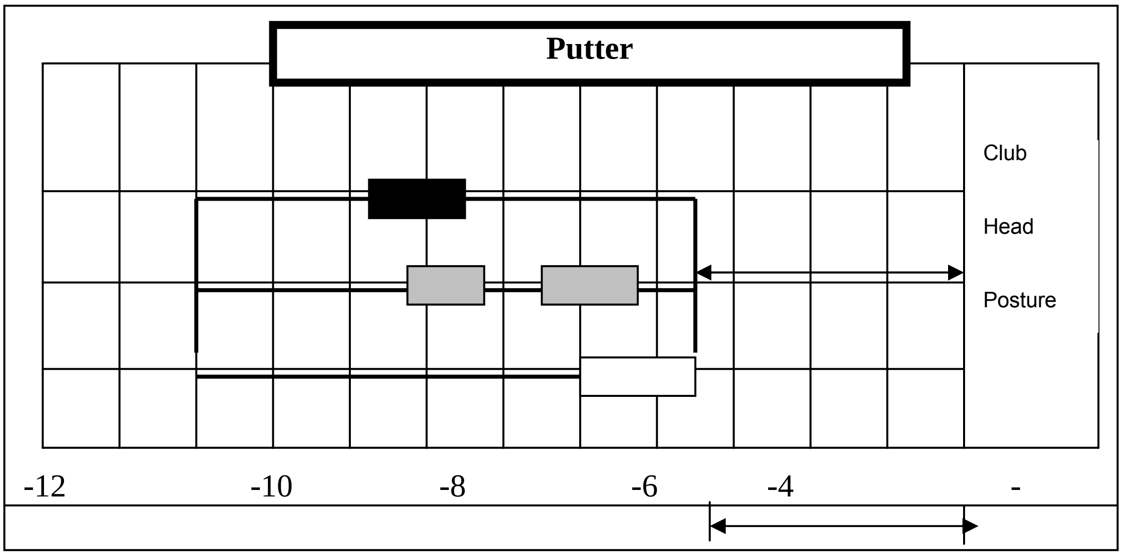


Figure 7. Graphical representation of the temporal and behavioural characteristics of the pre-performance routines utilised by participant four using the driver.



N = 16, M = 3.62s, SD = 0.209 R = 3.22

Figure 8. Graphical representation of the temporal and behavioural characteristics of the pre-performance routines utilised by participant four using the putter.

DISCUSSION

The results of this pilot study indicate that there could be potentially significant differences both behaviourally and temporally between the pre-performance routines utilised by the same participant for different types of shot. All four participants in this study had very different routines both temporally and behaviourally for putting when compared with teeing off with a driver.

A very interesting outcome of this pilot study was the identification of the potentially significant 'still' component of the pre-performance routine prior to ball strike. It appears that as the distance of the shot decreases there is a resulting increase in the required accuracy of the shot. In this study this resulted in the participants taking longer in their routine generally and longer specifically between the end of their routine and ball strike.

The results from this study appear to question the conclusions drawn by previous research into Pre-performance routines in golf. Previous research (Fairweather & Potgeiter, 1993; Boutcher & Crews, 1987) appears to have worked on the assumption that the routine utilised prior to performance is the same regardless of the nature and characteristics of the particular shot. Previous studies have adopted a too simplistic approach to the study of pre-performance routines in golfing performance. These preliminary results advocate further investigation of the nature of pre-performance routines utilised by golfers across a range of shot types.

CONCLUSION

The results of this study suggest that pre-performance routine research to date has not fully explored the nature and characteristics of the routines utilised by golfers. Participants utilised very different routines for different types of shot. When raises the question as to whether every different shot type has a different routine, whether a generic template exists which is modified per specific situation, or whether there are groupings of shot types into a category of routine.

APPENDIX D

STUDY TWO MANOVA ASSUMPTION TESTING DATA

MULTIVARIATE NORMALITY

Mahalanobis distance residual statistics for all six participants.

Participant	Minimum	Maximum	Mean	Std. Deviation	N
1	1.358	11.161	3.949	2.174	78
2	1.216	14.038	3.947	2.434	75
3	1.426	13.049	3.947	2.290	75
4	1.523	9.051	3.947	1.574	75
5	.706	9.494	3.947	2.015	75
6	.438	13.376	3.947	2.701	75

MULTIVARIATE OUTLINERS

Participant 1

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	38	38.00	11.16088
		2	40	40.00	10.30268
		3	59	59.00	10.01145
		4	65	65.00	9.22227
		5	48	48.00	8.40052
	Lowest	1	69	69.00	1.35837
		2	2	2.00	1.61036
		3	15	15.00	1.63398
		4	68	68.00	1.64786
		5	20	20.00	1.71514

Participant 2

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	61	61	14.03769
		2	58	58	11.28406
		3	71	71	11.12207
		4	17	17	9.39372
		5	18	18	9.14959
	Lowest	1	14	14	1.21559
		2	39	39	1.75132
		3	54	54	1.76722
		4	47	47	1.82288
		5	51	51	1.85998

Participant 3

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	27	27	13.04936
		2	61	61	10.37758
		3	3	3	10.09011
		4	2	2	8.76049
		5	19	19	8.49663
	Lowest	1	60	60	1.42587
		2	6	6	1.51776
		3	17	17	1.70104
		4	1	1	1.72786
		5	67	67	1.77708

Participant 4

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	9	9	9.05143
		2	16	16	7.53760
		3	39	39	7.39491
		4	54	54	6.80302
		5	4	4	6.65779
	Lowest	1	63	63	1.52347
		2	38	38	1.62810
		3	14	14	1.79456
		4	21	21	1.86930
		5	18	18	1.91633

Participant 5

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	47	47	9.49376
		2	61	61	8.42125
		3	28	28	8.26054
		4	54	54	7.67113
		5	41	41	7.50694
	Lowest	1	33	33	.70571
		2	11	11	.96010
		3	16	16	1.21175
		4	32	32	1.23116
		5	73	73	1.25865

Participant 6

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	32	32	13.37648
		2	36	36	12.69964
		3	10	10	11.62986
		4	31	31	9.48773
		5	15	15	8.24406
	Lowest	1	1	1	.43814
		2	20	20	.50114
		3	74	74	.59915
		4	23	23	1.05938
		5	21	21	1.13369

MULTICOLLINEARITY AND SINGULARITY

Participant 1

		Head	Club	Posture	Still
Head	Pearson Correlation	1	.103	.814(**)	.171
	Sig. (2-tailed)		.371	.000	.134
	N	78	78	78	78
Club	Pearson Correlation	.103	1	.001	-.929(**)
	Sig. (2-tailed)	.371		.994	.000
	N	78	78	78	78
Posture	Pearson Correlation	.814(**)	.001	1	.280(*)
	Sig. (2-tailed)	.000	.994		.013
	N	78	78	78	78
Still	Pearson Correlation	.171	-.929(**)	.280(*)	1
	Sig. (2-tailed)	.134	.000	.013	
	N	78	78	78	78

Participant 2

		Head	Club	Posture	Still
Head	Pearson Correlation	1	.831(**)	-.057	.628(**)
	Sig. (2-tailed)		.000	.627	.000
	N	75	75	75	75
Club	Pearson Correlation	.831(**)	1	.358(**)	.747(**)
	Sig. (2-tailed)	.000		.002	.000
	N	75	75	75	75
Posture	Pearson Correlation	-.057	.358(**)	1	.538(**)
	Sig. (2-tailed)	.627	.002		.000
	N	75	75	75	75
Still	Pearson Correlation	.628(**)	.747(**)	.538(**)	1
	Sig. (2-tailed)	.000	.000	.000	
	N	75	75	75	75

Participant 3

		Head	Club	Posture	Still
Head	Pearson Correlation	1	.280(*)	-.720(**)	.168
	Sig. (2-tailed)		.015	.000	.149
	N	75	75	75	75
Club	Pearson Correlation	.280(*)	1	-.203	-.839(**)
	Sig. (2-tailed)	.015		.080	.000
	N	75	75	75	75
Posture	Pearson Correlation	-.720(**)	-.203	1	-.287(*)
	Sig. (2-tailed)	.000	.080		.012
	N	75	75	75	75
Still	Pearson Correlation	.168	-.839(**)	-.287(*)	1
	Sig. (2-tailed)	.149	.000	.012	
	N	75	75	75	75

Participant 4

		Head	Club	Posture	Still
Head	Pearson Correlation	1	.694(**)	-.111	-.144
	Sig. (2-tailed)		.000	.341	.218
	N	75	75	75	75
Club	Pearson Correlation	.694(**)	1	.284(*)	-.565(**)
	Sig. (2-tailed)	.000		.013	.000
	N	75	75	75	75
Posture	Pearson Correlation	-.111	.284(*)	1	-.886(**)
	Sig. (2-tailed)	.341	.013		.000
	N	75	75	75	75
Still	Pearson Correlation	-.144	-.565(**)	-.886(**)	1
	Sig. (2-tailed)	.218	.000	.000	
	N	75	75	75	75

Participant 5

		Head	Club	Posture	Still
Head	Pearson Correlation	1	-.312(**)	-.746(**)	-.051
	Sig. (2-tailed)		.006	.000	.666
	N	75	75	75	75
Club	Pearson Correlation	-.312(**)	1	-.089	-.607(**)
	Sig. (2-tailed)	.006		.446	.000
	N	75	75	75	75
Posture	Pearson Correlation	-.746(**)	-.089	1	.565(**)
	Sig. (2-tailed)	.000	.446		.000
	N	75	75	75	75
Still	Pearson Correlation	-.051	-.607(**)	.565(**)	1
	Sig. (2-tailed)	.666	.000	.000	
	N	75	75	75	75

Participant 6

		Head	Club	Posture	Still
Head	Pearson Correlation	1	.010	.040	-.202
	Sig. (2-tailed)		.933	.732	.082
	N	75	75	75	75
Club	Pearson Correlation	.010	1	-.891(**)	-.568(**)
	Sig. (2-tailed)	.933		.000	.000
	N	75	75	75	75
Posture	Pearson Correlation	.040	-.891(**)	1	.521(**)
	Sig. (2-tailed)	.732	.000		.000
	N	75	75	75	75
Still	Pearson Correlation	-.202	-.568(**)	.521(**)	1
	Sig. (2-tailed)	.082	.000	.000	
	N	75	75	75	75

HOMOGENEITY OF VARIANCE-COVARIANCE MATRICES – Box's Test of Equality of Covariance Matrices

Participant 1

Box's M	70.158
F	3.236
df1	20
df2	20191.262
Sig.	.000

Participant 2

Box's M	16.615
F	1.511
df1	10
df2	11015.139
Sig.	.128

Participant 3

Box's M	32.808
F	1.508
df1	20
df2	18608.267
Sig.	.067

Participant 4

Box's M	42.327
F	1.946
df1	20
df2	18608.267
Sig.	.007

Participant 5

Box's M	37.150
F	1.707
df1	20
df2	18442.089
Sig.	.025

Participant 6

Box's M	16.615
F	1.511
df1	10
df2	11015.139
Sig.	.128

APPENDIX E

Exploring the consistency of pre-shot routines across shot types in golf.

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Introduction

Boutcher (1990), Lobmeyer & Wasserman (1986) suggested that a method for maintaining high levels of performance in the face of potential distractions is to develop a consistent pre-performance routine. Pre-performance routines (PPR's) were defined by Moran (1996) as "a sequence of task-relevant thoughts and actions which an athlete engages in systematically prior to his or her performance of a specific sports skill". Crampton (1989) suggested that ' elite golfers appear to do the same things in the same order and with the same timing'. He suggested that a pre-shot routine was an ordered collection of thoughts and behaviours that is aimed at achieving the necessary mind set, concentrational focus and physical readiness for each shot. A golfer may utilize several psychological skills combined within a particular physiological strategy for optimal execution of a putt. It has also been suggested that PPR's helped performers achieve behavioural and temporal consistency in their performance (Wrisberg & Penn, 1992). Crew's & Boutcher's (1987) study of elite golfers highlighted an apparent relationship between consistency of the timing of routines and the consistency of behavioural characteristics. Claiming that a fundamental characteristic of effective PPR's was the consistent duration of the routines. The major criticism of this and other studies is that the tasks subjects were required to perform were limited. In each study subjects performed the same tasks time after time. In Crews & Boutchers studies their subjects completed a putting task and a swing task, which were then assessed.

Research in golf to date has only explored pre-performance routines (PPR's) in putting tasks with a regulated variability in task difficulty (putting distance). Other in golf have also predominantly focused on putting (Fairweather & Potgeiter, 1993;Boutcher & Crews, 1987),The aim of this study was therefore to explore the extent to which these characteristics of PPR's hold true across a range of different shot types.

Previous measures to analyse PPR's have focused on the frequency, duration and consistency of behaviours which combine to form the routine. Boutcher and Zinesser (1990) specifically looked at the number of practice swings and the number of glances at the hole of elite golfers. Analysis of the combined behavioural and temporal characteristics of PPR's appears to be the most effective method in assessing these routines.

It is therefore the purpose of this study to explore the temporal and behavioural consistency of PPR's between shot types for individual golfers.

Methods

Subjects were 4 professional golfers with handicaps ranging from +2 to 0 (mean = +1.2). Each subject played 36 holes on a golf simulator (Smartgolf, Links LS Software, 10' x 12' high resolution screen & LCD projection system).

The golfers were required to play the holes under normal conditions including shot and club selection. Each shot played was videoed allowing the analysis of the major components of the pre-shot routines. The temporal components of these characteristics were also analysed. This allowed inter-shot type comparisons.

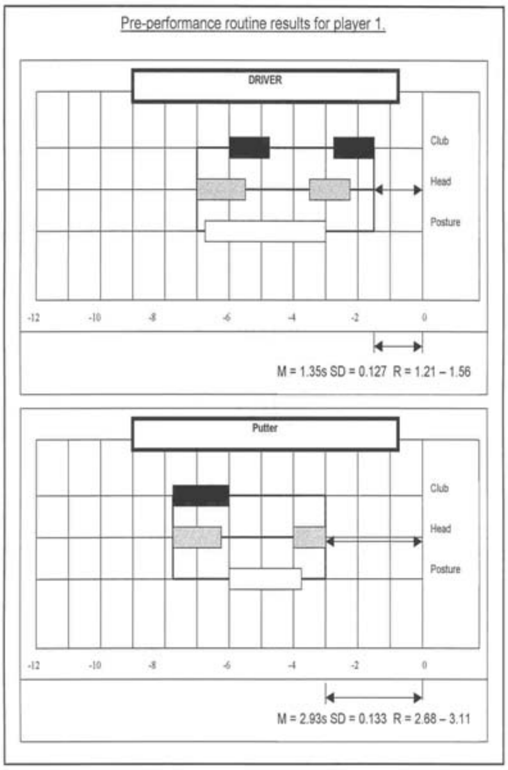
The video data was analysed using the DartGolf performance analysis package. The PPR's were separated into the defining behavioural characteristics, then the temporal components of the routine were analysed. Shots using the same club were combined and averaged.

Characteristic	Behaviour	Description
Head	Glance	Initiated by head movement towards the target. Ended when the focus returns to the ball and the head is stationary
Posture	Postural Adjustment	Any movement of the lower body whilst the feet remain fixed. E.g. knee bend
	Stepping	Change in foot position
Club	Raised	Initiated when the club is raised of the ground behind the ball. Ended when the club is re-grounded behind the ball.
	Practise Swing	Initiated when the club is drawn back from the ball. Ended when the club returns to its start position behind the ball

Table 1. Definitions of the behavioural characteristics monitored during the pre-performance routines

Results

The results indicate that there appears to be PPR's for different golfing shots. For each participant in the study call putting shots and shots utilising the driver have been combined and averaged. Figures 1-4 show the behavioural components of the combined routines. Specific data is also displayed the 'still' period of each participant between the end of their routine and initiation of ball strike. In all 4 cases the putting shots have a longer still period than the driving shots. In some cases subjects followed systematically different routines depending on the type of shot they were required to play. These routines were composed of temporally & behaviourally differing characteristics across the two different shot types.



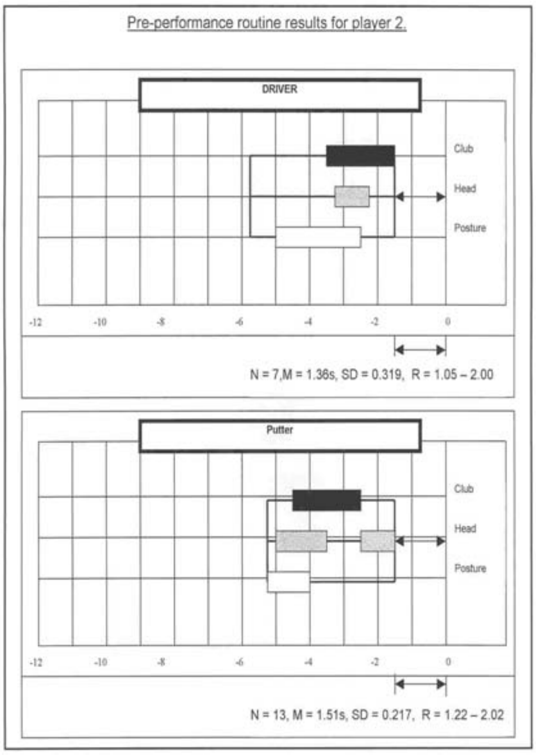
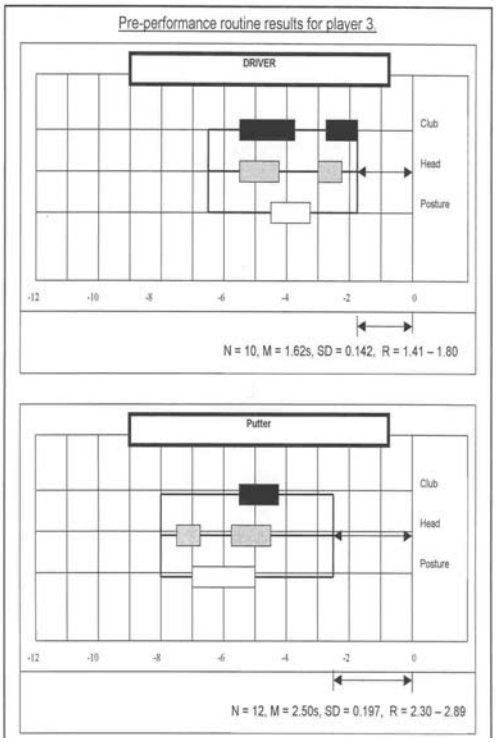


Figure 1. Pre-performance routines for player 1 Figure 2. Pre-performance routines



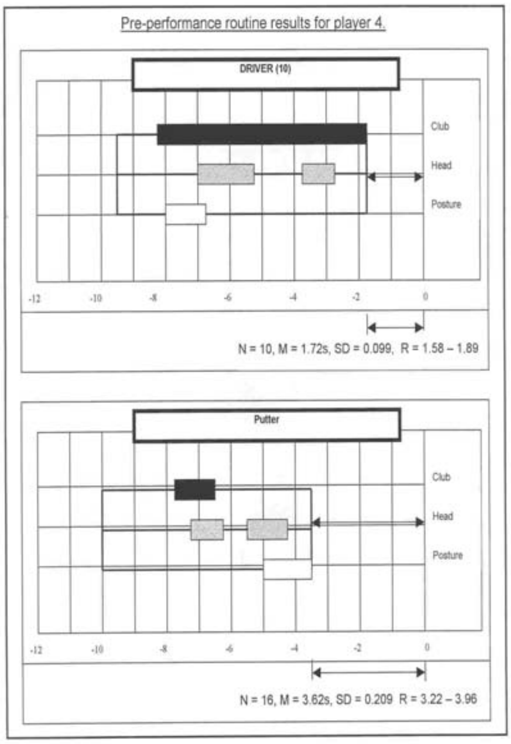


Figure 3. Pre-performance routines for player 3   Figure 4. Pre-performance routines for player 4.

Conclusion

The results indicate that there are significant differences both behaviourally and temporally between shot types by the same golfer. All 4 participants in this study had significantly different routines for putting when compared with teeing off with a driver. A very interesting outcome from this study was the identification of the 'still' component of the routine prior to ball strike. It appears that as the distance of the shot decreases and the required accuracy increases the golfers in this study took longer in the routine generally and longer specifically between the end of their routine and ball strike. The results from this study question the conclusions drawn by previous research into PPR's in golf. It appears that previous studies have adopted a too simplistic approach to the study of PPR's in golfing performance.

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APPENDIX F

PILOT STUDY THREE

INTRODUCTION

Understanding the relationship between the behavioural characteristics of pre-performance routines and the underlying psychological processes is intuitively essential in really developing an understanding of the function that pre-performance routines fulfil. The cognitive state of the performer appears to be the most important in understanding the function of the pre-performance routines (Singer, 1999; Murphy 1994). The ability then, to be able to measure the cognitive state during psychological preparation for sports performance appears to be key to understanding the nature of the pre-performance routines used immediately prior to sports performance.

Previous research (Boutcher and Zinsser, 1990; Landers et al, 1991) has utilised heart-rate variability data as a useful indicator of the underlying attentional processes utilised by sports performers prior to performance. This psychophysiological method can be used as a quantifiable alternative to the use of self report measures for studying attentional processes (Hassmen and Kolvula (2001).

Indeed previous research suggests that a specific relationship between attentional processes and heart rate exists. Singer (1999) reported that when an action requires an internal attentional focus, heart rate acceleration results in greater cortical activity. Landers, Petruzzello, Slazar et al (1991) also reported that there tends to be a decrease in HR during the preparation and concentration phase related to performing a motor skill.

Boutcher and Zinsser (1990) in their study of University golfers suggested that the heart rate deceleration of experienced performers before a motor response was associated with good performance.Boutcher and Zinsser measured the inter-beat intervals (IBI's) between heartbeats immediately prior to, during and post completing a putting task. Their results showed that this IBI increased significantly in length prior to performance indicating a decrease in Heart Rate. The overall conclusions they presented indicated that there was a greater cardiac deceleration associated with superior putting performance.

The aim of this study was to take this a stage further. Previous research exploring heart-rate characteristics in golf have focused on one type of shot (the putt). The specific aim of this study was to explore whether any identifiable differences existed when comparing inter-beat interval data for different types of shot category within participant.

METHOD

PARTICIPANTS

The participants were two County standard male golfers (County men's first team) with a mean handicap of 1.6 and a mean age of 19.17 years. Each participant was required to play thirty-six holes on a specified course on a Smart golf© golf simulator.

PROCEDURE

Each of the participants was required to play thirty-six holes on a specified course on a Smart golf© golf simulator.

Participants were required to play thirty-six holes on the virtual Belfry golf course (Birmingham, UK) generated by the Smartgolf simulator (Links LS Software, 10' x 12' high resolution screen & LCD projection system).

Participants recorded the clubs they selected for each shot attempted. Only shots involving the driver, wedge or putter were selected for further analysis. These shots were selected as Cotterill and Collins (2003) had suggested that golfers utilise different pre-performance routines for each category of shot. The number of each category of shot used by each participant during their two rounds varied depending on their personal club selection in response to how they were playing and their personal preferences.

Heart rate data in the form of inter-beat intervals (IBI's) was recorded for each participant using a Polar S810 heart rate monitor (HRM) with R-R inter-beat interval (IBI) recording capability. Each participant wore a polar HRM thoracic belt with a pulse transmitter, which transmitted IBI data to the polar S810 wrist receiver. The wrist receiver was not worn by the participants but located near-by. This allowed for 'online' transmission of the IBI data from the wrist receiver to the Polar precision performance software package located on a nearby computer. As a result IBI data for each performance could be recorded and saved for each participant ready for future analysis.

DATA ANALYSIS

Mean inter-beat intervals (IBI's) for the specific categories of shot performed by the participants were calculated for each shot type for all three participants. The four inter-beat intervals prior to ball strike (-4, -3, -2, -1), ball strike (0) and two post ball strike (+1, +2), for each shot type within participant were averaged. A repeated measures T-test (paired variables putter and driver) was then used within subject to ascertain if significant differences existed between corresponding IBIs across the two different shot types.

RESULTS

The results for each participant showed an increase in the duration of the IBI's prior to shot execution for all shot types, indicating a decrease in heart rate. Post shot execution IBI's decreased, which characterised an increase in heart rate. Both participants further demonstrated a greater increase in the IBI for shots using the putter when compared with the driver (see figures 1-4). These results further indicated that there is a decrease in heart rate prior to the execution of both golf shot types (putter and driver). This decrease however is more pronounced during the putt when compared to the shots involving the driver.

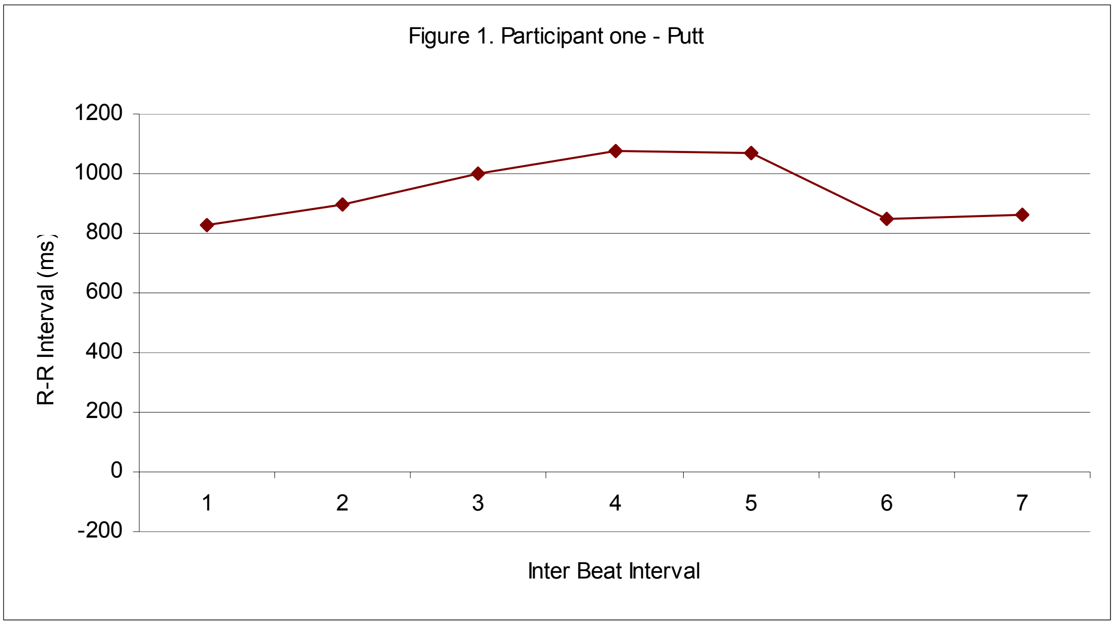


Figure 1. Averaged R – R inter-beat interval (IBI) data for participant one for shots involving the putter.

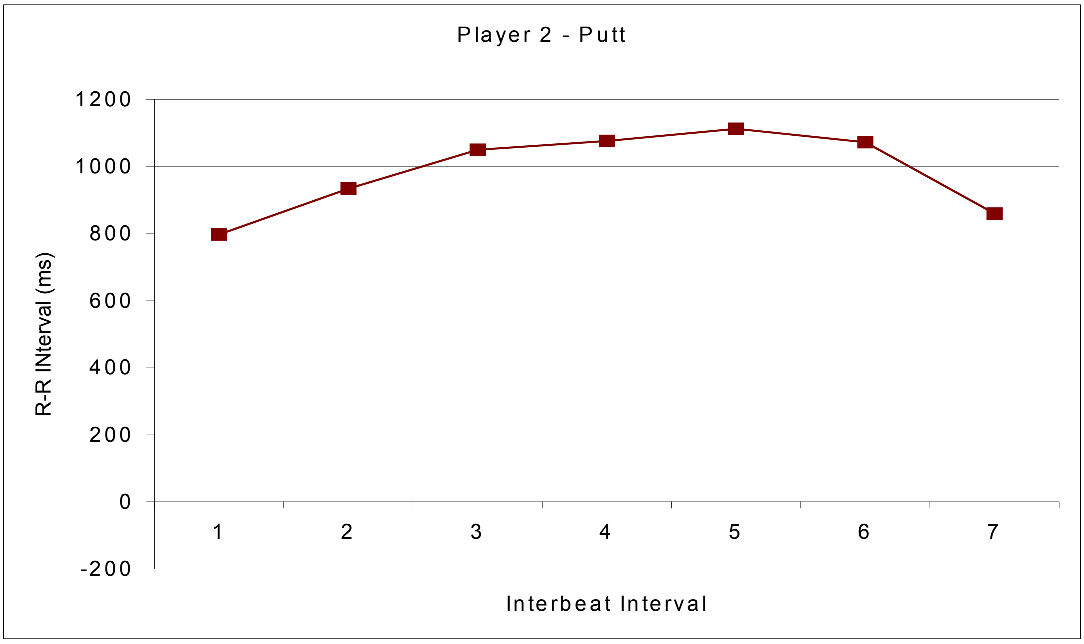


Figure 2. Averaged R – R inter-beat interval (IBI) data for participant two for shots involving the driver.

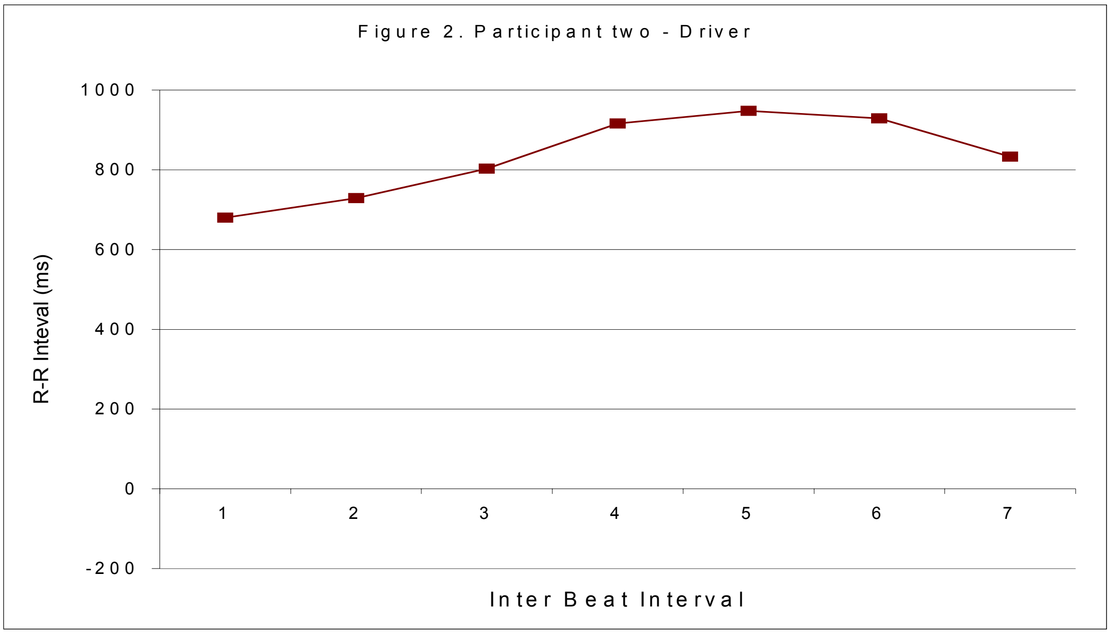


Figure 3. Averaged R – R inter-beat interval (IBI) data for participant two for shots involving the putter.

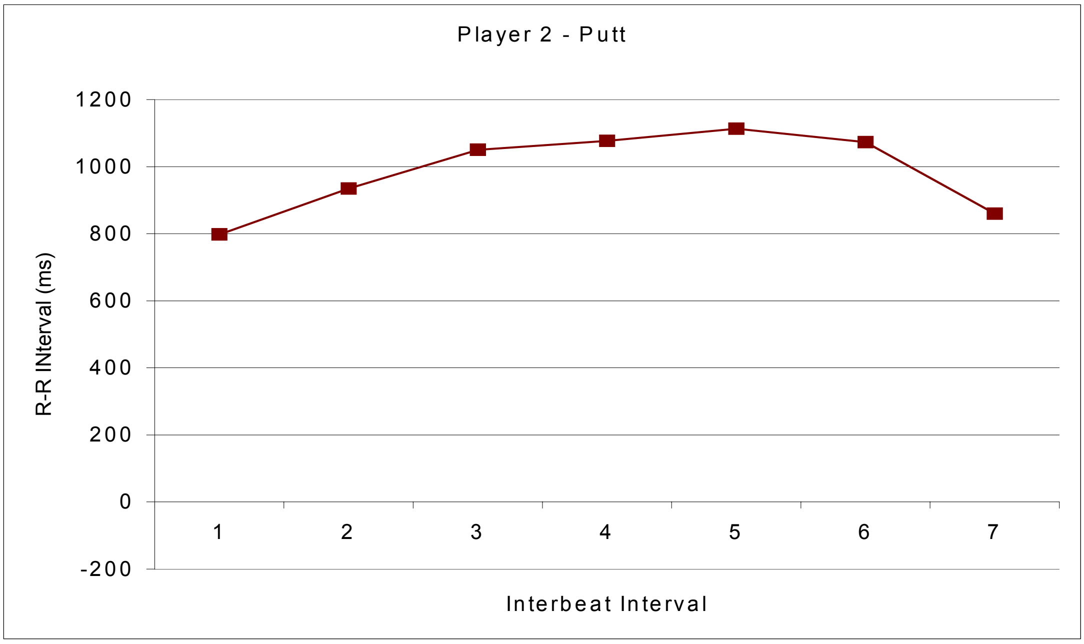


Figure 4. Averaged R – R inter-beat interval (IBI) data for participant two for shots involving the driver.

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Lower	95% Upper			
Putter - Driver	110.714	63.134	23.862	52.325	169.104	4.640	6	.004

Table 1. T-test results for participant one. IBI comparisons between shot type.

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Lower	95% Upper			
Pair 1	Putter - Driver	145.429	73.068	27.617	77.852	213.005	5.266	6	.002

Table 2. T-test results for participant two. IBI comparisons between shot type.

Statistical analysis of the IBI data concluded that there were significant differences in the R-R interbeat interval duration prior to shot execution when comparing the two shot types for participant one: $F (6) = 4.64$, $p < 0.005$, $eta^2 = 0.81$. This significant difference for participant one also resulted in a large effect size compared with Cohen's (1988) guidelines for interpreting eta squared (.01 = small effect; .06 = moderate effect; and .14 = large effect).

Participant two also demonstrated significant differences between the IBI's across the two shot types: $F (6) = 5.27$, $p < 0.005$, $eta^2 = 0.82$. Again, as for participant one the effect size here was large at 0.82.

	Interbeat Intervals						
	-4	-3	-2	-1	0	1	2
Putter (M)	835	900	999	1074	1071	844	862
Driver (M)	753	846	853	873	903	817	765
Difference	82	54	146	201	168	27	97

Table 3. Participant one mean IBI data and mean differences per epoch.

	Interbeat Intervals						
	-4	-3	-2	-1	0	1	2
Putter (M)	802	938	1052	1078	1113	1072	858
Driver (M)	684	732	805	917	948	978	831
Difference	118	206	247	160	165	94	27

Table 4. Participant two mean IBI data and mean differences per epoch.

Tables 3 and 4 further identify interesting differences in the mean duration of the IBI's across the seven epochs of interest to this study. Participant has an increasing differential between the two shot types at –2, -1 and 0. Participant two on the other hand also displays greater differences for a number of the epochs, but different epochs to participant one. Specifically participant two has a greater difference for epochs –3, and –2 with a not quite so high difference for epochs –1 and 0.

DISCUSSION

The first point to note here is that both participants demonstrated an increase in the interbeat intervals prior to shot execution and a decrease following ball strike. This indicates that this corresponding decrease in HR prior to ball strike is a desirable state when executing a golf shot. This is further supported by the notion that this HR deceleration occurred whilst the subjects performed pre-putt movement, as a result it is unlikely that this reduction in HR was caused by a relaxation response (Boutcher and Zinsser, 1990). Boutcher and Zinsser further suggested that this cardiac deceleration prior to ball strike was to "facilitate attentional processes by decreasing other feedback to the brain" (p.45).

The second major point to note from these results is the extent to which the IBI increases prior to and during shot execution is linked to the different characteristics of the shot. Both participants had significantly higher IBIs putting when compared to using the driver. One potential explanation for this could be the nature and duration of the pre-performance routines utilised by the participants, which vary with each shot type (Cotterill & Collins, 2003). This also suggests that different levels of attentional focus may be required to execute different shot types. Indeed, putting has a greater need for pinpoint accuracy than driving and as a result you would expect a greater reduction in feedback to the brain in order to execute putting performance effectively.

Finally, there is an interesting trend demonstrated by both participants when examining the difference between corresponding IBIs between shot types. Both participants demonstrate an increased difference for three / four IBIs. These increased differences however, do not occur at exactly the same points for the two participants, which suggests that a heightened attentional focus is required for different participants at slightly different times. This could reflect differences in the individual participants' preparation or possibly differing preparatory psychological strategies.

CONCLUSION

The results of this study suggest that differences exist is the required state to perform different types of shots. This could be linked to the different routines adopted by golfers, or alternatively could reflect the different attentional demand of the different shot types.

Furthermore, these differences between shot types appear to be individualistic which has implications for the development of appropriate and effective pre-performance routines in golfers. Future research should explore the individual nature of the pre-performance routines utilised by golfers and explore the psychological strategies utilised in the pre-performance period.

APPENDIX G

STUDY THREE MANOVA ASSUMPTION TESTING DATA

MULTIVARIATE NORMALITY

Mahalanobis distances for all six participants.

Participant	Minimum	Maximum	Mean	Std. Deviation	N
1	.206	15.89	3.95	3.35	78
2	.148	14.851	3.95	2.99	78
3	.480	17.143	3.949	3.3.39	78
4	.133	16.56	3.95	2.92	78
5	.090	12.39	3.95	3.15	78
6	.119	17.43	3.95	3.33	78

MULTIVARIATE OUTLINERS

Participant 1

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	8	8.00	9.02066
		2	11	11.00	6.70787
		3	10	10.00	5.59807
		4	9	9.00	5.01849
		5	2	2.00	4.86987
	Lowest	1	3	3.00	.56498
		2	1	1.00	.69365
		3	4	4.00	1.18423
		4	13	13.00	2.42655
		5	6	6.00	2.44595

Participant 2

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	4	4.00	8.32996
		2	3	3.00	6.08957
		3	1	1.00	5.61842
		4	7	7.00	4.95390
		5	2	2.00	4.33008
	Lowest	1	11	11.00	.96349
		2	8	8.00	1.05078
		3	5	5.00	1.57519
		4	6	6.00	1.72142
		5	9	9.00	2.04417

Participant 3

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	12	12.00	8.58587
		2	7	7.00	6.71495
		3	5	5.00	5.48595
		4	11	11.00	4.53388
		5	2	2.00	4.47900
	Lowest	1	4	4.00	.58828
		2	9	9.00	.91079
		3	8	8.00	1.50212
		4	1	1.00	1.66191
		5	3	3.00	1.95282

Participant 4

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	9	9.00	7.25195
		2	2	2.00	6.12626
		3	12	12.00	5.31215
		4	3	3.00	4.61961
		5	7	7.00	4.45544
	Lowest	1	10	10.00	.44672
		2	4	4.00	.64866
		3	11	11.00	1.81515
		4	1	1.00	2.62355
		5	8	8.00	3.24494

Participant 5

Extreme Values

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	12	12.00	7.02874
		2	11	11.00	6.28988
		3	4	4.00	5.96589
		4	7	7.00	5.42141
		5	8	8.00	5.06568
	Lowest	1	6	6.00	.51007
		2	9	9.00	1.01042
		3	10	10.00	1.33274
		4	5	5.00	1.36832
		5	2	2.00	2.07752

Participant 6 **Extreme Values**

			Case Number	Subject	Value
Mahalanobis Distance	Highest	1	4	4.00	7.66994
		2	6	6.00	6.53815
		3	9	9.00	6.05316
		4	2	2.00	4.04548
		5	11	11.00	3.90312
	Lowest	1	10	10.00	.82212
		2	8	8.00	1.81224
		3	1	1.00	2.11814
		4	5	5.00	2.18252
		5	7	7.00	2.24974

MULTICOLLINEARITY AND SINGULARITY

Participant 1 **Correlations**

		Head	Club	Posture	Still
Head	Pearson Correlation	1	-.156	-.112	-.366
	Sig. (2-tailed)		.565	.680	.163
	N	16	16	16	16
Club	Pearson Correlation	-.156	1	.565(*)	-.073
	Sig. (2-tailed)	.565		.023	.788
	N	16	16	16	16
Posture	Pearson Correlation	-.112	.565(*)	1	.050
	Sig. (2-tailed)	.680	.023		.854
	N	16	16	16	16
Still	Pearson Correlation	-.366	-.073	.050	1
	Sig. (2-tailed)	.163	.788	.854	
	N	16	16	16	16

* Correlation is significant at the 0.05 level (2-tailed).

Participant 2 **Correlations**

		Head	Club	Posture	Still
Head	Pearson Correlation	1	.478	.539	-.175
	Sig. (2-tailed)		.137	.087	.607
	N	11	11	11	11
Club	Pearson Correlation	.478	1	.595	.181
	Sig. (2-tailed)	.137		.054	.594
	N	11	11	11	11
Posture	Pearson Correlation	.539	.595	1	.573
	Sig. (2-tailed)	.087	.054		.066
	N	11	11	11	11
Still	Pearson Correlation	-.175	.181	.573	1
	Sig. (2-tailed)	.607	.594	.066	
	N	11	11	11	11

Participant 3 **Correlations**

		Head	Club	Posture	Still
Head	Pearson Correlation	1	-.028	.716(**)	.030
	Sig. (2-tailed)		.932	.009	.926
	N	12	12	12	12
Club	Pearson Correlation	-.028	1	.087	.378
	Sig. (2-tailed)	.932		.789	.225
	N	12	12	12	12
Posture	Pearson Correlation	.716(**)	.087	1	.250
	Sig. (2-tailed)	.009	.789		.433
	N	12	12	12	12
Still	Pearson Correlation	.030	.378	.250	1
	Sig. (2-tailed)	.926	.225	.433	
	N	12	12	12	12

** Correlation is significant at the 0.01 level (2-tailed).

Participant 4 **Correlations**

		Head	Club	Posture	Still
Head	Pearson Correlation	1	-.436	-.424	.567
	Sig. (2-tailed)		.156	.170	.055
	N	12	12	12	12
Club	Pearson Correlation	-.436	1	.279	-.137
	Sig. (2-tailed)	.156		.379	.672
	N	12	12	12	12
Posture	Pearson Correlation	-.424	.279	1	-.466
	Sig. (2-tailed)	.170	.379		.127
	N	12	12	12	12
Still	Pearson Correlation	.567	-.137	-.466	1
	Sig. (2-tailed)	.055	.672	.127	
	N	12	12	12	12

Participant 5 **Correlations**

		Head	Club	Posture	Still
Head	Pearson Correlation	1	.247	.021	-.032
	Sig. (2-tailed)		.439	.947	.921
	N	12	12	12	12
Club	Pearson Correlation	.247	1	.011	.198
	Sig. (2-tailed)	.439		.972	.538
	N	12	12	12	12
Posture	Pearson Correlation	.021	.011	1	-.103
	Sig. (2-tailed)	.947	.972		.750
	N	12	12	12	12
Still	Pearson Correlation	-.032	.198	-.103	1
	Sig. (2-tailed)	.921	.538	.750	
	N	12	12	12	12

Participant 6

Correlations

		Head	Club	Posture	Still
Head	Pearson Correlation	1	-.830(**)	.113	.260
	Sig. (2-tailed)		.001	.727	.414
	N	12	12	12	12
Club	Pearson Correlation	-.830(**)	1	-.136	-.298
	Sig. (2-tailed)	.001		.673	.346
	N	12	12	12	12
Posture	Pearson Correlation	.113	-.136	1	-.635(*)
	Sig. (2-tailed)	.727	.673		.026
	N	12	12	12	12
Still	Pearson Correlation	.260	-.298	-.635(*)	1
	Sig. (2-tailed)	.414	.346	.026	
	N	12	12	12	12

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

HOMOGENEITY OF VARIANCE-COVARIANCE MATRICES – Box's Test of Equality of Covariance Matrices

Participant 1

Box's M	17.994
F	1.208
df1	10
df2	786.795
Sig.	.281

Participant 2

Box's M	23.779
F	1.154
df1	10
df2	347.636
Sig.	.321

Participant 3

Box's M	18.511
F	1.016
df1	10
df2	478.088
Sig.	.428

Participant 4

Box's M	13.023
F	.715
df1	10
df2	478.088
Sig.	.711

Participant 5

Box's M	39.388
F	2.163
df1	10
df2	478.088
Sig.	.019

Participant 6

Box's M	10.806
F	.593
df1	10
df2	478.088
Sig.	.820

APPENDIX H

PILOT STUDY FOUR

INTRODUCTION

Previous research exploring pre performance routines in sport has not to date comprehensively explored in any real detail the psychological processes that occur during the routine stage prior to the execution of the required movement. Even though the importance of a positive affective state pre-competition has been identified (Jones et al, 1996).

Previous researchers in the area have hypothesised a number of potential psychological processes, which include the utilisation of imagery (Hall, Rodgers and Barr, 1990) and distracting the attentional focus from irrelevant thoughts (Maynard, 1998) during pre-performance routine execution. It has further been suggested that the pre-performance routine specifically improves both concentration and performance (Harle and Vickers, 2001), enhancing the recall of physiological and psychological states (Marlow, 1998). Indeed Jackson and Baker (2001) suggested that "it seems logical that routine times would be longer whenever other coping strategies, such as applied relaxation (Ost, 1988), attentional cueing (Hill and Borden, 1995) or thought stopping (Zinsser, Bunker and Williams, 1998) are incorporated into a pre-performance routine" (p50). Shaw (2002) in his case study of a professional golfer reported that the professional golfer had experienced some attentional benefits arising from the use of a pre-performance routine. Specifically the golfer reported that "the new routine had made him more focused for each shot and therefore, less distracted by irrelevancies"(p.117).

However, although a number of psychological processes have been suggested to accompany the pre-performance routine, to date only Jackson and Baker have explored these processes, and in that case the research was conducted in elite rugby kicking, strategies in golf have not been explored. This despite the potential benefits that a greater understanding of these processes would have for the performer, coach and sport psychologist.

Jackson and Baker in their case study of an elite rugby kicker found that the player utilised a range of psychological strategies including specific mental cues, thought stopping, inverse simulation, visualisation and relaxation techniques, but interestingly these differed from attempt to attempt. Indeed the authors concluded that the most important determinant of kicking performance in the competitive environment was the successful application of specific psychological strategies rather than the temporal consistency of the pre-performance routine.

As a result it would make sense to focus more on the underlying psychological processes and psychological strategies used than on the temporal consistency of pre-performance behaviours. The aim of this study was to explore the psychological strategies and tools utilised by an elite golfer during the pre-performance routine.

METHOD

PARTICIPANTS

The participant in this study was a right handed highly skilled professional golfer who was deliberately recruited through personal contact. The participant was observed playing a round of golf then interviewed, focusing on the psychological strategies utilised during the pre-performance period.

PROCEDURE

The participant was videoed playing round of golf. The video was then edited to produce two distinct sets of video clips. The first contained examples of the pre-performance period for shots involving the putter, the second set of clips for shots involving the driver. These video clips were then used to provide specific examples of the behaviours that occurred during this period which were the focus of the study, and to enhance the golfers recall of the situation and as a result the associated psychological processes and strategies that were utilised at that moment in time.

The focus of the subsequent interview was to gain an understanding of the psychological strategies and processes the participant felt he used or experienced whilst performing his pre-performance routines. The interview was recorded and transcribed verbatim to produce an accurate record of the interview. The interview transcript were then returned to the participant to check the accuracy of the transcription process. Interpretive phenomenological analysis was then used to explore the issues and meanings that were apparent from the participant's interview.

DATA ANALYSIS

The data collected via the interview process was analysed with the use of inductive content analysis. Content analysis was used as a tool to organise the raw interview data into interpretable and meaningful themes and categories' (Scanlan et al, 1989b, p.68). The organisation of this data involved two specific steps. Firstly, the raw data had to be assigned tags. These tags of data were then organised into categories from which a structure to the data could be developed.

Tags were created that represented the information contained in the interview transcript. Adopting an open coding strategy (Strauss, 1987) meaningful 'pieces' of information were identified. Each meaningful piece of information was then tagged with a provisional name that described the content. This process also served the function of separating relevant portions of data from their specific context, essentially de-contextualising the information (Cote et al, 1993).The next step analysis was to create categories, where tags with similar meanings were gathered together under a label that captured the substance of the topic. This category then reflected the cluster of tags underneath it (Miles and Huberman, 1984). This step served to re-contextualise the information into distinct categories, which then served as a preliminary organisation system.

From these categories and their relationship to each other a framework for the presentation of the data was created. This framework identified levels of information and it's relationship to other categories of the same or a different level. This data was then displayed in a tree diagram format and a table which, with the use of level indicators (e.g. 1.0., 1.1.2. etc) characterised the horizontal and vertical nature of these interrelationships of the data.

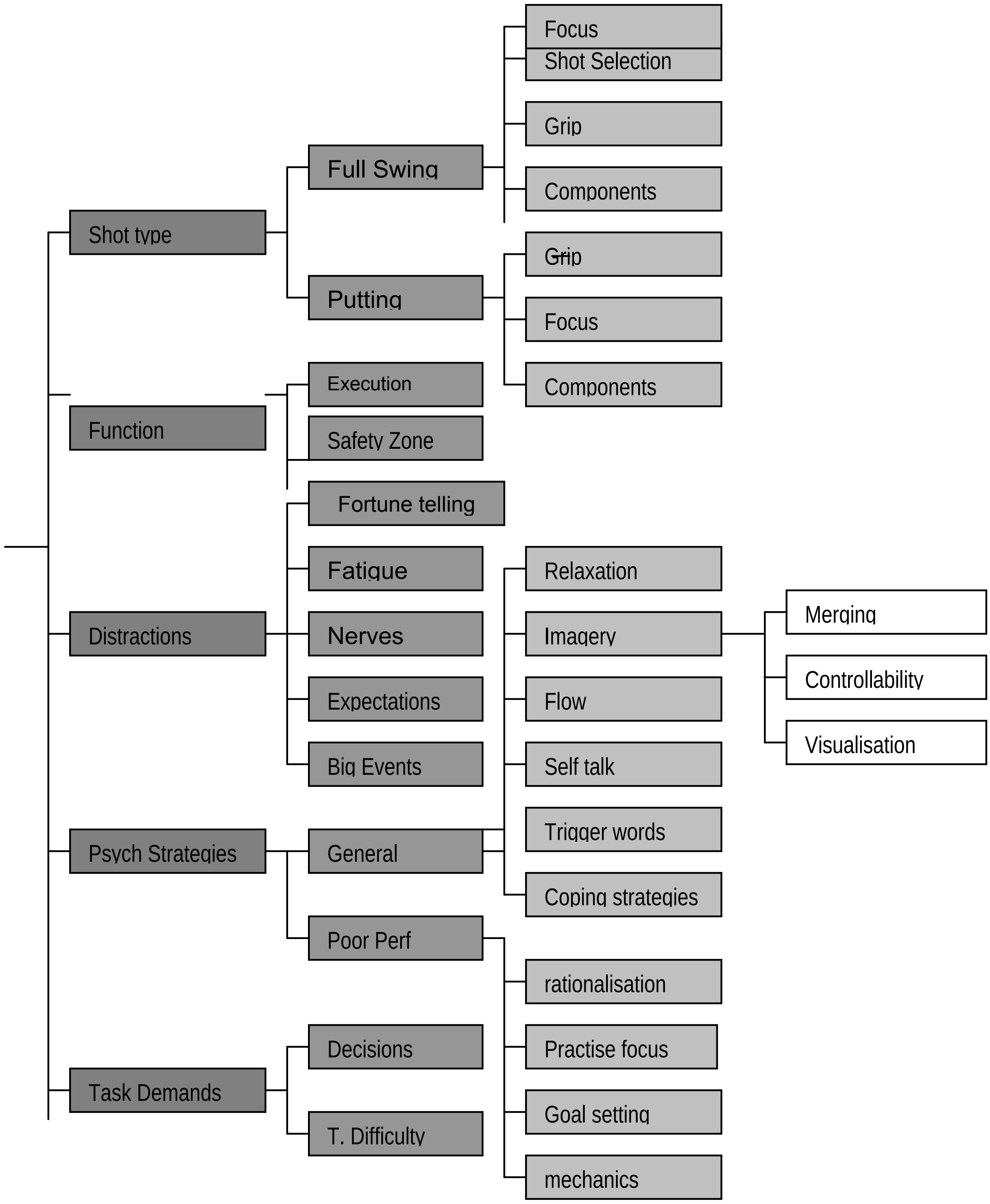
RESULTS

A summary of the major themes and categories arising from the analysis of interview data is presented in table 1 and figure 1.

1.0 Shot type 1.1 Full Swing 1.1.1 Focus 1.1.2 Shot Selection 1.1.3 Grip 1.1.4 Components 1.2 Putting 1.2.1 Grip 1.2.2 Focus Components	**4.0 Psychological Strategies** 4.1 General 4.1.1 Relaxation 4.1.2 Imagery 4.1.2.1 Merging 4.1.2.2 Controllability 4.1.2.3 Visualisation 4.1.3 Flow / Super Confidence 4.1.4 Self Talk 4.1.5 Trigger words 4.1.6 Coping strategies
2.0 Function 2.1 Execution 2.2 Safety Zone	**5.0 Task Demands** 5.1 Decision making 5.2 Task difficulty
3.0 Distractions 3.1 Fortune telling 3.2 Fatigue 3.3 Nerves 3.4 Expectations 3.5 Big Events	
4.0 Satisfaction 4.1 Levels of Satisfaction 4.2 Dissatisfaction 4.2.1 Handicap 4.2.2 Performance 4.2.3 Career 4.3 Satisfied 4.3.1 Performance 4.3.2 Goal setting	
5.0 Outcomes 5.1 Winning 5.1.1 Level 5.1.2 Matchplay 5.1.3 Singles 5.2 Losing 5.2.1 Big matches 5.2.2 Feelings 5.2.3 Recovery 5.3 Confidence	

Table 1. Tabular representation of the major themes emerging from the interview data.

Figure 1. Summary of interview data identifying major categories and themes.



The analysis of the interview data in this study identified five major categories of information relating to pre-performance routines covered: Shot type, function, distractions, psychological strategies / tools and task demands. Below these five higher order categories thirteen secondary level categories were identified, with a further seventeen tertiary level categories with a final three categories identified at the fourth level.

CONCLUSION

A number of key psychological strategies were identified by the participant as being employed through the execution of the pre-performance routine. These specifically included relaxation techniques, imagery, flow, self-talk and various coping strategies. Interestingly some of these strategies such as imagery were used every time where as other strategies were more transient depending on the task demands and environmental conditions. Interestingly the pre-performance routines appeared to be very consistent in their execution, the their purpose and related mind sets appeared to differ depending on the situational demands. This suggests that future research should focus more on the mental components of the pre-performance routine instead of focusing on the temporal and behavioural characteristics of the routines.

APPENDIX I

Critical Values of Chi-Square

	Probability under H_0 that $\chi^2 \geq$ chi-square													
df	.99	.98	.95	.90	.80	.70	.50	.30	.20	.10	.05	.02	.01	.001
1	.00016	.00063	.0039	.016	.064	.15	.46	1.07	1.64	2.71	3.84	5.41	6.64	10.83
2	.02	.04	.10	.21	.45	.71	1.39	2.41	3.22	4.60	5.99	7.82	9.21	13.82
3	.12	.18	.35	.58	1.00	1.42	2.37	3.66	4.64	6.25	7.82	9.84	11.34	16.27
4	.30	.43	.71	1.06	1.65	2.20	3.36	4.88	5.99	7.78	9.49	11.67	13.28	18.46
5	.55	.75	1.14	1.61	2.34	3.00	4.35	6.06	7.29	9.24	11.07	13.39	15.09	20.52
6	.87	1.13	1.64	2.20	3.07	3.83	5.35	7.23	8.56	10.64	12.59	15.03	16.81	22.46
7	1.24	1.56	2.17	2.83	3.82	4.67	6.35	8.38	9.80	12.02	14.07	16.62	18.48	24.32
8	1.65	2.03	2.73	3.49	4.59	45.53	7.34	9.52	11.03	13.36	15.51	18.17	20.09	26.12
9	2.09	2.53	3.32	4.17	5.38	6.39	8.34	10.66	12.24	14.68	16.92	19.68	21.67	27.88
10	2.56	3.06	3.94	4.86	6.18	7.27	9.34	11.78	13.44	15.99	18.31	21.16	23.21	29.59
11	3.05	3.61	4.58	5.58	6.99	8.15	10.34	12.90	14.63	17.28	19.68	22.62	24.72	31.26
12	3.57	4.18	5.23	6.30	7.81	9.03	11.34	14.01	15.81	18.55	21.03	24.05	26.22	32.91
13	4.11	4.76	5.89	7.04	8.63	9.93	12.34	15.12	16.98	19.81	22.36	25.47	27.69	34.53
14	4.66	5.37	6.57	7.79	9.47	10.82	13.34	16.22	18.15	21.06	23.68	26.87	29.14	26.12
15	5.23	5.98	7.26	8.55	10.31	11.72	14.34	17.32	19.31	22.31	25.00	28.26	30.58	37.70
16	5.81	6.61	7.96	9.31	11.15	12.62	15.34	18.42	20.46	23.54	26.30	29.63	32.00	39.29
17	6.41	7.26	8.67	10.08	12.00	13.53	16.34	19.51	21.62	24.77	27.59	31.00	33.41	40.75
18	7.02	7.91	9.39	10.86	12.86	14.44	17.34	20.60	22.76	25.99	28.87	32.35	34.80	42.31
19	7.63	8.57	10.12	11.65	13.72	15.35	18.34	21.69	23.90	27.20	30.14	33.69	36.19	43.82
20	8.26	9.24	10.85	12.44	14.58	16.27	19.34	22.78	25.04	28.41	31.41	35.02	37.57	45.32
21	8.90	9.92	11.59	13.24	15.44	17.18	20.34	23.86	26.17	29.62	32.67	36.34	38.93	46.80
22	9.54	10.60	12.34	14.04	16.31	18.10	21.34	24.94	27.30	30.81	33.92	37.66	40.29	48.27
23	10.20	11.29	13.09	14.85	17.19	19.02	22.34	26.02	28.43	32.01	35.17	38.97	41.64	49.73
24	10.86	11.99	13.85	15.66	18.06	19.94	23.34	27.10	29.55	33.20	36.42	40.27	42.98	51.18
25	11.52	12.70	14.61	16.47	18.94	20.87	24.34	28.17	30.68	34.38	37.65	41.57	44.31	52.62
26	12.20	13.41	15.38	17.29	19.82	21.79	25.34	29.25	31.80	35.56	38.88	42.86	45.64	54.05
27	12.88	14.12	16.15	18.11	20.70	22.72	26.34	30.32	32.91	36.74	40.11	44.14	46.96	55.48
28	13.56	14.85	16.93	18.94	21.59	23.65	27.34	31.39	34.03	37.92	41.34	45.42	48.28	56.89
29	14.26	15.57	17.71	19.77	22.48	24.58	28.34	32.46	35.14	39.09	42.56	46.69	49.59	58.30
30	14.95	16.31	18.49	20.60	23.36	25.51	29.34	33.53	36.25	40.26	43.77	47.96	50.89	59.70

APPENDIX J

Study 4 – Participant One

What I am going to do is start with one question and go from there, and then build on what you say, so I haven't got a list of questions. And what I am interested in is sort of what you are thinking or the processes that are going on before you hit the ball, and just after it. Obviously I have got some video footage and will just use a few prompts so we know what we are looking at, particularly with different types of shots as well. So if we just put the first one on so we can discuss what we have got

It's actually really good that it has come back to that position. I noticed two distinct parts to your routine. You have got the actual addressing the ball and the setting your stance and . . . that bit we will worry about a little bit later but I mean . . what's the first bit about?

Errm . . . . .I . . . .I've always struggled getting the handle of the club comfortable in my left hand. So, there are two stages to it. The first one is basically pointing the club at the target so I draw a mental line extending from the club to the target, erm . . then whilst I have got that in front of me I angle the actual club at the erm . . . like a compass it would be north-east and then that enables me to basically just bring my hand in, again this normal like angle then just set the club across the base of my fingers and when I do that I know my grip . . . especially my left hand is the same every single time. Then once I have got that my right hand just fits on top, and all the time I am trying to keep that line, erm of where I am relative to where the target is,

So would you say then that that first bit is very much about targeting?

Yeap! Yes, without a doubt! and err . . . and just getting that club perfect in my hand, because even though I may feel that I am not swinging particularly well, is that I know from past experience that I will swing even worse if I don't feel comfortable with the club in my hand, and erm it's the main thing that I just focus on in terms of anything mechanical, is to just ensure that the grip Is right in my hands.

So, when . . . there's your decision about the club you are going to use and how you are going to approach the shot, is the decision make before the targeting stage or . . . .

Yeah!

So you have already decided?

Yes, I have already made my decision about the type . . type of shot, erm shape of shot that I am going to hit. To be fair I don't have a tendency to linger on that too long. The only thing that I will sometimes erm, find is obviously that on a new course or sometimes if you haven't got a perfect yardage is that I might deliberate a little bit in-between. But even if I for instance had to go down from a seven to an eight or up from a seven to a six the actual style of shot that I have decided in my mind erm . . . obviously in my mind’s eye in the same. It’s just a different club in terms of the distance.

That’s an interesting phrase that you use ‘you see in your mind’s eye’ do you see the shot before you play it?

Yes! I have see it at the time.

What kind of stage before hand?

Errrm . . . . . . Usually just before I . . . . . firstly just stood behind the ball, me and my bag just, you know just seeing the type of shot that might be right, erm and then when I go through the process of the club being in my hand I am usually looking at the target all the time and trying to see that shot …. And visualise the actual trajectory of the shot right up to it landing on the green, erm . . . I am not . . . I don’t spend a lot of time trying to feel it I must say, I am more visual in a way, I see it rather than feel it.

That’s really interesting, do you see your shot, almost occurring in the environment that you can see . . . so your eyes are open, you can see the environment and you are almost adding your ball to that environment, or . . .do you think its more of a case of you close your eyes and sort of . . . .

No, I actually see it in the environment, and actually . . . whether or not I am actually seeing the ball I . . . . there is that vision of seeing the ball in the environment and I’m manipulating it where I want it to go and where I want it to land.

So there is almost a merging of what you can actually see and what you are thinking . . .

Yeah!

. . . . In your head as well so . . . . why imagine it when you can see it! That’s. . . . . that’s fair enough!

Obviously the second part of what you do . . . you move forward and address the ball obviously you set your stance and . . erm, what do you think about in that . . during that shot what were you thinking about?

Erm . . nothing . . . other than staying totally connected to the target. That’s all that I am focused on, I don’t . . . . I don’t deliberate on where I am holding the club, how hard I am going to hit it, all of that is automatic. Once I have made my decision on the shot and maybe sometimes I will have a practise swing just to gauge, you know, the feel or whatever erm, but when I actually set up to hit the ball I don’t have a solitary mechanical thing in my mind . . . . it would be best to suggest that there doesn’t appear to be any internal kind of thing that I am focused on I am just totally clued onto where the target is and that is where I am trying to send the ball.

Ok, so as you set up, obviously you have got the ball in front of you, you set your stance, a couple of looks at your target, would you say that you are thinking about nothing or are you thinking about nothing that is related to the execution of what you are going to do or maybe you are thinking about things that are very non-specific.

Erm, I definitely don't have anything related to the execution of the shot. On my pre-shot routine what I normally do is that . . . I want my last glance at the target normally to be a long stare, or at least it appears to me . . erm, of which as I bring my eyes back to the ball I try and retain the image of where I am trying to send the ball. And I keep that image in my mind . . minds' eye throughout the whole duration of the swing. That is what I am focused on, is trying to retain that image of where it is that I am trying to send the ball.

So, if you were trying to put the ball on the green, for example, you are picturing the specific part of the green?

Yeah! And . . . and more so for what I say scoring range, erm, I just have the flag in my mind, on the green . . . I just don't . . . most probably from 120 yards in I just see . . . . .if . . . if it's a fullish shot it's just the flag . . . I have a visual picture of the flag.

Ok, moving on, I think the next one is you putting. On that one there appears to be a slightly different routine, you do your lining the shot up, then you do sort of a practise run, and then address the ball for real. Do you think you do anything differently?

Erm, with putting yeah. I erm . . . . . because of the shape of the putter to handle it is not too much on an issue in terms of getting it comfortable in my hands, I don't know why, it's just a slightly different grip. . . a flat padded surface and what-not and it just seems I find it easier to get the putter handle in my hand more comfortably because it's a different shape, and a different style of putter so that doesn't seem to take as much effort for me to get the club comfortable in my hands erm . . . . and the main again . . . . I suppose the alignment of the club is hugely important. If I feel comfortable with that and everything else just seems to fall into place. So again, the actual alignment is very important. But, normally my pre-shot routine erm . . . is two practise puts. The first one is basically just the feel kind of put. Well it's worth mentioning that before hand I have actually visualised the ball . . . the line that the ball will take . . . erm, I then have a practise put which there doesn't seem to be anything too much that I am focused on . . . erm, the second practise put is basically . . I try and time sort of vocally . . one on the back swing and two at impact. And then when I align with the club . . when I am over the ball is that I basically don't try to hang around particularly long. I know . . I know that sometimes I have gone through periods where mentally I feel that I am actually over the ball too long and I find that if I can keep it, you know, pretty erm percussive . . .a rhythm to it, that I invariably putt better. . . because it prevents me from getting tense. On the actual putt itself erm, it's erm the only thing that I am focused on is one of the back swing and two on impact. On the putt I don't hold an image of the hole or the line that I am going to send the ball on in my mind.

So again, you have done the target thing earlier. Is there any difference between how long it takes, or what you do if it's . . I don't know, a forty-foot putt or a three or four foot putt?

Erm . . . . . . I think erm . . with regards to the actual time that it takes to set up to a putt erm I don't think the distance plays a factor I think that what plays the factor in terms of how long it will take you to erm, decide on what you want to do is the actual difficulty level of the putt and erm, also sometimes assessing where you are in the game. There are some times when I spend quite a long time over, say a five-footer erm, if the actual line of the putt has not sprung to mind. I just haven't been able to determine what . . . you know I know it is not going to go straight but I can't determine how much is it going to come off the left or is it going to come off the right, it's just sometimes there are these types of putts where, you know, it's impossible to, you know to concede that the ball is going to go in a straight line because you pick up other factors on the green, other areas on the green that would lead you to believe that there is just no way that this could go straight, but you walk round the putt . . look at it one way, look at it another and it totally seems to be contradictory information, so you are then in a little bit of confusion you know on what you should do. That then usually lends itself to taking longer over the putt erm . . sometimes you could walk up to a forty-footer and you know instantly that it is going to be, you know two, three, four, five inches off the right and it's easy to just go from there really, erm other times it's just . . . . . yeah a definite yeah, it's the severity and difficulty of the putt that . . . sometimes you know for a fact that the best you are going to be able to do is to get the ball within, say five feet from say forty feet, depending on where you are on the green. So what I sometimes work out is where I would actually like to miss it from, so do I want to leave myself . . . I would rather leave myself . . . rather than worry too much about getting it as close as I can . . I know it is not going to be possible because the slope, so I am better off say going five feet past the hole than five feet short, or even eight feet past the pole rather than three or four feet short, because at least that is going to leave you an uphill putt, and that is going to be easier coming back than the one that you could leave yourself if you hit it a little bit too cute.

So, bringing that back to your routine of what you do. Obviously you have the lining up phase, sort of the practise for putting and then the actual putting. Would you say that all of those decision-making processes occur in the first of those three phases or in aspects of all three?

Erm . . . usually before . . yeah! I like to of made my mind up before I get over the ball, and before I get anywhere near the ball I like to know what I am going to do. Erm . . and I would say nine times out of ten if I have not actually made my mind up . . .and I am still over the ball . . it's going to be a crap putt! If I have made the decision . . . . and also funnily enough, one thing of which I am always quite erm find an amazing feeling really is that when you know that you are going to hole the putt, and sometimes you are still walking towards the green, you just something, whether or not you've picked up that this type of putt is a particular distance and erm break that you have holed before or whatever, you just know that you are going to hole that putt, and it can sometimes happen before you have actually even walked onto the green. Erm . . so I definitely think that most putts are made, for me, erm . . way before I am actually over the ball.

So, when you are over the ball it's just . . . back to the previous one, you are not really focusing on anything to do with the execution?

No, not movement just . . . I use the one-two erm, basically it's because I find it a very good timing thing in putting . . . for me, just like the ticking of a clock one . . two . . erm and err and also it, I find it good regarding . . especially for say shorter putts, is that if you are feeling a little err a little bit nervous, you are not one hundred percent sure about the actual putt in terms of direction it just prevents you from focusing on anything else. It just fills your mind, gives you something to focus on, you know anyone can focus on it, it is not a difficult thing, it just takes your mind away from the mechanics.

When you are doing the bit before that, the practise phase, what are you thinking about then, is it still the same . . .the one-two?

Erm, the first one is basically just an erm, you I thinking basically to get you know a feel how well I am going to hit it, the second putt is basically, you could almost say a phantom attempt at it, its kind of erm, I also see the ball rolling, and taking the break and going into the hole on the second practise putt, and then once it has gone into the hole, erm . . I then step in, and set up and one-two.

During that period, particularly those first two practise putts do you, or are you aware of, sort of any dialogue in your head. Do you say, 'yeah that's good' or 'right I need to do the next bit' or do you purposely have thoughts that you make sure you think about, or you don't have a clue what's going on?

No, I sometimes say to myself 'you are going to get this one' erm, sometimes gee myself up with a few little positive prompts and phrases, but I don't have a lot of internal dialogue really Like that. I usually find that I play quite well erm, when I am just really just, shall we say, cruising through it really, and just giving myself very simple things. A lot of the time it's just not golf related, I will just be sometimes looking at the view, you know just taking in my surroundings really. Erm, and sometimes I will say to myself 'that's a lovely bit of scenery' or whatever I will sometimes acknowledge that to myself, erm very . . but sometimes it is nothing to do with the actual playing of the game. Or where I am or what I have got to do and things like that. I try not to get too involved.

Do you think it all works the same when you are playing badly?

Erm . . . . I think when I am playing badly sometimes I have, and this is something I have worked on most probably over the last couple of years, is to try and ensure that I find something to justify being out there. Because it is a long time to basically be involved in playing badly. I mean if you go for a run, you can do a six-mile run in under forty minutes, and have a bad run but it is only forty minutes. If you are playing a round of golf, you are sometimes out there for four or five hours. Erm, so it's a big chunk of time to be not playing particularly well, so I do sometimes, you know when I know or feel it's, obviously this has not gone today as good as I wanted it to, erm I will try and select something on which to just focus on erm, and treat it more like a trial run . . don't worry about the result, or where you are in the game, focus on something your, you know, practising in your practise time, utilise that time now, let's say the competition is now irrelevant, what's important is, you know if I had been working on, let's say for instance, building up more resistance in my right hand side, and I will try that on the golf course as well, you know which normally I wouldn't do. I wouldn't do that, so yeah, I suppose it does change. But to be fair, and also the level at which that kicks in, there are some times where it is bad, but it has only been bad for nine holes, and you are in a position where you still can recover it's determining when the recovery is not really going to happen, and it's not within the realms of let's say possibility, which would let's say amount to the last five holes really, where you think 'sod this' and focus on something, shall we say, more mechanics orientated, which is not the way that I choose to play the game naturally. I try and keep it, you know in my mind at least, technically free.

Linking that back to, you say that you have some positive thoughts when you are doing the putting, how do you think that is affected when you play badly? Do you think you possibly compensate by being more positive, or the same, or possibly not quite so positive?

Erm, ... most probably not, no. I don't suddenly start, I just think the more I emphasise it, the tenser I get. That's what I find, you know it's . . . . yeah. The main thing that I sometimes just focus on is just keep the same pace going, do not quicken up, but no, I don't keep trying to affirm positive statements to myself when I am not playing particularly well. Erm, I think for me that would probably signal that I have something to worry about, I think that most probably when that is happening, rather than affirm positive statements is that I actually seem to be telling me to just try and enjoy the fresh air, the walk, the surroundings, absorb that more, just try and enjoy it that way. It is definitely for me, the key thing is to try and justify why you are out there and erm if I can keep that very simple in terms of I can justify, even though I am playing badly I can justify being out here because I am getting some exercise with my friends, or I am enjoying playing with these partners or, and things like 'it beat's work', literally things like that, and you know, classic example is about two months ago I think I was playing reasonably well but erm, it doesn't matter if I am playing well or badly, is that I still would spend time . . . I saw two buzzards flying, and I will actually spend time, switch off from the game, because for me, that is part and parcel of being out there, it's not just about the game, and competing, and where you are. For me, it is about erm . . there has to be more to it than that. I think that maybe just stems back to the way I used to treat it when I was younger, there has definitely been a change, when I was in my twenties, earlier twenties, even when I was playing county and juniors, I was so tense, I was only interested in winning really, I couldn't really tell you about the surroundings, they did not seem to impinge at all on my enjoyment, it wouldn't matter if I was for instance playing a municipal course or I was playing Augusta, is that I was . . . I wanted to win. And erm, I think that erm. Definitely for me that caused me to at times get a little bit critical, self critical about my performance, and as I have shall we say matured a bit more and I think to my self, the nature of the game is that you can't win all of the time, so try and take things out of it so I even try and take, like I say even two buzzards, irrespective of whether I am playing well or badly being in a position where you could actually experience that and see them, erm is a reason to be out there, and that makes me feel positive about being out there, erm . . so that is how I keep myself upbeat whether or not I am playing well or playing badly and erm also most probably leads to the fact that I don't need to affirm positive statements to myself .

On, just back tracking a little bit, thinking about, generally when the task is more difficult you take longer, obviously longer to reach the decision of exactly how you are going to approach the shot, but once you have made that decision do you think that from that point forward you still . . obviously you do the same things, but still take the same time or, do you think that because it is more difficult it still lengthens your pre-shot routine?

Erm, I think that because it is more difficult it definitely erm. . . . are you including in the pre-performance routine the decision about how to play the ball or are we talking about when I am over the ball?

We will separate the two. So think about your putting, you have got the lining up the shot, deciding about the topography, then you have got the start of your discrete pre-performance routine which is your two practise putts and then your actual set-up. I think that the discrete is the same speed, the actual preparation is longer. But the actual over the ball I would like to think that it is as near enough he same amount of time over the ball.

So, again you have spent your time making your decision, and when you have made your decision, it's right 'let's go!

Yeah!

Just to clarify, you have talked about using imagery to get the picture of seeing yourself doing it then you have got this picture of almost taking a picture of the target, and it's as if you are programming it into your body to execute the skill in order to be able to do that. And then there is some aspects of internal dialogue, so you might say a couple of positive things, specifically in the practise couple of swings, and then during the actual putt you use a rhythm based word, so one. . two . . . is that accurate during that phase?

Yeah!

Good. Opening it up a little bit then. Do you think you do different things, obviously you will do different things to those, at other points before that? Obviously you have just teed off for example, you hit the ball . . fantastic . . between finishing that shot and getting to your next shot and the targeting bit, deciding exactly how you are going to hit that shot, what kind of things do you do in that time period. Obviously you can't concentrate the whole round?

A lot of the time again, I just think about my surroundings, being aware of my surroundings, one thing that I do always try and keep an eye on is erm my posture when I am walking, especially when I am carrying my bag it is very easy to get into this kind of angled position, and erm that is not a good position to be in walking five or six miles in especially when you have got thirty-odd pounds on your back, erm so I every now and again give myself a mental prompt to you know make sure I am stood up. And also I have also been a firm believer that your posture is important in terms of how it makes you feel, walking tall again makes me feel . . . just a great sense of being positive where I get in this position where my posture is shall we say stooping erm, it can sometimes lead me to be not feeling as comfortable out there.

Regarding the decision about the next shot. Do you wait until you are at the next shot or is it a conscious process where you think about it before hand or is it kind of an imprecise science where you are not quite sure when you start thinking about it?

I switch on about twenty-five to thirty yards away, that's when I make my . . . basically walk in and go from thinking about what ever I want to think about to erm I am thinking now about the shot, where I want the ball to go, style of shot visual imagery, it all starts to happen around twenty-five to thirty yards away.

Right, so you actually have . . .

I don't speak as well, it doesn't matter if someone was talking to me I am not interested. The conversation is now finished.

Would that be the same if you had a caddy?

Erm, most probably yeah, most probably . . just err apart from maybe saying, if someone was caddying for me, asking what the yardage was or something like that, erm that would probably be the exception. In terms of deciding what kind of shot, When people have caddied for me before, again, a lot of dialogue regarding the type of shot they should hit what club they should hit . . I just want the yardage I'll make a decision.

Is that the same when walking to the tee, and walking to the next tee as well?

Yeah!

So, that is really interesting. We are now identifying almost four separate phases of you preparing to take the shot, we have twenty-five to thirty yards away 'right I am switched on for this shot' then you have got the getting there and finishing the analysis of the situation, so we have got that. Then we have the targeting phase which, obviously on the full swing shots is the definite separate component. In the putting it is sort of the practise putting bit, then you have got the actual execution, and again you appear to do the same thing, same stance etc. So actually you think of the pre-performance routine as being the discrete behaviour sort of at the end.

You actually have sort of a long series of consistent behaviours, I suppose you are doing the same things but the timings is different, because how long it takes you to walk those last twenty-five to thirty yards could be different.

Yeah!

I suppose depending on how difficult the shot you are going to play is, how difficult it is, all those sort of things. Do you think during that period of time, you only think about the execution of the shot or do you possibly think about the execution of the shot in a wider context? So what it is going to mean to your round, your performance in the competition, your performance against other people you are playing with?

I suppose I can . . .there is one . . . there are always certain times when you think to yourself you know, you do ponder on the outcome of the shot and what it would mean, I think that the first time I realised that things are a little bit different when you have people watching you is when I played in a tournament where I played with Ian Painter in the Sunderland masters and it was the first time where I had been in a situation where people had actually been around the green watching you, and also stood around the tee box and erm, it was sponsored by Caledonian spring water or something like that, in terms of the refreshments. I remember going into the clubhouse then going out and erm to basically get my card and in that time it had basically taken me to get my studs on and then come out there was around one hundred and fifty people stood around the first tee box, and I was immediately thinking Jesus, this is a totally different, seemingly, it was a totally different situation, and yeah, its fair to say that I don't think I have ever hit a golf ball harder off that first tee box, to the extend that the only thing I wanted in my life at that particular time was for the ball to find the fairway. Which was unusual for me at the time because normally I didn't give a hoot really, erm I think that was the first time I had really been take out of my comfort zone and suddenly it mattered erm, to me for external reasons, You know I defiantly wanted to put on a good show, to show I was worthy of the title of golf professional, and after the first two rounds it did not matter . . . the exposure . . I think I had gotten used to the difference and then suddenly I wouldn't of known if there were one, two or three hundred people or three thousand, suddenly there are only so many people you can focus on, you know, in a small area, which is a tee box so, you wouldn't know if there were fifty or five-hundred to be fair. You do on the first time it actually happens.

With that, do you think, obviously you were conscious about it? Do you think it is something that you remained conscious of throughout the routine, throughout the targeting phase and throughout the actual setting up? Or do you think it was something you possibly thought about before and possibly after?

I think before and after. I was erm . . . . yeah. I was definitely erm, because I mean, fortunately it was a very good shot that I hit . I still remember it. It was that first time that I have hit my golf drive in front of a lot of people in a competition, I mean I have done it with members of the club I did it in junior competitions and what not, but in turns of playing in a tournament where people have turned up to see, it was that first realisation, yeah, this is . . they are expecting you to hit a good shot you know, and erm also just to cap it off is I suppose the other difference was that after the other two I was the last to tee off and I was playing with two very good players who both hit missiles off the tee as well, you know and you suddenly realise I am playing with some big boys here. So it is that first time . . I suppose you go from sort of like playing in more of a relaxed environment to suddenly it's a different, slightly different environment to have to perform in, erm of which I enjoyed the experience. I did enjoy the experience but it took me two rounds of golf to actually you know get to grips with. And now because over the past five or six years I have not really been in that position, erm it would probably take some exposure to get used to that situation again. It's . . . . I would be surprised if it did not effect everybody . . . but it doesn't necessarily have to affect you negatively, because it did not effect me negatively, erm but it is definitely a sharp intake of breathe and kind of like compose yourself .

Did the expectations make you nervous? Obviously not nervous in a 'oh god I can't do this' but as in I have got butterfly's or maybe I am slightly tenser than I usually am kind of way?

Erm. . . . . . yeah!

Is that something that you were consciously aware of throughout, or do you think you would of been consciously aware throughout your preparation to hit the ball?

Erm . . . no, no . . I think once I have switched into where I want the ball to go and what I want the ball to do, I think once the pre-shot routine took over erm . . .I errr was not really too aware. I wasn't aware of other people, I might of still been slightly aware of the importance of the shot, and that I wanted to swing it well, but there wasn't a . . . it wasn't like an 'oh god' this better not go into the trees on the right, but erm, there wasn't that kind of negativity attached to it.

If you still have this idea at the back of your mind 'this is important, I want to do well' do you think that would lengthen slightly your routine, because you have something else in there on top of the other things that you normally do, just that obviously if you are going through the motions and thinking 'I want to do well here' that's . . . .

I would never hit a golf ball until I was ready to hit it. So yes, so if I was . . . if I had butterflies to the degree where I felt that my heart rate was up I would most definitely wait until I could control it, or felt comfortable with it, then I would go and hit the golf ball. Whilst over the ball, I think that the routine would be the same, but again it is very much similar to the severity of the putt, I think the time is extra before I start walking into the shot and going through the actual set up, as that's all done before that.

One final thing, do you think that when you are tired that effects' your routine. Either what you do, or again what you are focusing on? Is it that you . . . when you are tired, obviously you have been out there for four and a half hours that you can actually feel that you are tired, do you think that that is something you actually pick up on?

Erm, I think yeah. Everybody . . .. I think everybody knows when they start to feel a little bit tired, or maybe a little cheesed off that they have been out there for that long, erm but the way in which it effects the outcome of the actual shot, I feel for myself is that erm . . I feel the fatigue never effected the swing of the club, but I can definitely remember instances because I obviously have started to get a little bit tired erm, failed to pick things up in the environment that I normally would of done, for instance like the direction of the wind. I have hit shots sometimes where I have hit a lovely shot and the thing is twenty-five yards too big, then I have put the club in my bag and I have just thought 'I can't believe you have just done that and I have actually failed in my analysis and decision making process to of taken into account the direction of the wind. Which in golf when you are hitting . . its so . . . most people always think golf is all about direction, its not, its about distance, the direction is important but, if you want to get the ball anywhere near the hole it is distance that is the most important variable really, erm because at the end of the day all the trouble is short and big more often that not, you know. So, you can be fifteen yards right of the hole, if you are spot on with your distance your still on the green, you know fifteen yards short you might be in a cavernous bunker or the lake. So erm picking up the direction of the wind and things along those lines are hugely, hugely important, and sometimes, because of tiredness, my concentration levels dip and I do not pick that up, and the ball has gone hurtling over the back of the green. Or I have made the wrong club selection . . I have not fully taken into account the wind is say in my face, which takes a club, club and a half extra, things along those lines, or for instance I basically just hit a full shot into the wind when really I should of punched the ball and tried to keep it a bit lower and manipulated the trajectory of the shot, so again for me it is before.

So, the discrete parts of the routine are the same but it is the decision making bit at the start that is effected?

I think so!

Brilliant! That's enough for me.

APPENDIX K

Study Four - Participant Two Interview Transcript

How consistent do you think your pre-putt routine is?

I would say . . . it has pretty much been the same for five years, so . . . I mean its almost as if I can't help but do it now. I have got the one-two thing that I say in my head 'one-two, one-two, one-two', put the toe of the putter to the ball, stare at the hole until I see the ball going in the hole then make the stroke, that's as simple as I can make it. It's not . . . . . . it's not executed with as much routine as I would like but it is almost as if I can't help but do it, sometimes it's a little bit quicker, sometimes it's a little bit longer the next time, and what-not, but in terms of my routine itself it's pretty . . . . . . pretty there every time, its very rare I don't do it, even . . . . not so much on the tiny putts their irrelevant sort of thing, but anything where I am playing a competition or I'm playing to do well sort of thing, which most of the time I would say my routine is pretty much spot-on.

How did it develop? Is it something that you put together over time or did someone think 'right we are going to do this'?

It's . . . . . more outside influences really the whole taking the putter back counting to one and hitting the ball on two believe it or not is all that man down stairs. He told me years ago in ninety . . . . about eight years ago, and the reason behind that is that it takes your mind off the putting stroke It let's your natural stroke . . . I am quite into the psychology of golf and what-not, golf is a very natural sport and you can't think of your technique while you are doing it . . because A it's too quick, and B you are just going to get yourself into all sorts of mess so taking your mind off what you are actually doing and letting your natural ability take over seems to make sense to me . . . . erm . . . . .and erm, yeah the whole putting the toe and . . . I don't know where that's come from . . . I . . . you see players on tour do it and what-not, maybe it is them, maybe . . . I've got no idea it just appeared one day, and once you find you do something and it works, that one thing, you try and do it every time . . . I don't know is the simplest answer, it just appeared.

So I suppose it sounds like its more a case of this has developed as opposed to a conscious process where you have practised doing this . . . .

In all fairness I am pretty slack . . . . . when I practise my putting I do a lot of putting practise and I am not . . . . . when I practise I don't do my routine, which is against the book if you like, I am supposed to do my routine . . and when I am playing badly I will hit a lot of putts and they start going a bit streaky and this and that . . . missing right sort of thing . . . . and then I will hole a couple and I will do my routine, then I will carry on . . . it's almost as if it is a trigger to make me concentrate back on my stroke rather than anything else. I wish I could actually just stand there and do my routine every time no matter what . . . whether practising or anything else, but when I am practising I tend to practise the stroke and not the routine which whether it be right or wrong is entirely a different question but . . . I should do it more . . . . see I am analysing my game already .

. . . I am conscious of the fact that I know that I don't do it . . . . I don't know why I don't . . . . when you practise its very difficult to get your mind into the set of 'this putt is very very important' I am just practising my stroke not focusing on the outcome sort of thing, but on the golf course there is an outcome, you need . . . you know what you've got to do sort of thing and you concentrate a little bit harder . . . well I find anyway.

When would you say . . .again specifically thinking about your putting routine for the moment, when do you think it starts? Kind of when does the routine thing that you do start?

Erm . . . . .what in terms of time scale?

Yeah, . . . you've got a putt . . .

Basically I read the line . . . .I am not a huge line reader, I am not someone who walks round the ball for long . . . A its too much time to think about . . . . the simpler I make golf the easier it is for me cos I think far too much on the golf course as it is erm . . . . I will pick the line . . .I will try and focus on home the ball is gonna . . . its imagination more than anything, you imagine how it is going to react along the putting surface, and its literally from the point I set my putter down . . . . as soon as I do my one-two I am doing three strokes every time, and sometimes I will do four which is when I have to stop and go back because I have done one too many, yeah its because my mind is not thinking about the actual putt, and I am not thinking what I am doing and the whole pro . . . the way I see it with routines is there good, but they can also be bad cos if you don't stick to it it could cause doubt in your mind, and you have to re-start it sort of thing . . anyway, erm, yeah as soon as I put my putter down to do my practise swings that's my routine and so stare at the hole, see the ball go in the hole put my head back I pick the line, I can't change anything as long as I make a good stroke, if it misses but I make a good stroke I still made a good shot, you know, once you have picked the line I have done my job and its just, all I am doing now is flapping my putter at it in my eyes its not . . . I try to concentrate on not changing my mind, so if I miss the putt, I miss the putt I can't do anything about it, but if I hit a bad putt then that's when I get annoyed with myself more than anything, don't change your mind, stick to your line and hit it, and away you go, if it hits, it hits, if it misses, it misses!

So am I right in saying that you are saying that you make your mind up regarding what you are going to do and then you start your routine, have a look that's my line then go into the . . . .

Yeah, again throughout golf, and I have been playing sixteen years I have received lots of advice, I have played county and now I am a professional . . . . and you get lots and lots of advice and the one thing that has always stuck in my mind through listening to people who can coach and all the coaching I have received over the years is one who said that 'once you have picked your line and you have set-up to the ball you don't change your shot, you can't do any more than that', if you hit a good putt and it misses it's a good putt still. If you misread . . .once you have set up to the ball don't change your mind, because if you change your mind you'll change your mind halfway through the stroke and that's when you start doubting your putting, and you miss a couple and it's like a snowball effect, you miss a couple of two-three footers and its like 'how many can I miss today' sort of thing, and that's the biggest key of anything in golf is not letting it effect you, if you can take everything positive out of the shot so, you know you have miss-clubbed and you have air-mailed it over the green and gone into the rough at the back you can say, well actually, it was not a bad golf shot it was a mad judgement so you don't start doubting yourself as soon as you start doubting yourself it can go from a sixty-five to a ninety-five in a short space of time, and once it starts it is very hard to stop the rot. You know, you get three or four bogies in a row with A the mental turmoil you are going through on the golf course and B the fact that you are trying to get yourself out of that mind-set, it is so difficult and it is trying to get something that helps you out . . if you have got a good routine, well the way I think, if I have got a good routine it doesn't matter what shot, the last shot on the last hole, the last putt . . irrespective because I am doing it, it is all very similar and before I know exactly what I am doing, it is just familiarising myself with situations so I can, I can't get nervous, and I can't get upset because I am concentrating on doing my routine, that's the way I think anyway.

So, how consistent do you think you kind of specific execution of your pre-shot routine is time-wise? Do you think it is very consistent?

I have never thought about that, because I suppose I stare, people have said that you can tell when you are going to hole a putt because I stare at the hole and can't help myself I just keep staring at the hole, like you will see on the video, I put the toe down, have a quick look then line up, and just look at the hole. I am not looking at the line, I am not looking at anything, I am just looking at the hole, all I am focusing on is seeing the ball go in the hole imagining that ball going in the hole. And it seems like the longer I stare at it sometimes, not consciously, more sub-consciously, the more likely I am to hole it. If I just have a quick glance you can tell that I will probably . . . if it is a short putt I don't over analyse it too much its just one-two bang but a longer putt you just get a feeling sometimes that you just know you are going to hole it. I said to John on the long one I just knew for some reason, I don't know what it was as soon as I looked at that hole and saw the ball going in I am going to turn my head back, and I don't know how long it is between my head returning back to the ball and my stroke, but I would say that if you look at all the good putts that I hit, it would be pretty close. I don't know, I maybe wrong but I reckon it would be pretty close . . the time scale.

So, if that is really consistent, the bit before that where you kind of make your choices about the line and what you are going to play, do you think that varies depending on the characteristics of the shot?

Yeah, obviously the harder the shot . . . for me its not about reading lines, I have never been A, very good at it and B I can't . . . . make something too difficult, if its too difficult . . . I am a simple bloke, but the thing I try and concentrate on is seeing how the ball . . . not seeing the line . . its just, I look at it and think that's just how I imagine the ball to react as it goes across the surface, I use that as my guide, and you know, you have got people out on tour who are great putters . . . . Roberts, where he gets it from I just don't know . . he is amazing, and I am sure he could probably read a putt in terms of measurement, I can't so think 'right, I will just see it, that's where I like to be able to see something rather than . . . its that far to the right, I just can't, my head won't cope with that sort of thing. I want to be able to stand there. Look at it, see where the ball is going to go, see how it is going to react and then I can hit that putt confidently. If I can't that's where I struggle, if I can't see a break, or I can't see it straight, then that's where my routine kicks out sort of thing I will try to stick to it, but I am consciously trying to stick to it, and as soon as I consciously try and do something I find it harder, and immediately you start thinking I didn't do that right and start analysing stuff where as it needs to feel natural for me, and that's where I would probably class myself as a bit of a streaky putter, when everything is relaxed and natural great, but when I have to really concentrate on going through my routine, doing my stroke reading the putt . . I find it very difficult sort of thing. But I am sure there are golfers out there like me, but then there are some people who have a mechanical routine, I am not a mechanical person I am a creature of habit more than anything, what I do is habit, I just can't help it you know.

You have just put the ball on the green, you are walking down the fairway to the green, when do you kind of switch to thinking about the next shot?

Ermm . . . . . Christ . . .

Or is it not something you consciously think about?

Do you know what, it all depends upon what I am thinking about full stop. If I am on the golf course I like to think that I try not to think about anything outside the world of golf erm, I have been known erm . . . when I was at the county to have the most negative thoughts on the golf course its unreal, and I can't . . . . I couldn't take my mind off it, you know you are talking to someone who if I got four up I would be working out what's the worst I could lose, that sort of might-set, and I suppose I try and take my mind off golf, but its almost like as soon as I tee off the first tee everything outside my world of golf disappears then its just focus, focus, focus on golf, I suppose that is why I get so tired and what-not but in terms of the actual point of the golf shot I would say it is pretty much as soon as I put the ball down it is, I mark the ball and I will be looking around sort of thing, so if my playing partner has a similar sort of putt sort of thing I will be conscious how his putt . . . . but regarding thinking this is my golf shot I suppose from the point I put the ball down I stand behind, I read the line, it is literally at that point I imagine. I don't know actually . . . . I mean its . . . . I used to do a thing of counting to ten so I will do my practise swings and nothing is going through my head I will just count to ten so once I get to one, that is when I will step into my golf shot and swing the club . . . . . I find it too bloody difficult though!

Going off on a tangent, if you can develop trigger words, so I worked with one guy who worked on getting the club out of the bag as the start and when the club when back into the bag then that shot was finished, He would switch to thinking about something unrelated to golf and when he got the club out of the bag again that was

kind of his trigger, and he was having a lot of problems with dwelling on shots that he had played . . err . . . his caddy then would introduce a range of topics for conversation which were unrelated to golf to work as a distraction, but it is different for different people.

It is funny that you say that cos, whenever I play in tournaments I need a caddy, and it's not to carry my bag, its not to give me the club, it's someone to talk to. Because if I'm out there . . . .European Pro qualifying I was by myself for two days, I had six hours wait and before I had even teed up on the first I knew I had lost because I had had so much time by myself to worry and to think about what other people think . . . before I had even teed off I had already made excuses in my head about what I was going to tell people about missing the cut, and I couldn't help it, I was trying to tell myself you know 'shut up', and my two playing partners were very very focused, they were not chatty, where as me as a golfer I need someone to talk to, just . . . not that I am nuts or anything like that, but it just takes my mind off it, if I am just by myself all I have got to think of is golf and that . . . . I do struggle . . . I can appreciate having a caddy with trigger words to take his mind off . . . because I am very much . . . . . if I am playing with people I can have a giggle with, brilliant, I am generally quite relaxed, but erm, when it comes to tournament golf and my playing partners aren't very chatty, I get really uncomfortable, which is wrong I know I should be comfortable in my game, but, to actually sit there and think about golf for four-and-a-half hours non-stop, is just a nightmare, you can beat yourself up over one golf shot that you hit two-and-a-half hours ago, and it will come back and you know, appear in your head, and it is trying to throw those thoughts out of your head and thinking 'no, I am going to just look at the trees' you know, and it is just so difficult to do.

As a sport psychologist I think golf is a god-send, it is as if it is a game that has been designed by sport psychologists to be employed, because there is just so much opportunity to shoot yourself in the foot with your mind that . . .

As I say, I read a lot of books regarding psychology, and non of them really sport psychology its more just learning to shut your mind off from certain things, and I can concentrate so hard on not thinking about something that . . . to actually sit there and say 'I am going to think about nothing' is nigh on impossible, it is physically and mentally . . . . .it is so hard to do, so on the golf course when you've got stuff always just throwing itself into your head, a putt you hit four holes ago will just pop back . . . where did that come from, you know? I then start analysing where it's come from, and before you know its like 'Oh my god get me out of here please' but when . . .I can guarantee you that when I play my best golf I am you know fully focused . . . playing quality, quality golf I couldn't tell you what I was thinking . . .I couldn't . . I couldn't even remember half the golf shots because I was just there, I was in the 'zone' I hit the shot, I walked on, I hit the putt, I was fully confident and that was it, I could tell you half the thoughts I had when I shot terrible scores but, you know because I am just so conscious of what I am doing and why I am out here sort of thing but, its weird!

What are you thinking about during your routine? Is it something that you consciously say 'I am going to think these things', or does something just get in there, or do you have general strategies . .

What in the pre-performance routine?

Yes, in the specific execution routine to start with.

Do you know what, I couldn't tell you what I think . . . . again, today, I suppose I had a few things on my mind so It was a little harder to concentrate, on the golf course because, even in my routine I count one-two in my head, this whole one-two thing . . . I am like the rainman, I just can't help but say it, now-days if I don't say it I know I am going to hit a bad shot, strange, but it has become such a part of my daily golf routine that its . . . . I don't even think about saying it, I just say it in my head anyway . . . erm . . so I tend not to think about much . . . . obviously if there is something on my mind it is hard to clear it out, like money, women, whatever, they still appear in your head on the golf course, mentally you can try and block them out but, they still come back . . . erm . . I tend not to think of anything really, just go through the same thing, as I say I'm pretty much a creature of habit, I smoke at the same times of day and drink coffee at the same times of day, I am just one of those people who, you know I don't do my shoe laces up because I think it is bad luck, I wear odd socks because I think it is bad luck . . . just stupid things . . . that's just me, I am just completely habitual, I just cannot help myself, its like the whole giving up smoking thing, on the golf course its . . . . I can tell you when I smoke on the golf course I will always have a cigarette on the first tee, I will always have a cigarette walking to the ninth green, I will always have a cigarette walking to the eighteenth green, the amount of people who have said 'you smoke at exactly the same time' and so giving up smoking and playing golf . . . . I am lost, I was so lost when I first played golf without a cigarette . . .i was like 'I am on the ninth green and I am not smoking' and I never thought . . . even if I put one out on the ninth tee by the time I get to the ninth green I would be smoking. I am just that sort of person, I can't help it I am just . . . . it's weird!

So, from what you said, during that sort of execution bit, there are two things that sort of shout out at me that you do. You have the kind of trigger-word thing, the sort of one-two thing, the kind of automatic thing that you have got, then you have the visualisation tied into there as well as the main psych strategies that you are using. Thinking about the visualisation, how clear can you see . . . just before you answer, is a case that its almost like you close your eyes and create a complete image in your mind, or is it a case that your eyes are open, you can see everything in front of you and you can also see in that landscape the ball doing what you want?

Erm . . . . when I'm . . . say when I line-up a putt I try and very much see it point for point how the ball goes in, with my eyes open, and I try and focus on how I imagine the ball to go in the hole sort of thing. When it comes to my routine when I stare at the hole I don't see it leaving the putter and going all the way I just see the last inch before the hole and its as if . . . when it is clear as bells I know I am going to hole it, I can see the ball going into the hole with my eyes wide open in the front of my head, I can see the ball going into the hole. And if it is really really clear, then I am confident, if I can't see it . . then I just hit it anyway . . which maybe I shouldn't do, you know I do think that sometimes maybe I just do . . .I am conscious about aiming too long and taking too long over the putt sort of thing, but erm . . yeah . .the actual visualisation thing I am quite good at imagining things, I have that sort of mind that I can picture things quite easily you know . . so . . .I don't struggle with . . . and when it is not so clear it is because there is doubt in my mind and I am not sure of the line and what-not, but I hit it anyway . . sometimes it goes in which is just pot-luck really, but seventy-five percent of the time I know it is going to miss, you just do it anyway, you think 'christ' . . you have putts where you just can't see it . . I was out in America playing tournaments out there and it was my first real professional tournament and I couldn't even see a golf shot, I was so nervous and so caught up in the moment that I couldn't even see how . . . when I stand behind the ball . . . you will see in my routine . . . the main thing . . . because I am trying to see the golf shot, I couldn't see a shot and I played terrible out there because I just had so much on my mind, even though my routine was the same, like my putting routine hasn't changed for years, I couldn't see anything. I couldn't see how the putter was going to react . . . there was so much doubt in my mind . . . with different greens with different grain and stuff in America that . . . erm . . because I couldn't see anything it was like I knew I wasn't going to hole anything, and the more I missed the more I knew I was going to miss you know, and I couldn't . . . I couldn't see a golf shot full-stop, and for eighteen holes I hit it . . . it was a lot to do with visualisation and imagination really, and I had non out there, and I really really struggled.

So, is it that being anxious or stressed affects your ability to visualisation the picture or is it affecting your ability to make the decision?

I would say that the stress and the anxiousness causes me self doubt, self-doubt then causes me not to be able to see things because if I can't see something I can't do it full-stop. It is like anything in life, you know, if you can't see yourself scoring a goal in football, your not going to do it are you! If you see some bird . . . if you think you are going to get a slap round the face you probably will do, if you go in with full confidence you do it and do it well to the best of your ability sort of thing and so the actual . . . . I suppose for me your imagination and ability to visualise things is probably more crucial than anything else, I don't know about for other people, but certainly for myself, it's the self belief that I need, some people just don't care . . . I care . . a lot actually too much sometimes and I suppose if I can't see anything then I can't have that confidence boost to go through and execute the shot sort of thing. If someone tells me I have got a great swing I can guarantee that the next shot I hit will be great . . .I am so . . . . 'yes I am'! If someone tells me I am swinging it a bit quick today I am sooo conscious of my swing that I end up hitting the ball crap. A lot of other people . . . . I am very aware about what other people . . . . playing infront of crowds for me, is either really really good, or just a nightmare . . .a living nightmare . . . and I don't know what flicks between the two I don't know how it works, one day I can be standing there and think 'lush, look at the people watching me . . . I'm the big boy' where as next time I just want to curl up in the corner and just disappear for a couple of days sort of thing, and It is very difficult . . for me anyway . . to get my head round sometimes . . . . . you're the golf psychologist . . . you are probably thinking 'yes, he's mad!'

You and every other decent sports person!

Its amazing how you think that your mind doesn't really play too much of a role, at the end of the day your sporting ability . . . no- one can take that away from you . . . no-one, they can beat you up or what ever . . . for me, its in my hand, you can't take it away, and I don't know where . . . . . the self doubt comes from. I know it's there, I am aware that I can hit a golf ball as well as anyone, I see people on tour who can't hit it better than me, and I truly believe . . . I truly think I should be out there, but there is something stopping me from doing it and I don't, I don't know how or what it is, that's what bugs me about golf . . . . any sport, football . . . . football is my first passion I don't know where this self doubt creeps in from . . . so tell me! But, but all sports people have this unbelievable mind that . . . the thoughts that go through some peoples heads on the golf course, I have met some people who are full-on wonky!

Yeah, I think part f that is that if you had someone stood next to you, every shot you played saying you are rubbish or you are not going to do very well, that would seriously affect your game, and most people have got it going on in their heads and they just let it go on!

If I had someone standing there saying . . . I would rise to the bait and I would make myself . . . I don't know what it is . . . if someone says I can't do something . . . I'll be like 'concentrate' I know I can . . . therefore I will, so I would love that person to be telling me 'your crap' sometimes because it gets me up for it sort of thing, so the actual . . .the inner mind telling me I am crap is the one that affects me . . . I don't know, maybe I am contradicting myself a little bit but . . .

It is all to do with preparation, people prepare physically really well, and even tactically, say in football 'if we get a player sent off, we will re-organise in this format' so they have prepared for that, but they don't prepare for bad refereeing decisions which winds them up, and then they get . . . . . penalties, that's a great example, Jamie Carrigher is a good example, he wanted to take a penalty, he had been practising taking a penalty had been practising putting it bottom right, keeper wasn't ready so he had to re-take it, all of a sudden it was like 'what do I do?'

If you haven't prepared for that it is like yeah . . . you are outside your comfort zone !

It is the same with like . . . some people say 'don't have negative thoughts' . . you can't not have negative thoughts, it just doesn't happen, but you have to be able to deal with them, it's like . . . I'm shit, well ok think about that rationally . . no I'm not, that wasn't a good shot but how many rounds do I play where every shot is great? I almost think that golf must be slightly easier for you than for a recreation golfer because at least you can think, ok I am not playing well but there is

something in here for me, if I keep playing well I can get some money or I can win or whatever, where as your rec golfer . . . .

Just want s to have some fun and he is not having any fun at all! I played the other day and the first five holes were shocking, I had hurt my back and it was the first time I had played in two to three weeks properly and I was with my potential sponsor so A I was a little bit, I don't want to play bad but . . I . . I had already made up my excuse on the first tee . . . . and I wasn't playing very well and on the fifth I hit a rubbish tee shot and it ran of the green to the right and I had a nigh on impossible chip, and I don't know what it was but I just stood up and new I was going to whole it, I just knew . . . I could feel the shot and I knew where it was going, it was nothing to do with the full swing, the full swing is the hard part, this is natural, this is my banker I can do it, and I stood there and popped it up and onto the green . . dead weight and it dropped in the hole, and that's where I suppose it is easier for me and the professional ranks and the good, good golfers because no matter what, no matter how bad you swing it if you can get into the mind set of it, if you can have the belief that you can play so many different golf shots that people physically cannot do . . . its nice to know in the back of your head that you can think 'well, I can spank this into the trees and I know I have done it before but can hit it underneath that branch and over that branch and through there, and you don't know how you do it . . you just stand there and think 'I can do this!' I suppose in a way it is easier, but in another way it is just so bloody frustrating thinking why can't I . . . . some people can't ever, they can't get frustrated about not being able to do it, it's being able to do it and not doing it every time that frustrates me . . . . I went to bed last night feeling great about my game and this morning . . .nothing . . . what have I done in my sleep to go from really really good to crap in eight hours . . that frustrates any golfer, but for me, I just don't get it, what has happened between the practise range and the first tee, I am ripping it on the range, I should be walking to that first tee with great confidence I have hit a poor first shot and for the rest of the round your fighting yourself all the time and I . . . What changed? The one thing that can change is what's going on up here . . . yeah, and I don't practise it, I don't practise what goes on in my head I practise I practise everything to do with my physical ability but I am probably about a twenty-eight handicap when it comes to the mental side, when you talk about being mentally strong on the golf course, I am not at all! Why? I don't know, I am very analytical though, about everything so I suppose that's part of it. I have never had to think about . . . . its only sat here talking to you . . . I have probably gone off on a complete tangent, I have never thought about it because I have never had to, no-one has asked me the question 'why do you do that?'

Final question, well sixty-four thousand dollar question, what function do you think your pre-shot routine actually fulfils? Do you think its physical, or psychological?

Definitely psychological. I mean my putting is set, it is very very set, even if I wanted to change it I probably couldn't now because it is just there, you know and the only way it would change would be me adding something to it, I would never take anything off, because I wouldn't be able to, I might do four strokes instead of three, but if I did two I couldn't do it. As I say, you asked the question 'where does it come from?' and I don't know, but it is there and if I don't do it or I do less than I did . . . . erm, so mentally in the case of putting it is definitely mental, but for the iron routine it does change I suppose, because if I was feeling the club and it didn't feel right on the swing, I would take another couple until Iget the feeling with my hands, I am very much that sort of golfer, I am not a mechanical golfer, its a lot to do with feel, but I try to keep it the same to a certain degree with everything but putting it is definitely mental!

I have never thought about that, I suppose in a certain sense my practise stroke is to get a feel for the distance of the putt, but there again I am not looking at the hole, I am not looking at the distance, in my head I am . . . . .

Maybe, it is as you said that you had already done your decision making, so right, this is how far it is, this is how I have got to play it, is it almost you are programming your body, I know how far it is, sort of adjusting how much force you need to apply to the club?

I mean . . . I have never . . . today for example I was putting at a white cross and I am sure I might do certain things that I never notice I always do on the golf course, when I am looking around the hole I may do things that I don't notice, but I was just concentrating on the actual putt itself so that was my routine, but maybe there were other bits I haven't noticed that I do when I look at the putt, I think a lot . . . I do tend to swing the putter one-handed looking at the putt, whether that is part of my routine I don't know, maybe that actually gives me the feel for the putt, but when I actually stand near the ball, you will see it on the video camera, it is not part of my routine, but every now and then I'll just stand sideways and just do that . . . and then go into my routine, that's when it is like 'here we go' . . I have never actually thought about it . . .

In lots of sports, lots of people do things that don't . . . they don't actually know why, but they know that if they didn't do those things . . .

I clicked once today, I click on the golf course, when a putt is going passed the hole I click . . . as if that is going to make the ball bloody stop, I am sure it stops me shouting obscenities . . . but where that came from I don't know, and you will see quite a few golfers do that, if they think the ball is going past they will click . .why, I don't know! What good does that actually do . . . . nothing! One day I noticed that I was doing it, whether I had been doing it for six years I don't know . . . . I remember clicking once when the ball went off the mat . . . . . what's that going to do, what difference is that going to make you –know, but for me . . .I have never thought about it, and don't know why I do things. . . . the gods-honest truth, but it works . . . it could be better though, I know it could be better, on my putting . . . . I wouldn't say I am a bad putter I wouldn't say I hole as many putts as I would like to, the difference between me and the guys who earn decent money on the tours and stuff like that, I would say is that I allow myself to miss a putt, I kind of accept too much sometimes, over the last three or four months I have been very conscious of the fact that I don't hole anything really outside of ten feet very often, and you look at the boys on TV and think he looks like he is going to hole it all day long . . . . why? . . . because he wants to hole it and makes himself hole it! Where as me I am like 'two putts, off you go!'. It almost accepting mediocrity, and for me, telling myself I think that is quite bizarre because I am a driven person in certain degrees. But erm . . . . yeah . . . I don't hole enough therefore I know it could be better, and so it makes me thin 'what's going on? Why, am I not holing that!' and I am sure it is nothing to do with my physical ability, it is to do with my approach to the shot. If I approach that shot thinking 'two putts, walk off the green and you've got par'. . . . . you never really give yourself . . . . . if you go into a footie match and go 'ok, lets accept a draw' you are never really going to play that great, so for me it is something I am conscious of, but it is hard to do, it is hard to get that, I am going to hole this all the time, because the more you try sometimes, the harder it gets, ask any golfer, your stood there, you've got a six-footer, stand there, tap it in, and it will go in, and you are like 'hang on a minute' why was that so bloody easy, you know what I mean? And you think to yourself 'it is that easy' so why am I worrying about stuff that really isn't that difficult, and you will vary rarely see someone want up to a two footer one handed and miss it . . . . put that ball back and make them step up to it properly, and make it matter, and you see the amount of golfers who will miss that putt, it is so easy, if you don't try, it is easy sometimes, if you get it in that happy balance it is like . . . . . that is alright, straight in! It is almost as if trying and not trying help, if you get that happy medium between those two you have cracked It, and I am sure that is what some of these boys out on tour do, it means everything in the world to them, and yet they can get their mind relaxed, its not the tournament or the feeling of winning, it is just the golf shot and it is just one shot at a time and not 'well, if I finish four under and you are only on the fourth, you know, I am halfway round the golf course sometimes before I have even got there, it is so difficult to do, and that is why I have got the upmost respect for how . . . .they do it out there . . . its not my full-time job you know, I am a coach first and a player second, but erm, to do that twenty-four seven every day . . . . I don't think I could cope with it. To worry about all the other things in your life and then think about golf everyday, twenty-four seven . . . I would struggle, I would like it if I had the ability to do it, but right now I couldn't do it, mentally I would be on burn-out. A round of golf for me takes it out of me completely, sometimes I want to get of the golf course sooo quickly . . . I am just not mentally prepared for it, which is again, quite annoying! I had never thought about that either, but erm . . .

I think with my putting it is definitely mental, with my full swing it is a little bit physical to get a feel for the shot, but again, I would say seventy-five percent mental and twenty-five percent physical, and that's as simple as I can make it!

Brilliant!, we will call it a day there!

APPENDIX L

Study 4 – Participant Three

First question, how consistent do you think your pre-shot routine is . . . we will just think about putting for the moment, so I am sure you have a routine thing that you do . . . how consistent do you think you are in what you do?

I would say . . . ninety percent consistent. I know when I have do something differently, I notice if IO have done something differently.

Is that you have done something differently and it hasn't gone as well as it should of or . . . .

I notice doing something differently during the routine, I think 'I haven't done this before or I haven't done this right . . . but its ok', its not going to make a huge difference. If I am playing in a competition it would be everything one-hundred percent, but if I am playing with my friends . . I will still do everything right, you still want to shoot a good score, you don't want to go out there and just hit it about the place, but . . erm, I know I am not being as thorough as I usually would be.

Time-wise, do you think you take the same amount of time doing the routine or do you think it varies depending on . . . . .

Erm, ... depends on the length of the putt and depends on the importance of the putt. I never take a long time because if you take a long time too many others thoughts get into your head . . . just get it over with

With that, could you quickly talk me through your routine?

Yeah, It starts with the golf ball, pick up the golf ball, always have the writing facing the hole so I can't see anything on top of the ball. I know some people have lines . . . . I don't want to see anything at all . . . that's a distraction. Then erm . . .take a few paces back, take a look at the line . . . I will sometimes lie on my chest if I have to, to get the . . . . the line is the most important thing to me, gotta get the line then I will walk up, as I walk up to the ball I am looking down the line, stand a putters distance away so I can have a free stroke or two, one stroke, easily one stroke then I will either be looking at the ball or looking at the hole, trying really hard to feel . . . feel the ball come off the face, if I hit the ball exactly like that I know how far the ball will go, then as long as that is right . . step straight into the putt . . . and repeat it.

Brilliant, so if it's a more difficult or an easier putt, which bits do you think that you take longer on?

Its line . . . all line! If you have got a ten footer I may not even get to my knees. Just tilt my head to the side . . . that's it . . bang it in. But obviously, if you have got a forty footer with a couple of breaks then . . . . . a good look! . . . . no more than fifteen seconds max!

When do you . . . you are probably not even aware of when you do it, . . . is there a conscious time that you start thinking about the next shot? You have just played the ball, it is on the green, you are walking down the fairway. When do you start thinking about the next shot?

Sort of . . . when I take a shot . . as soon as the ball has stopped I am thinking 'that's probably going to be a wedge up there, it is probably going to be an eight iron'. Then I will forget it and walk there . . . just so I know what to expect when I get there, then I will forget about it, get to the ball and start again.

Is that a conscious thing that you try and think about other things or . . . .

Erm, . . . I think to start with it was conscious because I though 'I am going to have to learn to do this' but then erm . . its like anything, it becomes more natural after a while . . . it just happens.

That's good. Right, my next question. What are you thinking about while your doing the routine? So, you are consistently doing these things from trying to sort out the line to the actual components of the routine when you are by the ball, are there any things that you are aware thinking about during that time?

Erm . . . . apart from just 'lets get this in the hole' erm . . . do you mean things like wind, ground etc?

Yeah, all those things!

Yeah, I think about all of those things . . .very analytical, erm . . . very varied, if it is windy . . . will the wind effect this putt, the line, length of the green, are the greens consistent today, obviously if they have just been cut they will all be consistent, maybe some greens will go quicker than another, erm . . . . weather comes into play, if it is raining obviously, if its early in the morning is there dew on the grass, but then by one o'clock it is going to of dried out, things like that. Anything that is going to change the shot.

That's good. Once you have kind of factored all of those things in . . . . this is how I am going to hit it, when you are stood over the ball doing some practice swings through to hitting the shot, do you consciously think about anything then other than, say hitting the ball? DO you use trigger words, or . . . . .

Not really! I erm . . . . when I am stood over the ball I don't . . . . I know that . . . I tell myself off about it really . . . . sometimes I can be over the ball for about twenty seconds thinking 'are you going to hit it? Are you going to hit it?' and then that makes it even worse, and I am stood there for even longer . . . this happened recently, and I don't hit it until something inside tells me to hit it. I don't think about 'let's take it away now' it just happens.

Oh right, so it is not a case of thinking that 'ok, ball down, check my stance, couple of practice swings and then hit the ball', it's a case of waiting until

Waiting until my body tells me to take it away!

That's really interesting!

Sometimes it takes a long time, but then when it takes a long time its like 'come on, people are waiting for you to take this putt, and you look at them thinking ' what are they thinking now, come on take the putt' then it gets worse . . . . that's when I hit a bad putt.

So you end up sometimes . . for what ever reason end up hitting it before you get to that point?

Yeah! I just think 'I am going to have to hit this now, otherwise people are going to think I am stupid' . . . and that's when the bad putts are.

Do you ever reach a point where you think 'this isn't feeling right I will start again'?

Very rarely, but sometimes yeah, ... maybe . . . . . once every four rounds I might do that. Most of the time I just think . . . . 'this isn't going to be a good put, I'll just hit it anyway' . Say it is like a competition and I am stood over it . . . and I might have been stood over it for twenty seconds thinking 'come-on' and I will just walk away. I don't really care what anybody else thinks in that situation because I want to win.

What function do you think your pre-shot routine actually fulfils, why do you think that doing it helps you?

Erm . . . . it puts my brain in like a . . . . putting mode. It's like walking through a door when you start it, its like everything else goes out the window and your putting, literally forget everything else, so it almost puts you in a mode.

So, there is obviously a sort of physical preparation in that your working out 'this is how I am going to hit the shot' and then you are saying that you also use it to get in the right frame of mind . . .

Yeah! . . . . . I can be walking down the fairway laughing and joking with my friends standing behind the putt with everything else blanked out, its like walking into a room and closing the door.

How has your routine developed? Is it a case that someone at some point or some people at some point have said 'we need to develop this, we need to be consistent, or is it something that has just happened, or something that you have read articles on or . . .

Yeah, I read a book about four or five years ago by Bob Rotella called putting out of your mind and basically he does not talk at all about erm . . . the swing, doesn't talk about the mechanics or anything, it is just psychological pre-shot routine. And that is when my game absolutely turned around, that made such a difference to my routine, and since then it is like a religion . . . . and he is like god! Yeah, I completely trust everything he says, it is totally unbelievable what he says . . .

Bob has done some good stuff, what I like about him is that he comes from an academic background so everything he talks about is backed up by relevant research, and there are a lot of people out there who say things but it is not really backed up, so yeah he is really good. What mental strategies, if any, do you use during that pre-shot period? Do you use anything such as relaxation techniques, imagery, erm . . any particular thoughts, or trigger words or . . . .

Erm, not over putting, cos when I'm . . . with irons and stuff my pre-shot routine starts when I put my glove on put the grip up . . . . err put the grip on, and then erm I will rip back the Velcro, that's it started, then I will . . .then its started, but putting erm . . . no there isn't really apart from putting the ball on the ground, marking the ball, making sure I can see nothing then I have begun, but nothing as much as my grip no, on my irons.

Are you aware that you use much in the way of visualisation?

Definitely yeah, when I am behind the ball, all I can see is the ball going towards the hole. Erm . . . .I always see John Parker . . . I always imagine him taking the putt. Absolutely . . . I have done that for about three or four years now, and every single putt stand behind it, just imagine he is there, putting that ball into the hole, putting it in, and sometimes feel it as well, but actually watch the ball go into the hole, watch it on its whole path into the hole.

That's good. So you are almost watching from outside of your own body. When you are actually over the ball do you use visualisation there?

No, its more feeling in that time will that stroke get that ball into the hole, will this weight of putt make the ball reach the hole. So it goes from sight into feel.

That's really interesting about John, because if you speak to John about his visualisation he is very much . . . he can stand there with his eyes open and almost see the ball doing what he wants it to do which is different. Obviously visualisation is really important. Do you think that it is that it is a disadvantage for you . . . because obviously you decide what shot you are going to play and how you are going to hit it, your seeing that putt from somewhere else to then stand over the ball and try to imitate that putt?

Erm . . . . (sigh). . .

Do you know what I am saying? If I was stood here and I visualise the ball going from here, its breaking left to right and I see it going in, then I am wanting my body to do what I have just seen?

No, I turn my body off really! If I think about it I turn my body off, I don't think about 'right, try and keep the arms in a triangle, keep shoulders in a triangle . . . I don't think about that , it just happens.

Ok, so we are not thinking 'for it to go right I have got to hit it right'?

No, not at all!

So it's more a case of it being a computer programme. Ok, this is what I have got to do . . . execute! And that is what your body is . . . .

Yeah, see it, feel it, then do it!

Fantastic! Do you think that when you are tired, either the end of a round, or on a day that you are just tired, that that effects your pre-shot routine? Either how consistent that is, how long it takes, how effective it is . .

Yeah, if it is a hot day yeah, because you just can't be bothered. . . like I was on holiday in Portugal and it was just so hot, your stood over the ball thinking 'I am not that fussed over whether this is such a great shot or not'. So, the pre-shot routine doesn't go out of the window, it is still like . . . its just habit, I don't think right do my pre-shot routine, its just habit, and I will do this and do that but won't go through the thought processes I just do it out of habit.

So, you are going through the motions doing it but not thinking do his, do this. How much do you think pressure has an effect? That could be that you are playing in a match situation or it could just be because you have got certain people there. Do you think that effects what you do, or effects what you think about? (14.05)

Erm, in pressure, because my pre-shot routine is just habit it does not affect the pre-shot routine what so ever, the thing that it effects is my natural ability to hit the shot. When I am under pressure I will do the pre-shot routine then when I am standing over the ball think 'right, take the club back square, lets bend my wrists here, let's do this' . . . that's what it effects.

Do you, when you go through your pre-shot routine, are you just focused on that putt or are you even thinking about things you have done before, or it's a long putt and you are thinking 'well, I could two-putt this' and in that case your next putt is going to be . . . .

Yeap, erm only if it is relevant really. Like erm if I had a six-footer and I had a six-footer on the green before I would be stupid not to think 'right, how fast did that putt go, how hard did I hit it', If I have a six foot slight uphill putt, the same gradient as the putt on the last hole , I will think right, how hard did I hit that putt? But if you have twenty foot left to right then twenty foot right to left , then it doesn't make a difference at all . . . completely different putts.

Ok, how consistent do you think top level players are in their routines, in what they do?

Erm, . . . ninety-five . . . ninety-seven . . . yeah! . . . . . obviously everybody feels pressure, no-one can say they don't feel pressure, obviously no-one can be one hundred percent. But I think I am a good putter and that's why.

That's good, and I suppose thinking you are a good putter is half the battle, because at least you are a bit more confident in executing it. What factors do you think can effect the top guys in there pre-shot routines? You see it all the time don't you with a pressure putt and all of a sudden it all falls apart.

Yeah, probably mainly the situation . . . . obviously I don't have . . . I have never had a crowd, obviously they do have crowds, and erm, if a crowd is chanting at you or something and they are shouting at you because you missed a putt a couple of minutes ago, a three-footer, and you are going on to the next green and they are reminding you of that, then . . . I haven't got that, but then I have never had that because I have never played in front of a crowd, I imagine that does. Obviously if you are on the eighteenth at the open and you have a fifteen-footer just to get into a play-off and you have fifty-million people watching you . . . I would be absolutely bricking myself . . . I couldn't do it!

Taking that that is the case. Obviously pressure is a big one, distraction, you mentioned the crowd chanting or someone with a mobile phone, or someone taking a picture, what mental strategies do you think those guys use during their pre-shot routine? Again, do you think they are just going through the motions physically or . . . . .

Well I mean, the only answer I can give to that is what I have read, when they just completely switch off. They don't even see the crowd, Tiger Woods doesn't even see the crowd, doesn't even acknowledge they are their half the time, unless they are taking photos and stuff, then he gets angry!

So you think he is using it to focus?

Oh yeah, that comes from practice as well, like if you have an amateur playing in his first big competition obviously he is going to be very nervous, it just all comes down to practise and experience, but if I had been put in that situation, never been there before I wouldn't do as well as I would if I had done a hundred of them . . . it would be just normal.

Do you think its important . . I know you mentioned this earlier, to do the routine exactly as you do when it matters when you are practicing, all the time, or sometimes, or depending on what you are actually practising?

Erm . . . it depends on what kind of level you are trying to get to I imagine, if you want to be a top professional then it is worth your while practising it and practising it exactly every time, but I don't cos I think that I have reached my peak now and erm a couple of years ago I was trying really hard, practising really hard, pre-shot routine every single time very hard, but now I have realised that this is probably the best that I am ever going to get, and I have got to choose a different career path now, and erm I have stopped doing that, although I don't want to play badly so I consistently do my pre-shot routine every time. But I won't do it religiously or anything.

The fifty-four thousand dollar question, do you think it makes a difference? Your pre-shot routine?

Yes! Absolutely yes! Absolutely yes in a good way! Completely!

So, you feel that you couldn't putt as well if you didn't?

Not at all!

Or maybe not putt as consistently?

No, not at all . . . no! Nowhere near as good I don't think!

Do you ever find yourself in a position where . . . because you mentioned about if your tired and you are not really that bothered you end up rushing things and its not particularly good. Do you ever find yourself in a situation where you don't do some of the components of the routine because for some reason you just know that you are going to hole it. For some reason you just thin, well, I don't need to do that and that I can just step up and hit the ball?

Err . . . you get the feeling, everybody has it, you get the feeling just like a twelve-footer that is going right to left and you think this is absolutely definitely going in, but I would still go through everything, but while I was going through everything I would be really confident going through everything . . . and if I was nervous about a putt, I would be going through everything nervously! But I wouldn't change my routine at all!

So you wouldn't step up to it and think 'ok, I know I am going to did it so I don't need to do those things'?

No, I go through the routine every single time! Because it gives me a slightly bigger chance of being successful.

Do you think that during a round, if your putting is not going too well you take longer setting up the putt. As if you are questioning your judgement because the putts have not been going in?

Erm . . . no, if I miss lots of putts, I am more confident of holing the next one, if they are really really bad putts, and I have never had it happen that bad, but if I was missing every single putt like a foot to the left I would stand on the next tee and think maybe have a little practise thinking why is this happening, but if I was just missing, missing, missing putts it wouldn't really bother me because I would just think 'well, no-one can hole every putt, if you were given a hundred ten-foot putts you might hole twenty-five of them or something or twenty of them and erm, but that means you could miss the first eighty but I would still be confident of holing the last twenty because I know that that is the percentage that I am going to hole. So if I am on the golf course and for the first fifteen holes I miss ten-footers I think right, the last three holes there is no way I am going to miss them. If I miss them I think 'right, the next round I am expecting eighteen.

Here is an interesting question. When you miss, do you think it is because of an error of judgement, or because you have just not executed it properly?

Err executed it properly! Err well it is probably fifty-fifty. If you have just read the line wrong, then you have just read the line wrong, there is nothing I can do about it. If I read the line and hit it perfectly along that line then there is nothing that I can do.

Which one do you think would have the biggest impact upon you? The biggest impact upon you performing? You have missed a few putts and you think 'I am just not judging this right at all, I am just not calling it', or you are thinking 'well, I know what I am supposed to be hitting but I am just not executing it properly, so I just need to modify that to get it in. And if you thought one over the other do you think it would be better or worse?

Errm . . . . .

Does that make sense?

Execution or . . . what was the other one?

Do you think that you are missing because you are not calling it right, so at the start you are deciding ok, this is how I need to hit it, but you are not getting that right. Or, missing because you are not executing what you should be doing right. Which is going to have the biggest effect?

Erm, executing probably, just because, at least you can then change it still . . . like I said before if I am just not executing it right erm I will have to have a think and re-do it, just completely change things 'right, for the rest of the day I will hit a little bit under, and I have an excuse then as well for hitting it badly.

How important to you is, and again we touched on this briefly, is how the putt feels?

Hugely . . . . massively . . . . yeah!

Do you think that possibly, although you said you are not really focusing on anything when you are executing, you are focusing on the strike?

Yeah, as long as I get a clean strike, if I hit the putt well and it comes off the club-face with the line I want it to . . . after the ball has left the putter there is nothing I can do then, if I hit the ball well along the lone and it misses I am happy, perfectly happy cos I know in myself I have it a really good putt, exactly the way I want to, exactly the distance . . . but it didn't go in! There is nothing else I can do.

And to you, the feel of it, is it important how the club feels in your hands or, how your stance feels, or the whole lot?

Everything, almost like when I am stood over the putt and I feel good it is just like, it just feels neutral, you are not stood there, you are not holding it, but sometimes you feel awkward because you feel a bit too upright today, and I just get comfortable, maybe I am holding it a bit . . . . like an inch down the grip or something, as you do, but when everything is right you just feel absolutely neutral . . . and . . . when I know my body is in the right position I know the putter is going to swing in the right position as well . . . my arms are going to fit perfectly into the swing and everything . . . it flows!

Last question, would you say then that when it is right, and you feel relaxed, its almost like you don't know what feels relaxed, because you are not thinking about your arms or your legs, where as when you don't quite feel relaxed, you know what doesn't feel relaxed because your hand doesn't feel right or your leg doesn't feel right, and do you think it could be because you are focusing on bits, and that could be what effects . . . .

Makes a bad putt? Absolutely! But then, when I do feel . . . when I don't feel relaxed erm sometimes I will try and move around but won't know what to do. And I will be stood there thinking 'oh, my right arm feels a bit awkward but I can't find the slot, I don't know where is it? Because its just erm, when you have got a natural putting position you just get used to it, it just becomes natural . . . but then you lose it and think 'oh no, where is that natural position?' because you don't think about where it is . . . your just in it. I don't think right 'right, here it is, this is my natural position, that is about half an inch from my arm there or' . . . its hard to find when you lose it.

I suppose you don't really know what it is that is right, but you know when it is not right!

Yeah, you know when it is not right, but then because you don't know what is right, you can't find it!

And if only you knew what it was then it would be perfect.

Yeah, but then it wouldn’t be natural!

Brilliant! We will call it a day there!

APPENDIX M

Study Four - Participant Four Interview Transcript

What I am interested in is . . or what I want to talk about is your pre shot routine, so last week when you were doing the putting task you . . . your pretty consistent, doing the same things . . .putting the ball down, doing practice swings, setting up the shot, that sort of thing, so I just want to explore what your thoughts and feelings are about them, or even whether you think you do the same things?

Yeah, alright yeah! I try and do the same thing every time!

Is that consciously?

Yeah, consciously! I make sure I do the same thing every time you know, to set me up before the putt, so . . . . do you want me to talk you through it?

Yeah!

Ok, right first of all, first thing I do is I get my golf ball and line it up level with the hole, just give me a sort of visual . . .you know . . that is where the ball is going . . .then I will walk backwards, take a general look at the hole, look at the lie of the ground, see which way I think it is going to roll, so first thing is a general picture, then I am looking in a bit more detail, I will aim exactly where I think I am going to have to hit the ball for it to go into the hole . . . . today I was practice putting which is dead straight all the time but, you know, sometimes you might see a little bit of a turn . . . err . . secondly, I will still standing behind the ball I will imagine myself above the ball putting, but watching myself hit the putt. I would be watching how fast I took the club head back and how hard I was going to strike it and also . . .one thing I have always managed to do that might be quite different . . . I always imagine, to get my pace right, I always imagine I was throwing a ball . . . rolling a ball along the floor seeing how long it took to get to the hole . . .it gives me two things in my mind about how far the ball is going . . . .erm . . next, once I have got all that information in my head I would walk up to the ball, I would stand above it, I would . . I have two practice swings, first practice swing would just be to get the feel right, so I know I am not going to hit the ground with the putter or anything like that, then I would erm imagine that I was taking a putt, pick the club head up as if I was taking a putt, look at the hole . . . putt it, imagine I really had putt that ball and imagine where it would go, sometimes it would feel right, and you think ‘right, I have got that perfect’, other times I think ‘right that didn’t feel right, I got the pace wrong’, you know I might of looked at the hole a bit wrong. . .then I would maybe have another practice putt, but once I have had the practice putt that feels perfect, and I am going to get that ball near the hole, that’s it, I go to take the putt. So again, I try to get the club head lined up where I would like the ball to start off, erm, then it is just a case of going over the ball, one last look, take my club head back, head down . . . hope for the best . . hope it goes in.

You mentioned about imagining at the start, seeing yourself sort of outside of your body, actually seeing yourself doing it, but, when you are doing your practice swings and you are seeing the shot is that the same as seeing it from outside?

Errr . . . yeah, the practice swing I take before I hit the ball, I won't be visualising anything, I would be in my own head sort of, I would be imagining myself taking a putt from inside my body, not looking . . . not with my eyes closed but not imagine looking at myself through a camera, but seeing within myself.

Ok, that's good! How consistent . . . . obviously you are very consistent in what you do, how consistent do you think you are time-wise? Do you think you take a similar amount of time, or does it vary, or . . . .

Mmmm . . . . . it would vary depending on the difficulty of the putt . . . . sometimes I get this feeling, sometimes I don't have to go through that routine, sometimes, I just look at . . . some people will mark their ball, walk away from the hole then put their ball back down, sometimes it is a short putt, or I think I know the green . . I just walk up to it and hit it and I know that it is going to go in. I have had that a couple of times today where I thought 'this is going in' so I don't take as much . . if it's a very long putt with maybe a double break or you know its going up a hill and you really have to think 'right, how hard am I going to have to hit this ball', sometimes the hole is on top of a ridge, errm and you would have to work out perfectly you know in your head how hard you have to hit it . . sometimes the putt is not quite so difficult, so definitely the shorter the putt the easier the time I take over my approach.

Do you think that counts for the whole of your pre-shot routine or do you think that that longer or shorter bit is to do with the initial deciding what you are going to do before you go into the 'right, practice swing, practice swing hit the ball?

I think that would be generally that for a more difficult putt the whole process would be longer . . . definitely! . . . . I could take more practice swings, I don't hit the ball until it feels right, you know sometimes when you have got like a putt with a double break you know, you might just have to have more than one practice swing so you know . . . when you get to a level of golf where you are like a low handicap, you've got to be trying to get that ball in the hole every single time, so you have to take longer over it or otherwise it is going to be a wasted shot. There is no point just walking up to it and hitting it all the time!

You have just put the ball on the green, so you are walking towards the green. When do you switch on to your next shot?

Err . . . .

Is it something that you are consciously aware of so maybe, when I get my club out of my bag, or when I put my ball down, or when I do this, or is it just that you are always thinking about it?

I don’t think that I am thinking about my pre-putt routine or the putt until I walk onto that green, definitely not when . . . if I have hit the ball on the green from a hundred and fifty yards I won’t be thinking about it then, I won’t be thinking about the putt until I can see the contours of the green and you know the way that the grass is lying, you know whether the conditions are damp or dry, it is something, putting, because it is so fine . . . you know like it is not like you are trying to hit a big white target, it is a very small target, I don’t think it is something you can really start thinking about until you can see everything around you, you can see all the details. Some people might, some people might be thinking about it from far away but I tend to in between shots distance myself from golf, try thinking about something else, not getting too intense and start losing my concentration, so I try and keep my concentration for the actual moment.

That is quite interesting actually, because I did some consultancy work with quite a good level golfer and he was having real trouble just leaving things behind so working with his caddy we were working on, he would obviously play his stroke and then once he had put the club back in the bag, that was kind of his switching off, the caddy was primed to talk to him about anything as long as it wasn’t to do with golf to keep his mind off, and then when he got to the next shot, take the club out of the bag and switch on again! Where as someone else that I interviewed was the exact opposite they were kind of for the whole three or four hours switch on to golf.

I can imagine that being really mentally draining, after four hours of that your brain must be in pieces!

What are you thinking about when you are going through your pre-shot routine. Are you thinking about doing the routine, or are you thinking about the shot, or are you not aware of what you think about?

Err that is interesting . . something I have not really, no I don’t . . before I take my putt I don’t think to myself ‘right, I have got to do my routine’, because I have done it so many times it just becomes natural, you just don’t think of anything else, that’s just the order you do things in and it just becomes natural, so I don’t . . . yeah so I don’t really concentrate . . .the only thing . . you think about the individual elements of it consciously like look at the line, look at the ball stuff like that but it all flows naturally, I don’t think, right I have put the ball on the ground and now I have got to go back, its not like a comfort thing that . . . I don’t do it so I feel calm about . . . I do it because I want to get the ball in the hole . . so . . . I am doing everything for a reason.

So, as far as you are concerned you are lining it up because you need to not because you are thinking ‘I need to line it up’

Yeah, its not a mental thing it is a physical thing, I need to get that ball in the hole, not that mentally I need to be in this state to putt this, where as for a very very good golfer that might be different.

So, in your opinion what role do your pre-shot routines actually fulfil?

Ermm . . . . my pre-shot routine is I would say purely practical, erm . . . . everything I do is to get that ball in the hole, I haven't got like certain things that I do, like a habit, I haven't got . . . . I know some people who twitch their trouser leg or, like I know my brother does that, I think he might have a different mindset to me but erm . . .yeah it is purely to get the ball in the hole. I don't think that anything I do is for comfort, you know.

Why . . . is your pre-shot routine how it is? Is it something that has just developed naturally, you just happen to do these things, or is it that at some point someone has said you need to do this?

Everything I do I have got from different magazine articles, or people . . ever since I first started to play golf . . . everything is . . .lots of information I have received from magazines, videos, the telly, things you see on the telly, people talking in the clubhouse its all just added together and you know it has all been added together over a few years so, I don't suppose it will ever change.

Just to clarify what you said earlier, all I think you said is that sometimes you don't need to go through all of that when you know you are going to hit it!

Yeah, it is really strange to describe. Sometimes I get a feeling over a putt, I will see a putt it might have a bit of break or a putt that I've been in that position before in the last few weeks, and I feel that I don't need . . . because my routine is practical . . I do it so I can hit a good putt, sometimes I can miss elements of it out . . . .I may not have a practice swing, I know the length because I have hit it a couple of week ago, I know the line of the putt, and I just walk up to it and , I will probably always have a look at it, you gotta look at it, but sometimes I just walk up to it and hit it. Definitely, I can miss those bits of it out.

When it feels right?

Yeah when it feels right, once I have got the feeling I know the putt I don't have to go through all the routine.

Putting the putt aside for a minute, obviously putting is the easy one for pre-shot routines. Do you have or are you aware of having a routine for other shots?

Erm . . . . yes, definitely! I definitely have a routine for my driving and probably the same . . . .actually it is probably different for irons, you know on the driver you always have the tee in the ground, where as you have got an iron shot you have the ground to think about erm, but it would more or less go along the same lines, the only thing different to putting would be you would probably have to look at the ground you are on, you know it is not always going to be nice . . covered in mud or yu know in deep rough, then you have to start thinking about how hard you have to hit the ball, what sort of angle you have got to hit the ball at, so yeah, iron shots are probably the most difficult, but as a pre-shot routine I wouldn't say it is the same every time, putting would always be the same because you are always hitting off a consistent surface, but erm there is definitely some sort of routine to irons and drivers. They pretty much go along the same sort of line, you look at the line, I always line the ball up the same way, obviously not on the fairway but if its going off the tee I would always line up the wording on the golf ball for where I want to aim it, and I would always stand behind the ball, slightly differently, not low to the ground your upright, but erm its pretty much the same . . there is definitely a routine there.

Yeah, so you think that your putting, iron shots, driver, might be different but there might be some sort of consistency?

Yeah there is . . yeah. You are looking at the same sort of things, all the variables around you definitely.

Do you use, and if you do, what sort of mental strategies do you use during that time? Is it that your . . . I don't know, using relaxation techniques, or imagery, or setting goals, or trying to concentrate, or you are talking to yourself, or you are using trigger words . . . . any of those things that you are aware of?

Erm . . . . I don't think so . . . . no I don't . . I don't think I use any mental strategies for hitting the ball, I can understand some people using certain words such as one take the club back and two forward, but no, get ready for the shot, stand above the ball, I probably wait a few seconds till I am relaxed, that way I know I am ready, you know what I mean, I have a bit of a waggle, make sure everything feels comfortable, when you feel right, just take it back, there is no trigger, I don't say anything to myself in my head . . . when I feel right I will take the club back and hit it.

Is that feeling right the club in your hands or your stance?

Err . . . its more like a mental state really like, in my head I know everything is alright, I have done a waggle to make sure I have done my checks, I have checked my feet are inline I have checked, you know that my stance is alright, and checked my grip feels nice and if I am on the tee and my grip doesn't feel right I will adjust my grip, when everything is right, I stand above the ball, take a deep breath, right ready to hit. Then just go with it, and when its . . . when I feel calm with the shot I hit it.

When you are tired, towards the end of a round or when you are just tired, do you think that has an effect? Do you think it takes you longer or maybe longer to make up your mind about what you are going to do?

Err . . I find when I am tired, I usually, I have a tendency to ruin my round over the last few holes, I'll get, I don't know if its mental, maybe I get mentally tired easier than other people but, the last few holes I might get tired and I won't do anything at all I will just get my clubs, out the bag . . . seven iron, walk up to the ball and hit it. So I think definitely, when I get mentally tired and physically tired, especially when . . .the type of weather when it is hot, sometimes you just think 'lets get this round over with' you just don't bother with the pre-shot routines, or you don't even bother looking at as many variables as you should do, so yeah, a shot will speed up!

Now that is interesting, because we now have the case that sometimes when it feels right you don't need your routine, you can hit it perfect, and then other times you get tired, you don't use your routine, and performance ends up suffering. I suppose the difference there is that in the second situation you haven't paid attention to all the things you need to where as in the first one you . . . .

Already know yeah, it is already in your head, yeah definitely the second one you haven't looked at half the variables you should do, you just go ahead and hit it.

I suppose you would be more likely to be in a position where you know you are going to hit a good shot on a course that you know, because . . . . .

Yeah, definitely, because you have been there before, if it is say a course that you are a member of , and you play every week, you will probably find that a lot more . . . . even so on courses you don't play you still have those where you sometimes think 'I know I can hole this', like when we were doing our putting in the gym there were a couple of holes where I thought 'I just know I am going to walk up to this and it is going to roll across that hole on the floor, and its . . . it did as well, that's the . . . usually when you get that feeling to usually does just go in.

It might be difficult for you to think in situations like this but, try anyway. Can you remember times when you have been playing golf and you have had other things on your mind, probably things outside of golf, and do you think when you are going through your pre-shot routine it is easy to blank those things out?

Errrrm . . . I find that I have definitely had situations where something has happened the day before . . . the night before and then you have gone to sleep, you have gone to play golf first thing in the morning, and the first thing on your mind is you know what's happened the night before, and it is very difficult to get out of your head, and errr yeah, it definitely does interfere with your game. Something intense, something that is more important than your round of golf definitely I would say is impossible to block out completely. Especially if you are say over a putt and you are thinking about something else, it is going to be more difficult to make that putt, I think probably you still do your pre-shot routine the same, but you may not take in . . . you know if you were looking at how far you have to hit this putt you might be looking, but you might be daydreaming, not taking in what you are actually seeing.

So possibly things can . . . .

Yeah, definitely, I would say that something else in your life that you are thinking about could definitely take over.

How about pressure when you are playing golf? It could be that you are playing with your brother and you want to beat him, and its tight, or could be something else. Do you think in that situation having your pre-shot routine helps because you are going to do these things so you don’t think about pressure or do you think that that can have the same sort of effect?

Erm . . it depends how mentally tough you are, and I would probably describe myself as not the mentally toughest person on the . . .you know the world, and I know for a fact that I am more likely to mess up on a putt that there is pressure on, because I will be thinking about the pressure and my pre-putt routine will be going out the window, where as other people such as very good players wouldn’t forget their routine, to them it is just another putt, because I would be thinking ‘what is going to be the result of this putt’ so more than likely that would overtake my pre-shot routine . . sort of preparation for taking that putt.

Would you think that top players. And you can probably think of some off the top of your head, would have very consistent pre-shot routines?

Yeah I would. Interestingly I read a bit on err David Duval when he shot his fifty-nine. I can’t remember where he shot it but he shot a fifty-nine, errm, I don’t know how long the last putt was but he said he didn’t feel any nerves at all because all he was thinking about was his routine, and things like that make you realise how important the routine is, but it is hard, I find to put it into place every time, I would definitely say that a sound pre-putt routine was key in over-coming any stress or nerves about a putt.

When you are practicing, do you use the routine then? Or do you only use it when you are actually playing?

Erm . . . It depends. If I was having a proper practice on my own . . . . . I don’t know, because sometimes you might practice the whole aspect of the putt from beginning to end and sometimes you might just practice the stroke, but I definitely have spent some time practicing the whole thing. So, I would definitely say that I practice my pre-putt routine.

Again, is that to make what you do more consistent, or your ability to do the things, such as read what the shot is?

Erm, I would say that it is to make sure everything is consistent, as well as everything being practical, because I know how important a pre-putt routine is, I suppose consciously I have tried to do the same thing all the time.

That is an interesting point, because there is a lot that has been written about people must have a consistent pre-performance routine, so people then have a consistent pre-performance routine, but there is not much in the way of evidence to say why they should have it. No-one has answered the question of whether you play well because you have a consistent routine or you develop the pre-shot routine because you are playing well.

Its got to be practical hasn’t it!

Your routine sounds like it has developed through things that you have read and also things that you do on the course, obviously developing something you are comfortable with. Would that be fair?

Yeah, fair to say that yeah! It was developed through . . . I have been playing since I was very young . . . obviously developed more and more through the years, but I would say now it is pretty much sound, wouldn't change, yeah it's a . . . . .what you said is right yeah!

Final question, why, obviously you say that you sue it very much from a very practical point of view, it helps me sort out what shot I am going to take, feels right, hit it, job done, do you think that is the same for other golfers or do you think that they use their pre-shot routine for other reasons?

Erm, yeah I would definitely say that a pre-shot routine is very very individual erm, I know some people who use their pre-shot routine, even though it might be practical erm, where my'n is very practical but not very mental, some people could use it to block out the pressure of the putt and the consequences of the putt, where as I would like to think that my'n is for that but it doesn't really work like that, my'n is more of a practical routine. Many I should develop it into like a switch off routine where I can do something and thing this is putt time, I don't have to think about anything else, but that pressure does creep into my head.

APPENDIX N

Study 4 – Participant Five

What I am going to do is start with one question and go from there, and then build on what you say.

I am interested in your thoughts and ideas about your pre-performance routine. I have some video footage of you going through your routines that we can use to illustrate what I mean.

So first question, how consistent do you feel that your pre-performance routines are?

Generally I would say pretty consistent. . . . . . I mean I am consistent in the way I approach the shot and always take the same steps before hitting the ball . . . . . . so yeah, I would say that I am pretty consistent.

Do you think that you are as consistent in training and competition?

Err . . . . . . I would say that I am more consistent in competition, I mean doing things in practice is important, but it depends what I am working on. . . . . I suppose I should really use it every time in practice, but if I am honest I don't. Mind you though, it doesn't seem to effect me in competition as it's like second nature . . . . . I mean that . . . . . in competition I always use my routine without really thinking about it, I have been doing it for so long that it is just erm kinda there automatically . . . . I don't really have to think about it.

Has your routine always been automatic?

Err . . . . . no, it is something that has developed over time with different coaches and other players having input. . . . . . then over time it has just sorta become more and more consistent . . . . . . I have made changes along the way but it kinda feels right now. If I didn't to it correctly the shot would just not feel right.

So, err . . . what would you say are the components of your routine? What is the sequence, as in, what are the things that you do as part of your routine prior to hitting the ball?

Well . . . . . . err . . . . . . I would say that my routine starts when I approach the shot . . . . if it is a putt it is when I get to the green, if it is a fairway shot . . . . then it is when I get close to the ball on the fairway and so on. . . . . . The first thing I do is decide what shot I need to play . . . . . . I need to take lots of things into account to do it right so . . . . . lets say I am putting I need to decide on the way the green is playing and think about other things such as distance, weather and so on . . . . . . I will crouch and look at the shot from the front . . . . as in the direction I am playing, from behind . . . . looking back from the hole and from the side . . . . . . seeing the shot from side on. Err . . . when I have done that then I will step into the shot and get my stance and grip right . . . . . the grip is

really important you know, if that doesn't feel right then I don't think the shot feels right.
When I am happy with my stance I take a couple of practice swings, err . . . first one I look at the hole before the practice swing and afterwards . . . . second one I don't look up at all and just take the swing, then err, when I am ready I become still then take the shot. . . . . yeah, that's pretty much it!

That's great; sounds like you have a really good routine for the putt. Is err it the same for other shots?

Err . . . . . well . . . err . . . . I guess. There are some bits the same. When I am chipping or playing off the fairway I don't err line the shot up from lots of positions, I just step back from the shot and line it up from there . . . . err . . . then it's a couple of practice swings then off we go . . . . . so those bits are the same.

Do you think . . . . . . lets use the putt as an example, that the time it takes to complete the putt is consistent, as in you take the same time each putt?

To be honest I am not sure, I think being as I pretty much do the same things in my routine that yeah I am pretty consistent in how long I take, although you are probably going to tell me now that I'm not!

No, not at all, I am just interested in what you think!
Talking of your thoughts, what are you thinking about when you are going through your routine; again we can use your putting as an example?

Do you want me to go through each of my steps?

Yes please, that sounds like a really good idea!

When I approach the shot I am thinking about what shot I need to play, so thinking about where it is and also what I need to get out of the shot, this will have a say on the shot that I play. Err . . . Once I get to the ball then I am thinking about the factors that will decide the shape of the shot, so err whether it is an uphill shot, maybe left to right or right to left, also the condition of the green . . . is it playing fast, what the whether is like and . . . . . sometimes . . . . sometimes I will also think about the shot I want to leave myself with, particularly if it's a longer putt . . . . do I want to try and hole it, or do I plan to two putt it? . . . . . . Anyway when I have done that and made a decision I start the actual shot prep . . . . I will take as long as I need so when I am standing over the shot I have made my decision and know what shot I am playing. . . Anyway, like I said the first thing I do is get my posture right and make sure I feel happy with my stance. Once I have got that the focus is on the grip of the club in my hands, that has to feel right, if not I will start again . . . . . Then for the first practice swing I look at the hole and imagine seeing the ball going to the hole, play the practice swing then watch the ball keep going into the hole. The next practice swing is all about getting the same shot but without looking at the hole, then I am ready, steady myself, then hit the ball.

Do you do the same thing every time?

Yeah, pretty much!

How about for poor shots?

Although they end up being poor shots I still prepare for them the same!

What are you actually focusing on when you steady yourself and then hit the ball?

On the actual putt itself, its erm the only thing that I am focused on is one on the back swing and two on impact. On the putt I don't hold an image of the hole or the line that I am going to send the ball on in my mind . . . . . it is all about the rhythm and the words one . . . . two!

Do you have any internal thoughts when you are just starting your pre-performance routine . . . . when you have just got to the shot?

Do you mean like motivating myself?

Yeah anything like that?

There are times when I really have to gee myself up . . . you know get myself motivated, say things like come on, you know you can do it, or this is it, its time to perform, you need to think like a winner, when the going gets tough . . . that sort of thing!

When you were talking about the things you think about in your pre-shot routine you mentioned imagery. Tell me a bit more about how you experience your imagery?

How do you mean?

Well, how do you see it, what do you see, do you have control and so-on!

When I first see the shot it is as if I have just played it, so I see the ball rolling along the green and heading towards the hole. . . . . really I see the shot that I am looking to play, the ball does what I think based upon my reading of the line . . . . I then see it drop into the hole . . . . . err, then when I get to doing my practice swing, I swing then see the ball going along the line I am looking for and again dropping into the hole . . . . . just like on the previous image . . . . then it's my final practice swing to get the feel of the shot and then I finally play the shot.

Ok, that's interesting, if you imagine seeing the execution of the shot, and then feel the correct execution of the shot, what happens between seeing and feeling the shot working, and the execution of the shot which might end up being incorrect?

Errr!

Put it another way, where do you think the error occurs if you know, see and feel the correct shot but then fail to execute it?

Well I suppose the first reason might be that I have miss-read the shot, If I have not called it right then the ball won't do what I expect it to do . . . . so if I see the green as a left to right shot, but it ends up being right to left, then I will see and feel the shot that I think should be played but the green won't play that way and it will look like a poor shot.

So it is not an error between what you see and feel, and what you play, it's a decision making error?

Yeah!

How about if you have made the right decision, or are all bad shots due to poor decision making?

I think it's probably half and half . . . if I hit a bad shot it might be because I called it wrong, or it might be that I have not executed the shot correctly . . . . I have made the right call but not hit it right!

How do you think that works?

I think it is to do with how well I feel the shot, if the grip on the club does not feel right . . . . then that has an effect on the shot I am playing, sometimes the club does not feel right in y hands.

Do you still play the shot, even though it does not feel right?

Sometimes . . . I . . . err . . . .sometimes I stop the routine and start again, but other times if I am under pressure or have taken a long time I will play it anyway . . . If I am having a bad round the grip on the club just does not feel right, but I have to keep playing anyway.

Why do you think you use a pre-performance routine?

Err . . . . that's a good question, ... I suppose I have always been told to do it, and I have had coaches early in my career who have helped to develop my routine . . ..

Sorry, I meant what function do you think you're routine fulfils for you . . . How do you think it helps you to execute your shot?

Hmm . . . . . well . . . err . . . I suppose it gives me something to do . . . . . . Well the first bit is based around me deciding what shot I am actually going play, so there is a decision making focus in there, then I suppose all the other stuff is getting me ready to play the shot, making sure that I feel right and can see the shot I want to play. . . . I suppose it also gives me something to think about . . . . there would be nothing worse than not having something usual do to on the big shots, otherwise who knows what I would be thinking about, possibly, the routine is kind of a safety zone for me, where I can step out of the pressure of the game and just do my thing . . . . . yeah, I think it helps to protect me from other things such as pressure, things that have gone wrong earlier in the round . . . or possibly in other rounds.

Is that something you think about a lot? What has happened in other rounds or earlier in this round?

Yeah, of course, no matter how hard you try there are always things that have happened that get in your head . . . . if you have played the course before and something bad happened, say on a particular hole, then yeah it plays on your mind, so having something else to think about is really important.

Do you ever find yourself thinking of the future; say the next hole or the end of the round?

Yeah, sometimes, although I really try not to do that. I find that it happens most when I am playing well . . err . . . I might think like . . .well if I can birdy the next two that will put me in with a shout, or if I can pick up a couple more by the time I get to the eighteenth I should be . . . wherever. . . . . Although I really try not to do this too much, and definitely not when I am trying to play a shot, I suppose that is where the routine comes in useful, if I have deliberately given myself something to think about then I don't really have the time to get ahead of myself when playing the shots.

You say that this thinking ahead or fortune telling can be a problem, are there any other factors that you think can have an impact upon your ability to play . . .or possibly to execute your pre-performance routine?

I suppose having other things on my mind is a biggy, err . . . especially things from outside of the game, stuff from home . . that kind of thing. Also, I suppose generally being stressed or worked up stops me being able to play too well . . . err . . . . and definitely tiredness . . . when I am tired I find it difficult to concentrate and to relax.

The things from outside golf that stress you, how do they have an effect?

Well, I find no matter how much I try to ignore them they just start to creep in and my mind starts to wonder, especially if I am not really focused on something specific. . . . .things like money worries, or family problems are all rattling around in your head . . . and a round of golf is a long time . . . there is lots of time in two or three hours of play where these things have a chance of taking over your mind. Especially if it is something big or something that has just happened . . . . and if you get tired it makes it harder to concentrate, and therefore easier for something else to get in to your head.

You mentioned that when you are tired you find it difficult to concentrate? How does this tiredness have an effect?

I think everybody knows when they start to feel a little bit tired, or maybe a little cheesed off that they have been out there for that long, erm but the way in which it affects the outcome of the actual shot, I feel for myself is that erm . . I feel the fatigue never effected the swing of the club, but I can definitely remember instances because I obviously have started to get a little bit tired erm, failed to pick things up in the environment that I normally would of done, for instance like the direction of the wind. I have hit shots sometimes where I have hit a lovely shot and the thing is twenty-five yards too big, then I have put the club in my bag and I have just thought ‘I can’t believe you have just done that and I have actually failed in my analysis and decision making process to of taken into account the direction of the wind.

The times that become stressed and anxious. What impact does it have on your golf and your preparation for each shot?

I would say that the stress and the anxiousness causes me self doubt, self-doubt then causes me not to be able to see things because if I can’t see something I can’t do it full-stop. It is like anything in life, you know, if you can’t see yourself scoring a goal in football, your not going to do it are you! If you see some bird . . . if you think you are going to get a slap round the face you probably will do, if you go in with full confidence you do it and do it well to the best of your ability sort of thing.

Ok, final question then. Do you think that other pro’s use there pre-performance routines for the same reasons as you, or do you think there might be other reasons or possibilities for why they might use a pre-performance routine to prepare for their shots?

Well, I think part of it is that everyone does it, so you err think that you should have a routine . . . . . that said though I think that most players use them to focus and to give themselves something to think about, so they err . . . don’t get distracted by other things and can concentrate on their own game, to prepare for the shot or shots in there own way . . . . . pretty much the same as me.

Thank you, that’s it we are finished!

APPENDIX O

Study 4 – Participant Six

Right, what we are going to do is to start with a simple question about your pre-performance routine and take it from there. I am really interested in what your think and feel, so just be as honest as you Can. We are focusing on your pre-performance routines and I have some video footage as a prompt which I will show you. It's the stuff from the other day, so hopefully you will remember it quite easily.

So first question, how consistent do you feel that your pre-performance routines are?
Errrrr . . . . . . I would say quite consistent . . . . . although I do think I do things differently for different shots, for example I would same that what I do for putting is different to what I do when I am teeing off.

Talk me through the bits of your routine. What are the steps that you go through before you hit the shot?

Well I start with . . with the golf ball, I pick up the golf ball, then erm . . . . . . take a few paces back, take a look at the line . . . I will usually crouch, to get the . . . . the line is the most important thing to me, gotta get the line then I will walk up, as I walk up to the ball I am looking down the line, stand about a putters distance away so I can have a couple of practice swings, one stroke, easily one stroke then I will either be looking at the ball or looking at the hole, trying really hard to feel . . . feel the ball come off the face, if I hit the ball exactly like that I know how far the ball will go, then as long as that is right . . step straight into the putt . . . and repeat it.

Time-wise, do you think you take the same amount of time doing the routine or do you think there are times when the duration would vary . . . . . say, when the shot is more difficult or something?

Erm, ... depends on the putt and depends on the importance of the putt. I never take a long time because if you take a long time too many others thoughts get into your head . . . just get it over with

Ok, do you use any mental skills at all during your pre-performance routine?

Err . . . . . . I am not sure . . . . what kind of thing do you mean?

Say . . . . . . something like relaxation techniques, focusing strategies, imagery . . . . that sort of thing?

Yeah . . . . I would say that I try to relax and definitely use imagery when I am preparing for the shot!

Do you use the imagery as part of your pre-performance routine? Do you picture yourself playing the shots?

Yeah I use it as part of my routine when I am preparing to play the shot, it helps me see the shot I am looking to play

When you use it do you use an internal or external perspective? Do you see yourself putting from the side or from Inside, as in seeing I through your own eyes?

Both, I erm, because I have seen so much video of my self its quite, you can get drawn into seeing it from an external perspective, and that's how I used to do it a lot, but erm, I don't think you get as much sensation from that as you do when you try and picture it from your own point of view, I think its harder to do from internal because of the amount of video that's out there now and you see yourself playing all the time, and so its easy to build up pictures of what . . . . . but I do try and do some seeing it from my eyes, where I am playing the shot and that sort of thing. I think the only problem with that is, like I say, when I am really on my game and everything is perfect I don't actually remember a lot about what's happened. So I don't have that feedback to work with so a lot, you know I am not saying they are bad shots I am using as my template but they are not my best shots just because, like I say it is very difficult to get any feedback, its more ones where I have stepped on to the green and thought 'what am I doing here' and things rather that just letting it flow. Not an ideal world, but I do try and use it for sure, yeah!

Do you think its more the visual aspects, so if you are using internal imagery you are playing the shot and seeing the club make contact with the ball and the ball travelling all the way to the hole or do you think its more the feeling. . . you sort of imagine the feeling, particularly once you initiate the shot and are moving the club toward the ball . . . .

No, I completely . . . . you have taken the words right out of my mouth really, that's exactly what I was about to say on the green preparing its very much a visual thing, but, like when I am stood over the ball I don't really see anything its more about the feeling then, the feeling of the club in my hands and the feeling of the ball leaving the club.

That's Great, you mentioned earlier about also using relaxation strategies whilst preparing for the shot. Could you tell me a little more about that please?

Well . . . . it's like . . . . . . when I have lined up the shot, and have my club and everything . . . . . and have set my stance I then . . . . . once my stance feels right and I have the club in my hand just try and close my eyes and relax myself . . . . .you know . . . . . . take a deep breath . . . . . . then let it out and . . . . . sort of . . . . . you know try and expel all the tension or stress I might be feeling when I breath out . . . . that's it . . . like trying to get my body totally relaxed and ready to prepare to hit the shot.

Does this work every time?

Err . . . . what do you mean?

Well, do you always release all the tension, or do you find that sometimes you have to go on and play the shot even though you are still feeling a little bit tense?

Err . . . . . yeah, well I suppose that sometimes it doesn't always work completely . . . . . especially in big tournaments . . . . . it is sometimes difficult to relax . . . . .so there is kind of an acceptable level of nerves or tension that I know go with the tournament so it is trying to get down to that level . . . . . and stopping any extra tension or nerves from developing.

Do you ever find that when you are playing golf that you kind of reach a super-confident state or . . . . . .to use an American term . . . .get in the zone?

Yeah . . . .sometimes I just know that it is going to go well . . . . walking up to the shot I just know that I am just going to hit the ball really really well . . . . . . like it is going to go right down the middle of the fairway . . . . . or . . . . . .even though it is a challenging putt . . . . . it is going right in the whole! I suppose it kinda . . . . . kinda being really confident . . . . . almost arrogant because you just know . . . . . .I don't know why . . . . . .but you just know!

Do you think that your pre-performance routine helps you to get into this super confident state?

Ok . . . . well if I do the same things as before I am more likely to achieve the same result aren't I? It's a question of process if I reached the right state once I can do it again . . . just follow the same steps . . . do the same things! I suppose any techniques or things that I can do to get into that state and feel the same feelings are the kind of things I am looking to do!

A technique that other sports people have used is to kind of put together some video footage of their best performances, and putting together a montage of kind of your best bits so visually it is you at your best then put some motivational music that you like over the top, so you have then got this video that you can kind of watch before getting positive feelings, then when you get used to watching that having the music with you while you are competing so whatever the music that you have got, you can then listen to it and it evokes the same sort of positive, confident emotions, to get you subconsciously thinking, yeah I am a good performer, technically I am really good, I can do this, and it kind of helps you to get there. It also serves the other function of stopping other things from getting in there and distracting you before you play, Talking of distractions, do you have any strategies that you use during your pre-performance routine to stop yourself becoming distracted?

Errr . . . . . . not really no!

So you don't necessarily have anything specific that you think about like counting or . . . .

A lot of people could but that doesn't work for me. I just like to . . . .cos counting works if you use it from the very beginning when you are learning to play golf but if you . . . . I never used it so now ******** tried to get me to use it and it throws me all over the place, I am very much a kind of feeling golfer, actually I don't think that much about it, but once I get a certain distance from the next shot I start to feel the shot and once I get over the ball I feel the club and things like that but, its all sort of quite natural, it doesn't. . . .it just flows by itself I don't think about when to do certain things it just happens.

I know, some people . . . . . . I worked with a golfer who, when he was swinging liked to count as quickly as he could so he would be like 1,2,3,4,5,6,7, he was doing that to stop anything else getting in his head and that would work for him. Other people, that sort of thing throws them completely so they might use a word with a number of syllables that fits in with the swing, again, to give themselves a focus and they can't be distracted by anything else. So different things work for different people, nothing is necessarily right or wrong its just what works for you really. How aware are you sort of throughout this pre-performance stage stage?

Err . . .

In this case a good example is the crowd, or external noise. Is it a case that you can hear things going on up till a point, so then you can block it out or . . . .

Yeah, unquestionably! I mean I think when I'm . . . . before I pick up the club and start my routine then if someone shouts out 'come on ******' or something like that then I do pick up on it, and I think that helps to be fair when people are shouting it kind of , its almost like when you shout at yourself it gets you a little bit pumped up and that sort of stuff and erm . . . I can't . . . . like I say once I am on the green and I pick that my club I am not really aware of anything apart from the thing that I am feeling, like it its not good or if its actually good or not. If some one shouts something once I have picked the club . . . I don't even know if people have shouted or not I don't hear anything. . . really, its quite strange, yeah . . . I am not conscious of any calls so I assume I don't hear anything its just as soon as I get that club . . . . . . if someone shouts something or the crowds clapping, or a gun goes off I am just oblivious.

Do you think the crowd then is useful for you . . . . or at least in part, helping to get you in the right frame of mind?

Erm . . . . . I don't think the crowd determines my success. I don't think that. I mean you could . . . when there has been no crowd I have played really well, and when there has been a big crowd I have played really well . . . . so no . . . I think it is just one of those things! But that said . . . . . . I do more often than not play well with a good crowd watching!

How does that help? Does it get you more up for it or does it put more pressure on you, because you now have the attention of all these people.

It definitely doesn't put more pressure on you. But it does give you a buzz, I think it does give you a buzz that people are watching, I wouldn't of said it was a pressure thing but suddenly yeah all the focus of everyone around the green is on you, and I think you can use that to your advantage. Its like shouting 'come on' and you know ' lets go this time' or whatever I may say to myself erm . . . its knowing they are really focusing on what I am doing I another kind of mental stimulus for getting the adrenaline going and that sort of thing, I think it makes you try a little harder and that sort of thing so . . . its only a good thing as far as I am concerned, I like it so, . . . some people don't like it but, for me, yeah its pretty good.

Talking of crowds Do you remember the first time you played with a decent sized crowd?

I remember going into the clubhouse then going out and erm to basically get my card and in that time it had basically taken me to get my studs on and then come out there was around one hundred and fifty people stood around the first tee box, and I was immediately thinking Jesus, this is a totally different, seemingly, it was a totally different situation, and yeah, its fair to say that I don't think I have ever hit a golf ball harder off that first tee box, to the extend that the only thing I wanted in my life at that particular time was for the ball to find the fairway.

Do you ever find that your mind wonders . . . . possibly thinking of past holes or holes still to come in the round?

Yeah, when I am concentrating poorly I sometimes start thinking right, when I get to the sixteenth I am going to need to do this, but the sixteenth is still three holes away. Also . . . . if I am tired I sometimes find it harder to shut out the other things that have happened in the round . . . . . whether they are good or bad . . . . they just seem to creep in. It's like . . . . . . like the other day I was playing really well and was on the back nine . . . . but I couldn't stop thinking about this great shot I had played off the tee on the second hole . . . . and I knew that I had to get my mind back on the current shot . . . . . . but the more I thought about getting my mind back on the current shot the more I seemed to think about this shot!

What effect did that have? . . . . How did you feel?

Well it was a strange one, because . . . . . obviously the shot I had played on the second was great . . . . . which made me smile . . . . but at the same time I was frustrated . . . . frustrated that I couldn't take control of my mind and . . . . . . and get my mind back on the present!

Ok, final question then, what do you think is the function for your pre-performance routine? Why would you say that you use it?

erm . . . I would say it gives me a focus so I know what I have got to do in order to execute the shot, without my routine I think I would be all over the place. . . . . yeah it just gives me something to do . . . . .something to occupy my mind . . . . . without it . . . . . with out it who knows what I would be thinking about . . . . . it is difficult enough to focus sometimes with having a plan!

That's great, thank you every much, We will call it a day there!