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**THE
HOT HAND PHENOMENON
IN AMATEUR GOLF:
EXAMINATION OF
PSYCHOLOGICAL MOMENTUM**

A thesis presented in partial fulfillment of the requirements for
the degree of Master of Arts in Psychology

at Massey University, Albany, New Zealand

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ABSTRACT

This dissertation explored the notion of the hot hand phenomenon and psychological momentum in the sport of amateur golf within two separate but interrelated studies. Study one investigated the hot hand phenomenon with a sample of amateur golfers ($N = 3238$). Participant's hole-by-hole scores for rounds played over a two-year period were analysed. The results showed performance on a hole was influenced by prior performance for a greater number of golfers than would be expected by chance, thus supporting the notion of the hot hand phenomenon. The results are discussed in relation to previous hot hand research. The aim of Study Two was to investigate reasons behind individual and gender differences in psychological momentum after an error. A selection of participants from study one were assigned to a negative momentum, negative facilitation, or no-momentum group, by virtue of how they tend to perform after an error and completed questionnaires measuring fear of failure, telic dominance, rumination, trait anxiety, self-confidence, perfectionism, and motivation orientation. The results suggest an individual's self-confidence, telic dominance, and task orientation influence one's performance after an error. These findings provide some supporting evidence for the Vallerand et al.'s (1988) antecedents-consequences psychological momentum model and Taylor and Demick's (1994) multidimensional model of momentum.

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CHAPTER ONE

INTRODUCTION

It is mental power that separates the exceptional from the very good. When they line up in the 100-metre sprint in Barcelona there will be nothing to choose between them, talent for talent, training for training. What separates them is what goes on behind the eyes. (*p. 2*)

Frank Dick, former coach of the Great Britain track and field team

(Bull, Albinson, & Shambrook, 1996).

The above quote illustrates the importance leading sportspeople place on the psychological aspects of sport. The difference between winning and losing in sport is not solely dependent upon physical skills but on psychological factors as well (Richardson, Adler, & Hanks, 1988; Miller & Weinberg, 1991).

Momentum is one such factor widely believed by the sporting community to have an influential role on the outcome of sporting events. Athletes, commentators, and fans alike often refer to ‘critical’ moments in a game that are perceived as momentum ‘starters’ or ‘shifters’ which seemingly alter the dynamics of a contest (Silva, Cornelius, & Finch, 1992; Miller & Weinberg, 1991).

Psychological momentum is the term used by sport psychologists to describe the notion that performance is influenced by the outcome of a preceding event or events (Adler,

1981). Adler (1981), a pioneer of psychological momentum research in sport, defined psychological momentum in terms of a bidirectional concept. I.e. psychological momentum can manifest in either a positive or negative manner.

Positive momentum refers to an increase in an athlete's probability of future success following a successful performance, because of his/her positive reaction to success. For example, the athlete will experience a rise in feelings of self-confidence, perceptions of control, motivation, satisfaction, etc, which increases his/her chance of future success. Whereas negative momentum refers to an increase in an athlete's probability of future failure following an unsuccessful performance, due to his/her negative reaction to failure (Adler, 1981; Vallerand, Calavecchio, & Pelletier, 1988).

Scoring just before the halftime break or scoring a slam-dunk in basketball are examples of events that are believed to generate positive psychological momentum. The following is an excerpt from a book called *Rugby Tough* written by Hale and Collins (2002) that perfectly captures how a particular moment in a game can be perceived as a momentum shifter.

One example of legitimate instrumental aggression that may have influenced the self-confidence of teammates was the tackle Mickey Skinner (England) put on one of the back row of France in the Five Nations encounter in Paris in the 1980's...The single tackle was symbolic of England's defence and marked a change in the psychological momentum of that period of the game. (p. 189)

The importance placed on psychological momentum emanates from the belief that it influences an athlete's performance. Coaches have been known to change their line-ups and game strategies to accommodate athletes experiencing momentum (Vergin, 2000). For example, a basketball coach may advise players in his/her team to give the ball as often as possible to the player with momentum, in the belief that player has an increased chance of future success.

There is little doubt the notion of psychological momentum is inherently compelling to the sporting public and the belief in its power is widespread. However, empirical research investigating the existence of psychological momentum and its influence on performance has hitherto produced inconclusive findings. Studies within a number of different sports, such as pocket billiards (more commonly referred to as pool), horseshoe pitching, and tenpin bowling (Adams, 1995; Smith, 2003; Dorsey-Palmateer & Smith, 2004), have shown the majority of athletes perform better after a successful performance compared to after an unsuccessful performance, supporting the notion of psychological momentum. Also Iso-Ahola and Mobily (1980) and Weinberg, Richardson, & Jackson (1981) have reported gender differences in psychological momentum. Iso-Ahola and Mobily reported a greater positive momentum effect for males, and Weinberg, Richardson et al. showed women were less likely to improve their performance when losing. These findings suggest men and women react differently to performance outcome and generate different perceptions of psychological momentum.

However, researchers such as Gilovich, Vallone, and Tversky (1985), Albright (1993), and Clark (2005) found for the vast majority of participants, prior performance did not produce any significant changes in future performance, which they claimed provided no

evidence for the existence of psychological momentum. Gilovich et al. argued that people held an erroneous belief in psychological momentum, a cognitive illusion emanating from memory bias, and a misconception of randomness.

Aims of the Dissertation

General Aims

Clearly more research is required before any meaningful conclusions can be reached. Therefore, the aim of this project is to add to the existing knowledge by investigating psychological momentums effect on performance within the game of golf. A further aim is to investigate the gender and individual differences in psychological momentum, which to date has been sparsely researched.

Objectives

1. To examine whether a golfers score on a hole is influenced by their score on the previous hole.
2. To test for gender differences in psychological momentum.
3. To investigate potential reasons behind gender and individual differences in psychological momentum, by examining whether men and women golfers differ on personality components, specifically anxiety, rumination, confidence, fear of failure, motivation orientation, perfectionism, coping style, and telic state.

CHAPTER TWO

LITERATURE REVIEW

Overview

This chapter reviews literature pertinent to psychological momentum. For coherence, the review has been divided into two sections. The first section will introduce the three major psychological momentum models devised to date, developed to conceptualise the relationship between psychological momentum and performance. The first two models introduced support the notion of psychological momentum and are somewhat similar in nature. Whereas the last model presents an entirely contrasting view, as it disputes the existence of psychological momentum. The second section will review the studies conducted on psychological momentum in sport, and discuss the empirical support established for the competing viewpoints. The review will show research into psychological momentum has yet to produce any definitive conclusions, but much progress has been made since the initial studies conducted in the early 1980's.

Psychological Momentum Models

The Antecedents-Consequences Psychological Momentum Model

According to Vallerand et al. (1988) positive psychological momentum “refers to a perception that the actor is progressing towards his or her goal” (p. 94). Due to this

perception, an individual will “experience heightened levels of motivation, and enhanced perceptions of control, confidence, optimism, energy, and synchronism” (Vallerand et al, 1988, p. 94), thus providing a psychological state conducive to optimal performance. Alternatively negative psychological momentum is supposed to have the opposite effect. If an individual perceives he or she is not progressing towards a desired goal, he or she will experience reduced levels of motivation, feelings of control, etc, producing a psychological state detrimental to performance (Vallerand et al, 1988).

A central feature of the antecedents-consequences model is that perceptions of psychological momentum are subjective. Specifically, individuals will differ in their perceptions of psychological momentum due to personal and situational antecedents. Situational antecedents such as game context and scripts are believed to influence perceptions of psychological momentum. Individuals possess perceived ‘scripts’ or ‘schemas’ of situations that they believe act as momentum starters (Vallerand et al., 1988). Events such as winning a tiebreaker in tennis, scoring a slam-dunk in basketball, or scoring late to force a game into overtime are examples of pre-conceived scripts. So when these events occur they generate enhanced feelings and perceptions of psychological momentum (Richardson et al, 1988).

The context of the game situation is believed to play an important role in whether perceptions of psychological momentum are generated. For example, if a contest is not close, then it is unlikely feelings of psychological momentum will change (Richardson et al., 1988). A soccer team for example who are down 4-0 and scores a goal with 10 minutes to go is unlikely to experience enhanced perceptions of psychological momentum because they still have practically no chance of winning the game. In

contrast, a soccer team who scores to level the game with 10 minutes to go is more likely to experience enhanced feelings of psychological momentum because they now have a chance of winning. However, to date there has been no empirical research testing this hypothesis (Richardson et al., 1988; Vallerand et al., 1988).

Also, personal antecedents such as ones expertise and need for control are believed to influence perceptions of psychological momentum. For example, experienced athletes with well-formed schemas have a greater ability to recognise the critical moments that can alter the momentum of a game. So, when these critical moments occur, experienced athletes will generate greater perceptions of psychological momentum compared to their oblivious less experienced counterparts (Vallerand et al., 1988).

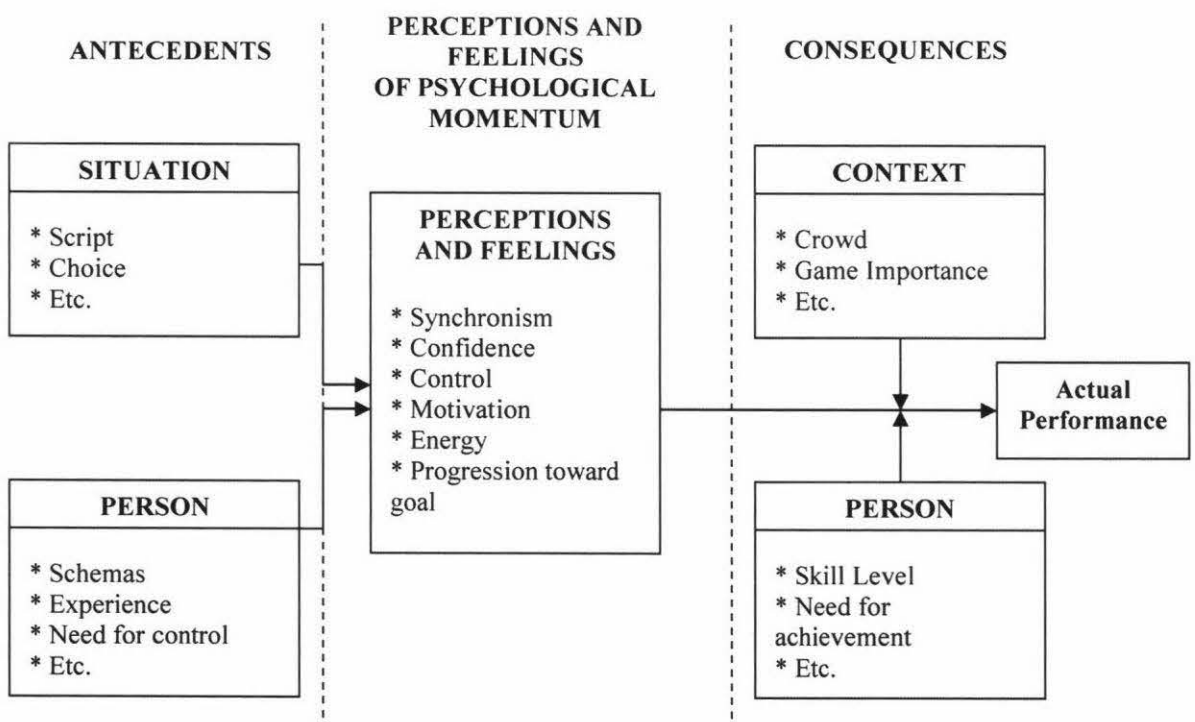


Figure 1. The antecedent-consequences model of psychological momentum (Vallerand et al, 1988).

Although, as figure 1 shows whether perceptions of psychological momentum actually produce a change in performance is a consequence of the moderating effects of contextual and personal variables. For example, contextual variables such as performing in front of large crowds, and performing in important events can increase an individual's arousal to a level outside his/her optimal performance zone, which will nullify any positive perceptions of psychological momentum (Vallerand et al., 1988).

Also personal variables such as anxiety, achievement motivation, and skill level are personal variables believed to limit the degree in which perceptions of psychological momentum can affect performance. For example, if an athlete is too anxious their performance is unlikely to reach an optimal level, and skill level would provide a 'performance cap', i.e. perceptions of psychological momentum would only enhance performance to a point within the bounds of an athlete's skill level (Vallerand et al., 1988).

In summary, the antecedents-consequences psychological momentum model offers a significant contribution to the theoretical conception of psychological momentum. Separating perceptions of psychological momentum from possible antecedents and consequences provides a model open to investigation and empirical research (Vallerand et al., 1988; Taylor & Demick, 1994).

However, Taylor and Demick (1994) argued the model had some inadequacies because it included constructs such as synchronism and energy that are difficult to operationalise and measure. They also claimed Vallerand et al. (1988) did not give enough attention to the influence of emotions on psychological momentum, and proposed their

multidimensional model of momentum provided a clearer, more comprehensive view of the factors involved in the development of momentum.

The Multidimensional Model of Momentum in Sport

Taylor and Demick (1994) offered a model that displayed a chain of events they believed occurred during the development of momentum, which they termed the momentum chain. Taylor and Demick (1994) avoided using the term ‘psychological’ momentum in their model, as they considered using the word ‘psychological’ did not reflect the importance of other components, such as the “physiological, emotional, behavioural, social, and environmental factors” (p. 54), which also influence the development of momentum.

Taylor and Demick (1994) described momentum as “a positive or negative change in cognition, affect, physiology, and behaviour caused by an event or series of events that will result in a commensurate shift in performance and competitive outcome” (p. 54). A diagram of the multidimensional model of momentum is shown below, illustrating the series of events that need to occur for perceptions of momentum to generate changes in performance.

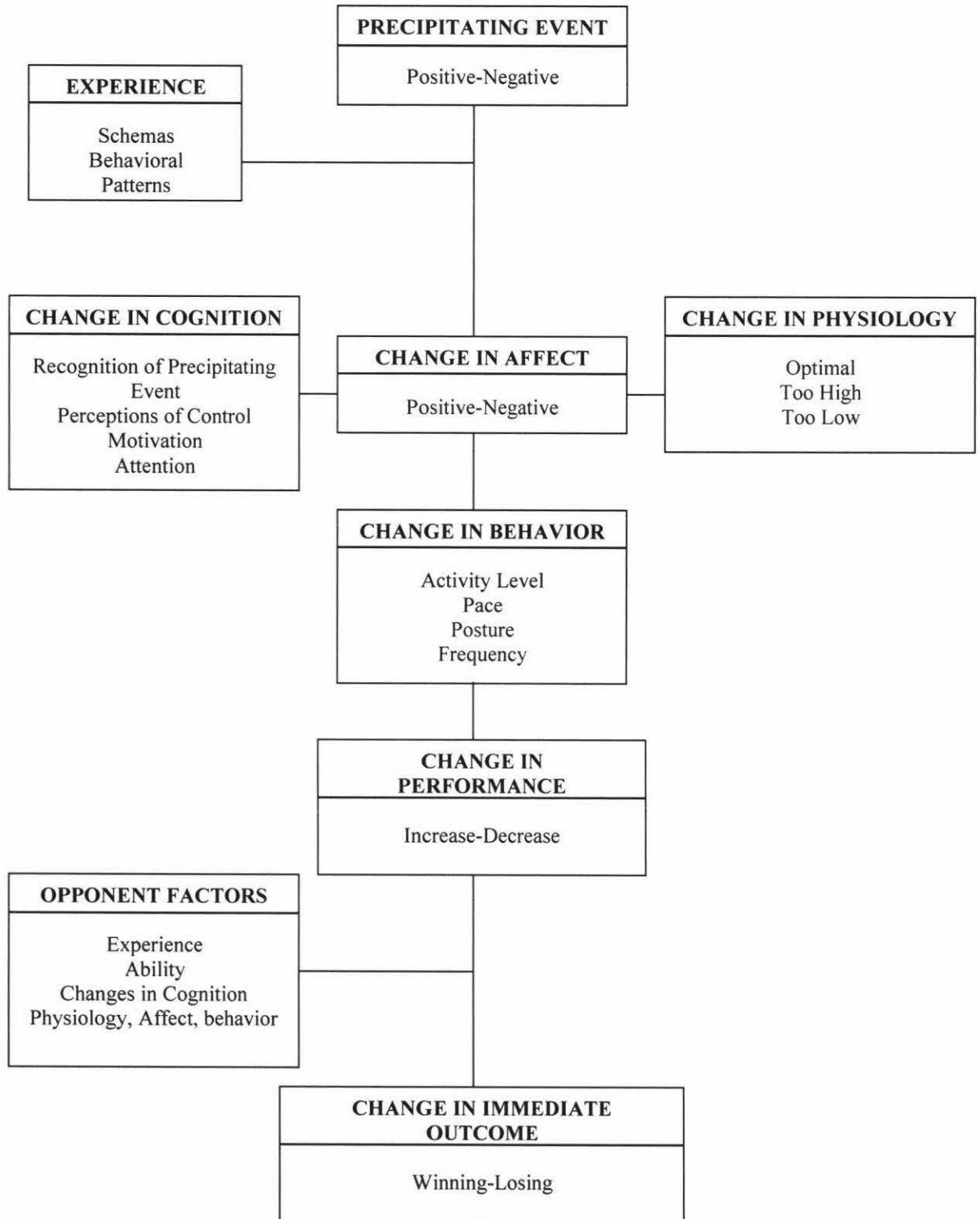


Figure 2. The multidimensional model of momentum in sports (Taylor & Demick, 1994).

Precipitating Event - A precipitating event is an event that has the capability of producing a change in an athlete's perception of their performance. Whether and how much a precipitating event/s alters an individual's perceptions of momentum is reliant upon personal and situation variables similar to those described by Vallerand et al. (1988) in their antecedents-consequences psychological momentum model.

Personal variables such as an athlete's level of competitive experience, self-efficacy, cognitive schemas, and feelings of control are believed to influence one's perceptions of momentum. Situational variables, such as how the onset of the precipitating event occurred, e.g. gradually or instantly, or whether the event was attributed internally, e.g. to one's ability, or externally, e.g. a referee's call, are also important (Taylor & Demick, 1994).

Changes in Cognition. If a precipitating event/s is recognised by an athlete as a potential momentum starter or shifter, then changes in cognition may occur. For example, experiencing a positive event will enhance feelings of self-efficacy, control, and satisfaction (Taylor & Demick, 1994). In contrast, experiencing negative or unsuccessful events are believed to create the reverse psychological state.

Change in Physiology. It is hypothesised that an individual's physiological responses will correspond with the changes in cognitions described above. Changes to physiology include changes to an individual's heart rate, respiration, blood pressure, sweat, and adrenaline (Taylor & Demick, 1994; Anshel, 1995). For positive momentum to occur, athletes must shift to, or be operating within their optimal arousal level. In contrast, for

negative momentum to occur, athletes will be operating outside their ideal 'zone' with an arousal level that is either too high or too low (Taylor & Demick, 1994).

Change in Affect. Taylor and Demick (1994) state affect will change in conjunction with the cognitive and physiological responses described above, i.e. positive affect will result from positive cognitions and negative affect from negative cognitions. Positive affect refers to when a person feels enthusiastic and active, whereas negative affect refers to feelings of distress, fear, and nerves (Stanimirovic & Hanrahan, 2004).

Change in Behaviour. The changes in cognitions, physiology, and affect generated from a precipitating event/s, will manifest into a change in observable behaviour. For example, there will be observable changes to ones activity level, speed of play, general demeanour, and posture (Taylor & Demick, 1994).

Change in Performance. All the changes occurred to this point will accrue to produce a change in performance. If the athlete has followed the positive momentum chain their performance is expected to improve. If the athlete has followed the negative momentum chain, then performance is expected to decline (Taylor & Demick, 1994).

Opponent Factors. Whether changes in performance have an impact on the immediate outcome of competition (i.e. influences the result of a match) depends upon opponent factors (Taylor & Demick, 1994). For example, a losing tennis player may progress through the positive momentum chain after a series of good shots, resulting in improved performance. But performance may not improve to a level good enough to surpass the level of their opponent. Therefore, the immediate result remains the same, i.e. they

continue losing. Taylor and Demick (1994) state the opposing player may have to simultaneously experience negative momentum for the immediate outcome of the match to change.

Change in Immediate Outcome. In sporting events that do not involve direct head-to-head competition, where performance is independent of their opponent (e.g. golf and shooting), performance change will have an instant affect on the immediate outcome (Taylor and Demick, 1994).

In summary, the multidimensional model of momentum provides a comprehensive conceptualisation of the processes involved in the development of momentum, with each stage of the proposed momentum chain clearly defined. As with the antecedents-consequences psychological momentum model, the multidimensional model clearly supports the notion of psychological momentum and its significance to sporting performance.

Cornelius, Silva, Conroy, and Petersen (1997) on the other hand proposed a completely contrasting model. Cornelius et al. claim positive and negative psychological momentum are merely labels people use to describe the normal natural fluctuations found in performance, and believe psychological momentum is a cognitive illusion, which in reality has little or no influence on sporting performance. Cornelius et al. were also dissatisfied with Vallerand et al. (1988) and Taylor and Demick (1994) bi-directional concept of momentum, and introduced two new concepts to better conceptualise the relationship between performance fluctuations and psychological momentum.

The Projected Performance Model

Cornelius et al. (1997) claim athletes are unlikely to consistently perform at the same level throughout an event. Rather their performances are likely to vary around a mean level, at times surpassing or falling short of norms due to natural fluctuations in performance. For example, it is quite possible for a basketball player who makes on average 50% of his/her shots, to make (or miss) three or four baskets in a row from time to time. But many athletes and observers view these streaks in performance as 'abnormal' or 'unnatural' and seek causal explanations for the apparent break from the norm (Gilovich et al., 1985). Randomness is frequently disregarded while concepts such as positive psychological momentum are derived in an attempt to explain the 'abnormal' phases of performance (e.g., making four baskets in a row), when in fact making 4 baskets in row is quite likely just a natural fluctuation within a random sequence (Cornelius et al., 1997).

Gilovich et al. (1985) concur with Cornelius et al. (1997) sentiments stating 'people's intuitive conceptions of randomness depart statistically from the laws of chance' (p. 296). For example, it is quite possible, for a short sequence of 20 coin tosses (an unpredictable event) to include a 'run' of four heads or four tails. However, these kinds of 'runs' often lead people to reject the randomness of the sequence, because people erroneously assume short sequences should consistently produce a 50% head and 50% tail pattern, which is essentially a representative heuristic (Burns & Corpus, 2004). This assumption would be statistically correct for long sequences, but it is flawed cognition to always expect short sequences to follow this pattern (Gilovich et al.).

Memory bias may be an additional reason why athletes, fans, and commentators believe so strongly in the influence of psychological momentum on performance. 'Runs' of good performance and poor performances are more memorable than runs that include a mixture of hits and misses. Therefore, people recall runs of good or poor performances more easily and due to this overestimate the occurrence of performance streaks (Gilovich et al., 1985).

Cornelius et al. (1997) also claim the performance streaks people label as positive and negative momentum will not last for any lengthy period of time, because of the forces at work, such as statistical regression to the mean, which will typically revert the brief abnormal phases of performance back to normal levels. For example, if a golfer has made three birdies in a row (a birdie is an above average performance), statistical regression to the mean would predict a worse score on the subsequent hole, because the golfer's performance will typically regress back to their normal standard (opposite of positive momentum). Similarly, if a golfer has made three bogies in a row (a below average performance), statistical regression to the mean would predict a better score on the subsequent hole (opposite of negative momentum).

The above two scenarios conflict with Vallerand et al.'s (1988) Taylor and Demick's (1994) bi-directional view of psychological momentum because the performance change is in the opposite direction of what they suggested. Research has shown some athletes actually perform better after an unsuccessful performance compared to after a successful performance, which suggests a bi-directional model is inadequate. Neither the antecedents-consequences model nor the multidimensional model accounts for the

occasions when an athlete's performance improves after failure, or for when an athlete's performance declines after success.

Silva, Hardy, and Crace (1988) derived the terms negative facilitation and positive inhibition to describe these two occasions. 'Negative facilitation' refers to when an unsuccessful performance leads to a positive change in future performance (opposite reaction to negative momentum), whereas 'positive inhibition' refers to when successful performance leads to a negative change in future performance (opposite reaction to positive momentum).

Cornelius et al (1997) suggest performance may improve after failure (negative facilitation), because failure may lead to an increase in an individual's motivation and effort, or a change of tactics or technique may be implemented to counter the poor performance, or they may be more conservative, i.e. only attempting low-risk plays to increase his or her success rate (Gilovich et al., 1985; Cornelius et al., 1997). Possible reasons for positive inhibition include athletes becoming too complacent or bored after success, becoming over-confident and attempting a greater number of high-risk plays, looking to conserve energy for future performance, becoming too anxious when in a winning position, or opponents may produce extra effort in response to poor performance (Cornelius et al., 1997; Smith, 2003).

Figure 3 shown below illustrates how the above forces operate to quickly revert abnormal phases of performance back to a mean level. The natural performance fluctuations away from the mean (i.e. the optimal and suppressed performance zone) are labelled positive and negative momentum, but Cornelius et al. (1997) argue these

phases are just part of a natural cycle of performance and occur without any psychological influence.

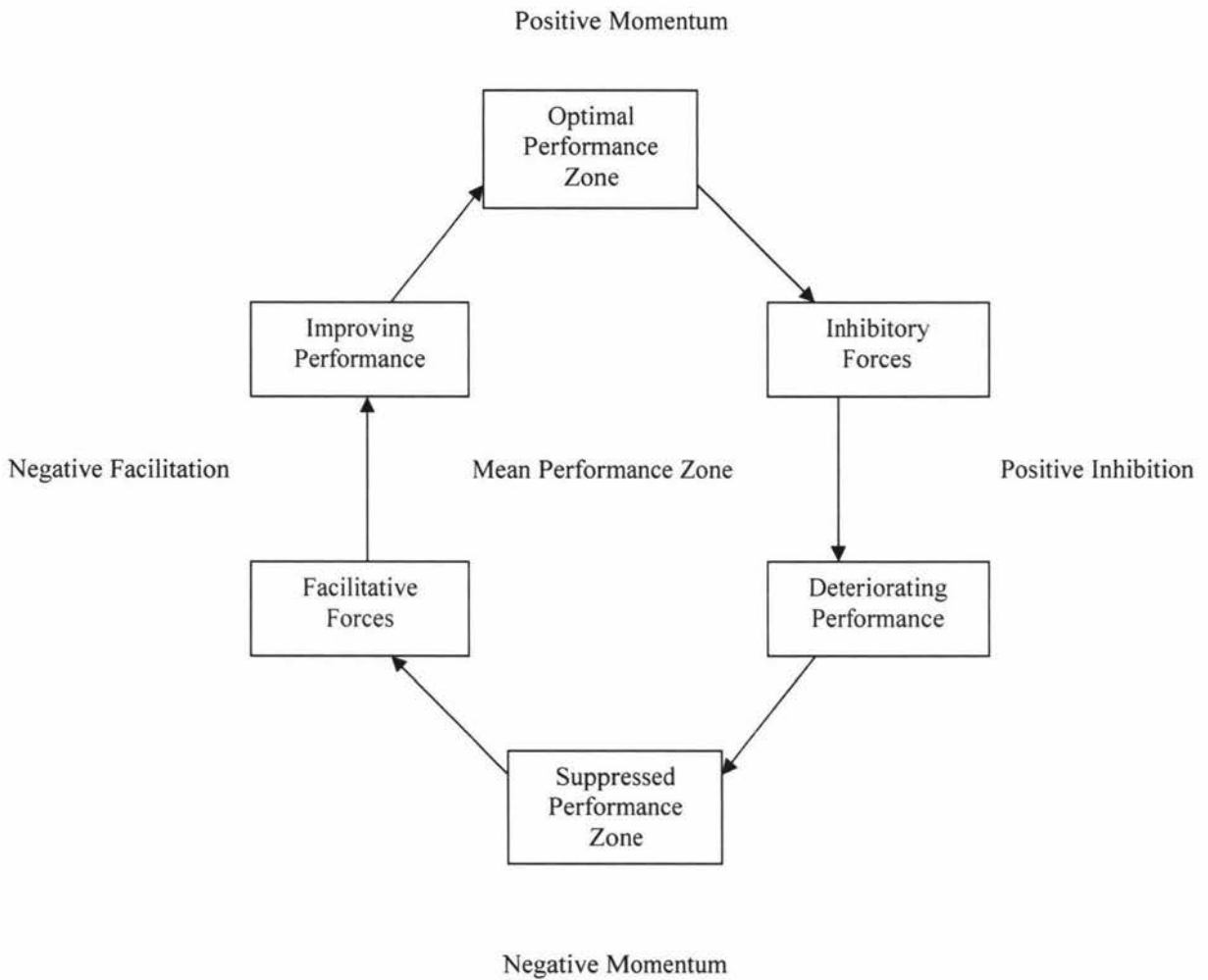


Figure 3. The projected performance model (Cornelius et al., 1997).

In summary, Cornelius et al. (1997) added to the complexity of psychological momentum by introducing the concepts of negative facilitation and positive inhibition, but more importantly their model refutes the existence of psychological momentum altogether. This is in complete contrast to the previous two models, which suggests

defining and explaining psychological momentums effect on performance appears to be in its relative infancy if agreement on its existence has yet to be established. The major point of difference is Cornelius et al. believe performance is independent of prior performance, whereas Vallerand et al. (1988) and Taylor and Demick (1994) believe performance is influenced by prior performance due to perceptions of psychological momentum.

Psychological Momentum Research

Overview

Over the last 30 years sport psychologists have investigated the relationship between psychological momentum and performance within a variety of different sports, such as basketball, golf, tenpin bowling, racquetball, baseball, ice hockey, pool, horseshoe pitching, cycling, shooting, racquetball, and tennis (Iso-Ahola & Mobily, 1980; Gilovich et al., 1985; Iso-Ahola & Blanchard, 1986; Larkey, Smith, & Kadane, 1989; Taylor & Demick, 1994; Adams, 1995; Gilden & Wilson, 1995; Cornelius et al., 1997; Morrison & Schmittlein, 1998; Perreault, Vallerand, Montgomery, & Provencher, 1998; Kerrick, Iso-Ahola, & Hatfield, 2000; Klaassen & Magnus, 2001; Smith, 2003; Clark, 2004; Dorsey-Palmateer & Smith, 2004, Clark, 2005). The following is a review of the pertinent research conducted on psychological momentum.

Initial Research

Adler (1981) stated sport provides a great medium for observing momentum due to the

frequent ebb and flows often seen in sport competition. This view appeared justified when early researchers uncovered a significant relationship between psychological momentum and performance.

In the first empirical study on psychological momentum in sport, Iso-Ahola and Mobily (1980) analysed tournament data from 134, best of three game racquetball matches.

They hypothesised the winner of the first game would be more likely to win the second game, because of the positive psychological momentum gained from winning the opening game. The results supported this hypothesis as 73.1% of the players who won their first game, also went on to win the second.

A number of subsequent studies produced similar results. Iso-Ahola and Blanchard (1986) collected data from two additional racquetball tournaments and reported nearly identical results, with 71.4% and 74.3% of first game winners also going on to win the second game of the match. Weinberg, Richardson, Jackson, and Yukelson (1983) found 86% of volleyball teams who won the first set, and 70% of basketball teams who were winning at the half-time break, ended up winning the match. In a nine-ball pool tournament (Adams, 1995) found the player who won the first game of a best of 21-game match, went on to win the match 70% of the time. The premise was the increased likelihood of success was due to improved performance, which occurred as a result of the positive psychological momentum gained from experiencing early triumph.

To test the underlying premise that athletes gain positive psychological momentum after success, Iso-Ahola and Blanchard (1986) asked racquetball players to rate their confidence and ability after completing the first game of a match. They found the

winners of the first game had higher levels of confidence and self-ratings of ability compared to the losers of the first game, which suggests first game outcome influences perceptions of psychological momentum. A number of other researchers have also shown that performance success increases perceptions of positive psychological momentum (Vallerand et al., 1988; Burke & Houseworth, 1995; Eisler & Spink, 1998).

The above results provided strong support for the notion that psychological momentum influences performance. However, Silva et al. (1988) and Cornelius et al. (1997) argued a difference in the skill level of opponents was as an equally plausible explanation of why the winner of the first game/set went on to win the second game (and the match). For example, the player or team with the greatest skill is most likely to win the first set/game, or be leading at half-time due to their superior ability, and for the same reason also win the next set/game, or half. Therefore, it is quite possible the correlation found between winning the first and second set/game could be due to a disparity in skill level rather than any possible effects of psychological momentum.

It was evident future research needed to remove the potential confound of skill. The problem with the early research into psychological momentum was that a player's performance success was directly linked to the performance outcome of their opponent. To break this link a number of experimenters turned their attention to laboratory studies. In the controlled environment of the laboratory experimenters could employ false feedback, allowing an individual's performance to be isolated from the influence of opponents.

Laboratory Studies

Silva et al. (1992) conducted a laboratory study where participants competed against an opponent in a series of mazes, and the competition was scored in a similar fashion to a tennis match. Participants could not see how their opponent was doing and after completing each maze (each maze was counted as one game), the participants were given false feedback on who had won and by how much (the outcome had already been predetermined by the researchers).

Participants were assigned to either a positive momentum condition or a negative momentum condition. In the positive momentum condition participants won their games by a 4-10 point margin, and won the set 6-0, 6-1, 6-2, or 6-3. In the negative momentum condition the outcome of the sets were reversed and the games won were only with a margin of 1-3 points (Silva et al., 1992).

Silva et al. (1992) hypothesised if psychological momentum influences performance, then participants in the positive momentum condition should perform better than participants in the negative momentum condition in latter games due to their superior position and prior experience of success. Even though participants in the positive momentum group reported greater perceptions of positive psychological momentum, no difference was found in performance over the latter games.

Kerrick et al. (2000) found similar results in their investigation into psychological momentum. They conducted a laboratory study where participants fired a rifle equipped with laser technology at a target four metres away. However, participants

could not see the results of their shots, which allowed the experimenters to provide false feedback to participants.

There were four different false feedback conditions, each consisting of 40 shots. Regardless of what the participant actually scored, for an entire 40 shot sequence participants were either given either no feedback, low, moderate, or high scoring feedback. If psychological momentum influences performance, the 40 shots within the high scoring feedback condition should produce the best shooting performance. However, even though perceptions of psychological momentum were highest in the high-score feedback condition and lowest in the low-score feedback condition, no significant differences in shooting performance were found (Kerick et al., 2000).

The above two studies produced evidence that suggests perceptions of psychological momentum have no influence on performance, supporting Cornelius et al.'s (1997) projected performance model of psychological momentum. However, there are two underlying assumptions of the above research that require some scrutiny.

Assumptions:

- Individual's self-reported perceptions of psychological momentum should have a direct relationship to how they perform.
- Everybody reacts to success and failure in the same manner, i.e. people react to success with positive momentum and react to failure with negative momentum (a bi-directional concept of psychological momentum).

People have scripts or schemas of the types of scenarios, which generate psychological momentum (Vallerand et al., 1988; Taylor & Demick, 1994). For example, if a player gets asked 'do you feel that you have positive or negative momentum at this moment' (which is a question in the Subjective Performance Questionnaire used by Kerick et al. (2000)) when they are losing the first set of a tennis match 0-3, it is quite understandable the player will report they have negative momentum rather than positive momentum because the situation fits the script of negative psychological momentum.

The script of being down 0-3 tells a player they should declare a position of negative momentum. When losing or after encountering a run of poor performance most people would report they have negative momentum, but this does not necessarily mean they are experiencing negative momentum. For example, not all players will lose motivation and confidence when behind in a match. Some players may increase their effort or change their tactics in an attempt to counter the poor performance (i.e. negative facilitation). These changes are likely to improve performance even though they may have described themselves as possessing negative psychological momentum.

This is what Shaw, Dzewaltowski, and McElroy (1992) found in their basketball study. Participants competed in a shooting competition against a confederate. False feedback was given to the participants, as game results were pre-determined. Participants were assigned to either a group that won three games in succession or a group that lost 3 games in succession. The group who lost three games in succession had lower reports of positive psychological momentum compared to the other group, but their performance improved from game one to game three. Meaning this group actually exhibited negative facilitation.

Perreault et al. (1998) also conducted a study that showed participants exhibiting negative facilitation. Participants took part in a 12-minute bike race against a 'bogus' opponent. During the race the participant faced a television screen that displayed their position in relation to their opponent (the screen actually displayed a pre-recorded tape of a 'fake' race).

There was a no-momentum condition in which participants were given a race script that showed them as being practically tied with their opponent for the entirety of the race. In the momentum condition, after being relatively even until about the halfway stage, the participant would fall behind and remain behind until about the three-quarter stage, then in the last quarter the participant gradually came from behind to draw level with a minute to go. For both conditions the screen was switched off for the last minute of the race (Perreault et al., 1998).

Perreault et al. (1998) calculated the average power output generated during each quarter of the race. They found participants in the no-momentum condition had no significant differences across time periods. In contrast, participants in the momentum condition generated more power in the third quarter (when they lost the lead), which supports the notion of negative facilitation. Even though during this phase 'momentum' participants reported a decrease in perceptions of psychological momentum, they still were able to improve their performance.

These studies suggest individual's self-reports of psychological momentum may be incongruent with their physiological, emotional, and behavioural response to performance. This could explain why a number of researchers have found no

relationship between self-reported perceptions of psychological momentum and performance.

Perreault et al. (1998) and Shaw et al. (1992) studies show that Adler's (1981) bi-directional concept of psychological momentum was deficient, as it appears people can respond to performance success and failure in different ways. For example, at times some individuals may react to success with perceptions of positive momentum, and at other times with positive inhibition. Similarly at times some may react to failure with perceptions of negative momentum, and at times with negative facilitation. Or perhaps individuals have a consistent tendency to respond a particular way (Koehler & Conley, 2003).

The antecedents-consequence model and the multidimensional model state that perceptions of psychological momentum are subjective. Therefore, one should not assume that people are going to respond to prior performance in the same manner. There have been few attempts to date to investigate possible reasons behind individual differences in psychological momentum. However, a limited number of researchers have examined whether gender influences one's response (performance wise) to performance success and failure.

Gender Differences

Previous research into psychological momentum has shown that men and women differ in how they respond to prior performance. Iso-Ahola and Mobily (1980) reported a greater positive momentum effect for males. Weinberg et al. (1981) found males were

more likely to experience negative facilitation in tennis, as they were more likely than women to come from behind and win a best of three set match after losing the first set. Also, Weinberg et al. (1983) found that men were more likely to come from behind to win in professional and collegiate basketball, but found no gender difference in collegiate volleyball.

The above studies were limited in that performance success was directly linked to the performance outcome of their opponent (as was the case with the early research into psychological momentum). I.e. the skill level of opponents was a possible confounding variable, which threatens the validity of the results. However, Iso-Ahola and Mobily (1980), Weinberg et al. (1981), and Weinberg et al. (1983) offered some notable theoretical explanations for the possible gender difference in the ability to come from behind in sport.

Iso-Ahola and Mobily (1980) suggested women are socialised to be less competitive and achievement orientated, and consequently react to performance outcome differently to men. Weinberg et al. (1981) suggested athletes with higher levels of self-confidence would have a greater ability to come from behind in sport. Weinberg et al. (1983) referred to Bandura's (1977) self-efficacy theory, which suggests those high in confidence will intensify their efforts and persist for longer after experiencing failure. Whereas, individuals with lower self-confidence will give up more readily when confronted with potential failure. Males have displayed higher levels of self-confidence across a wide variety of achievement situations, and if male athletes do have higher self-confidence, this could explain why they have a greater ability to come from behind (Weinberg et al).

The research into gender differences in psychological momentum has been scarce over recent years. Further studies using better methodology are required before any definitive conclusions can be made about gender difference in psychological momentum. If a gender difference is noted, further investigation into whether male and female athletes differ in personal variables such as confidence, may produce further understanding of the personal antecedents of psychological momentum.

If individuals do differ in the way they respond (behave) to performance success or failure, this could explain why some researchers have failed to find a relationship between psychological momentum and performance. Researchers have not accounted for individual differences in their groups. If a random group of participants are told (via false feedback) they are performing poorly, some participants may experience negative momentum while others experience negative facilitation. These responses will affect future performance differently and produce mixed results for that group.

Using self-reported perceptions of psychological momentum may not necessarily correspond with an individual's behavioural response to success or failure, or reflect the actual physiological, emotional, or behaviour changes that occur. Therefore, research using this type of methodology may be unproductive.

An alternative way to research psychological momentum is by taking a more behavioural approach by investigating performance only. Instead of measuring perceptions of psychological momentum, archival data is analysed to investigate patterns in performance that would imply momentum (Vergin, 2000). For example, if one's performance is significantly better after a successful performance compared to

after an unsuccessful performance, this in itself provides strong evidence that prior performance is impacting upon an individual (i.e. psychological momentum is inferred) to a degree that produces subsequent performance change. However, if there is no significant difference in performance after a successful performance compared to after an unsuccessful performance, then it would appear prior performance is having no impact upon an individual, which suggests psychological momentum either does not exist and/or has no effect on performance.

The research that has utilised this form of methodology falls under the umbrella of hot hand research. The following is a review of the key research findings thus far.

Hot Hand Research

‘Hot hand’ is a term in basketball used to describe a player who is experiencing a ‘purple patch’ in their shooting. Gilovich et al. (1985), the pioneers of hot hand research, described the term hot hand as ‘a belief that the performance of a player during a particular period is significantly better than expected on the basis of the player’s overall record.’

The theory behind the hot hand phenomenon is synonymous to psychological momentum. A player with a ‘hot hand’ is thought to possess enhanced feelings of psychological momentum gained from making a successful shot/s, which increases the player’s chance of making a subsequent shot/s. Gilovich et al. (1985) conducted a study that showed 91% of basketball fans surveyed believed a basketball player is more likely

to make a shot after just having made two or three successive shots, compared to after just missing two or three successive shots.

There are two main assertions of the hot hand phenomenon.

- A successful shot increases the likelihood of success on the next shot.
- A player experiences streaks in performance where their success rate is significantly better than their normal success rate.

To test these assertions Gilovich et al. (1985) analysed the shooting statistics of 23 NBA players, gathered from 83 games played during the 1980-1981 seasons. To test the first assertion, Gilovich et al. investigated whether a player made a greater percentage of shots after just making one, two, and three shots in succession compared to just after missing one, two, and three shots in succession. They found for only 2 of the 23 players, the probability of making a shot was influenced by the previous shot/s, which they argued went against the notion of psychological momentum.

To test the second assertion, Gilovich et al. (1985) conducted an analysis of runs, and a test of stationarity. The analysis of runs looks at the frequency of runs within a series of shots (a run refers to each consecutive sequence of hits and misses). For example, a series of shots may produce a pattern such as HHH, M, HHH, MMMM, HHH, (H refers to a hit, M refers to a miss). This series of 14 hits contains 5 runs (separated by commas). Fewer runs than expected by chance would suggest performance streaks and provide supporting evidence for the hot hand phenomenon. The test of stationarity involves breaking down periods of performances into smaller equal segments (e.g.

analyse each block of four consecutive attempts) to test whether during these segments a player's performance varies from their base success rate. If there are significantly more segments of performances above or below a player's normal standard than expected by chance, this would suggest the existence of 'hot' or 'cold' stretches/streaks. However, both analyses provided no evidence to support the notion of the hot hand phenomenon. Gilovich et al. concluded people were wrong to believe in the hot hand phenomenon. They argued the phenomenon was merely a cognitive illusion, emanating from peoples misconception of randomness, and memory bias.

Larkey et al. (1989) took umbrage to this view and challenged Gilovich et al.'s (1985) methodology and conceptualisation of the hot hand. Larkey et al. argued spectators view 'hot' players as those who make baskets within a relatively quick succession of time. Shots spread over a long period of time are less likely to be remembered as a sequence and described as a streak. Gilovich et al. analysis had not taken into account the inconsistency in time between successive shots, because each shot was treated equally. Therefore, their analysis may have masked any real sign of a hot hand (Larkey et al.).

In response Tversky and Gilovich (1989) analysed pairs of successive shots taken by each player, separated at most by one other shot, by a player on their own team. Doing this meant the shots analysed were taken in relatively quick succession, usually within a minute and a half of each other. However, they still reported no evidence to support the hot hand phenomenon.

Larkey et al. (1989) conducted their own basketball research, analysing data for 18 players from 39 NBA games during the 1987-1988 season. They hypothesised that Vinny Johnson, a player commonly referred to as a streak shooter, would possess a shooting pattern that was different to the other 17 players, who were not recognised as streak shooters. They found Vinny Johnson did possess a higher rate of streak shooting compared to the other players, and Larkey et al. claimed spectators were once again vindicated in their belief of the hot hand.

However, Gilovich et al. (1989) argued that finding one single 'streaky' player does not provide sufficient evidence for the hot hand phenomenon. But the most damaging critique of their work came when Gilovich, Vallone et al. re-analysed Larkey et al.'s (1989) data and discovered they had erroneously coded a shooting sequence of four hits, one miss, and two hits, as a streak of seven hits in a row for Vinny Johnson. When this data was corrected for, Vinny Johnson shooting pattern did not differ significantly from any other player.

Gilovich et al. (1985) research had appeared to survive Larkey et al.'s (1989) criticism. However, a number of other researchers also began to question the validity of their findings (Koehler & Conley, 2003; Smith, 2003; Dorsey-Palmateer & Smith, 2004). The main concern surrounded the complexities of investigating the performance of 'open skills', as is the case in the sport of basketball.

Schmidt and Wrisberg (2000) define open skills as skills that are attempted within "an environment that is variable and unpredictable" (p. 8). Basketball shooting in general play is an open skill because shooting conditions are variable and unpredictable. Shots

are taken from different areas of the court and the pressure from opposition defenders varies on each shot. Gilovich et al. (1985) did not account for these contextual variables in their design, which may explain why no evidence of psychological momentum was found.

It was clear more controlled research was required to remove the potential confounds found with open skill performances. As an alternative, one method of doing this was to analyse 'closed skill' performances instead. A closed skill is 'performed in an environment that is stable and predictable (Schmidt & Wrisberg, 2000), and thus reduces extraneous variables.

Closed Skill Analysis

Gilovich et al. (1985) had in fact conducted closed skill analyses in two of their basketball studies. Firstly, when they investigated the free-throw shooting of professional basketball players, and secondly when they investigated the shooting of college students in a controlled setting.

Free-throws are unopposed shots normally taken in pairs from the same place (13 feet 9 inches from the basket), making the performance environment stable and predictable. Also, pairs of free-throw shots are taken in quick succession, avoiding the problem of possible time lags between consecutive shots.

Gilovich et al (1985) analysed data over two seasons for nine members of the Boston Celtics NBA team. If the hot hand phenomenon exists, then the outcome of first shot

should have an influence on the outcome of the second shot. However, Gilovich, Vallone et al. found no significant difference in the probability of making the second shot after making or missing the first shot, for any player.

Gilovich et al. (1985) also conducted a controlled shooting experiment to analyse the shooting statistics of 26 members of an intercollegiate basketball team. Firstly, a distance was determined for each participant in which they made approximately 50% of their shots. Then each participant took 100 shots from varying positions left and right of the basket but from roughly the same distance from the basket. Only one player significantly made more shots after just making a shot compared to after just missing a shot. Gilovich et al. (1985) claimed this provided no evidence for psychological momentum.

However, Wardrop (1999) stated Gilovich et al. (1985) should have mentioned that the one-sided P-value for the runs test they conducted was 0.0000044 for the player with the significant result. This result suggests the increased likelihood of that player making a shot after just making a shot compared to after just missing a shot was extremely unlikely to be a 'chance' finding. The result provides strong evidence for the existence of psychological momentum, at least for this player.

Analysing a closed skill had removed the variance that occurred during 'open skill' performance, and this improved methodology prompted a number of similar 'hot hand' studies within a number of different sports to further investigate the phenomenon of psychological momentum and the hot hand. These studies have produced mixed results.

Supporting Research

Tenpin Bowling. Dorsey-Palmateer and Smith (2004) studied the match-play performances of professional tenpin bowlers. Tenpin provides stable performance conditions because players attempt each bowl from the same position within brief regular intervals, and performance outcome is void of any opponent influence.

Performances from the 2002-2003 Professional Bowlers' Association (PBA) season were analysed to ascertain whether bowlers were more likely to hit a strike just after hitting a strike (a strike is when a player hits all ten pins down with one bowl), compared to just after a non-strike. Dorsey-Palmateer and Smith (2004) investigated performance in four different categories, comparing the percentage of strikes after one to four consecutive strikes with the percentage strikes after one to four consecutive non-strikes.

The majority of bowlers had a higher proportion of strikes after just hitting a strike within each category. 59.7% of bowlers were more likely to get a strike after a strike compared to after a non-strike, 69.4% of bowlers more likely after two strikes, 72.8% after three strikes, and 79.1% of bowlers more likely to get a strike after four successive strikes compared to after four successive non-strikes (Dorsey-Palmateer & Smith, 2004), which suggests psychological momentum influences performance.

Out of 43 bowlers who had opportunities to bowl after four strikes in a row and four non-strikes in a row, 7 had a significant difference in their strike rate at an alpha level of .05. The binomial probability of getting 7 significant results out of 43 participants at an

alpha level of .05 is .005 (Dorsey-Palmateer & Smith, 2004). These results show a greater number of bowlers were influenced by prior performance than would be expected by chance.

Horseshoe Pitching. In horseshoe pitching, players pitch two shoes in succession on each turn. Players attempt to encircle a stake placed 37 feet away for men, and 27 feet away for women. A shoe that encircles the stake is called a 'ringer', and a 'double' is when a player encircles the stake with both of their pitches (Smith, 2003).

Smith (2003) found 51 of the 64 (79.7%) horseshoe pitchers were more likely to score a double after a double, compared to after a non-double. The binomial distribution showed the likelihood of having 51 of 64 players more likely to hit a double just after hitting a double was .0000009. Also, 13 of the 64 pitchers had a significant difference in their performance after a double compared to a non-double. The probability of having at least 13 pitchers with a p value of less than .05 is .00001.

Pocket Billiards (Pool). Adams (1995) investigated the occurrence of psychological momentum within a short rack pocket billiards tournament (more commonly known as a nine-ball pool tournament). Adams found that billiard players were significantly more likely to win a game with a run (a run is when a player pockets all 9-balls on the table in succession to win the game) directly following a game won by a run, compared to a after a game that was not won with a run. Adams suggested the reason he found evidence for the hot hand phenomenon in contrast to some previous studies, was due pool being game of fine motor skills. Arguably changes in psychology will have a greater effect on performance in sports involving fine rather than gross motor skills.

Non-Supporting Research

Basketball Shootout. Koehler and Conley (2003) investigated the 'hot hand' phenomenon for contestants who competed in the National Basketball Association Long Distance Shootout contest between 1994-1997. Players were given one minute to complete a series of 25 shots, and each contestant shot without interference and from similar distances from the basket. Koehler and Conley conducted a runs analysis and found only 2 of the 23 shooters had significant streaks of performance. They also aggregated the shots for all participants and reported that after three successive shots players made the next shot 57.3% of the time. In comparison, after missing three successive shots, players made the next shot 57.5% of the time. Koehler and Conley (2003) claimed these results provided little support for the notion of psychological momentum.

Koehler and Conley (2003) also conducted an interesting analysis where they examined the shots taken immediately before and after the commentator had referred to a player as being 'hot' (or a similar comment). Players made 55.2% of the shots immediately following a comment of being hot, which was not much different than their average success rate of 53.9%. However, they made 86.2% of the shots that immediately preceded a comment of being hot. Koehler and Conley (2003) state "declarations of hotness are probably best viewed as a commentary on past performance rather than as prophecy about future performance" (p. 257). This result supports the notion of the projected performance model that people are quick to label increases in performance as psychological momentum.

Baseball. Albright (1993) studied the batting performance of Major League professional baseball players over the course of four seasons, 1987-1990. He looked at whether a hit in the previous turn at bat influenced whether a player got a hit or out in their next turn at bat. Albright also tested the dependence of performance using a rather complex logistic regression model that accounted for situational effects such as the handedness of the pitcher faced, whether the game was home or away, or played during the day or night.

Albright (1993) tested 501 batting records and 50 of these records showed significant evidence of streaky performance (i.e. runs of good and poor performances). However, Albright used an alpha level of .10. One should expect close to 50 significant results within a sample of 500 participants using an alpha level of .10, i.e. it is what you would expect from a normal distribution. Therefore, the results did not differ from what would be expected by chance.

Golf. Clark (2004) conducted a study looking at streakiness among rounds of 35 professional golfers, played during the 1997 and 1998 PGA Tour season. Clark found streaks of good and poor performances tended to cluster together, providing evidence for psychological momentum. However, upon further analysis this pattern of streaky performance could be explained by the difficulty of the course rather than the tendency for a player to streak. Generally, for each tournament, four consecutive rounds of golf are played on the same course. So, if the golf course at any given tournament were easy, players would tend to show a cluster of good rounds. Alternatively, if the course were hard, players would tend to show a cluster of bad rounds.

Clark (2004) argued these results might explain why people mistakenly believe in the hot hand phenomenon/psychological momentum in golf. People observe streaky performance and in an attempt to explain it, derive terms such as momentum and fail to consider the possible situational causes (e.g. course difficulty).

However, Clark (2004) stated that hole-by-hole analysis as opposed to round scores may be a better way to investigate streaky behaviour. Players will find it hard to ignore their performance during an actual round, and may find it difficult to avoid conscious attempts to control performance, which Beilock and Carr (2001) has shown can have a negative influence on performance. Also, players have the challenge of dealing with situations while they are still involved with the performance at hand. In contrast there can be days or weeks between tournament rounds. This makes it easier for players to forget about past performances and provides time for players to work on their games between performances.

Therefore, Clark (2005) analysed the hole-by-hole scores for the rounds of 35 professional golfers, played during the 1997 PGA Tour season, to determine whether performance on a hole influenced the performance on the following hole. He found two of the players were significantly more likely to score a bogey or worse after a hole of bogey or worse (negative momentum), and one player was significantly more likely to score a par or better after a hole of bogey or worse (negative facilitation). But the binomial probability of having 3 or more players out of 35 with a significant result is only .25, which means the results did not reach a significance level of .05 and thus differ from chance expectations (Clark, 2005).

Clark (2005) also analysed for streakiness within each tournament. In total 747 tournaments were analysed and produced 31 significant results. Once again this finding was within chance expectations. However, the chance of finding significant results within such a small sample (4 rounds of 18 holes; only 2 rounds for some tournaments if the player did not make the cut) would be extremely small.

Statistical Limitations

Hot hand research provided a systematic way to explore the effects of psychological momentum on performance, but research still produced equivocal findings. Supporters of psychological momentum blamed the poor ability of statistical tests and small sample sizes to explain why a number of studies failed to find the hot hand phenomenon.

Dorsey-Palmateer and Smith (2004) argue that Gilovich et al. (1985) used statistical tests that often have little power with few observations to detect the occurrence of hot hands, unless there are 'large violations' from the norm. Wardrop (1999) states that the test of stationarity used by Gilovich et al. (1985) is "abysmally poor at detecting any but the most extreme form of nonstationarity" (p. 4), i.e. a data set would need to contain an extremely high number of runs. Stern and Morris (1993) state the logistic regression used by Albright (1993) in his baseball study had very low power; less than a 10% chance to find evidence of hitting streaks.

Stern and Morris (1993) suggest combining the player's data may be a better method to investigate streaky performance because it increases the sample size and power of the study. Adams (1995) who found support for psychological momentum analysed his

nine-ball tournament data as a group (which provided a sample size of 1464 games of pool), in discovering there was a significant tendency for players to follow a run with a run. When Wardrop (1995) reanalysed Gilovich et al.'s (1985) basketball shooting data as a group (effectively increasing the sample size), they found players made 79% of free-throws after hitting their first and only 74% after missing their first shot, which was a significant difference.

It is possible the size of psychological momentums effect on performance is small and a large sample is required to find the effect. Even if the effect size is small, investigation into this phenomenon still has importance. If psychological momentum does have an impact on performance, even if it is small, it still may have 'reality significance', because the difference between winning and losing in sport may be minimal, often hundredths of seconds or inches (Silva et al., 1992).

Current Investigations

The current study investigated psychological momentum in the sporting arena of golf by researching the hot hand phenomenon in amateur golfers in two separate but related studies. The first study examined whether a golfer's performance after an error is different compared to their performance after a non-error. Also, due to the scarcity of research on gender differences within hot hand research, male and female performances were analysed to determine whether they differ in their response (i.e. subsequent performance) to an error in performance.

The second study investigated possible reasons behind gender and individual differences of psychological momentum-hot hand phenomenon. Golfers were tested on a number of different personality components (e.g. trait anxiety, confidence, and fear of failure) to investigate whether these variables influence ones response to an error in performance.

The first study looked at performance data for 3214 participants from nine different golf clubs. For the second study, 1132 participants were selected from the initial study and sent questionnaires. 403 participants returned questionnaires and the responses were used in conjunction with the performance data used in the first study.

CHAPTER THREE

STUDY ONE: THE HOT HAND PHENOMENON IN AMATEUR GOLF

Introduction

To produce evidence for the hot hand phenomenon a sample must find more statistically significant results than would be expected by chance alone. For example, if you conducted tests of dependence on 100 participants/golfers using an alpha level of .05, one would expect approximately five significant results from a normal distribution. So finding 5 significant results would not be surprising and within chance expectations. However, if your analysis found 20 significant results from a sample of 100, this shows a greater number of golfers are influenced by prior performance than what would be expected by chance, thus supporting the notion of the hot hand phenomenon.

The current study replicated Clark's (2005) study but with a few differences. Firstly, a much larger sample size was used, i.e. 3214 participants compared to 35. It is possible Clark's (2005) small sample was not representative of the general population.

Secondly, amateur golfers were used in preference to professional golfers. All previous hot hand research on sportspeople has exclusively used professional athletes as participants. However, it could be argued the effects of psychological momentum in professional sport are minimal. Professional athletes are psychologically prepared and coached to focus on the performance at hand (e.g. take one shot at a time), and therefore

should be less likely to be influenced by prior performance. Amateur athletes may provide a better subject to investigate perceptions of psychological momentum. Lastly, men as well as women were included as participants, allowing analysis of the previously scarcely researched area of gender differences in the hot hand.

The hypotheses of this study were: (a) a golfer's score on a hole is influenced by their score on the previous hole at a statistically significant level, for a greater number of golfers than would be expected by chance; (b) males will have a significantly higher percentage of negative facilitators (i.e. male golfers will perform significantly better after an error compared to female golfers).

Method

Participants

Nine golf club managers were approached for permission to obtain their club members' round data for rounds played within the last two years. All club managers complied and provided a database that contained hole-by-hole round data for all of their members.

Alternatively, the round data could have been accessed from a 'public' website.

However, the preferred option was to obtain the data directly from the golf clubs because each club had maintained their member's hole-by-hole data in an existing database.

In total, the nine databases contained round data for 6475 potential participants. But before the members were included as participants, they had to meet the following criteria.

- Participants had to be over the age of 18. Compas (1987) states that adults differ in their cognitive development and coping skills compared to the young. As the current research was heavily focused on cognition (i.e. psychological momentum) and the ability to cope with performance mistakes, members under the age of 18 were excluded from the study.
- Participants must have played at least fifteen rounds (within the conditions described below) within the last two years, dated from the time the members data was received.

Only rounds that met the following conditions were counted as a round.

- The round must have been played at the member's home course (i.e. rounds played at other courses were not included).
- The round must have been played with a handicap index of less than 36.4 for men, and less than 40.4 for women.
- The round must have been an 18-hole round (i.e. 9-hole rounds were not included).
- The round must have been entered with hole-by-hole scores (i.e. summary rounds that are entered without hole-by-hole scores were not included).

3214 participants met the above criteria. Of these participants, 2511 were male, and 703 were female. The discrepancy in numbers merely reflects the greater percentage of registered male golfers in New Zealand. Male golfers encompass 73.5% of the total registered golfers in New Zealand (New Zealand Golf Network, Unknown).

Materials

A computer software program was specifically developed for the purposes of this study. The format of all nine databases attained was identical, as all the clubs use the same golf computer software. The software program was designed to extract the required information (described in the procedure section) for each participant from the club databases supplied. The program was thoroughly tested to ensure the accuracy of the extracted data. Fictional members and rounds were entered into a copied version of one of the golf club databases supplied, and the expected results were manually calculated and checked for accuracy against the data extracted from the software program. The process of comparing manual and automated results was also conducted for a random sample of participants using genuine participant data.

Measures

Performance. Participant's hole-by-hole nett scores were used as the measure of performance. Nett scores were used in preference to gross scores because nett scores are a standardised measure of performance that takes into account a player's handicap.

A handicap is a numerical measurement, which represents a player's playing ability, and is designed to allow players of different abilities to compete against each other on a level playing field. A player's handicap is used to calculate a 'handicapped' performance score, which in golf is called a 'nett' score. A player's nett score for a hole is the actual number of shots taken on a hole (their gross score) minus the number of handicap shots a player is allocated for that hole.

For example, if a player is on a five handicap, they receive five shots over an 18-hole round, which are dispersed (one per hole) over the five hardest ranked holes on the course. So, if the player shoots six (gross score) on the second hardest golf hole, he/she will receive a nett score of five ($6 - 1$, as they receive a handicap shot on that hole). If the player shoots a six (gross score) on the eighth hardest hole, he/she will receive a nett score of six ($6 - 0$, as they do not receive a handicap shot on that hole).

As the main focus of the current research is on how prior performance influences subsequent performance via perceptions of psychological momentum, it was important to utilise a standardised measure of performance (such as nett score) that is likely to produce similar perceptions of success and failure for participants. Golfers are more likely to base performance success or failure in terms of their standardised 'handicapped' nett score rather than their gross score.

For example, a golfer who is on a high handicap (e.g. 36, gets two handicap shots on every hole) is likely to perceive a gross score of five (gross bogey) on a par four as a successful performance because the score is lower than what is expected for his/her skill level (the player actually scored a nett birdie, $5 - 2 = \text{Nett } 3$). In contrast, a golfer who

is on a low handicap (e.g. 0, gets no handicap shots) is likely to perceive a gross score of five (gross bogey) on the same par four as an unsuccessful performance, because the score is higher than what is expected for his/her skill level (the player actually scored a nett bogey, $5 - 0 = \text{Nett } 5$). So even though the gross score for both players is identical, it is reasonable to assume the players will perceive performance differently because of their difference in skill level. A gross bogey could be a success for one golfer but a failure for another.

However, a score of nett bogey is likely to be perceived as an error by all golfers regardless of their skill level, and a nett birdie as a success, because the nett score is a standardised measure of performance. Therefore, golfers are more likely to respond to a nett score (as opposed to a gross score) with similar perceptions of psychological momentum. As the focus of this study was to gauge how a precipitating event (performance) influences future performance (via perceptions of psychological momentum), it was important to use a measure of performance in which participants would define a precipitating events similarly, e.g. as a success or failure.

Procedure

The software program was used to generate an excel spreadsheet that reported the (within the conditions described below):

- Number of times each participant followed a nett par or better hole with a nett par or better hole.

- Number of times each participant followed a nett par or better hole with a nett bogey or worse hole.
- Number of times each participant followed a nett bogey or worse hole with a nett par or better hole.
- Number of times each participant followed a nett bogey or worse hole with a nett bogey or worse hole.

Conditions:

Starting Hole. There was no way of determining which hole a player started their round on, as this information was not recorded in the databases provided. Because the vast majority of rounds played are started from hole number one, all rounds were analysed as if the player had began their round from the first hole.

Rounds. 18-hole members are only permitted to enter scores for 18-hole rounds. Therefore, only 18-hole rounds were included in the analysis.

Summary Rounds. Occasionally rounds are entered into a club database with only a 'summary' 18-hole total gross score, i.e. no hole-by-hole scores are recorded. Summary rounds were not included in the analysis, as they include no hole-by-hole data.

Date Range. Only rounds played within the last two years were included in the analysis, dated from the time the respective club database was received.

Pick-ups. For handicapping purposes in New Zealand the maximum score a player can record for a hole is a nett bogey. When a player has played more strokes than the maximum allowed but has still not finished the hole, the player will often pick-up his/her ball and progresses to the next hole without taking any further shots. This is done in the endeavour to speed up play. The player will mark a 'P' on their scorecard to indicate they have picked-up on that hole. Therefore, any hole scored as a 'P' was categorised as a score of nett bogey or worse, because it is known players will only pick-up their ball and record a 'P' after they have taken more shots than a nett bogey.

Auto-Fills. In conjunction with the rules of golf in New Zealand, when a player hands in an incomplete scorecard (e.g. a player may not have played all 18 holes, or more likely, mistakenly forgotten to write a score for a particular hole/s), a 'fill in' score of nett par is recorded for any hole/s missed. Up to a maximum of five uncompleted holes are allowed for an eighteen hole round, any more and the round is null and void. Any hole/s scored as a 'fill-in' were excluded from the analysis, because the scores are simulated and do not reflect the actual performance of the participant.

Handicaps. In New Zealand, when golf players join or re-join a club they are not given an official handicap until after they have completed five rounds of golf. For the first five rounds males are given an unofficial arbitrary handicap index of 36.4, and women an index of 40.4 (which are the maximum official handicaps allowed for each gender). However, these arbitrary handicaps may not accurately reflect a player's skill level.

For example, an experienced male player (e.g. previously played off a four handicap) who re-joins a club after a small layoff is likely to play to a better standard than

expected for a 36 handicapper (a beginner). However, for the first five rounds, the round details of the experienced player are recorded with a handicap of 36.4. So the player is likely to record extremely low nett scores that in reality are meaningless because his handicap for the first five rounds does not accurately reflect his true skill level. Therefore, only male rounds played with a handicap index of less than 36.4, and female rounds played with a handicap index of less than 40.4 were included in the analysis. Handicap indices below these numbers are official handicaps assigned after five rounds of golf and are therefore representative of the golfer's skill level.

Results

Prior to analysis

Prior to analysis, the mean and standard deviation of each participant's 18-hole nett score was calculated to check for any abnormalities that would indicate incorrect data entry. Four participants were identified as having incorrectly imputed data. For each participant a solitary round had been clearly entered with erroneous information (e.g. for two of the participants, nett scores of lower than 35 were entered, which is virtually impossible). Therefore, the four offending rounds were deleted from the analysis.

Analysis

Each participant's hole-by-hole round data was arranged in a 2 X 2 contingency table as shown in Table 1 (adapted from Clark, 2005).

Table 1

Example of 2 X 2 Contingency Table

Preceding Hole	Subsequent Hole		Total
	Nett Par or Better	Nett Bogey or Worse	
Nett Par or Better	a	b	a + b
Nett Bogey or Worse	c	d	c + d
Total	a + c	b + d	a + b + c + d = N

a = the number of times a participant followed a nett par or better hole with a nett par or better hole; b = The number of times a participant followed a nett par or better hole with a nett bogey or worse hole; c = The number of times a participant followed a nett bogey or worse hole with a nett par or better hole; d = the number of times a participant followed a nett bogey or worse hole with a nett bogey or worse hole (Clark, 2005).

Using a two-tailed chi-square test with an alpha level of .05, a chi-square (χ^2) statistic was calculated for each golfer, to determine whether a player's frequency of bogey or worse holes following a bogey or worse hole differed from a player's frequency of bogey or worse holes following a hole of nett par or better.

Out of 3214 participants, 391 had a p value less than .05. Within a model of randomness one could expect a significant result for 5% of participants. Finding 391 (12.2%) significant cases is almost two and a half times greater than the number of

cases expected by chance alone, and the binomial probability of having 391 or more cases with a p value less than 0.05 is $P[x \geq 391] = .00$.

Out of the 391 golfers, 286 were statistically more likely to follow a score of nett bogey or worse with a score of nett bogey or worse (negative momentum), and 105 golfers were statistically more likely to follow a score of nett bogey or worse with a score of nett bogey or better (negative facilitation). Table 2 shows the results for each gender.

Table 2

Significant Results for Gender and Psychological Momentum Type

Momentum Condition	Negative Momentum	Negative Facilitation	Total Significant
Number of participants (percentage in brackets)			
Males	187 (7.4)	99 (3.9)	286 (11.4)
Females	99 (14.1)	6 (0.9)	105 (14.9)
Total	286 (8.9)	105 (3.3)	391 (12.2)

Males were approximately four times more likely than females to have a significant tendency to follow a score of nett bogey or worse with a score of nett bogey or better (negative facilitation). This difference was at a significant level, $\chi^2(1, N = 3238) = .00$, $p < .01$. Women were almost twice as likely to have a significant tendency to follow a score of nett bogey or worse with a score of nett bogey or worse (negative momentum). This difference was also at a significant level, $\chi^2(1, N = 3238) = .00$, $p < .01$.

Z scores were also calculated for each participant using the formula below (adapted from Clark, 2005). Refer table 1 for values.

$$E(a) = \frac{(a + b)(a + c)}{N}$$

$$Var(a) = \frac{(a + b)(c + d)(a + c)(b + d)}{(N - 1) N^2}$$

$$Z \text{ Score} = \frac{a - E(a)}{\sqrt{Var(a)}}$$

The frequency of female and male Z scores are shown in figure 4 and 5 respectively.

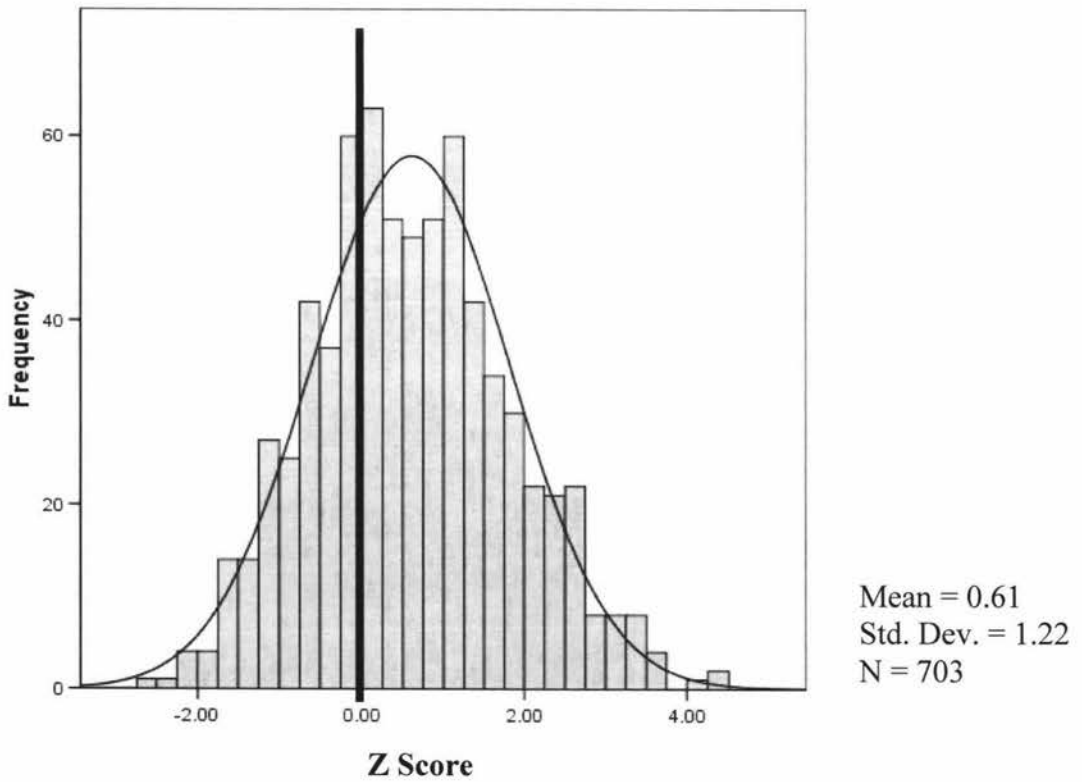


Figure 4. Frequency of females Z scores

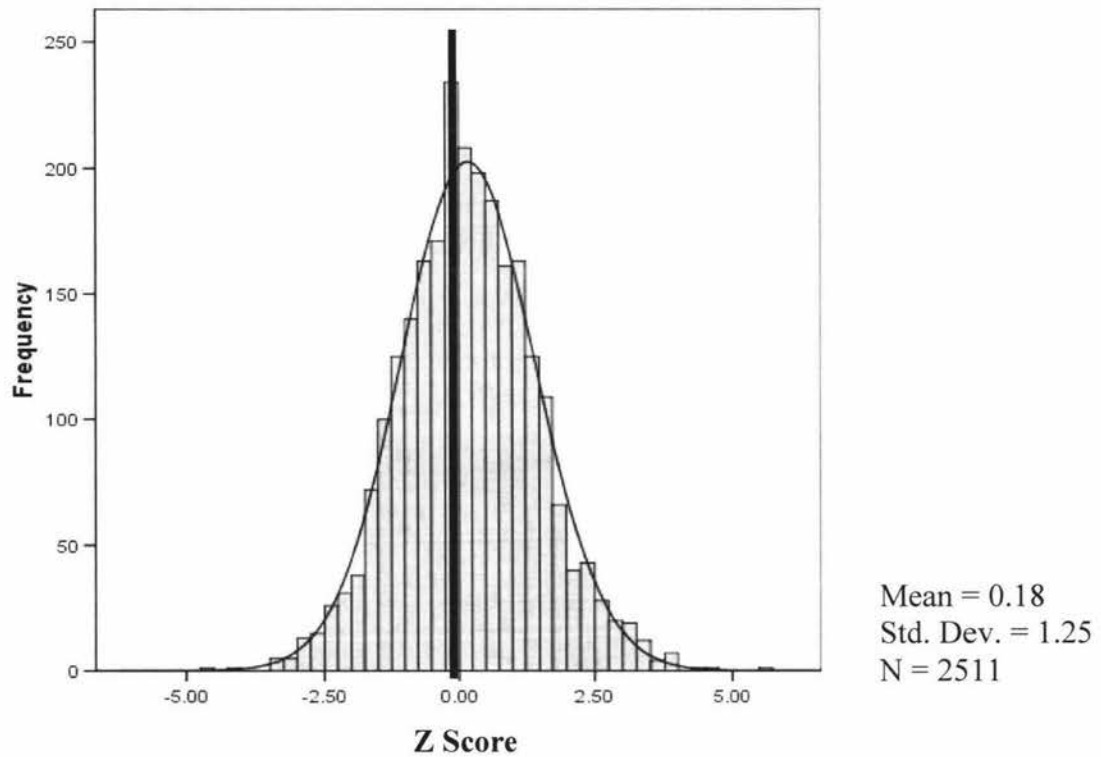


Figure 5. Frequency of males Z scores

Figure 4 clearly shows a positive skewness for the Z scores for women golfers, whereas the Z scores for men show a relatively normal distribution. A positive Z score reflects a participant's tendency to perform worse after an error. An analysis of variance (ANOVA) was conducted and showed that women significantly perform worse after an error in performance compared to men, $F(1, 3212) = 66.61, p < .01$.

Discussion

The hypothesis that a golfer's score on a hole would be influenced by their score on the previous hole, for a greater number of golfers than would be expected by chance was supported. The second hypothesis that males would have a significantly higher percentage of negative facilitators compared to women was also supported.

These findings support the 'hot hand' phenomenon, and contradict the research conducted by Gilovich et al. (1985), Tversky and Gilovich (1989), and Koehler and Conroy (2003). One reason for the discrepancy in results could be due to the smaller number of performance attempts Gilovich et al., Tversky and Gilovich, and Koehler and Conroy analysed for each participant. The participants in the current study averaged 923 attempts and only golfers who had a minimum of 255 performance attempts were included. Whereas in Gilovich et al. controlled shooting experiment participants took only 100 attempts each. And in their NBA free-throw study participants averaged only 114 attempts each. Also in Koehler and Conley basketball shootout (which found no evidence for the hot hand phenomenon) participants had a mean of only 49 attempts each.

Stern and Morris (1993) state that finding evidence of streak shooting requires either a large effect size or a large sample, i.e. a large number of attempts. Analysing a greater number of attempts will increase the power of a study. When Wardrop (1995) reanalysed Gilovich et al. (1985) participants free-throw data as a group (effectively increasing the power and number of attempts analysed), he found participants were significantly more likely to make their second free-throw shot after hitting their first shot compared to after missing their first shot, which supports the notion of the hot hand.

A small sample size may explain why Gilovich et al. (1985), Tversky and Gilovich (1985), and Koehler and Conroy (2003) found no evidence for the hot hand. However, Albright (1993) who analysed the hitting statistics of baseball players who had at least 500 attempts at bat still found no evidence for the hot hand.

Another possible reason for the discrepancy in results could be due to the differing characteristics of golf compared to sports such as baseball and basketball. Adams (1995) suggested the impact of psychological momentum on performance might be more or less prominent depending on the characteristics of each sport.

Adams (1995), who found support for the hot hand in the game of pool, described pool as an intensely solitary game of fine motor skills. He argued these conditions provide an environment where psychological and cognitive components have a greater impact on performance. Golf is a similar game in nature to pool as it is also intensely solitary and dominated by fine motor skills with 60% to 65% of all shots played within 100 yards of the hole (Pelz, 1999).

Clark (2005) supported Adams' (1995) concept by claiming golf is a more suitable sport to investigate psychological momentum because of the relatively long breaks between performances. A round of golf takes approximately 4 to 5 hours, but players only spend around 2 minutes of that time actually hitting the ball (Kerr, 1999). These conditions provide a golfer with ample time to reflect on past performances and generate perceptions of psychological momentum.

In contrast, generally performance in open skilled sports such as basketball, baseball, and volleyball is continuous and performance is more reactive. The ever-changing environment requires constant attention, meaning an individual will have less cognitive resources and time to reflect on past performances, and are therefore less likely to generate and be affected by perceptions of psychological momentum.

Vallerand et al. (1988) referred to situational antecedents and contextual variables that may influence the psychological momentum-performance relationship. Perhaps the type of skill being performed falls into one or both of these categories. This theory is somewhat supported by the fact the tenpin bowling, horseshoe throwing, and pool studies conducted by (Smith, 2003; Dorsey-Palmateer & Smith, 2004) that found evidence supporting the hot hand phenomenon are all individual sports, like golf, that require proactive performance.

So arguably golf provides a superior arena for the investigation of psychological momentum and this may explain why support for the hot hand was found in the current study in contrast to previous studies conducted by Gilovich et al. (1985), Tversky and Gilovich (1989), Albright (1993), and Koehler and Conroy (2003). However, Clark (2005) also investigated the hot hand phenomenon in golf, using the same method of analysis as the current study but found no supporting evidence.

Clark (2005) only found three significant results from a sample of 35 professional golfers. The likelihood of finding at least three significant results was well within chance expectations. Perhaps the inconsistency in results is due to Clark's small sample size, as it may not have been representative of the population. Or perhaps it was because Clark analysed the performance of professional golfers, whereas the performance of amateur golfers were analysed in the current study.

Most of the previous hot hand research has been done on professional athletes. But it could be argued professional athletes are less likely to be affected by previous performances. Athletes are taught to stay in the 'present' by taking one performance at

a time, golfers one shot at a time, because looking forward or reflecting back on past performances can produce changes in arousal or attention which can have a negative effect on performance. Orlick (1986) found that elite athletes try not to focus on performance outcome but rather the task at hand. Presumably one of the reasons professional athletes are superior is because they are better at staying in the present, which makes them less likely to be affected by prior performance, and less likely to generate perceptions of psychological momentum compared to amateurs. Landers, Boutcher, and Wang (1986) found archers who let their attention divert to past performance, performed worse than archers who keep their focus on the present, i.e. on the task at hand.

The second hypothesis that males would have a significantly higher percentage of negative facilitators compared to women was also supported, which suggests women respond to performance failure differently than men in amateur golf. It was also interesting to find women had a significantly higher chance of experiencing negative momentum, showing women perform worse after an error in performance compared to men. There may be a number of reasons why women perform worse after an error compared to men but little research has investigated this topic hitherto. Both the antecedents-consequences model and the multidimensional model propose perceptions of psychological momentum are subjective, and state that personal variables, such as experience, need for control, self-efficacy, and personality will influence these perceptions (Vallerand et al., 1988; Taylor & Demick, 1994).

It is possible that men and women differ in their perception of performance failure, which may explain the gender difference in subsequent performance after failure. Iso-

Ahola and Mobily (1980) claim that men and women view performance differently because women are socialised to be less competitive and achievement orientated than men.

Perhaps men and women differ on personal variables such as confidence. For example, Ransom and Weinberg (1985) claim an individual's level of confidence has an impact on one's ability to recover from a performance mistake, and that women have been shown to have lower levels of confidence across a number of achievement situations. Bandura (1977) self-efficacy theory suggests that individuals high in self-efficacy will persist for longer after failure, whereas those low in self-efficacy will lose motivation and 'give up' more easily. It is quite possible women golfers have lower levels of confidence and self-efficacy, which makes them more prone to poor performance after an error.

Limitations

There are a few limitations that need to be addressed when considering the implications of this first study. Firstly, perceptions of psychological momentum have been inferred as the reason for changes in performance. However, there were no direct measures of perceptions of psychological momentum in this study as the research is using archival data, but also because of the difficulty in measuring psychological momentum during actual performance.

Second, there was no way of determining which hole a player started their round on. As the large majority of rounds are started from hole number one, all rounds were analysed

as if the player had began their round from the first hole. Potentially this could cause some inconsistencies in the data. However, this was not considered a major problem as most rounds are started from the first hole, and on the few occasions a round was started from another hole, the majority of scores are still correct.

Thirdly, the performance statistics gained were all rounds played by a participant at their home course. The rounds included competition and non-competition rounds, but mainly non-competition rounds. If rounds were attained from competition play only, then one might expect an even stronger 'hot hand' effect, because competition would arguably provide greater pressure and greater perceptions of psychological momentum.

Future Research

The notion of momentum is entrenched in sport society. But there is still much to be learnt about psychological momentum from an empirical level and further investigation is required to advance our knowledge of this phenomenon.

It has been suggested that the type of skill being performed mediates the relationship between psychological momentum and performance, as investigation into the hot hand phenomenon has produced some encouraging results in 'closed skilled' sports.

Although possibly the biggest challengers of psychological momentum, Gilovich et al. (1985), found no evidence for the hot hand phenomenon in their free-throw (closed skill) shooting experiment. However, their sample size may have been too small to have a realistic chance of finding significant results. Future researchers are encouraged to replicate Gilovich et al.'s (1985) study with a greater number of attempts for each

participant, to increase the power and chance of finding an effect. Finding evidence for the hot hand phenomenon using Gilovich et al.'s (1985) methodology would go along way to vindicating ones belief in the existence of psychological momentum.

The present study showed that women golfers were significantly more likely to experience negative momentum and less likely to experience negative facilitation compared to men. Future research could examine possible reasons behind this apparent gender difference. It could be women have a more adverse reaction to failure than men (which has a negative impact on subsequent performance), because of differences in personal variables such as ones level of trait anxiety, fear of failure, and confidence. Further research in this area could advance our knowledge of the personal variables that Vallerand et al. (1988) and Taylor and Demick (1994) referred to in their psychological momentum models.

Conclusion

Despite a large number of sport psychologists investigating the relationship between psychological momentum and performance, few definitive conclusions have been drawn. The aim of this research was to add to the existing literature on psychological momentum by investigating the hot hand phenomenon in the sport of amateur golf.

The current study expanded on previous psychological momentum research by analysing the hot hand phenomenon on a sample of 3214 participants (a considerably larger sample size than any preceding). The main findings are summarised below:

- For a greater number of golfers than would be expected by chance, a golfer's score on a hole was influenced by their score on the previous hole. This finding supports the notion of the hot hand phenomenon, and suggests psychological momentum does have an influence on performance.
- The results of this study concur with research conducted in sports with similar characteristics, i.e. research in other closed skilled sports. It appears closed skill (and amateur) sports may lend themselves to conditions that generate greater perceptions of psychological momentum, and/or where perceptions of psychological momentum have a greater impact on performance.
- Significant differences were found in the way males and females perform after an error. There were a significantly higher percentage of males who performed better after an error (negative facilitation) compared to females. Also, there were a significantly lower percentage of males who performed significantly worse after an error (negative momentum) compared to females. This finding suggests females have a more adverse reaction to an error in performance compared to males.

The gender difference illustrates the existence of individual differences in psychological momentum. Study two of this dissertation investigates possible reasons behind these individual differences.

CHAPTER FOUR

STUDY TWO: GENDER AND INDIVIDUAL DIFFERENCES IN PSYCHOLOGICAL MOMENTUM: PERFORMANCE AFTER AN ERROR

Introduction

Adler's (1981) bi-directional definition of psychological momentum implies all performers will respond to prior performance in the same manner, i.e. experience positive momentum after a successful performance, and negative momentum after an unsuccessful performance. However, a number of studies (Shaw et al., 1992; Adams, 1995; Perreault et al., 1998; Smith, 2003; Dorsey-Palmateer & Smith, 2004) investigating psychological momentum have shown that some athletes actually tend to perform worse after a successful performance, and some perform better after an unsuccessful performance. These findings show a bi-directional concept of psychological momentum is inadequate, as there appear to be individual differences in how athletes respond to prior performance.

Study one of this dissertation found individual differences in psychological momentum. 1855 golfers (8.9% at a significant level) had a tendency to perform worse after an error in performance (referred to as negative momentum), while 1369 golfers (3.3% at a significant level) had a tendency to perform better after an error (referred to as negative

facilitation). In addition, a gender difference in psychological momentum was found, as female golfers were significantly more likely to experience negative momentum and significantly less likely to experience negative facilitation after an error in performance compared to male golfers.

Why is it that some individuals seemingly falter after a performance mistake while others recover? Performance mistakes are an inevitable part of sport, and if athletes wish to perform to the best of their ability they need to be able to recover quickly from errors. Attaining a greater understanding of the psychological processes that enhance an athlete's ability to recover quickly from performance mistakes has real practical implications, as greater knowledge may lead to the developed of interventions to assist athletes in performing optimally after an error. Therefore, the objective of this study is to investigate the potential reasons behind the gender and individual differences in psychological momentum/performance after an error found in study one.

Vallerand et al.'s (1988) antecedents-consequences model and Taylor and Demick's (1994) multidimensional model of momentum proposed perceptions of psychological momentum were subjective, and influenced by personal variables, such as ones level of anxiety, self-efficacy, motivation, and need for control. Perhaps the gender and individual differences in ones performance after an error found in study one can be explained by differences in such personal variables.

To date, there has been limited empirical research investigating the influence of personal variables on psychological momentum. Cornelius et al. (1997) found no evidence to suggest anxiety and self-confidence were predictors of psychological

momentum, and Shaw et al. (1992) found only limited support for the influence of self-efficacy on perceptions of psychological momentum.

The lack of findings could be attributed to the fact they were conducted in a laboratory setting. Arguably neither study produced an environment that was competitive enough to induce psychological responses that parallel a genuine competitive environment. If a competition is perceived as unimportant, then it is unlikely perceptions of psychological momentum will transpire (Iso-Ahola & Mobily, 1980). Also, Shaw et al's (1992) research was conducted using a bi-directional conception of psychological momentum, as participants were randomly assigned to either a repeated success (positive momentum group) or repeated failure group (negative momentum group). Grouping participants in this way is done under the invalid assumption that individuals respond to repeated success and failure in the same manner. It is erroneous for researchers to assume they have created a group that will respond to success with positive momentum and failure with negative momentum by mere random assignment, when previous research has shown the existence of individual differences in how one responds to prior performance.

The current study differed to the above studies by using data that was obtained from a naturally occurring environment. Also, in contrast to random assignment, participants were purposely assigned to different momentum groups by virtue of their 'actual' performance data.

Performance data (that is taken over a sufficient period of time) provides a behavioural measure of how an individual typically responds to prior performance, and their behavioural pattern implies their tendency to experience a particular form of

psychological momentum. For example, the tendency for an individual to experience negative momentum after an error in performance, can be inferred when their performance is worse after an error compared to after their normal standard of performance. Similarly, the tendency for an individual to experience negative facilitation after an error in performance, can be inferred when their performance is better after an error compared to after their normal standard of performance.

Therefore, participants were characterised into one of three groups, negative momentum (tend to perform worse after an error), negative facilitation (tend to perform better after an error), or a no-momentum group (performance is unaffected after an error), by virtue of their 'actual' performance data. The groups were tested on personal variables theorised to influence psychological momentum. If the groups were found to differ in these personal variables, this would provide evidence that these variables influence an individual's performance after an error.

Also, as study one showed a gender difference in performance after an error (males tended to perform better after an error), male and female participants were tested on the same personal variables. If males and females were found to differ in personal variables similar to the differences found across the psychological momentum groups, then this would provide strong empirical evidence for the notion that these variables influence an individual's response to a performance error.

Participants were tested on eleven personal variables. The hypotheses, specific to each variable are addressed below.

Trait Anxiety

Anshel et al. (1991) define anxiety as a 'subjective feeling of apprehension or perceived threat, sometimes accompanied by heightened physiological arousal' (p. 9). Scholars have defined two distinct types of anxiety, trait and state anxiety. State anxiety is dynamic and refers to one's actual state of anxiety in response to a specific isolated situation, whereas trait anxiety is regarded as a stable personality characteristic that reflects one's tendency to appraise a wide range of situations as threatening (Anshel, 1995).

Individuals with high trait anxiety appraise a wider range of situations as threatening and respond to those situations with higher state anxiety, compared to individuals with low trait anxiety (Anshel, 1995). Therefore, it is likely individuals high in trait anxiety will be more threatened after an error in performance, and consequently experience greater state anxiety. Generally, high levels of state anxiety are believed to be detrimental to performance (Anshel, 1995; Woodman & Hardy, 2003).

Therefore, it is hypothesised that: (a) that females will have significantly higher levels of trait anxiety compared to males; (b) participants in the negative momentum group will have significantly higher levels of trait anxiety compared to the other two psychological momentum groups.

Fear of Failure

Conroy (2004) states fear of failure ‘involves appraising threat in evaluative situations with the potential for failure because those situations activate cognitive schemas or beliefs associated with the aversive consequences of failing’ (p.484). An individual’s tendency to fear failure is viewed as a stable disposition (Atkinson, 1957), with high levels of fear associated with inferior performance (Conroy, Willow, & Metzler, 2002).

It is suggested by the current authors, that individuals who have a predisposition to fear failure will appraise performance mistakes as more threatening, because mistakes will activate schemas associated with the aversive consequences of failure. Appraisals of threat are positively associated with constructs believed to have a negative effect on performance, such as anger, state anxiety, and worry (Anshel & Delany, 2001),

Therefore it is hypothesised that: (a) that females have significantly higher levels of fear of failure compared to males; (b) participants in the negative momentum group have significantly higher levels of fear of failure.

Negative Perfectionism

Negative perfectionists are driven by extremely high standards, are self-critical, hardly ever satisfied with their level of performance, demonstrate little self-mercy after mistakes, and are somewhat driven by a fear of failure (Frost, Marten, Lahart, & Rosenblate, 1990; Terry-Short, Owens, Slade, & Dewey, 1995). Slaney, Rice, Mobley, Trippi, and Ashby (2001) claim negative perfectionism is characterised by the distress

caused when an individual's performance level does not meet their high and often unrealistic standards.

Frost and Henderson (1991) found negative perfectionists have a greater concern of, more difficulty in forgetting about, and a greater negative reaction to performance mistakes. They theorized this would make it difficult for perfectionists to recover from performance mistakes, and supposed negative perfectionists would perform poorly immediately following a mistake.

Therefore, it is hypothesised that: (a) that females will have significantly higher levels of negative perfectionism compared to males; (b) participants in the negative momentum group will have significantly higher levels of negative perfectionism.

Positive Perfectionism

Positive perfectionists are described as those who have a desire and drive for success, gain satisfaction from the achievement of goals. They are less concerned with performance mistakes than negative perfectionists, as they are more accepting of the fact that it is unrealistic to expect top-quality performance at all times (Frost et al., 1990).

Therefore, it is hypothesised that: (a) that males will have significantly higher levels of positive perfectionism compared to females; (b) participants in the negative facilitation group will have significantly higher levels of positive perfectionism.

Rumination

Trapnell and Campbell (1999) defined rumination as a neurotic style of thinking in which thoughts are repetitively re-directed inward at the self in response to threatening situations. Trapnell and Campbell (1999) divided rumination into two further dimensions, public and private rumination. Public rumination refers to ones tendency to focus on their environment because of their concern on how they are being perceived by others, whereas private rumination refers to the tendency for an individual to focus on their personal thoughts and feelings with respect to self (Martin & Debus, 1999).

Attentional distraction theories suggest rumination may have a negative impact upon performance, because ruminating fills working memory up with task-irrelevant thoughts, and competes with the attention normally assigned to the execution of a task (Beilock & Carr, 2001; Beilock, Kulp, Holt, & Carr, 2004). Scheier and Carver (1977) and Blagden and Craske (1996) state individuals who tend to ruminate will prolong feelings of state anxiety and experience greater negative affect.

Therefore, it is hypothesised: (a) that females will have significantly higher levels of rumination compared to men; (b) participants in the negative momentum group will have significantly higher levels of rumination compared to the negative facilitation and no-momentum groups.

Telic Dominance State

Apter's (1982, as cited in Grewal & Lafreniere, 2003) reversal theory proposed four pairs of contrasting bipolar metamotivational states that individuals can switch or 'reverse' between at any given time. One pair of the metamotivational states is the telic-paratelic pair of states.

Even though individuals can easily switch between a pair of states, it is believed individuals have a dominance to spend more time in one particular state. Telic dominance refers to the tendency for an individual to spend more of their time in a telic state as opposed to a paratelic state (Martin, Kuiper, Olinger, & Dobbin, 1987).

Individuals in a telic state are typically characterised by their serious mindedness, planning focus, and goal oriented disposition. In a telic state, lower levels of arousal are preferred, as high levels of arousal are viewed as unpleasant and often accompanied by an increase in ones level of anxiety. In contrast, individuals in a paratelic state are spontaneous, energetic, and find pleasure in experiencing the present, and heightened arousal is often preferred (Summers & Stewart, 1993 as cited in Kerr, 1997; Bindarwish & Tenebaum, 2006).

Performance errors are likely to increase arousal levels, and if telic dominant individuals accompany increases in arousal with heightened anxiety, then a subsequent drop in performance after an error may occur. Martin et al. (1987) found the performance of telic dominant individuals dropped under conditions of stress, whereas the performance of paratelic individuals did not. Also, Grewal and Lafreniere (2003)

found telic dominant individuals experience more adverse emotions compared to paratelic dominant in response to failure.

Therefore, it is hypothesised: (a) that females will have significantly higher levels of telic state dominance compared to men; (b) participants in the negative momentum group will have significantly higher levels of telic state dominance.

Self-Confidence

Self-confidence refers to an individual's belief in their ability to successfully perform a task (Weinberg & Gould, 1999). Weinberg et al. (1981) suggest athletes with higher levels of self-confidence will have a greater ability to come from behind in sport, as they tend to intensify their effort and persist for longer after experiencing failure. Whereas athletes low in self-confidence are more likely to give up when confronted with failure, and as a consequence perform worse after an error.

Therefore, it is hypothesised: (a) that males will have significantly higher levels of self-confidence compared to females; (b) participants in the negative facilitation group will have significantly higher levels of self-confidence.

Coping Styles. A Coping style refers to an individual's disposition to react to a stressor in a particular way (Anshel, 1996). Coping strategies can be maladaptive as well as adaptive; meaning a particular style of coping may be more beneficial than others (Compas, 1987). Researchers have primarily directed their attention towards two forms of coping styles, approach and avoidance (Anshel & Anderson, 2002).

Approach Coping

An approach coping style refers to an individual's tendency to try and reduce the effects of a stressor by taking direct steps to confront the problem that is causing the stress, by using strategies such as problem solving or initiating action such as increasing effort (Anshel, 1996; Anshel, Williams, & Williams, 2000; Wang, Marchant, & Morris, 2004).

Avoidance Coping

An avoidance coping style refers to when an individual distances himself or herself psychologically from a stressful event by ignoring, disengaging, or distracting himself or herself from the problem that is causing the stress (Anshel et al., 2000).

Research conducted by Wang et al. (2004), and Krohne and Hindel (1988) has shown participants who use an avoidance coping style had lower levels of perceived threat, state anxiety, and negative affect, and performed better compared to participants who utilised an approach coping style under conditions of high stress. Krohne and Hindel suggest that avoidance coping reduces cognitive interference that otherwise may distract an athletes attention from the performance tasks required.

Therefore, it is hypothesised: (a) that females will have significantly higher levels of an approach coping style and lower levels of avoidance compared to females; (b) participants in the negative momentum group will have significantly higher levels of an approach coping style and lower levels of avoidance.

Achievement (Goal) Orientation. Achievement theory consists of two goal orientations that are believed to influence how an individual defines success and failure in achievement settings. They are termed task and ego orientation (Weinberg & Gould, 1999).

Ego Orientation

Ego orientation (also referred to as a performance orientation) refers to individuals who rate their degree of success in comparison to others (Voight, Callaghan, & Ryska, 2000). Their primary goal is to perform better than their adversaries. Ego orientation has been associated with greater task avoidance, higher levels of anxiety, and a tendency to withdraw and reduce effort when facing failure (Voight et al., 2000).

Task Orientation

Task Orientation (also referred to as a learning orientation) refers to individuals who gauge success in relation to their own personal improvement, and focus their attention on improving skill, effort, and persistence (Dweck, 1986; Dunn, Dunn, & Syrotuik, 2002). Individuals high on task orientation associate hard work with success, and will try harder in the face of failure, as they believe increasing effort can earn subsequent success (Hatzigeorgiadis, 2002). Because task-oriented individuals predominantly focus on goals under the control of the individual, they are less likely to experience increased state anxiety when losing (Shaw et al., 1992; Newton & Duda, 1993; Hall, Kerr, & Matthews, 1998; Weinberg & Gould, 1999; Voight et al., 2000).

Therefore, it is hypothesised: (a) that males will have significantly higher task orientation and lower ego orientation compared to females; (b) participants in the negative momentum group will have significantly higher ego orientation and lower task orientation.

Method

Participants

All 3214 participants used for study number one were potential participants for this study. Firstly, all participants from study one were assigned to one of three groups (negative facilitation, negative momentum, or a no-momentum group) depending on how they perform after an error. How a participant performed after an error was derived from the p-value and Z score calculated for each participant in study one (categorisation is explained in more detail in the procedure section below). 645 (456 male and 189 female) participants were assigned to the negative momentum group, 328 (293 male and 35 female) to the negative facilitation group, and 2241 (1762 male and 479 female) to the no-momentum group.

Questionnaires were sent to a sample selected from each of these groups. To gain sufficient power it was estimated that each group would require approximately 100 participants (Cohen, 1988).

Therefore, all 328 participants assigned to the negative facilitation group were posted questionnaire packs, hoping for a response rate of close to 30%, which would ensure a

group size of approximately 100. A random sample of participants were selected (400 from each group to keep the group sizes relatively even) from the two remaining groups.

In total 403 questionnaires were returned. However, 19 of the questionnaires were returned without identification, so the respondents were unknown and the applicable group could not be assigned. This left an overall sample size of 384 participants (275 male and 109 female), and a response rate of 34%. There were 106 (91 male and 15 female) participants in the negative facilitation group, 165 (104 male and 61 female) in the negative momentum group, and 113 (81 male and 32 female) in the no-momentum group.

Demographics such as age and experience were not obtained from participants for a couple of reasons. Firstly, it was believed leaving out personally intrusive questions such as age would increase the chances of getting a returned questionnaire. And secondly, the psychological momentum groups are grouped by their performance after an error (not random assignment), so if the groups do differ in age or experience, this would just reflect what is happening in the real world.

Materials

SPSS (version 14.0) was used for statistical analysis of the results.

Measures

Performance. Performance was measured in the same manner as in study one. Refer study one.

Questionnaires. Participants completed eight questionnaires. However, prior to group analysis, confirmatory factor analysis (CFA) was conducted to assess the model-fit of each questionnaire to ensure the questionnaires behaved in concurrence with the theorised models.

Confirmatory Factor Analysis

Because knowing the identity of participants is irrelevant for the process of CFA, the data from all 403 returned questionnaires were used. To examine model-fit, a number of fit indices were used, such as the chi-square statistic (χ^2), Tucker-Lewis index (TLI), comparative-fit index (CFI), and the root-mean-square error of approximation (RMSEA).

The chi-square statistic examines whether the “factor loadings, factor variances/co-variances, and error variances for the model under study are valid” (Bryne, 2001, p. 79).

The null hypothesis postulates that the model is valid, which means a non-significant chi-square result is desirable, as this would suggest a good model-fit (Bryne, 2001).

However, Bryne (2001) states the finding of well-fitting models using the chi-square statistic is somewhat unrealistic in structural equation modelling. The chi-square

statistic is sensitive to large sample sizes, and the assumption that the model fits perfectly in the population is unrealistic. More often than not, significant results are commonly found and should not be unexpected. The limitation of the chi-square statistic in structural equation modelling has led researchers to place greater importance on a number of other more pragmatic goodness-of-fit indexes, such as the CFI, TLI, and RMSEA.

The comparative-fit index (CFI) and the Tucker-Lewis index (TLI) statistics are derived from the comparison of the proposed model with the independence model. Values can range from 0 to 1.00. A value closest to 1.00 represents a good fit but values greater than .90 are considered acceptable (Bryne, 2001). Benter (1990, as cited in Bryne, 2001) has suggested the CFI should be the index of choice, and a more adequate method of analysis compared to the chi-square statistic for evaluating the fit of a structural model.

Another index used to evaluate model-fit is the root mean square error of approximation statistic (RMSEA), which shows how well the model may fit the population. The closer the RMSEA is to zero, the better the hypothesised model fits the data. Values below .05 indicate a good fit, and values between .05 and .10 are regarded as an acceptable fit, and values higher than .10 are considered as a poor fit (Browne & Cudeck, 1993; MacCallum et al., 1996, as cited in Bryne, 2001).

During the CFA process, items from two of the questionnaires were removed (specifics are addressed below), to produce the best fitting models. The CFA statistics for each

questionnaire (after item removal) are reported in Table 4. The results indicate that the majority of questionnaires produced a relatively good fit with the data.

Table 3

Questionnaire Goodness of Fit Indexes

	Df	χ^2	TLI	CFI	RMSEA
POSQ	53	258.06*	.87	.91	.10
CS	26	48.71*	.91	.95	.05
PFAI	270	920.52*	.83	.86	.08
PRQ	9	12.44	.99	.99	.03
SCAT	35	180.93*	.86	.91	.10
PANPS	151	406.92*	.84	.87	.07
TSCI	65	376.02*	.92	.94	.11
TDS	591	1027.98*	.60	.64	.04

Note. * = $p < .00$; Df = degrees of freedom; χ^2 = chi square; TLI = Tucker Lewis index; CFI = comparative fit index; RMSEA = root-mean-square error of approximation; POSQ = Perception of Success Questionnaire; PANPS = Positive and Negative Perfectionism Scale; PFAI = Performance Failure Appraisal Inventory; SCAT = Sport Competition Anxiety Test; TDS = Telic Dominance Scale; PRQ = Public Rumination Questionnaire; TSCI = Trait Sport Confidence Inventory; CS = Coping Style

Perception of Success Questionnaire (POSQ). The POSQ is a 12-item questionnaire developed by Roberts, Treasure, and Balague (1998) to measure goal orientation in sport. The questionnaire consists of two 6-item subscales that independently measure an individual's ego goal orientation and task goal orientation. Participants respond to each item using a 5-point Likert-type scale ranging from '1' (Strongly Disagree) to '5' (Strongly Agree). The respective items on each subscale are summed to produce a

scoring range between 5 and 30. A higher score on the respective scale reflects a higher tendency for task or ego goal orientation.

Roberts and Balague (1991, as cited in Roberts et al., 1998) reported coefficient alphas of .90 for ego goal orientation and .92 for task goal orientation, and a test-retest reliability of .80 for ego and .78 for task. Within the current sample a Cronbach's Alpha of .90 for ego and .83 for task was found. Both the CFI (.91) and RMSEA (.10) reach an acceptable standard, which suggests a reasonable fit and supports the proposed two-factor model. The Perception of Success Questionnaire is included in Appendix A.

Coping Scale (CS). The questionnaire sent to participants was a modified version of the coping scale inventory developed and used by (Anshel & Sutarso, 2006) to measure an individual's prevalence of an approach and avoidance coping style. The scale consisted of two subscales that independently measure an individual's tendency towards an approach and avoidance coping style. For the sake of parsimony 6 items of each scale were taken from the original CS scale (Anshel & Sutarso, 2006). Participants responded to items using a 5-point Likert-type scale ranging from 1 (not at all like me) to 5 (very much like me).

The CFA goodness-of-fit indexes suggested a poor model of fit, as the TFI was .5 and the CFI .654. Removing 3 items (2 non significant items and one item with a large parameter estimate) produced a TFI of .91, CFI of .95 and a RMSEA of .05 suggesting a good fitting model. However, the avoidance scale and approach scale produced a Cronbach's alpha of .58, and .64 respectively, suggesting only moderate reliability.

The modified CS consisted of 4 avoidance items, with a range of 4 to 20, and 5 approach items with a range of 5 to 25. A higher score reflects a greater prevalence for an approach and avoidance coping style. The Coping Scale (also showing items removed; 2, 4, and 5) is included in Appendix B.

Performance Failure Appraisal Inventory (PFAI). Fear of Failure was measured using the PFAI 25-item (form b) version, developed by Conroy et al. (2002).

Participants respond to a 5-point Likert-type scale ranging from ‘-2’ (Do Not Believe At All) to ‘+2’ (Believe 100% of the Time). For ease of interpretation these responses were recoded using a scale of 1 to 5 (i.e. the items were recoded as, -2 = 1, -1 = 2, 0 = 3, etc).

The PFAI contains a single higher order factor that represents ones ‘general fear of failure’, and 5 lower order fear of failure scores. The lower order scales are, experiencing shame and embarrassment, devaluing one’s self-estimate, having an uncertain future, important others losing interest, and upsetting important others (Conroy et al., 2002).

To calculate the subscale scores, each item score is summed and then divided by the number of items on each subscale. However, only the general fear of failure score was used in the study. The general fear of failure score is calculated by combining the score for each subscale and dividing the outcome by five (the number of subscales). A higher score (range between 1 and 5) reflects a greater tendency to fear failure.

A Cronbach's alpha of .93 for the general fear of failure scale was found within the current study, suggesting good reliability. A CFI of .86 and RMSEA of .08 suggest a reasonable model fit. The Performance Failure Appraisal Inventory is included in Appendix C.

Public Rumination Questionnaire. Public Rumination was measured using the public rumination scale from Trapnell and Campbell's (1999) Rumination-Reflection Questionnaire (RRQ). Participants were sent Trapnell and Campbell's (1999) 12-item rumination scale, which consisted of two subscales, private rumination and public rumination. Participants were asked to respond to 12 statements (e.g. 'often I'm playing back over in my mind how I acted towards others in a past situation'), using a 5-point scale by indicating whether they strongly disagree (1), disagree (2), neutral (3), agree (4), or strongly agree (5) with the statement. Items 6, 9, and 10 were reversed scored.

CFA of the two-factor higher order model produced poor model fit statistics. A number of alternative models were tested with minimal to no improvement. When each subscale was analysed separately, public rumination produced a TLI and CFI of .99 and a RMSEA of .031, whereas private rumination produced a TLI of .44 and CFI of .76, with a RMSEA of .168. It appeared the private rumination part of the scale was affecting the model fit so it was dropped, and only the public rumination scale was used for analysis. A Cronbach's alpha of .79 was found for the public rumination scale, suggesting acceptable reliability.

The public rumination score was calculated by summing all public rumination responses, and a higher score reflects a greater tendency for public rumination. The

original Rumination Questionnaire sent to participants (includes private rumination items removed; 1, 3, 6, 8, 9, and 12) is included in Appendix D.

Sport Competition Anxiety Test (SCAT). The SCAT was developed by Martens (1977) to measure trait anxiety. The measure contains 15 items, but only ten of the items measure competitive trait anxiety (e.g. ‘Before I compete I feel uneasy’). The remaining 5 items are spurious items that are not scored (e.g. ‘Team sports are more exciting than individual sports’), and are included to reduce the likelihood of response bias.

The participants were asked to indicate how they usually feel when competing in sports and games and respond to each item by selecting either, ‘1’ (Hardly Ever), ‘2’ (Sometimes), and ‘3’ (Often). Items 6 and 11 are reversed scored. The scores are summed to produce a range between 10 and 30, with a higher score reflecting a greater predisposition to respond to competitive situations with elevated levels of anxiety.

Within the current study a Cronbach’s Alpha of .89 was found suggesting good reliability. Also, a CFI of .91 and an RMSEA of .10 are within the boundaries of what is regarded as an acceptable fit to the data. The Sport Competition Anxiety Test is included in Appendix E.

Positive and Negative Perfectionism Scale (PANPS) in Sport. The PANPS in Sport is an adapted/shortened version of the original Positive and Negative Perfectionism Scale (PANPS) developed by Terry-Short et al. (1995). The PANPS in sport contains 19-

items of the original 40 items, and was derived by Haase and Prapavessis (2004) to measure positive and negative levels of perfectionism in sport.

Participants were asked to respond to a 5-point Likert-type scale that ranged from '1' (Strongly Disagree) to '5' (Strongly Agree). The range of scores for negative perfectionism (12 items) was 12 to 60, and 7 to 35 for positive perfectionism (7 items). A higher score represented a greater level of negative or positive perfectionism.

Haase and Prapavessis (2004) reported a Cronbach's alpha of .75 for positive perfectionism and .79 for negative perfectionism. Within the current study a Cronbach's alpha of .85 for positive perfectionism and .77 for negative perfectionism was found. A CFI score of .87 and RMSEA of 0.07 indicate an acceptable fit. The Positive and Negative Perfectionism Scale in Sport is included in Appendix F.

Trait Sport Confidence Inventory (TSCI). Sport confidence was measured using the Trait Sport-Confidence Inventory developed by Vealey (1986). Participants were asked to compare their self-confidence to the most self-confident athlete they know and respond to 13 items (e.g. compare your confidence in your ability to perform under pressure to the most confident athlete you know), using a 9-point Likert-type scale, '1' (Low) to '9' (High). The items scores are summed to produce a range between 13 and 117, with a higher score reflecting a greater level of sport-confidence.

The current sample produced a TLI of .92 and CFI of .94, which indicate a good model fit, and a Cronbach's alpha of .97 suggesting strong reliability. The Trait Sport Confidence Inventory is included in Appendix G.

Telic Dominance Scale (TDS). The TDS is a personality scale developed by Murgatroyd, Rushton, Apter, and Ray (1978) containing 42-items, and measures an individual's tendency to spend time in a telic dominance state (Kerr, 1997). For each item, participants were asked to make a choice between alternatives, e.g. would you prefer 'work that earns promotion (a telic response)?' or 'work that you enjoy doing (a non-telic response)?' Participants were also given a third alternative, 'not sure', but were instructed to use this option sparingly. A 'telic' response was scored as 1, and a 'not sure' response scored as a ½. The higher the score, the greater the disposition an individual has towards a telic dominance state

The TDS includes three 14-item subscales, seriousmindedness, planning orientation, and arousal avoidance. However, only the total TDS score was used in the present study.

The current data produced a Cronbach's alpha of .74, suggesting acceptable reliability. However, the TDS initially produced a very low TLI of .358 and CFI of .418, suggesting a very poor model fit. 6 items (non significant items) were removed (items number 9, 28, 31, 32, 33, 34) which improved the TLI to .60 and CFI to .64. The revised TDS scale still produced TLI and CFI scores that were well under the acceptable standard. The researchers decided to use the modified TDS (with the 6 items removed) but acknowledge the limitations of using a poor fitting model. The Telic Dominance Scale (also showing items removed) is included in Appendix H.

Procedure

Firstly, the Z scores calculated for each of the 3214 participants in study one were used to group participants into one of three groups. Participants with a negative Z-score equal to or less than -1.29 (p-value less than 0.20) were assigned to the negative facilitation group. Participants with a positive Z-score equal to or greater than 1.29 (p-value less than 0.20) were assigned to the negative momentum group. Participants with a Z score between -1.29 and 1.29 (p-value greater than 0.20) were assigned to the no momentum group. A pictorial example of the three categories is shown below.

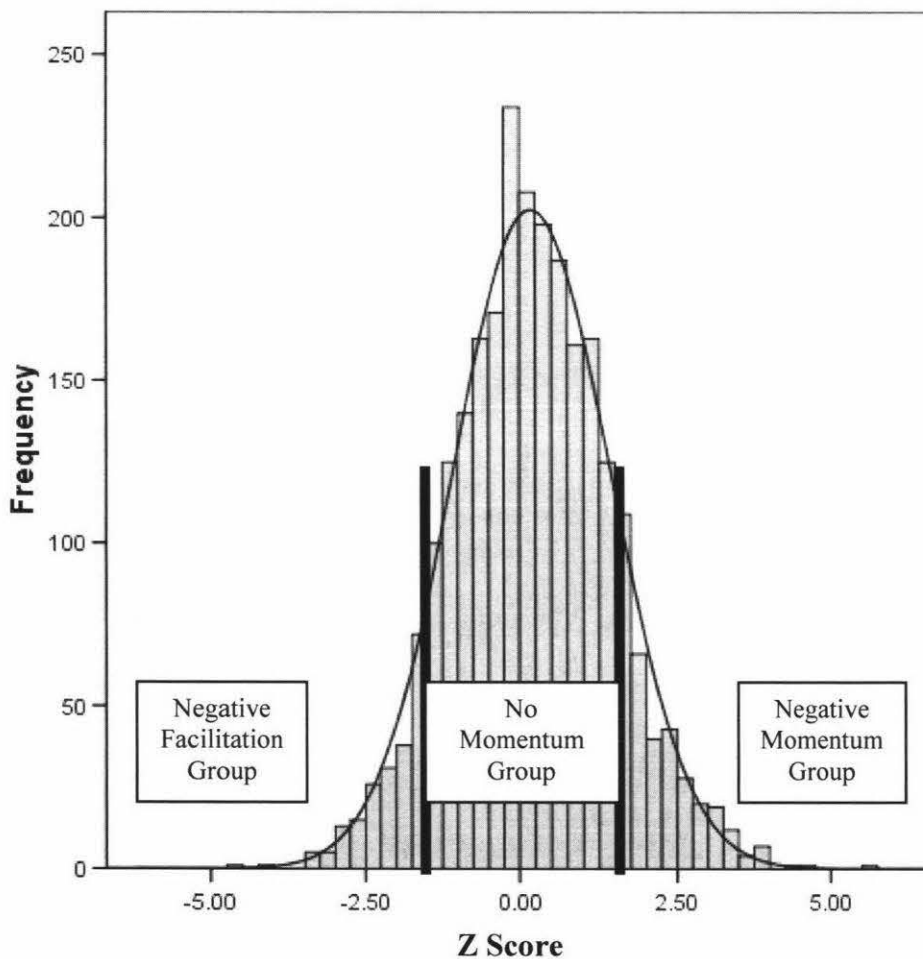


Figure 6. Pictorial example of psychological momentum group categorisation based on individual Z scores.

All 328 participants assigned to the negative facilitation group were posted questionnaires. Questionnaires were also posted to 400 participants who were randomly selected from each of the two remaining groups (800 in total).

As the researcher did not have access to the addresses of potential participants, the nine club managers (refer study one) were approached and asked if they would forward the questionnaire packs to their respective members, on the researchers behalf. All club managers agreed and were given a list of participants that had been selected who were members at their club. The questionnaire pack contained a cover sheet from the respective golf club manager (included in Appendix I), an information sheet (included in Appendix J), 8 questionnaires (included in Appendix A-H), and a return freepost envelope.

Participants were advised the questionnaires would take just over 20 minutes to complete, and requested to return the questionnaires within two weeks of receiving the pack, to ensure their inclusion in the study. A time frame of two-weeks was given in an attempt to motivate participants to return the questionnaires as soon as possible, and make it less likely they would procrastinate and later forget to complete and/or return the questionnaires.

Results

Prior to Analysis

Prior to analysis, a number of steps were performed to ensure the trustworthiness of the results. Firstly, the means, standard deviations, and frequency statistics (maximum and

minimum values) of each variable were checked for any abnormalities that would indicate incorrect data entry.

Secondly, missing value analysis was conducted to determine the extent of missing data. Across all items to be analysed there was only 1.2% of missing data, and no item or variable had greater than 2.9% of missing responses. Tabachnick and Fidell (2007) state if less than 5% of data is missing from a large sample, and as long as it is missing in a random pattern, then almost any procedure for dealing with missing data is acceptable because the various procedures will produce similar results.

To test whether the missing data was missing in a random pattern, a MCAR test was conducted. The MCAR test produced a statistically significant result, which suggests the missing data was not MCAR (missing completely at random). Follow up separate variance t-tests were run to ascertain whether the data was MAR (missing at random) or MNAR (missing not at random). The variance t-tests produced an insufficient number of significant p-values to suggest considerable relationships between items, so the data was inferred as MAR (missing at random).

Tabachnick and Fidell (2007) state the 'most reasonable approach to imputation of missing data', as long as the data is missing randomly, is expectation maximisation (EM). Therefore, expectation maximisation (EM) was used to impute scores for missing data.

EM was run separately on each questionnaire, i.e. in isolation of other questionnaire responses. However, before EM was run, participants who had missed all items on any

one questionnaire were deleted from further analysis. There were 17 cases removed for this reason.

After EM imputation, univariate and multivariate outliers were searched for. When analysing group differences, univariate and multivariate outliers are searched for across groups, as opposed to across the entire sample. If a 2x3 design had been used then univariate variables would have been identified across the 6 groups. However, it was decided not to use a 2x3 design because of the low number of participants (fifteen) in the female-negative facilitation group. This number was deemed to small especially when you consider there were eleven dependent variables.

Therefore, separate analyses were conducted for gender and the psychological momentum groups. However, this presented a methodological problem with respect to univariate and multivariate outliers. Potentially the gender and psychological momentum groups had different outliers. I.e. a case may be an outlier on a variable for gender but not an outlier for psychological momentum groups, or vice-versa.

For this reason it did not seem sensible to remove outliers from both groups. So it was decided to search for univariate outliers within the psychological momentum groups only. It was believed individual's results framed within the psychological momentum groups provided a better indication of how they fit within the sample and construct of interest (performance after an error), as the psychological momentum groups were solely separated by virtue of how they perform after an error (and was void of the individual differences contained in the gender groups).

There were 32 univariate outliers found that were spread across the personal variables. This number seems quite high, but when you consider there were eleven independent variables (on average, approximately three outliers per variable), it is not exceptionally high. In addition, 12 cases were identified as multivariate outliers. All cases with univariate or multivariate outliers were removed from the analysis.

This left a total of 323 participants, 232 males and 91 females. Also there was 132 in the negative momentum group, 93 in the negative facilitation group, and 98 in the no-momentum groups.

Test of normality, homoscedasticity, and multicollinearity were also conducted. After univariate and multivariate outliers were removed, all personal variables illustrated a normal distribution. To test for homoscedasticity, a Box's M test was conducted for both gender and psychological momentum groups. Both tests produced non-significant results, suggesting no violation in homogeneity. Multicollinearity was checked with collinearity diagnostics, specifically the conditioning index and variance proportions of each variable. Belsely, Kuh, and Welsch (1980, as cited in Tabachnick & Fidell, 2007) provided criteria for multicollinearity as "a conditioning index greater than 30 for a given dimension coupled with variance proportions greater than .50 for at least two different variables" (p.91). Using this criterion, no multicollinearity was detected.

Preliminary Analyses

In study one it was established males and females differed significantly in their performance after an error. However, as the current sample included only a small

portion of the participants from study one, it would be incorrect to assume the current sample was representative of the sample in study one. Therefore, to ensure males and females differed significantly in how they tend to perform after an error within the current sample, an analysis of variance (ANOVA) was conducted for gender using the Z scores (a measure of how a participant tends to perform after an error) of participants calculated in study one (refer study one). The ANOVA result indicated males perform significantly better after an error ($M = .16, SD = 1.85$) compared to females ($M = 1.07, SD = 1.63$), $F(1, 321) = 16.60, p < .01$.

In addition, an ANOVA was conducted to examine whether the psychological momentum groups differed significantly in how they tend to perform after an error. The ANOVA results produced a significant result, $F(2, 320) = 1184.22, p < .01$. Post hoc pairwise comparison analyses showed each psychological momentum group differed significantly from the other in the expected direction.

Gender Analyses

To test whether male and female golfers differ significantly on personal variables, a MANOVA analysis was conducted. The MANOVA produced a significant result, Wilks' Lambda = $F(11, 311) = 2.62, p < .01$. Follow up ANOVA tests were conducted on each variable, and the ANOVA F statistic for each variable is shown in table 4, along with the means and standard deviations for males and females.

Table 4

Means and Standard Deviations of Personal Variables by Gender

Personal Variable	Males ($N = 232$)		Females ($N = 91$)		F
	M	SD	M	SD	
Anxiety	16.04	3.95	16.80	4.28	2.28
Public Rumination	16.93	4.37	17.07	4.26	.07
Self-Confidence	70.23	16.73	65.73	19.01	4.37*
Fear of Failure	1.99	.59	1.94	.60	.44
Telic Dominance	15.34	4.89	15.37	4.36	.00
Positive Perfectionism	26.69	3.31	27.30	3.34	2.19
Negative Perfectionism	25.60	6.58	24.98	6.93	.58
Approach Coping	11.64	3.21	10.90	3.25	3.51
Avoidance Coping	11.82	2.68	12.33	2.85	2.32
Ego	19.20	4.66	18.81	5.45	.44
Task	25.57	2.80	26.46	3.25	6.01*

Note. M = mean; SD = standard deviation; F = F statistics for univariate test; * = $p < .05$.

Table 4 shows two variables reached significance at the .05 level. Specifically, males scored significantly higher in self-confidence, $F(1, 321) = 4.37$, $p < .05$, and lower in task orientation, $F(1, 321) = 6.01$, $p < .05$. No other personal variable produced a significant result.

Psychological Momentum Group Analyses

To test whether psychological momentum groups differ significantly on personal variables, a MANOVA analysis was conducted. The MANOVA produced a significant

result, Wilks' Lambda = $F(22, 620) = 1.82, p = .012$. Follow up ANOVA tests were conducted and the ANOVA F statistic for each variable is shown in table 5, along with the means and standard deviations for each psychological momentum group

Table 5

Means and Standard Deviations of Personal Variables by Psychological Momentum

Group

Personal Variable	Negative Facilitation (<i>N</i> = 93)		No Momentum (<i>N</i> = 132)		Negative Momentum (<i>N</i> = 98)		<i>F</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Anxiety	15.77	4.24	16.59	4.33	16.34	3.69	1.02
Public Rumination	17.12	4.44	16.76	4.67	17.02	4.02	.18
Self-Confidence	72.72	15.93	65.32	18.08	69.02	17.65	4.37*
Fear of Failure	1.98	.60	2.01	.60	1.95	.57	.27
Telic Dominance	16.10	4.83	13.87	4.60	15.93	4.56	7.21*
Positive Perfectionism	26.64	3.69	26.47	2.93	27.30	3.32	2.05
Negative Perfectionism	25.77	7.07	24.60	6.69	25.80	6.38	1.08
Approach Coping	10.87	3.12	11.87	3.42	11.51	3.14	2.34
Avoidance Coping	11.99	2.65	12.05	2.74	11.87	2.80	.13
Ego	19.47	5.17	18.54	5.09	19.24	4.52	.98
Task	25.66	3.05	25.61	2.93	26.09	3.05	.93

Note. *M* = mean; *SD* = standard deviation; *F* = F statistics for univariate test; * = $p < .05$;

Table 5 shows two variables reached significance at the .05 level. Specifically, groups differed in self-confidence, $F(2, 323) = 3.63$, $p = .03$, and telic dominance, $F(2, 323) = 7.51$, $p = .00$. No other personal variable produced a significant result.

Follow up post hoc pairwise comparison analyses indicated the negative facilitation group ($M = 72.72$, $SD = 15.93$) scored significantly higher in self-confidence compared to the no-momentum group ($M = 65.32$, $SD = 18.08$), but not the negative momentum group ($M = 69.02$, $SD = 17.65$). For telic dominance, the no-momentum group scored significantly lower ($M = 13.87$, $SD = 4.60$) than both the negative facilitation group ($M = 16.10$, $SD = 4.83$) and the negative momentum group ($M = 15.93$, $SD = 4.56$).

Discussion

It was hypothesised that male and female golfers would differ significantly in personal variables believed to influence an individual's performance after an error, and partial support for this hypothesis was found. Males and females differed significantly in two personal variables, self-confidence and task orientation. Self-confidence produced a significant result in the hypothesised direction, with male golfers having significantly higher levels of self-confidence compared to female golfers. Contradictory to what were hypothesised, female golfers had significantly higher task orientation compared to male golfers.

It was also hypothesised the psychological momentum groups would differ in personal variables. The psychological momentum groups were found to differ significantly in self-confidence and telic dominance. Partial support for the hypothesis that the negative

facilitation group would have significantly higher levels of self-confidence compared to the other two momentum groups was found, as the negative facilitation group scored significantly higher in self-confidence compared to the no-momentum group, but not the negative momentum group. Also, partial support for the hypothesis that the negative momentum group would score higher in telic dominance compared to the other two momentum groups was found, as the negative momentum group scored significantly higher in telic dominance compared to the no-momentum group, but not the negative facilitation group.

No significant differences in personal variables for gender or the psychological momentum groups was found for approach, avoidance, ego, trait anxiety, negative perfectionism, positive perfectionism, fear of failure, or rumination. Possible reasons for the lack of significant findings for these variables will not be addressed specifically, but in general under the limitations of this study. Discussions regarding the variables with significant findings, i.e. self-confidence, task orientation, and telic dominance will be addressed separately.

Task Orientation

It was hypothesised male golfers (who tend to perform better after an error) would have greater task orientation compared to female golfers. However, contrary to this hypothesis, male golfers were found to have significantly lower task orientation than female golfers.

This result was unexpected, as task orientation is associated with concepts that are seemingly conducive to optimal performance, such as focusing one's attention on improving skills, attaining task-mastery, persistence, and placing a high value on effort (Dweck, 1986; Dunn, Dunn, & Syrotuik, 2002). The researchers offer two potential explanations.

The traits of task-oriented individuals appear especially favourable to learning new skills, but perhaps certain aspects are counterproductive during performance, or more specifically, after an error in performance. For example, task-oriented individuals tend to try harder in the face of failure, due to the belief that increasing effort can earn future success (Hatzigeorgiadis, 2002). However, previous research has shown that increasing one's effort can actually have a paradoxical effect on performance. Laboratory studies have shown in situations where people tend to try harder (e.g. participants are offered rewards for improved performance) performance detriments often occur. Also, when competing in competitions, a highly motivating event, many athletes tend to perform worse (Baumeister & Showers, 1986). Therefore, it is possible task-oriented individuals perform worse after an error because of their tendency to increase their effort when confronted with failure.

An alternative explanation for why task orientation may be associated with poor performance after an error derives from an argument put forward by Hatzigeorgiadis and Biddle (2002). They speculated individuals high in task orientation have an adverse reaction when there is a discrepancy between their targeted and actual level of performance.

Generally, scholars claim that task oriented individuals are somewhat protected from perceptions of failure because of their internal focus on personal standards, which makes them less concerned when losing (Shaw et al., 1992). However, this definition of failure and losing only extends to failure in regards to ones performance in relation to others. What about when task oriented individuals are failing in relation to their own self-set standards?

Wilson, Hardy, and Harwood (2006) state, task oriented individuals feel successful when they reach a personal goal or standard. Therefore, it is reasonable to assume these individuals will also feel failure and experience adverse feelings when they do not achieve a personal goal or fall below their expected personal standard.

As an error (nett bogey) in the current study was a self-referenced standardised measure of performance, it seems plausible to suggest individuals high in task orientation may have experienced a greater negative reaction after an error. And this greater adverse reaction could explain why female golfers (who performed worse after an error) scored higher in task orientation compared to male golfers.

However, task orientation only produced a significant difference across gender. There were no significant differences found in task orientation across the three psychological momentum groups. Although the negative momentum group (perform worse after an error) did score highest in task orientation, which is consistent with the finding that females (perform worse after an error) scored highest in task orientation. Further research is encouraged to see whether support can be found for the negative influence of task orientation on performance after an error.

Self-Confidence

As hypothesised, male golfers (who tended to perform better after an error) had significantly higher levels of self-confidence compared to female golfers. The hypothesis that the negative facilitation group (who tended to perform better after an error) would perform significantly higher than the two other psychological momentum groups was partially supported. The negative facilitation scored the highest in self-confidence for all groups but only differed significantly from the no-momentum group.

The results of the current study contrasts the findings of Cornelius et al. (1997) who found no evidence to suggest self-confidence influences psychological momentum. However, Cornelius et al. study had low ecological validity, as it was held in a laboratory setting. Arguably, an artificial environment would not generate perceptions of psychological momentum that would mirror those generated in 'real-life' situations.

The results did concur with Weinberg et al. (1983) notion that athletes with higher levels of self-confidence would have a greater ability to come from behind. Weinberg et al. (1981) and Weinberg et al. (1983) found in their studies of tennis and basketball players respectively, that males were more likely than females to come from behind and win. They proposed the reason for the difference was due to a difference in self-confidence, and the results of the current study have produced some evidence supporting their theory.

Weinberg et al. (1983) believed athletes with greater self-confidence are more likely to come from behind, because they persist and apply effort for longer when facing failure,

whereas athletes with low self-confidence are more likely to give up. However, as discussed in the task orientation section, applying extra effort after an error in performance might actually produce a paradoxical effect. Therefore, the current researchers offer an alternative explanation.

Self-confidence may influence one's ability to recover from an error because of its effect on an individual's perception of threat. Individuals high in self-confidence remain calmer under pressure (Weinberg & Gould, 1999), and arguably are less likely to appraise an error in performance as a threat because of their expectation of future success and a belief in their ability to recover. Due to this belief they will experience less of the negative effects associated with perceptions of threat, such as anger, worry, and state anxiety after an error (Anshel & Delany, 2001), that can have a negative effect on subsequent performance.

However, the implications drawn regarding the influence of self-confidence on performance after an error must be viewed with caution, as the hypothesis for the psychological momentum groups was only partially supported. The result that the negative facilitation group did not score significantly higher than the negative momentum group was unexpected and future research is required before any definitive conclusions can be drawn.

Although, the current research has produced encouraging results that suggest self-confidence plays an important role in how one tends to perform after an error in performance. Self-confidence was the only personal variable to produce a significant result in the hypothesised direction, for both gender and psychological momentum

groups. Zinsser, Bunker, and Williams (1998) suggested self-confidence is the most important variable to performance success in sport and the results of this study somewhat supports this notion, as both the negative facilitation group (who perform better after an error) and male golfers (who perform better after an error) scored highest in self-confidence.

Telic Dominance

The hypothesis that the negative momentum group would score higher in telic dominance across the psychological momentum groups was partially supported. The negative momentum scored significantly higher than the no-momentum group, but not significantly higher than the negative facilitation group. Interestingly, the no-momentum group scored significantly lower in telic dominance than both the negative facilitation and negative momentum group. For gender, there was no significant difference found.

Although not hypothesised, finding the no-momentum group scored significantly lower in telic dominance (meaning they have a greater dominance towards the paratelic state, as the pair of states operate as bipolar opposites), appears to fit with Apter's (1982) reversal theory. Paratelic dominant individuals find pleasure in experiencing the present and gain satisfaction from an activity itself (Summers & Stewart, 1993, as cited in Kerr, 1997; Martin et al., 1987), and thus are presumably less concerned with errors in performance. Therefore, it should not be unexpected to find the no-momentum group (who by definition were unaffected by prior performance, as performance did not significantly change after an error) score significantly lower in telic dominance

compared to the negative momentum and negative facilitation group (who by definition, were both affected by prior performance, as performance got significantly worse or better after an error, respectively).

However, it was unexpected to find the negative facilitation group (who performed better after an error) scored similarly to the negative momentum group in telic dominance. It was believed telic dominance would have a negative affect on performance after an error, as Grewal and Lafreniere (2003) had found telic dominant individuals experience more adverse reaction to failure, and Martin et al. (1987) found telic dominant individuals performed worse under conditions of stress.

Perhaps differences in arousal levels could explain why the negative momentum and negative facilitation group both had high state dominance but differed in how they performed after an error. The telic-paratelic states have generated the most interest of metamotivational states because of the effect these states are believed to have on an individuals arousal levels (Kerr, 1999). For example, Bindarwish and Tenebaum (2006) found telic dominant individuals experienced greater arousal after negative feedback, compared to after false feedback. Whereas, paratelic dominant individuals experienced no change in arousal for the two feedback conditions, possibly because paratelic individuals, as previously mentioned, are less effect by prior performance.

Maybe the negative momentum and negative facilitation group differ in their 'base' arousal levels. For example, individuals in the negative momentum group may generally perform with average or slightly heightened levels of arousal, and after experiencing an error in performance arousal level may increase to a level that is

detrimental to performance (generally high levels of arousal are considered detrimental to performance, especially in tasks that require fine motor skills such as golf (Jones, 1995)). Whereas, individuals in the negative facilitation group may generally perform with low levels of arousal, and after an error their arousal level increases to an optimal level, improving subsequent performance. Future research could investigate differences in arousal levels across psychological momentum groups to ascertain whether the above theory has merit.

Limitations and Future Research

The limitations referred to in study one regarding how performance statistics were obtained also apply to this study (refer study one). In addition a few limitations specific to the current study need to be addressed, that may explain why a greater number of significant results were not found across the 11 personal variables. Avenues for future research are also addressed.

Firstly, the current study was limited in that contextual variables were not accounted for. Vallerand et al. (1988) claimed contextual variables such as whether a person is winning or losing, or the perceived importance of an event would influence perceptions of psychological momentum.

Therefore, how a golfer reacts to an 'objective' performance error (i.e. nett bogey or worse) may fluctuate because of contextual variables. For example, a golfer may score a nett bogey on a hole (which may normally generate perceptions of negative momentum), but if their score of nett bogey is the best score on that hole compared to

his or her playing partners, then perceptions of negative momentum may not eventuate, as comparatively he or she performed well.

In the current study, each objective error (nett bogey) was treated equally, i.e. in isolation of any contextual variables. Cornelius et al. (1997) found participant's perceptions of psychological momentum were influenced more by the knowledge of whether they were winning or losing (a contextual variable), rather than in relation to their own 'objective' individual performance. Cornelius et al.'s finding may explain why a greater number of significant results were not found in the current study. Future research should attempt to design studies that account for contextual variables to get a more accurate reflection of how an individual responds to prior performance.

Secondly, the current study examined the relationship between performance and personal variables. Participant's performance statistics were obtained over a period of two-years, but participants were only measured on personal variables at the end of this period. For the purposes of this study it was assumed a participant's questionnaire score reflected personal constructs (e.g. an individual's trait confidence, trait dominance, and trait anxiety) that remain relatively stable over time. However, it is quite possible an individual's level of self-confidence, coping style, or tendency to ruminate, etc., may have fluctuated or changed throughout the two-year period, which would affect the validity of the results.

Thirdly, perhaps a greater 'manipulation' of a performance error was required, to better categorise the different psychological momentum groups. Individuals were placed into one of three groups (negative momentum, negative facilitation, or no-momentum) by

virtue of how they perform after each *single* error (in comparison to their normal standard of performance). However, the affect of personal variables on an individual's performance after an error may be more evident after experiencing a greater number of errors, e.g. after three or four successive performance errors.

For example, an individual high or low in trait anxiety may be similarly affected by a solitary error in performance. But after three or four errors in succession, an individual high in trait anxiety may experience a much greater negative reaction compared to an individual low in trait anxiety, and as a result subsequent performance may differ more than it would than after a solitary error in performance. Therefore, analysing performance trends after more drastic errors may produce a better categorisation and separation of psychological momentum groups, and increase the power to detect significant results.

Finally, the current study was somewhat exploratory in nature, and due to its brevity only skimmed the surface in relation to the potential influence of personal variables on performance after an error. Future research could investigate this topic further by examining interactions between variables. It is possible interactions may have existed within the current variables tested, which may have masked further significant findings.

Conclusion

Study one found gender and individuals differences in how one tends to perform after an error. The aim of this study was to examine possible psychological reasons behind these differences.

A sample of golfers from study one were selected and examined on personal variables hypothesised to influence ones performance after an error. The personal variables were, trait anxiety, public rumination, telic dominance, negative perfectionism, positive perfectionism, self-confidence, approach coping, avoidance coping, ego orientation, task orientation, and fear of failure. The significant findings are summarised below:

- Male and female golfers differed significantly on two personal variables. Males had higher levels of self-confidence and lower task orientation.

In addition to the gender analysis, the entire sample was categorised into one of three psychological momentum groups by virtue of how they perform after an error. The groups were negative facilitation (performance tends to get better after an error), negative momentum (performance tends to get worse after an error), and a no-momentum group (subsequent performance was unaffected by an error). The main findings are summarised below.

- The psychological momentum groups differed significantly on two personal variables, self-confidence and telic dominance. For self-confidence, the negative facilitation group had significantly higher levels of self-confidence compared to the no-momentum group. For telic dominance, the no-momentum group were significantly less telic dominant compared to both the negative momentum and negative facilitation groups.

CHAPTER FIVE

GENERAL CONCLUSIONS

This dissertation has produced results in both study one and 2 that support the existence of psychological momentum and its affect on performance. Study one showed in a sample of over 3000 amateur golfers, that a greater number of golfers were influenced by prior performance than would be expected by chance alone.

This finding suggests the hot hand phenomenon is alive and kicking in the sport of amateur golf. The fact that 12.2% of golfers showed their performance was dependent on prior performance (at an alpha level of 0.05) has real life significance. The figure may not seem very high, but when you consider there are 158,000 registered golf club members (plus many more who play casually) in New Zealand (New Zealand Golf, Unknown), extrapolating these results would equate to nearly 20,000 golfers whose performance is seemingly affected by psychological momentum.

The first study also highlighted the existence of gender and individual differences in performance after an error, and the aim of Study Two was to investigate reasons behind these differences. Study Two found ones performance after an error was indeed influenced by personal variables, thus supporting the antecedents-consequences psychological momentum model (Vallerand et al., 1988) and multidimensional model of momentum (Taylor and Demick, 1994).

Specifically, self-confidence, task orientation, and telic dominance produced significant results. The no-momentum group was found to score significantly lower in telic dominance compared to the other two psychological momentum groups. This result suggests a low level of telic dominance somewhat inoculates individuals from being affected by prior performance.

Self-confidence and task orientation displayed consistent results across both gender and psychological momentum groups, with high levels of self-confidence seemingly advantageous to successful performance after an error. Whereas, possessing a high task orientation appears detrimental to subsequent performance after an error. Finding results that were consistent across both gender and psychological momentum groups provided additional support for the notion these variables influence performance after an error

The current dissertation has produced sufficient evidence to encourage future research into the influence of personal variables on psychological momentum. With further thought and improved methodologies, additional insight into this previously illusive construct may eventuate.

The strive for further knowledge is important, as attaining a greater understanding of the psychological variables that influence an athlete's ability to recover quickly from performance mistakes has real practical implications. Performance mistakes are an inevitable part of sport, and if athletes wish to perform to the best of their ability they need to be able to recover quickly from errors. Learning about variables that influence

performance after an error may advance our knowledge to a stage in which interventions can be developed to assist athletes in performing optimally after an error.

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APPENDICES

Appendix A: The Perception of Success Questionnaire

Name: _____

QUESTIONNAIRE 1

What does success in GOLF mean to you? There are no right or wrong answers. Circle the letter that best indicates how you feel.

WHEN PLAYING GOLF, I FEEL MOST SUCCESSFUL WHEN:

	Strongly Agree		Neutral		Strongly Disagree
I beat other people	A	B	C	D	E
I am clearly superior	A	B	C	D	E
I am the best	A	B	C	D	E
I work hard	A	B	C	D	E
I show clear personal improvement	A	B	C	D	E
I outperform my opponents	A	B	C	D	E
I reach a goal	A	B	C	D	E
I overcome difficulties	A	B	C	D	E
I reach personal goals	A	B	C	D	E
I win	A	B	C	D	E
I show other people I am the best	A	B	C	D	E
I perform to the best of my ability	A	B	C	D	E

Appendix B: The Coping Scale

QUESTIONNAIRE 2

The purpose of this questionnaire is to find out how you react to stressful events (e.g., making a physical or mental error) during golf competition. Before each statement, write the number that best describes how much each statement reflects your immediate reaction to a stressful experience, e.g. making a nett double bogey on the first and second holes.

Note: There are no right or wrong answers, so please be as candid as possible.

1	2	3	4	5
Not at All Like Me		Somewhat Like Me		Very Much Like Me

- _____ 1. I thought about everything that could now go wrong.
- _____ 2. I thought about something else that took my mind of the problem.
- _____ 3. I kept thinking about how I might have reacted differently.
- _____ 4. I thought about what to do next.
- _____ 5. I focused my attention on something else.
- _____ 6. I showed aggressive actions of frustration or anger.
- _____ 7. I kept thinking about what had happened.
- _____ 8. I accepted the problem as just part of the game.
- _____ 9. I thought about revenge, or striking back.
- _____ 10. I ignored or forgot about the problem.
- _____ 11. I tell myself that it's nothing serious.
- _____ 12. I closed my eyes and thought of something pleasant.

Appendix C: The Performance Failure Appraisal Inventory

Name: _____

QUESTIONNAIRE 3

Read each statement below and think of *how often you believe each is true* in your performance domain (i.e. golf). Use the rating scale below to indicate how much you believe each statement applies to you.

Response Scale				
-2	-1	0	+1	+2
Do not believe at all		Believe 50% of the time		Believe 100% of the time

- _____ 1. When I am failing, it is often because I am not smart enough to perform successfully.
- _____ 2. When I am failing, my future seems uncertain.
- _____ 3. When I am failing, it upsets important others.
- _____ 4. When I am failing, I blame my lack of talent.
- _____ 5. When I am failing, I believe that my future plans will change.
- _____ 6. When I am failing, I expect to be criticised by important others.
- _____ 7. When I am failing, I am afraid that I might not have enough talent.
- _____ 8. When I am failing, it upsets my "plan" for the future.
- _____ 9. When I am failing, I lose the trust of people who are important to me.
- _____ 10. When I am not succeeding, I am less valuable than when I succeed.
- _____ 11. When I am not succeeding, people are less interested in me.
- _____ 12. When I am failing, I worry that failing will affect my future plans.
- _____ 13. When I am not succeeding, people seem to want to help me less.
- _____ 14. When I am failing, important others are not happy.
- _____ 15. When I am not succeeding, I get down on myself easily.
- _____ 16. When I am failing, I hate the fact that I am not in control of the outcome.
- _____ 17. When I am not succeeding, people tend to leave me alone.
- _____ 18. When I am failing, it is embarrassing if others are there to see it.
- _____ 19. When I am failing, important others are disappointed.
- _____ 20. When I am failing, I believe that everybody knows I am failing.
- _____ 21. When I am not succeeding, some people are not interested in me anymore.
- _____ 22. When I am failing, I believe that my doubters feel that they were right about me.
- _____ 23. When I am not succeeding, my value decreases for some people.
- _____ 24. When I am failing, I worry about what others think about me.
- _____ 25. When I am failing, I worry that others may think I am not trying.

Appendix D: The Rumination Questionnaire

QUESTIONNAIRE 4

Please use the scale listed below and circle the number which best reflects to what extent you agree or disagree with each statement.

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					

Appendix E: Sport Competition Anxiety Test

Name: _____

QUESTIONNAIRE 5

Below are some statements about how persons feel when they compete in golf. Read each statement and describe if you HARDLY EVER, or SOMETIMES, or OFTEN feel this way when you compete in golf. If your choice is HARDLY EVER, blacken the square labelled A; if your choice is SOMETIMES, blacken the square labelled B; and if your choice is OFTEN, blacken the square labelled C. There are no right or wrong answers. Do not spend too much time on any one question. Remember to choose the word that describes how you *usually* feel when competing in *golf*.

	Hardly Ever	Sometimes	Often
1. Competing against others is socially enjoyable.	A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>
2. Before I compete I feel uneasy.	A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>
3. Before I compete I worry about not performing well.	A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>
4. I am a good sport when I compete.	A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>
5. When I compete I Worry about making mistakes.	A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>
6. Before I compete I am calm.	A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>
7. Setting a goal is important when competing.	A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>
8. Before I compete I get a queasy feeling in my stomach.	A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>
9. Just before competing I notice my heart beats faster than usual.	A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>
10. I like to compete in games that demand considerable physical energy.	A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>
11. Before I compete I feel relaxed.	A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>
12. Before I compete I feel nervous.	A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>
13. Team sports are more exciting than individual sports.	A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>
14. I get nervous wanting to start the game.	A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>
15. Before I compete I usually get uptight.	A <input type="checkbox"/>	B <input type="checkbox"/>	C <input type="checkbox"/>

Appendix F: The Positive and Negative Perfectionism Scale in Sport

Name: _____

QUESTIONNAIRE 6

Please circle the appropriate number under the column which applies best to each of the following statements. Ensure none are missed out. All replies are strictly confidential.

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
1.	It feels as though my best is never good enough for other people				1 2 3 4 5
2.	If I make a mistake I feel the whole thing is ruined				1 2 3 4 5
3.	When I am competing against others, I am motivated by wanting to be the best				1 2 3 4 5
4.	I know the kind of person I ought or want to be, but feel I always fall short of this				1 2 3 4 5
5.	I feel good when pushing out the limits				1 2 3 4 5
6.	Other people expect nothing less than perfection of me				1 2 3 4 5
7.	My successes spur me on to greater achievements				1 2 3 4 5
8.	If I fail people, I fear they will cease to respect or care for me				1 2 3 4 5
9.	I feel guilty or ashamed if I do less than perfectly				1 2 3 4 5
10.	No matter how well I do I never feel satisfied with my performance				1 2 3 4 5
11.	I gain deep satisfaction when I have perfected something				1 2 3 4 5
12.	I feel I have to be perfect to gain people's approval				1 2 3 4 5
13.	I worry what others think if I make mistakes				1 2 3 4 5
14.	I get fulfilment from totally dedicating myself to a task				1 2 3 4 5
15.	The better I do, the better I am expected to do by others				1 2 3 4 5
16.	I enjoy working towards greater levels of precision and accuracy				1 2 3 4 5
17.	I would rather not start something than risk doing it less than perfectly				1 2 3 4 5
18.	When I do things I feel others will judge critically the standard of my work				1 2 3 4 5
19.	I like the challenge of setting very high standards for myself				1 2 3 4 5

Appendix G: The Trait Sport Confidence Inventory

Name: _____

QUESTIONNAIRE 7

Think about how self-confident you are when you compete in golf. Answer the questions below based on how confident you *generally feel* when you compete in golf. Compare your self-confidence to the *most self-confident golfer* you know. Please answer as you *really* feel, not how you would like to feel.

When you compete, how confident do you *generally feel*? (circle number)

- | | | | | |
|-----|--|-----|-----------------|------|
| 1. | Compare your confidence in <i>your ability to the execute skills necessary to be successful</i> to the most confident athlete you know. | Low | Medium | High |
| | | 1 | 2 3 4 5 6 7 8 9 | |
| 2. | Compare you confidence in <i>your ability to make critical decisions during competition</i> to the most confident athlete you know. | Low | Medium | High |
| | | 1 | 2 3 4 5 6 7 8 9 | |
| 3. | Compare your confidence in <i>your ability to perform under pressure</i> to the most confident athlete you know. | Low | Medium | High |
| | | 1 | 2 3 4 5 6 7 8 9 | |
| 4. | Compare your confidence in <i>your ability to execute successful strategy</i> to the most confident athlete you know. | Low | Medium | High |
| | | 1 | 2 3 4 5 6 7 8 9 | |
| 5. | Compare your confidence in <i>your ability to concentrate well enough to be successful</i> to the most confident athlete you know. | Low | Medium | High |
| | | 1 | 2 3 4 5 6 7 8 9 | |
| 6. | Compare your confidence in <i>your ability to adapt to different game situations and still be successful</i> to the most confident athlete you know. | Low | Medium | High |
| | | 1 | 2 3 4 5 6 7 8 9 | |
| 7. | Compare your confidence in <i>your ability to achieve your competitive goals</i> to the most confident athlete you know. | Low | Medium | High |
| | | 1 | 2 3 4 5 6 7 8 9 | |
| 8. | Compare you confidence in <i>your ability to be successful</i> to the most confident athlete you know. | Low | Medium | High |
| | | 1 | 2 3 4 5 6 7 8 9 | |
| 9. | Compare your confidence in <i>your ability to consistently be successful</i> to the most confident athlete you know. | Low | Medium | High |
| | | 1 | 2 3 4 5 6 7 8 9 | |
| 10. | Compare your confidence in <i>your ability to think and respond successfully during competition</i> to the most confident athlete you know. | Low | Medium | High |
| | | 1 | 2 3 4 5 6 7 8 9 | |
| 11. | Compare your confidence in <i>your ability to meet the challenge of competition</i> to the most confident athlete you know. | Low | Medium | High |
| | | 1 | 2 3 4 5 6 7 8 9 | |
| 12. | Compare your confidence in <i>your ability to be successful even when the odds are against you</i> to the most confident athlete you know. | Low | Medium | High |
| | | 1 | 2 3 4 5 6 7 8 9 | |
| 13. | Compare your confidence in <i>your ability to bounce back from performing poorly and be successful</i> to the most confident athlete you know. | Low | Medium | High |
| | | 1 | 2 3 4 5 6 7 8 9 | |

13.

- Going to a party
 Going to a meeting
 Not sure

14.

- Leisure activities
 Work activities
 Not sure

15.

- Taking holidays in many different places
 Taking holidays always in the same place
 Not sure

16.

- Going away on holiday for two weeks
 Given two weeks of free time, finishing a needed improvement at home
 Not sure

17.

- Taking life seriously
 Treating life light-heartedly
 Not sure

18.

- Frequently trying strange foods
 Always eating familiar foods
 Not sure

19.

- Recounting an incident accurately
 Exaggerating for effect
 Not sure

20.

- Spending \$100 having an enjoyable weekend
 Spending \$100 on repaying a loan
 Not sure

21.

- Having continuity in the place where you live
 Having frequent moves of house
 Not sure

22.

- Going to an art gallery to enjoy the exhibits
 To learn about the exhibits
 Not sure

23.

- Watching a game
 Refereeing a game
 Not sure

24.

- Eating special things because you enjoy them
 Eating special things because they are good for your health
 Not sure

25.

- Fixing long-term life ambitions
 Living life as it comes
 Not sure

26.

- Always trying to finish your work before you enjoy yourself
 Frequently going out for enjoyment before all your work is finished
 Not sure

27.

- Not needing to explain your behaviour
 Having purposes for your behaviour
 Not sure

28.

- Climbing a mountain to try to save someone
 Climbing a mountain for pleasure
 Not sure

Name: _____.

29.

- Happy to waste time
 Always having to be busy
 Not sure

30.

- Taking risks
 Going through life safely
 Not sure

31.

- Watching a crucial match between two ordinary sides
 Watching an exhibition game with star performers
 Not sure

32.

- Playing a game
 Organising a game
 Not sure

33.

- Glancing at pictures in a book
 Reading a biography
 Not sure

34.

- Winning a game easily
 Playing a game with the scores very close
 Not sure

35.

- Steady routine in life
 Continual unexpectedness or surprise
 Not sure

36.

- Working in a garden
 Picking wild fruit
 Not sure

37.

- Reading for information
 Reading for fun
 Not sure

38.

- Arguing for fun
 Arguing with others seriously to change their opinions
 Not sure

39.

- Winning a game
 Playing the game for fun
 Not sure

40.

- Travelling a great deal in one's job
 Working in one office or workshop
 Not sure

41.

- Planning ahead
 Taking each day as it comes
 Not sure

42.

- Planning a holiday
 Being on holiday
 Not sure

Appendix I: Example of Questionnaire Pack Cover Sheet

22 May 2007

Dear Member,

We have been approached by Gavin Hamlyn, a Massey University student, who is undertaking a golf research project to gain his Master of Arts, with a major in psychology.

To complete his study, Gavin has asked us to see if we could approach a number of our members to complete questionnaires relating to their golf games over the past two years.

To this end, we are forwarding the project information on Gavin's behalf to a small number of our members. Attached to this letter is an information sheet together with the questionnaires. Participation would be greatly appreciated but we advise you that you are under no obligation to complete or take part in this study.

If you have any queries, please do not hesitate to contact us.

Kind Regards

Gary Smith

General Manager

Appendix J: Questionnaire Pack Information Sheet

INDIVIDUAL DIFFERENCES OF PSYCHOLOGICAL MOMENTUM IN GOLF

Information Sheet

Project Outline

You are invited to take part in a student research project undertaken as part of the requirements for attaining a Master of Arts, with a Major in Psychology at Massey University. Please read the information below if you are interested in participating. Your participation would be greatly appreciated and assist the researcher in attaining the above qualification.

The research is being conducted by Gavin J Hamlyn, Masters Student, School of Psychology, Massey University, [REDACTED] The research will be supervised by Dr Richard Fletcher, School of Psychology, Private Bag 102 904, Massey University, Albany, Auckland, 09 414 0800 x 41213, R.B.Fletcher@massey.ac.nz.

The researcher selected New Zealand Golf Clubs that use the Golf AutoScore™ automated scoring system, and your Golf Club was one of those selected. The manager was approached to gain permission to post the research project to club members over 18 years of age, and who have at least 15 rounds of golf (with an official New Zealand handicap) recorded in the clubs database within the last two years.

Note: Please only return questionnaires if you are over 18 years of age. If you are under 18 years of age and have received this letter please accept our apologies.

The purpose of this research is to explore the impact our minds can have on various aspects of golfing performance. For example, do particular thinking styles affect ones ability to recover from an error (e.g. scoring a double bogey on a hole)? To explore the answer to this question, we would like you to complete 8 straightforward short questionnaires.

If you agree to participate in the project, the researcher would like to use the data attained from your questionnaire in conjunction with your golf round statistics. Returning the questionnaires in the prepaid envelope provided will imply your informed consent for the researcher to use your golf round statistics over the last 2 years, which will be attained from either your respective golf club or from the www.dotgolf.co.nz national golf website for the purposes of this research.

The enclosed questionnaires should take just over 20 minutes to complete. Upon completion you will need to return the questionnaires in the prepaid envelope provided. Please return the questionnaires within 2 weeks of receiving this letter to ensure your inclusion in the research project.

Confidentiality

- Only the researcher will have access to the information you provide and it will not be used for any other research without attaining your consent to do so.
- The research paper will not disclose the personal identity of participants or report any individual results. The project results will only report group data.

Returned questionnaires will be stored under lock and key at the Massey University Campus located in Wellington for a period of 5 years. After the 5-year period, the researcher will use a paper shredder to dispose of the questionnaires.

The researcher will record your questionnaire responses in a computer excel file on the researcher laptop. The computer will be protected by a password known only by the researcher. After a period of 5 years all computer files relating to the project will be deleted.

Participation

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- Decline to answer any particular question;
- Ask any questions about the study at any time during participation;
- Provide information on the understanding that your name will not be used.
- Be given access to a summary of the project findings when it is concluded.

Note: The questionnaires must be returned to (a prepaid envelope has been provided):

██████████
██████████
██████████

If you have any questions or concerns regarding the project, or wish to obtain a summary of the project's findings, please do not hesitate to contact either the researcher and/or supervisor via email (details provided above). If you request a summary of the results, an email will be sent promptly confirming receipt of your email, and the results of the study will be emailed after its completion.

This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application 06/079. If you have any concerns about the conduct of this research, please contact Associate-Professor Ann Dupuis, Acting Chair, Massey University Human Ethics Committee: Northern, telephone 09 414 0800 x 9054, email humanethicsnorth@massey.ac.nz.