Attentional focus, motor learning, and expectancy effect

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Abstract

This dissertation examines the effect of attentional focus and expectancy on motor performance. The theoretical basis of attentional focus effects come from previous works of internal versus external type of focuses (Wulf, 2007), which states that external type of focus is superior for learning and performing motor skills. The theoretical mechanism of external versus internal focus is explained in relation to motor automaticity. Another series of research on the similar concept of attentional focus and motor performance utilised a distraction method (dual-task paradigm) to come to a similar conclusion (Beilock, 2011). Experts’ performance is not affected by distraction because their motor skills is automated and require low attentional capacity. The current research ran a series of studies to replicate and extend these previous findings and clarify some of the conflicting classification of different types of focuses. The purpose was to simplify some of the theoretical issues and enhance ecological validity for practitioners (e.g. coaches and athletes). However, current experiments did not find statistical significance of attentional focus effects on performance. Hence, the direction of the research turned to look at other variables potentially affecting performance. A key variable from the conducted experiments was identified as participants’ outcome expectancy. This expectancy effect was then manipulated in the research designs of two further studies which found significant effects. Participants performed accordingly to their outcome expectation regardless of the internal, external, or distraction methodology used. This finding was discussed in terms of potential research issue and practical implications in coaching and learning area.
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Attention, motor automaticity, motor learning, golf putt, distraction, internal focus, external focus, outcome expectancy

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Chapter 1

In Thailand, the Thai Junior Golf Club (TJGC) is the main governing body for junior golfers around the country. It organises two-day tournaments every month in an attempt to rank junior golfers from the ages of 9 to 18. The TJGC is also the primary funder of top players who compete in international competitions. In 2002, on a Sunday (the second day of tournament), an 18-year-old golfer approached the tee-off of the 17th hole. He felt good, with a comfortable three shot lead and only two holes to go. Several players competed on that day, which meant that the pace of play was slow and players had to wait around for their turn. Like any sportsperson, he kept himself warmed up and ready for play by practicing his swings. His friend, who ranked second on the leader board, had been watching him practice for some time. The friend casually commented, “You are playing really well today, what have you done to your swing? New coach? Any new techniques you are holding out on me?” Even though the comments were innocent, without any ill intention, the 18-year-old golfer was suddenly aware of how he was swinging the club. He began to unconsciously compare his current technique to previous swing techniques. He felt that the swing was not smooth, the grip was awkward, and his stance was off. For his 17th hole, he hit a triple bogey and went on to hit a bogey for the last two holes. He finished second, one stroke after his friend. Unfortunately, this is a true story, which happened to the author a little over 10 years ago. This sporting experience is quite common to golfers and other members of the sporting community. Rotella (2009), the acclaimed author of Golf is not a Game of Perfect, stated in Golf Digest that one of his professional clients received negative comments from his peers about the stance and posture of his putt. Soon after, his performance suffered. A similar note from Beilock (2011), a researcher in the area of choking under pressure, mentioned that during her academic years, she noticed that her friend was much better at taking tests and performing when it counted. On the other hand, Beilock’s performance (both in the sporting field and classroom) was not at the same level as the practice sessions she had prior to testing or competitions. In these situations, effects on performance are often attributed to the cognitive component of attentional focus (Baddeley, 1972; Kahneman, 1973; Pashler, 1998; Pashler, Johnston, & Ruthruff, 2001). The current thesis is interested in the effects of attentional focus on motor skills, especially in relation to the golf putting skill. The reasoning for choosing this skill was two-fold: one, it is a movement that the author is comfortable and experienced with, and two, the movement does not require a high level of physical ability and is simplistic enough to describe and demonstrate to novices in laboratory setting. It is worth noting that golf putting is still complex in the sense that fine motor accuracy is needed to achieve a high performance outcome. The following literature review will describe the most relevant studies in the arena of golf putting.
The literature review includes an investigation in the area of choking and performance. The phenomenon of choking, explained by Baumeister (1984) in the theory of self-focused attention, is caused when attention is allocated towards the mechanisms of a skill. It is suggested that when performers pay close attention to the step-by-step mechanisms of a movement, their attention interferes with the procedural knowledge and impairs performance. Recently, Beilock and Carr (2001) compared the theory of self-focused attention (Baumeister, 1984) to the distraction theory (Wine, 1971). A common theme in these two theories is the explanation of attentional focus. The authors suggest that whether it is the pressure to perform which is causing an attentional shift or not, attention is still the final factor affecting performance.

Another example of attentional shift is verbal instructions to performers (e.g. Wulf & Su, 2007), whereby the experimenter instructs the participants to focus their attention on different aspects of the movement during the performance. Arguably, this resembles coaching when athletes receive feedback or instructions. Wulf (2007) argues that attention that is directed towards skills or bodily movements (i.e. internal focus) impairs performance, because the allocation of attention disrupts the motor automaticity of the skilled movement. On the other hand, attention that is directed towards the outcome of the movement (i.e. external focus) enhances motor automaticity and leads to better performance. It should be noted that this enhancement of motor automaticity was not discussed in much further detail.

The recurring theme in existing research is that different types of attentional focus affect motor performance. The issue lies in the variation of how attentional focus was categorised and manipulated. As previously mentioned, some researchers simply used verbal instructions to direct the allocation of attentional focus (e.g. Wulf & Su, 2007), whereas others applied a secondary or distractor task to occupy attentional capacity (Beilock & Carr, 2001). Consequently, the effect of attentional focus differs depending on research methodologies. The overall aim of the current thesis is to investigate the effect of attentional focus on motor skills. Although part of the interest comes from choking under pressure, the thesis will focus on the allocation of attentional focus. This is because the effects of choking are attributed to changes in the locality of attention (e.g., Wine, 1971; Baumeister, 1984; Beilock & Carr, 2001; Wulf, 2007). Practically, understanding the effects of different styles of attentional focus will help to enhance the motor skills of individuals during training and performance. The first chapter will provide a comprehensive overview of the relevant literature and cognitive theories relating to attentional focus and motor skills. Chapters two to five will report on four studies, conducted by the author, which examine the interaction between attention and motor performance in a golf-putting task. Chapters six and seven will discuss the issue of the expectancy effect to follow up issues that were raised in previous studies. The final
chapters will provide a general discussion about the methodological, theoretical, and applied implications of the research project.

Attention

Attention is one of the major research topics in cognitive psychology. The notion of attention as a cognitive process can be evidenced back as far as the 1930s; for example, the psychological refractory period (Telford, 1931) and the stroop effect (Stroop, 1935). These researches were the first to consider the idea of central mechanisms or processes that govern human ability to perform tasks or respond to stimuli (Welford, 1952). Attention is often studied in the context of stimulus-response theory, which differentiates between sensory systems, for example visual attention or auditory attention. For the purpose of this dissertation, attention will be discussed in terms of a central cognitive process that is required for the completion of a motor task.

Attention as a central cognitive process

As a central cognitive process, attention is defined as the selection of thoughts, stimuli, or environmental information, for further cognitive processing (Anderson, 2005). An example to illustrate attention as a central cognitive process is the fact that human performance tends to suffer when two tasks are performed simultaneously. There are two main theories that explain this phenomenon. The central processing bottleneck concept, whereby cognitive processes are carried out sequentially, suggests that two tasks need to compete in order to be processed by the same underlying mechanism, which results in an inability to process two tasks at once. On the other hand, the limiting resources concept argues that different tasks require different amounts of mental processing resources. Therefore, if one task occupies the majority of resource capacity, the secondary task will suffer due to the lack of mental resource capacity (Pashler & Johnston, 1989).

The majority of empirical evidence to support the limitations of attention largely stem from research looking at the human perceptual system. The most popular perceptual modalities studied are the auditory system and the visual system. Research on the auditory system includes the early work on Broadbent’s Filter Theory (Broadbent, 1958) of unattended stimuli, looking at participants’ ability to hold information without attention (e.g. letters at left or right visual fields, words spoken into left or right ears; Erikson & Hoffman, 1973). Visual perception research often looks at divided attention tasks, in which participants need to identify visual stimuli simultaneously (e.g., Sperling, 1960; Estes & Taylor, 1964). These tasks typically involve searching for a target stimulus among distractors. Studies using these tasks have consistently found that response times increase when the number of distractors increases on search display.

Pashler and Johnston (1998) viewed central processing of attention as a time-sharing entity that holds information temporarily, ready to be processed for outputs. Thus, explaining the psychological refractory period as the mechanism that allocates resource capacity to tasks in a
timely fashion. Evidence of this notion is typically demonstrated with dual-task methods, for example, shadowing spoken words while typing a manuscript (Shaffer, 1975) or playing the piano (Allport, Antonis, & Reynolds, 1972). Pashler and Johnston (1998) suggest that these dual-task skills are due to one’s ability to effectively switch attentional resources between two tasks to the point that they are carried out simultaneously. The psychological refractory period also supports the notion of dual-tasks methods (e.g., Borger, 1963; Bertelson & Tisseyre, 1969; Pashler, 1994), whereby a processing delay is experienced when the stimulus of different tasks are presented closely in time. In addition, it should be noted that the performance of dual-tasks tends to be slightly worse compared to single-task counterparts.

The purpose of this dissertation is to examine the effect of attentional focus on motor skills within the sport domain of golf. Based on the existing body of research, it can be established that there are cognitive mechanisms involved in selecting and processing environmental stimuli in order to respond to or perform tasks. However, these cognitive mechanisms are limited due to the bottleneck issue or limited resources. Therefore, both distractions and dual-tasks can be expected to disrupt performance.

**Theoretical Framework: Attention and Motor Skills**

Based on the properties of attention as a central cognitive process as discussed previously, the link between attentional focus and motor skills can be established. First, attentional capacity is required in order to perform motor tasks which vary in the amount of attentional capacity they require. Second, the amount of attentional capacity needed depends on many factors (e.g., concurrent task, task difficulty, and motor automaticity). Automaticity in motor skills is related to the concept of motor program, which is a mental representation of a predetermined sequence of movement after a period of repeated practice (Keele (1973). Motor program has also been described as a skill or movement that is centrally represented in one’s memory (Summers, 1981), or a set of pre-structured motor commands from the executive level of cognitive functioning (Schmidt and Wrisberg, 2004).

The evidence for the relationship between attention and motor automaticity can be seen in the novice versus expert research paradigm. Typically, the early stage of skill acquisition in novices demands a large attentional capacity for movement preparation and control (Anderson, 1993). This is because novices need to constantly access their declarative knowledge about the skill from their working memory (Anderson, 1993; Fitts & Posner, 1967). Once novices have had enough repeated practice, their declarative knowledge becomes procedural, which is less attention demanding and more automatic. Therefore, it can be argued that the link between attentional focus and motor performance is related to the automaticity of the skilled movement. That is, a motor
movement that has been repeatedly practiced and can be performed automatically does not require as much attentional focus resources as a novel movement (Shiffrin & Schneider, 1977).

**Effect of attentional focus on motor skills**

Aside from the difference in motor automaticity between novices and experts, another notable link between attention and motor performance stems from research on choking under pressure. Baumesiter (1984) defined choking under pressure as a situation where there is a decrease in the level of performance as a result of an increase in expectations, specifically in pressure situations. Issues regarding the practicality of this definition are discussed in recent reviews (Mesagno & Hill, 2013; Buszard, Farrow, & Masters, 2013). Topics such as the definition of optimal performance, criteria for choking, and level of perceived pressure will not be discussed in detail as the main aim of the current project is to specifically investigate the effect of attentional focus on performance.

Although the current research does not directly investigate choking under pressure, many theoretical explanations on the effects of attentional focus on performance come from this premise. The empirical purpose of the current research is to examine whether the different locality of attentional focus leads to differences in performance. It is expected that regardless of whether one is in a pressured situation or not, the motor performance should be affected by a diversion of attentional focus.

One research method that can be used to examine attention and motor performance is the dual-task paradigm, which asks participants to perform a secondary task concurrently with the primary task of interest. According to the Distraction Theory (Wine, 1971), pressure causes the attentional focus to shift from the task at hand to other irrelevant cues, such as worries. Therefore, pressure creates a dual task situation that competes for attention. Performance is expected to suffer when participants have to perform two tasks simultaneously compared to a single task.

Alternatively, Explicit Monitoring theory (Beilock & Carr, 2001) suggests that pressure causes a shift of attention to the step-by-step skill movements, which disrupts the well-learned performance that is procedural in nature. Theoretical explanations of this phenomenon have been discussed extensively. For example, Progression-regression Hypothesis (Fitts, Bahrick, Noble, & Briggs, 1961) proposes that human perceptual-motor performance develops systematically through skill progression, and that this progression can be reverted back to earlier stages of development through induced stress. This hypothesis is often tested with a continuous visual-motor tracking task, whereby different types of error (e.g. velocity, acceleration) were interpreted as different cognitive strategies that developed as a result of practice (e.g. Fuchs, 1962; Garvey; 1960; Jagacinski & Hah, 1988). General findings were that when participants were induced with stress, the systematic trends of error reverted back to similar trends in the initial stages of learning. Henry
and Rogers (1960) proposed the Memory Drum theory, which states that there is an unconscious mechanism that executes complex motor movements through the use of stored information in motor memory. This mechanism controls the nerve impulses in the appropriate pathways and thus generates longer reaction times compared to a simpler response movement. In relation to choking, these explanations can be compared to a similar conclusion that complex motor movements are automatic in nature (e.g. unconscious execution) and that this automaticity can be disrupted.

The concept of re-investment can also be applied to the choking phenomenon through the disruption of automatic skills. Deikman (1969) first used the term in the context of deautomization of movements due to the re-investment of attentional focus on actions. Reinvestment theory is based on the notion of progressive skill learning from declarative knowledge to procedural knowledge (Fitts & Posner, 1967). Specifically, it proposes that experts’ skill movements can be disrupted by using declarative knowledge to control the action. Masters (1992) and Masters, Polman, and Hammond (1993) unified the Reinvestment Theory for different views of conscious attentional control and operationalised reinvestment as the “manipulation of conscious, explicit, rule based knowledge, by working memory, to control the mechanics of one’s movements during motor output” (Masters & Maxwell, 2004, p. 208).

These theories all agree that attentional focus can influence the performance of motor movement. This is the basis of the current project, which will investigate the effects of different styles of attentional focus on movement performance. Since the attentional focus manipulations in this project are based on the relatively recent work of Beilock and Wulf, their studies will be discussed in more detail in the next section.

**Distraction research paradigm**

In their study of four experiments, Beilock & Carr (2001) aimed to examine two competing theories that explain the phenomenon of choking under pressure, including the Explicit Monitoring Theory and Distraction Theory. First, they established that expert skill movements are controlled by procedural knowledge; thus, the movements are executed automatically in real-time performance. They achieved this by comparing generic knowledge (i.e. steps that are involved in golf putting) and episodic recollection (i.e. the recollection of steps that golfers use in a particular golf putt). The golf experts produced more steps in generic knowledge but less in episodic recollection compared to novice golfers. This means that even though experts are more knowledgeable in the steps used in a golf putt, they are not necessarily aware that they executed the steps in real-time performance. Beilock and Carr (2001) established that this was evidence for proceduralised skills in experts. In their other experiments, Beilock and Carr (2001) created a dual-task situation and self-conscious condition to investigate the credibility of the Distraction theory and Explicit Monitoring theory. The dual-task condition involved performing a golf putting task
simultaneously with a word monitoring task, in which participants had to indicate a target word in a sequence of random words played at two second intervals. The self-conscious condition was arranged by setting up a video camera in front of participants and informing them that they would be filmed, and that the film would be analysed by a number of golf teachers and coaches. This was done to induce self-consciousness in participants by raising the awareness of their movements. Beilock and Carr (2001) found that when golf putting was more proceduralised (i.e. for expert participants), the heightened pressure situation (i.e. dual task) had detrimental effects on performance. However, experts who were accustomed to the self-conscious condition did not exhibit deterioration in putting performance under the high-pressure situation. Therefore, it was concluded that pressure situations shift attention to focus on the skill processes and disrupt the automatic control of movements, consequently worsening performance.

Beilock et al., (2002) conducted a similar study to address the issue of attentional focus and motor skill performance directly. In this study Beilock et al., (2002) recruited 21 undergraduate students who had at least two years of high school varsity golf experience or an official golfer’s handicap less than 8. The task was to putt golf balls on a carpet from the distances of 1.2, 1.4, and 1.5 metres in dual-task and skill-focused conditions. The dual-task condition was similar to that in Beilock and Carr (2001), whereby participants were required to perform a golf putting task and tone monitoring task simultaneously. The only difference was that tones were used instead of words. In the skill-focused condition, participants were instructed to monitor their putting swing and to say ‘stop’ out loud when they finished the follow-through of their swing. They found that participants performed better in the distraction condition compared to the swing monitoring condition and concluded that attending to skill execution negatively affects the performance of well-learned motor skills.

Beilock et al (2002) also extended the study by using a soccer dribbling task with similar methods. The same pattern of results emerged, such that expert soccer players dribbled faster in the dual-task condition compared to the skill-focused condition. It was also discovered that in novice players, skill-focused attention actually produced better performance compared to the dual-task condition. Based on this finding, the authors suggested that the execution of a well-learned motor skill does not require online attentional focus and thus experts’ performance was not affected by the dual-task. Beilock et al (2002) concluded that skill-focused attention harms motor skill performance in experts, which is consistent with the Explicit Monitoring Theory that explains ‘choking under pressure’.

Beilock et al (2002) used a similar manipulation of attention as their previous studies, with the additional task of a ‘funny putter’, which was an S-shaped shaft putter. The aim of their study was to constrain experts with a novel instrument to make their skill execution less automatic. They
found that when experts used an S-shape putter, their attention focused on skill execution and they had less attentional capacity to attend to other tasks (i.e. dual-task). Therefore, movement that is well-learned or automatic in nature does not require attentional capacity for execution. In addition, it was found that experts’ performance benefited from situations that limited attentional focus to skill execution, particularly under time constraint conditions (Beilock, Bertenthal, McCoy, and Carr, 2004). Furthermore, the more time available to imagine skill execution harms experts’ proceduralised motor skill performance (Beilock & Gonso, 2008). The interesting aspect of this distraction methodology is that for experts, performance could potentially benefit from having limiting attentional resources on the task at hand. From a practical point of view, this is somewhat contradictory to common sense, in that experts’ performance could be improved by directing attention away from the main task. For novices, however, the findings still adhere to the common practice that they should not be distracted and all attentional focus resources should be allocated to the motor task.

**Verbal instruction as attentional focus manipulation**

The use of verbal instructions to direct performers’ attentional focus is a different research method used in the area of attentional focus. Overall, the explanation was that a particular type of focus can lead to an enhancement in motor automaticity (Wulf, 2007). Arguably, this method of directing attentional focus holds better practical implications compared to the distraction method, especially in the arena of coaching and learning. Research findings can be applied to the sporting context, by teaching coaches how to properly direct athletes’ attention with verbal instructions.

Wulf’s series of studies aimed to investigate the effects of different verbal instructions on acquiring new motor skills. Wulf, Hob, and Prinz (1998) reported that there were many pieces of anecdotal evidence to suggest that attentional focus on players’ movements may disrupt performance. For example, it is generally believed that sports players will perform poorer if they direct their attentional focus towards their movements. As stated earlier, the author experienced this first hand in a junior-level golf competition. The effectiveness of this tactic is very hard to evaluate objectively as some golfers seem to be very sensitive about comments while others are not.

Wulf, Hob, and Prinz (1998) classified attentional focus into two categories: internal, which is attending to one’s own movements, and external, which is attending to the environment. The authors hypothesised that attending externally would enhance players’ motor performance. This hypothesis was based on the concept of automaticity of well-learned movements, whereby not focusing on the movement would facilitate the automaticity of motor skills.

Wulf, Hob, and Prinz (1998) conducted a study with a classic learning design. The task for participants was to balance on a ski simulator. They practiced under external instruction (exert force on the wheel of ski simulator machine), internal instruction (exert force on participants’ own
feet), or no instruction (control condition). After training for two days, they did a retention test without any instruction on the third day. Wulf, Hob, and Prinz (1998) found that during the practice trials, the external group performed the best while the internal group performed the worst. In retention trials, the external group still had superior performance while the internal and control groups performed similarly. Therefore, giving verbal instructions during practice, without directing comments to bodily movements, is the most beneficial form of coaching.

The balancing task method has been replicated many times. For example, Wulf, McNevin, and Shea (2001), Shea and Wulf (1999), and Wulf, Shea, and Park (2001) all used a stabilometer and found differences in performance favouring external focus in retention trials. McNevin, Shea, and Wulf (2003) extended the study by increasing the magnitude of the external focus. It was explained that the locality of external cues directly correlates with the magnitude of effect. Farther locality of attention (i.e., more distance away from the bodily aspect of movement) has a stronger beneficial effect on motor skills compared to an external focus that is closer to the performer. They demonstrated this on the stabilometer task with three sub-categories of external focus. Participants were instructed to focus on markers placed near their feet, on the platform of the stabilometer, or away from the platform. They found that not all forms of external focus produce superior performance compared to forms of internal focus. Specifically, participants performed best when they focused on the markers away from the platform compared to markers placed near their feet and on the platform.

This methodology has been applied to golf tasks. Wulf, Lauterbach, and Toole (1999) conducted an experiment on an outdoor lawn. Twenty-two participants who had no golfing experience were recruited and taught how to make a chip shot with different instruction methods. The study was a between-subjects design, with two conditions (internal versus external), and included both practice trials with instructions and retention trials with no instructions. Participants had to chip a golf ball from 15 metres away from the target with four concentric circles that had radii of 1.45, 2.45, 3.45, and 4.45 metres. The participants’ performance in the external group was superior to the internal group in both practice and retention trials.

One interesting point is the particular instructions that were used to teach participants how to perform a chip shot. There are several difficulties in teaching complex movements to individuals who have never played golf before. Wulf, Lauterbach, and Toole (1999) reported that they spent approximately 10 minutes explaining the basics of a chip shot. Participants received the same instructions regarding the stance, posture, and grip. However, the only difference was the focus on swing mechanics. Participants in the external group were instructed to focus on the club, or specifically the pendulum-like motion of the club, whereas participants in the internal group were
instructed to focus on the arm movement. The actual instructions described in the study are provided below:

The internal group:

The participants were asked to put their hands together in the correct "grip," but without the club, and to swing their arms back and forth. The participants’ attention was directed to the left arm being straight and the right arm being somewhat bent during the backswing, both arms being straight during the forward swing, and the right arm being straight and the left arm being bent during the follow-through.

The external group:

The attentional focus of the external participants was directed towards the club movement. Specifically, the participants were asked to let the club perform a pendulum-like motion. To illustrate this point, the participants were told to hold the club by the grip between the thumb and index finger of the right hand, push the club to start a pendulum motion, and concentrate on the weight of the club head.

According to Wulf, Lauterbach, and Toole (1999) these instructions were provided after the generic information about the chip shot (i.e. grip, stance, posture). It is worth noting the difference in the amount of information between the two conditions. Participants in the internal group had to focus on straightening the left arm and slightly bending the right arm during their backswing, straightening both arms during the forward swing, and straightening the right arm but bending the left arm during follow-through. In contrast, participants in the external group were only told to swing the club like a pendulum. Thus, the study is simply confounded with the amount of information. It is likely that participants in the internal group performed badly because of the amount of information they had to consider or focus on when making a shot. Arguably, participants in the external group had to process less information, and thus had more attentional capacity left to process environmental information, such as direction of the ball, trajectory of the ball, distance, and quality of striking. The capacity to consider these relevant sources of information clearly benefits those in the external group.

Wulf and Su (2007) replicated the golf experiment with a similar method, but provided more practice for participants compared to their previous study in 1999. However, Wulf and Su (2007) conducted an additional experiment with the same method using six expert golfers from the university golf team. They successfully replicated the results from their previous study in 1999. Both trained-novices and experts performed better in the external focus condition compared to the internal focus and control (no instruction) conditions.

Again, the main criticism of Wulf’s (2007) study involves the instruction of each attentional cue. Wulf and Su (2007) provided limited details about the specific instructions given to
participants. The article only indicates that participants in the internal focus condition were told to focus on the swing motion of their arms, whereas participants in the external focus condition were told to attend to the swing motion of their golf club. This raises a concern about the classification of internal versus external attentional cues. Wulf, Hob, and Prinz (1998) defined external focus as attention that is directed towards the object or effect of an action. However, the equipment of a sportsperson is hardly considered as an effect of their movement. Consider a racquet sport such as tennis, for example, the racquet could easily be considered as an extension of the tennis player’s arm. On the other hand, a footballer’s shoes are hardly considered as an extension of their legs. Thus, apparatus that acts as a part of the movement raises the question of whether or not it falls into the category of external focus as defined by Wulf, Hob, and Prinz (1998).

**Other research studies**

The previous section discussed the different methodologies used by researchers to manipulate attentional focus, as this will be relevant for the current project. The previous section discussed the manipulation methodologies used by Beilock’s and Wulf’s series of research in detail because they are the basis of current project’s methodology. However, there are many other research studies on this topic. For example, similar to Wulf’s line of research, Bell and Hardy (2009) added a measure of state anxiety during performance, under different styles of attentional focus. They found evidence to support the beneficial effect of external focus on anxiety. Kasper, Elliott, and Giesbrecht (2012) also found evidence for the positive effect of external focus when it was given as a set of instructions. Unlike Wulf’s single instruction, Kasper et al (2012) provided information on the five steps of golf putting for both internal and external focus conditions. Merchant, Clough, and Crawshaw (2011) utilised a similar method of instructions for a dart-throwing task. Apart from the superior performance observed in the external focus condition, they also discovered that participants rated external focus instructions as easier to follow and less mentally demanding. These findings demonstrate a differential effect of verbal instructions due to specific integrated-properties associated with internal and external focus conditions.

A study by Land, Tenenbaum, Gershon, and Ward (2013) adds to the beneficial effects of external focus. The study occluded the vision of experts while they performed putts under external focus instructions. The findings confirmed that external focus benefits performance, even without the online use of vision, suggesting that external focus effects performance through cognitive processes. Recently, Land, Frank, and Schack (2014) replicated the effects of external focus (Wulf, 2007) in a learning and retention test method. The methodology did subject to the amount of information confound similar to the discussion earlier. However, the external focus instruction included information on the outcome (i.e. ideal speed of the ball) compared to the internal focus instruction, in which participants were told to focus on the swing of the arm.
In contrast, there is evidence for the non-beneficial effects of external focus instructions. Masters and Maxwell (2002) found that novices switched to an external focus during a balancing task, which could be evidence for a default type of attentional focus preference. Furthermore, Perkins-Ceccato, Passmore, and Lee (2003) utilised a complex task of golf pitch shooting and found that novices performed better with internal focus instructions (e.g. form of golf swing). Recently, Denny (2010) investigated the effects of internal versus external focus instructions in participants performing a volleyball jump float serve, and found no differential performance effect.

Mullen and Hardy (2000) utilised both an internal focus manipulation and distraction manipulation. Participants were told to focus on self-selected coaches’ instructions relating to putting skills versus an irrelevant number generation task. They found that performance on secondary tasks (number generation) were negatively affected in high anxiety circumstances, where participants thought that their putting mechanics would be evaluated and compared to professionals. Toner and Moran (2011) investigated the different categories of self-focused attention styles of conscious-control versus explicit-monitoring (as suggested by Jackson, Ashford, & Norsworthy, 2006). Interestingly, impaired performance in experts was only found in explicit-monitoring, where the expert was instructed to verbally monitor the golf putt process after each trial session. In addition, Gabbett and Abernethy (2012) investigated task complexity in draw-and-pass performance of professional rugby players. It was found that the secondary/distraction task negatively affected the high complexity task, but not the low complexity task. The findings confirm the concept of required attentional capacity and its’ effects on performance.

General aims and motivation

Based on the external versus internal focus studies discussed, there is some scepticism regarding the effectiveness of verbal manipulations. In reference to the author’s personal experience, the coaches’ instructions did not have much influence on cognitive processes, even though the instructions were described in step-by-step detail. Therefore, it is surprising that encouragement such as ‘focus on the target’ and ‘focus on the hands’ can have a positive effect on performance. On the other hand, effect of distraction is expected intuitively on the face value, performance should be worsen when there are distraction. Also, this methodology of administering a concurrent secondary task has been utilised extensively in previous cognitive studies (e.g. Broadbent, 1958; Bertelson, 1967; Welford, 1967; Kantowitz, 1974, Broadbent, 1982). Thus, utilising a secondary or distraction task is arguably a more valid manipulation in research settings compared to verbal instructions. However, verbal instructions are more applicable to coaching and learning due to the ecological validity. This issue has led the author to believe that a valuable aim in this area of research is to validate the beneficial effects of verbal instructions, which can be
readily applied to practical settings. One method to achieve this goal is to manipulate attentional focus and examine the effects on motor skills.

This idea was attempted by the author in an unpublished pilot study, conducted before the commencement of the current research project. The study required intermediate golfers to perform chips and putts on an actual practice green. The two manipulations (verbal instruction of internal versus external focus and distraction vs no distraction) were administered in a 2 × 2 factorial design. Participants in the auditory tone monitoring condition (i.e. distraction) were instructed to focus either internally or externally. Participants in the no distraction condition were also instructed to focus either internally or externally. The study was particularly interested in the performance of participants in the distraction condition with an external vs. internal focus. The justification for this is that if external focus interacts or enhances motor automaticity, performance should be better in the external focus condition compared to the internal focus condition, despite the distraction. The study hypothesised that participants would need to hold external focus in order to obtain optimal performance; however, if their attentional capacity were occupied by the distraction, performance would not be optimal. By the same logic, if external focus is beneficial to performance because it prevents participants from focusing internally, then performance should be at a similar level to being distracted at the same time. The findings did not lend support to a conclusive interpretation, since the performance did not differ statistically in any of the experimental conditions.

The author believes that a replication of the previously found effect is needed before applying the findings in a practical setting. The methodology in current work is consequently affected in such a way that experiments are conducted in a controlled, laboratory-like setting in order to reduce the variability of environmental confounds. Furthermore, novices are preferred for the reason that their skill level does not vary as much as intermediate golfers or experts, with more room for improvement. This should be statistically evident if the manipulation of attention has an effect on the performance outcome.

**Replicability issue**

The current research was interested in the motor skills used in a golf-putting task. For this reason, the study used distractions and verbal instructions based on Beilock et al., (2002) and Wulf, Lauterbach, and Toole, (1999), respectively. In terms of the experimental replicability, both manipulations have shown to be effective in previous studies, as discussed in the earlier section. Outside of this area of research, Beilock’s et al., (2002) have used the skill-focused condition for studies of anxiety and performance (e.g. Wilson, Smith, & Holmes, 2007), while the distraction method of additional tone monitoring has been replicated for testing of explicit theory versus distraction theory (e.g. golf putting task, Jackson, Ashford, & Norsworthy, 2006; soccer dribbling task, Ford, Hodges, & Williams, 2005; baseball batting task, Gray, 2008). The findings of these
studies are generally in agreement with Beilock et al., (2002), even with simple motor tasks such as balancing (Swan, Otani, Loubert, Sheffert, & Dunbar, 2010); different biological measures of performance (e.g. efficiency of oxygen consumption in running, Schucker, Norbert, Hagemann, Strauss, & Volker, 2009); and a case study of musical performance attempting to alleviate choking as explained by explicit monitoring theory (Mesagno, Marchant, & Morris, 2009). A major contradiction in findings was observed in the study by Wulf and McNevin (2010), which incorporated the word-monitoring task into the usual learning-retention-test design, with an internal and external focus. It was claimed that the distraction task, compared to the external focus, was not beneficial to learners. To the author’s knowledge, a direct examination of the distraction task versus the verbal instructions was not further examined. The most recent study that had a similar comparison was a gymnastic task study (Lawrence, Gottwald, Hardy, & Khan, 2013). The study found that novice performance during the acquisition phase was better with an irrelevant-internal type of focus (i.e. focus on their own facial expression) compared to an internal or external focus. This irrelevant-internal focus is arguably similar to a distraction task, such that it directs the attention away from the task at hand.

The author’s concern regarding replicability stems from the reason that the failed replication study has not been given as much attention as the successful studies. Denny (2010), for example, utilised the internal versus external focus in an actual training session with volleyball athletes and found no beneficial effects of external focus. Although it was published in the same year as Wulf and McNevin (2010), Denny (2010) was only cited eight times over four years, compared to the 67 citations of Wulf and McNevin (2010). It should be noted that the 67 citations of Wulf and McNevin (2010) does not consist of exact replications. Additional database searches for unpublished replication studies (http://psycfiledrawer.org) found no related replication attempt. The fact that the successful study had more acknowledgements holds no value in terms of the integrity of previous studies that found significant effects of either external focus styles of distraction methods. Since the author did not find a satisfying amount of evidence on this topic, the preliminary aim of this current project is to replicate the effects of attentional focus by manipulating distraction methods and verbal instructions. In light of a recent issue on the non-replicability of a flagship study in cognitive psychology (discussed in, Yong, 2012; Pashler & Wagenmakers, 2012; Cesario, 2014), the author believes that the initial replication attempt in the first two studies is justified. This is especially true for the reason of reproducing the effect as a basis for further studies on practical implications.

**The current project**

The main aim of the current research is to advance the understanding of attentional focus in motor learning and/or performance. This aim will be achieved through bridging the gap between
different research methodologies, namely the manipulation of attentional focus through distraction methods versus verbal instructions. Furthermore, a better understandings of the underlying mechanisms will lead to a better application of attentional focus issues in practical settings (e.g. coaching/learning, athletes performance, etc), which is the ultimate goal for this area of research.

**Motor learning versus motor performance**

The distinction between motor learning and motor performance is an issue in this area of research, partly due to the nature of attentional focus manipulations. Most of the verbal instruction methods are done within the framework of motor learning (e.g. Wulf & Su, 2007; Wulf, Hob, & Prinz, 1998; Wulf, Lauterbach, & Toole, 1999); that is, having a learning phase with different attentional focus instructions before conducting a performance-testing phase. Understandably, this makes sense for practical implications, since the attentional focus instructions resemble coaches’ verbal instructions during training sessions. On the other hand, distraction methods (such as those in Beilock & Carr, 2001; Beilock, Bertenthal, McCoy, & Carr, 2004; Beilock & Gonzo, 2008) have less importance for practical issues in terms of motor learning. At least from the author’s personal experience, it is not common practice to distract learners with secondary tasks during training sessions. These learning versus performance methodologies have led to a difference in theoretical conclusions. For example, studies conducted with verbal instructions claim that their method of attentional focus can be used to enhance motor skills. On the other hand, distraction methods are not able to make this claim on motor learning. Instead, they rely on the basis that learners acquire the skills through repeated practice, which leads to performance during distraction tests.

**Studies outline**

The current project will incorporate distraction and verbal instruction methodologies for two main reasons: one, to replicate the effects of attentional focus found in previous research, and two, to provide a comparison of the effects between distraction versus verbal instructions on motor learning and performance. To the author’s knowledge, Wulf and McNevin (2003) is the only study to directly compare the two methodologies, with the aim of comparing the effects. The study claimed that distracting learners during practice does not provide any benefit in terms of motor learning compared to external focus. In the author’s opinion, if external focus truly manipulates attention alone, it should have a similar effect as distraction because both methodologies are directing attention away from bodily movements or mechanisms of movement. However, since Wulf and McNevin (2003) claimed that external focus is superior to distraction, it must be the case that external focus has a beneficial effect on physical movements, in addition to directing attentional focus. As explained by Wulf (2007), it could be that external focus enhances the development of motor automaticity or that the properties of verbal instructions in external focus change the physical movement itself. If, indeed, the properties within external focus affect actual
physical movement (e.g. target oriented, functionality-related, etc), then it should be addressed further for the purpose of practical implications, such as using outcome-related focus rather than external focus. It should be noted that this is not to establish that external focus does not have benefits in terms of directing attentional focus, but rather to establish a specific common attribute that further enhances motor skills in addition to the benefits of attention.

The following chapters will report six experimental studies in total. The first two experiments attempted to replicate the effects of attentional focus in different research designs, which was done to provide a basis for further follow up studies. However, the null results from studies one and two led to the rationale for the third experiment, which was conducted to address the issue of a possible confounding variable. The fourth study dealt with novices versus experts by allowing a training period for novices and comparing performance between the two groups before and after training. The null results found in the set of experiments examining the direction of attention with instructions (Wulf, Lauterbach, Toole, 1999) and performance of distracted participants (Beilock et al., 2002) led to a change in the overall direction of the research project. Participants’ expectancy was selected based on their comments from the previous four studies. Additional background literature on the topic was reviewed in chapter five. Two additional experiments were conducted with the addition of an expectancy manipulation to the original attentional focus manipulation. The consistent finding was that participants performed according to their outcome expectation regardless of the attentional focus manipulation. The implications and avenues for future studies are discussed in chapter eight.
Chapter 2

Study 1: Replication of the verbal instruction method (internal versus external focus)

Attentional focus has been viewed as a major cognitive component influencing sport performance (Wulf, 2007; Wulf, Hob & Prinz, 1998; Lewis & Linder, 1997). Recently, the idea of categorising attentional focus into external focus versus internal focus has been put forward by Wulf, McNevin, and Shea (2001). External focus is defined as attention directed towards the environment as a result of a sportsperson's actions whereas internal focus is defined as attention directed towards one's own bodily movements or the skill mechanics (Wulf, Hob, and Prinz, 1998). The attentional focus theory states that external focus is more beneficial to motor performance compared to internal focus as external focus promotes and encourages the automaticity of the movement. It is believed that internal focus disrupts or interferes with the automatic control of a movement. This explanation was originally coined as the "constraint-action hypothesis" (McNevin, Shea, Wulf, 2003). There are other lines of research that propose a similar theoretical explanation using the explicit monitoring theory (Baumeister, 1984; Lewis & Linder, 1997). According to the explicit monitoring theory, attention that is directed towards the step-by-step processes of a movement disrupts skilled-performance. Furthermore, Masters (1992) and Masters, Polman, and Hammond (1993) suggested that experts’ performance is impaired by paying attention to the rule-based declarative knowledge of a motor movement. According to these authors, the explicit manipulation of attention towards a movement mechanic is called ‘reinvestment’ (Masters, 1992).

To date, the constrained-action theory is the pillar of research explaining the beneficial effects of external focus on motor skills. The augmented claim that sets it apart from alternative theoretical explanations is the categorisation of external types of attentional focus, which are argued to have a beneficial effect on motor skills regardless of a performers’ skill level (Wulf, 2007). Based on the theory, both novices and experts should benefit from adopting an external focus while executing a skill. Theoretically, this claim contradicts the concept of motor automaticity, which explains the effect of attention on motor skills, particularly for experts. The issue with the motor automaticity explanation is that novices, who have not developed motor automaticity, should not be affected by the different localities of attention. However, several studies have shown that external focus has a beneficial effect on motor learning for novices in a variety of motor tasks. For example, a golf pitch shot task (Wulf, Lauterbach & Toole, 1999), a balancing task on a stabilometer (Wulf, McNevin & Shea, 2001), a jump-and-reach task (Wulf, Zachry, Granados, Dufek, 2006), and a basketball free-throw task (Zachry, Wulf, Mercer, & Bezodis, 2005). Even simple movements, such as leg extensions while seated, yield supporting evidence for smoother and regular movements through external focus for novices (Kal, van der Kamp, & Houdijk, 2013). Laufer et al. (2007) also found a beneficial effect of external focus for novices in rehabilitation exercises among patients.
with an ankle sprain injury. The typical method used in these studies is to separate participants into different attentional focus groups; first directing them towards one type of the attentional focus (i.e., internal versus external) during the practice period and then testing their performance on a retention test without attentional focus cues. Overall, these studies found that external focus is more beneficial to motor performance during both practice and retention tests.

A limitation of the studies discussed above, is the presence of a potential confounding variable through the overloading of attentional focus. For example, in the golf pitch shot study (Wulf, Lauterbach & Toole, 1999), the experimenter spent approximately ten minutes explaining the basics of a chip shot. Participants received the same instructions regarding stance, posture, and grip. However, they received different instructions regarding swing mechanics. That is, participants in the external group were instructed to focus on the club, specifically the pendulum-like motion of the club, whereas participants in the internal group were instructed to focus on their arm movement. The exact instructions from the study included:

**For the internal group.** Participants were asked to put their hands together in the correct "grip," but without a club, and to swing their arms back and forth. Participants' were instructed to pay attention to their arm movements, specifically that the left arm was straight and the right arm was bent during the backswing, both arms were straight during the forward swing, and the right arm was straight and the left arm was bent during the follow-through.

**For the external group.** Participants in the external focus group were instructed to pay attention to the club movement. Specifically, participants were asked to let the club perform a pendulum-like motion. To illustrate this point, participants were asked to use their right hand to hold the club by the grip between their thumb and index finger, push the club to create a pendulum motion, and concentrate on the weight of the clubhead.

It is clear that the amount of information received by participants in the internal focus group was much more than participants in the external focus group. While participants in the internal focus group were instructed to focus on step-by-step arm movements, participants in the external focus group were only told to swing the club like a pendulum. Therefore, it is possible that participants in the internal focus group performed worse because of an attentional capacity overload (Kahneman, 1973; Keele, 1973) as opposed to limited level of motor automaticity.

Poolton, Maxwell, Masters, and Raab (2006) explored the possibility of adding a secondary task to a golf-putting task to examine the issue of attentional capacity overload. The participants in their study were trained during a practice trial with internal or external focus styles. They found that when a secondary task was introduced, performance suffered with participants trained in the internal focus group. Poolton, Maxwell, Masters, and Raab (2006) found that participants in the internal focus group accumulated a greater amount of knowledge about the putting task compared to
participants in the external focus group. Therefore, in their second experiment participants were trained with an extra set of rules (six rules in total) that reflect either internal or external focus. The study found that performance in both groups was impaired when a secondary task was introduced. Hence, it was argued that an overwhelming amount of information or rules provided to participants is responsible for the deterioration in performance.

However, the findings are inconsistent when it comes to the effects of attentional capacity overload in sporting contexts. Merchant, Clough, and Crawshaw (2007) investigated the effect of external focus on dart throwing performance. Their attentional focus instructions were similar to those used by Poolton, Maxwell, Masters, and Raab's (2006), as it included multiple steps for participants to follow. While Poolton, Maxwell, Masters, and Raab (2006) found that internal and external focus do not differ in motor performance (without a secondary task), Merchant, Clough, and Crawshaw (2007) found a beneficial effect of external focus in dart throwing performance. Apart from Wulf and her colleagues, other experiments have failed to produce similar findings. For instance, a recent study on the effects of attentional focus on a volleyball jump float serve (Denny, 2010) found that external focus was no more effective than internal focus in a group of competitive volleyball players. Zentgraf and Munzert (2009) also found no difference in performance during the acquisition and test phases in a ball-juggling task. Similarly, unpublished dissertations examining the effect of internal focus versus external focus in long jump (Fremd, 2013) and dart throwing (Goodhead, 2013) did not find any differences in performance between internal focus and external focus conditions. Furthermore, studies have also shown a beneficial effect of internal focus in novices for various motor tasks, including a soccer chipping task (Uehara, Button, and Davids, 2008), golf chipping task (Perkins-Ceccato et al., 2003), gymnastic routine task (Lawrence et al., 2011), and baseball batting task (Castaneda & Gray, 2007). Some researchers have argued that internal focus and external focus operate on different domains and create different goals for motor systems (e.g. Bell & Hardy, 2009; Lohse et al., 2010; Vance et al., 2004; Zachary et al., 2005). Lohse et al, (2013) suggests that while internal focus aims to control the movement, external focus is related to the objective outcome which ultimately leads to better performance. The contradictory findings in the existing literature are the motivation behind the current research. The current research aims to examine whether internal focus and external focus manipulations produce differences in golf putting performance.

The current study aims to investigate the effect of attentional focus on golf putting performance. Specifically, it investigates whether there is a beneficial effect of external focus on motor skills. The study will control for the confounding variable of information overload identified in a previous study (Wulf, Lauterbach, & Toole, 1999) by limiting the amount of information on swing mechanics and verbal instructions provided to participants. The golf-putting task was
selected due to the fact that the author is highly familiar with the movements involved in golf and the outcome can be measured quantitatively. The aim is to examine whether the beneficial effects of external focus can be replicated without the potential confound of information overload. A second concern aside from the attentional capacity overload issue, is the functionality of the attentional cues provided to participants. For example, an external focus cue may include a more effective component of skill mechanics compared to an internal focus cue. Therefore, the current study will ensure that the attentional focus cues do not interfere with physical components. The original prediction from previous research is retained; if the constrained action hypothesis holds true, the external focus condition will produce better performance compared to the internal focus condition.

**Method**

**Participants**

Participants were 37 first year psychology students (20 females, 17 males) with a mean age of 20.27 years old ($SD = 3.15$). Twenty six participants reported no prior golf experience, seven reported some golf experience but had stopped playing one to five years ago, and four participants reported golf experience a couple of months before the experiment. No participants reported having any professional golf lessons.

**Design and procedure**

Participants were randomly allocated to one of three experimental conditions: control, internal focus, and external focus. Participants were instructed to putt a golf ball and aim for the target 2.60 metres away from the starting position. The experiment included three parts: the instructional phase, the training phase, and the last test phase.

In the instructional phase, participants were introduced to the tasks and were asked to fill out a demographic questionnaire about their past golfing experiences. The experimenter then provided generic instructions about golf putting skills, including the stance, posture, grip, and stroke. Participants were given three minutes to familiarise themselves with the putter and were allowed to putt at their own pace without being monitored during this time. The number of putts by each participant during the instructional phase was not controlled.

After the instructional phase, participants in the control group went into the training phase while participants in the internal focus and external focus groups were given extra instructions about attentional focus. The participants in the internal group were told to focus on and be aware of the movement of their hands during every putt in the training phase and participants in the external group were told to focus on and be aware of the movement of the clubhead.

The training phase consisted of 10 practice blocks, with ten shots of putt in each block. While there were no pre-determined break periods, the participants were allowed to take a short
break between each practice block. At the beginning of the first and sixth putts of each block, attentional focus cues were provided as a reminder. The cue for the internal focus group was "remember to focus on your hands" and the cue for the external focus group was "remember to focus on the clubhead". The participants in the control group were not given any reminders. At the end of each block, the experimenter provided performance feedback to each participant. It should be noted that the feedback did not include comments relating to the participants movements or how well they performed in comparison to others. However, participants were told how close they came to the target for each putt.

The participants took a short, ten minute break after the training phase. Participants were provided with a logic puzzle game to keep occupied during the break and to control cognitive processes in each experimental group. After the break, participants continued on to the test phase which consisted of 20 putting shots. No reminder or performance feedback was given to the participants during the test phase.

**Measurements**

**Focus.** A self-report questionnaire was used to measure participants' compliance with the attentional focus instruction. After each training block, the experimenter asked, "Out of the previous 10 putts, how many shots were you able to focus on your hands/the clubhead?" The level of focus was then recorded as the number of shots participants paid attention to. Participants in the control group did not receive any questions regarding their attentional focus.

**Putting performance.** Performance in the golf-putting task was measured with a scoring system, combining both the distance left to the target and the deviation from the target line. The target was a set of five concentric circles, in which the smallest circle was the size of a standard golf cup (10.80 centimetres in diameter). The outer circles increased in size, with the largest circle having a diameter of 54 centimetres.

The scores for the distance left to the target were measured from where the golf ball stopped in the concentric circles. The smallest circle yielded a score of five and the largest circle yielded a score of one. If the golf ball did not stop within the largest circle, the putt distance score was 0. The scores for the deviation from the target were measured from how far the ball deviated from the imaginary target line. If the golf ball deviated from the target line, to the left or right, in an amount less than 5.40 centimetres when measured perpendicularly to the target (i.e., smallest circle), the participants received a full score of five. Scores of four, three, two, one, and zero were given if the ball deviated even further from the target or if it missed the largest circle completely. Therefore, participants' putting scores range from zero to ten, with ten representing the best possible performance.
Results

Focus

The focus results were expressed as a ratio of the total number of putts participants reported paying attention to in their attentional focus condition. The mean for the internal focus group was .72 (SD = .13) and the mean for the external focus group was .77 (SD = .17). Therefore, participants reported that they were paying attention to the instructions for more than 70 percent of the putts. The difference between the internal and external focus groups was not statistically significant statistically.

Putting performance

A mixed ANOVA (3 × 10; focus groups × training blocks) was run using an average of the combined scores from the training phase. The main effect of focus group was not significant, $F(2, 33) = 0.79, p = .464, \eta^2_p = .05$, as there was no overall difference across training blocks between the control group ($M = 4.42, SD = 0.74$), internal focus group ($M = 4.75, SD = 0.64$), and external focus group ($M = 4.72, SD = 0.82$). The main effect of training block was significant, $F(9, 297) = 4.05, p < .000, \eta^2_p = .11$, indicating that performance improved over a period of time (i.e., practices). There was no significant interaction, $F(18, 297) = 1.25, p = .218, \eta^2_p = .07$. Figure 1 illustrates performance during the training phase.

![Figure 1](image_url)

*Figure 1*. Putting performance in each attentional focus condition during the training phase, averaged across each training block. Higher scores indicate better putting performance. Error bars represent standard error.

A one-way ANOVA was run using an average of the combined scores from the test phase, to compare scores from the control group ($M = 4.81, SD = 0.96$), internal focus group ($M = 5.30, SD = .}
1.01), and external focus group ($M = 4.62$, $SD = 1.09$). The results showed that there were no significant differences between groups, $F(2, 33) = 1.07$, $p = .353$, $\eta_p^2 = .06$. Figure 2 illustrates the averaged performance scores for each of the three attentional focus conditions at testing phase.

![Figure 2. Averaged putting performance scores at testing phase as a function of three attentional focus style. Higher scores indicate better performance. Error bars represent standard error.](image)

**Discussion**

It was predicted that an external focus would produce superior performance compared to internal focus during both the practice phase and test phase. However, the findings revealed that there were no significant differences in putting performance between the groups that were told to focus on their hands (internal focus condition), the clubhead (external focus condition), or not to focus on anything in particular (control condition). The findings were the same for both the practice phase and retention test phase. The only significant finding was a practice effect, such that participants in each condition performed better over time.

The current results failed to replicate findings from previous research (e.g. Wulf, Hob, & Prinz, 1998; Wulf, Lauterbach, & Toole, 1999) and thus, found no evidence for the effect of attentional focus on motor performance. It is possible that the putting performance measure in the current study was not sensitive enough to capture differences between focus conditions. This is more likely given the fact that all participants reported that they had never played professional golf before. Nevertheless, it should be noted that Wulf and colleagues have found a beneficial effect of external focus in novices in a series of studies. Furthermore, the largest concentric circle may have been too small for the participants, resulting in a floor effect of putting performance. However,
given that a practice effect was found throughout the practice phase, it is clear that performance measures adequately captured changes in putting performance. Finally, it is worth noting that if the attentional focus effect is not as strong as the practice effect, the explicit manipulation of attention may not have any practical applications in the sporting context.

In terms of statistical power, the current study successfully replicated previous studies (Wulf, Lauterbach, & Toole, 1999) in terms of experimental design and sample size. The only major difference was the manipulation of attentional focus. As discussed earlier, this study attempted to provide simplified verbal instructions to avoid overwhelming participants with information. It is possible that the instructions only affected the allocation of participants’ attentional focus. If the constraint action hypothesis explains the link between attentional focus and performance, the effect should have emerged in the current experiment even with simplified instructions. Since the study failed to replicate previous findings, it raises the question of what mechanisms are actually involved in the effect of different attentional focus styles on motor performance.

A number of other methodological issues are present. For example, after the generic instruction was provided to participants, those in the control group immediately went on to the training phase, while those in the internal focus and external focus groups received extra instructions about the allocation of focus. Arguably, the control group may have retained more putting information compared to the other two conditions. To control for this issue, future research should ensure that the control group receive extra, irrelevant information to match the amount of information received by the focus groups. Although the number of putts were controlled during the ten training block sessions, the participants were allowed to putt freely during the three minute instructional phase. Although there is no way to tell whether or not one experimental condition putted more or less compared to others during this time, the issue is prevalent and may have increased the variation in putting performance.

In terms of measurement, the focus manipulation check could have been administered to the control group, especially to determine whether or not the control participants developed an attentional focus strategy during the training phase. This was an oversight due to the authors’ motivation to quantify attentional focus styles by asking participants to estimate the number of times they focused on their hands or clubhead. A similar measure would not be applicable to participants in the control group. However, a question about attentional focus (e.g., ‘did you focus on your hands or clubhead?’) may have elicited some awareness about focus strategies. Even though the subjective manipulation check cannot be statistically compared to other manipulation checks used in this study, it would have worthwhile to find out whether any focus strategies were used in the control group. If participants in the control group developed a common focus strategy
(from the generic putting information provided), it may have led to an improvement in putting performance, and produced the non-significant difference compared to other focus conditions.

A key issue within this area of research, is the classification of different focus styles. For example, studies have used inconsistent verbal instructions to manipulate attentional focus styles, which contributes to the lack of consistency in the categorization of external versus internal focus. For example, an alternative categorisation of attentional focus could be outcome focus versus movement focus, which would still be applicable to the external and internal focus instructions used in previous studies (e.g. Zachry, Wulf, Mercer, & Bezodis, 2005; Wulf, Zachry, Granados, Dufek, 2006). For example, in a high jump experiment, in which participants in the external focus condition were told to focus on the highest jump and reach for the highest rungs (external focus; Wulf, Zachry, Granados, Dufek, 2006), the external focus may be viewed as outcome oriented focus. On the other hand, focusing on one’s finger tips (internal focus) is arguably less meaningful in terms of reaching for the highest rungs. Hence, it is likely that performance would be affected since one type of focus directs participants’ attention to the actual outcome while the other type of focus directs participants’ attention to the movement.

Another issue is the theoretical explanation of motor automaticity provided in previous research (Shea & Wulf, 1999; Wulf, McNevin, & Shea, 2001). Given that previous literature and the current experiment used novices as participants, it may be argued that the explanation of motor automaticity is not applicable to novices who have not developed automaticity. Even if the explanation of motor automaticity is not applicable to novices, previous studies have shown contradictory findings. For example, some studies have provided evidence supporting the beneficial effect of external focus in beginners (e.g., Wulf, Lauterbach, & Toole, 1999; Wulf & Su, 2007; Wulf, Hob, & Prinz, 1998; Wulf et al., 2002), while other studies have found that internal focus is beneficial to novices (Peh, Chow, & Davids, 2011; Uehara, Button, and Davids (2008); Perkins-Ceccato et al. (2003); Lawrence et al. (2011). The current findings further highlight the issue of reliability and generalisability of internal versus external focus styles.

The nature of the between-participants design may have also contributed to the non-significant results. Since baseline putting performance was not held constant between the conditions, it is possible that variation in putting performance between the three groups was too large and masked the effect of attentional focus. The current study aimed to replicate previous studies that have employed a between-participants design and obtained significant results. It would be interesting to clarify this methodological issue by using a within-participants design, which would eliminate the issue of individual differences between groups. The current experiment attempted to replicate the effect of external focus versus internal focus in novice golfers. Although there were no significant results, the simplified verbal instructions arguably accounted for a major
confound issue observed in previous experiments. The practical implications of this attentional focus intervention is questionable given that the practice effect was of a much higher magnitude than the attentional focus effect. Study two will modify the methodological design used in this study and keep the simplified version of verbal instructions for both the internal and external focus groups.
Chapter 3

Study 2: Replication and comparison between verbal instruction and distraction task.

The purpose of this study is to follow up study one with a slight modification in research design. In addition to the original research design, an attentional focus manipulation using a distraction task will be examined. The aim of this study is to find an effect of attentional focus (i.e., internal focus versus external focus) on golf putting performance using verbal instructions and an additional distractor task to manipulate attention.

Beilock and Carr (2001) claimed that performance under pressure suffers due to a shift in attentional focus towards skill-mechanics. This self-focused style of attention is detrimental to motor performance because it disrupts the automaticity of a well-learnt movement. Their claim of self-focused attention can be linked to the motor control theory of procedural versus declarative skills (Keele, 1973). It is widely accepted that once a motor movement is repeatedly practiced, it becomes proceduralised, automatic, and requires less attentional capacity (Beilock, Carr, MacMahon, & Starkes, 2002). Several experiments have shown that distractions (i.e., typically a dual-task or secondary task designed to occupy attentional capacity) do not affect the performance of experts, but impair novices’ ability to fully utilise their attentional capacity on a task (Beilock & Carr, 2001; Beilock, Carr, MacMahon, & Starkes, 2002; Beilock, Wierenga, & Carr, 2002).

There are a number of different distraction methods used in attentional focus studies. Beilock, Carr, MacMahon, & Starkes (2002) used an auditory tone monitoring task to occupy participants’ attention. The task required participants to identify a target tone among other non-target tones while they were performing a task. Lewis and Linder (1997) asked participants to count backward while putting golf balls. Beilock, Bertenthal, McCoy, and Carr (2004) instructed participants to putt golf balls as fast as possible to limit the amount of attentional focus that is spent on the putting task. Regardless of the manipulation method used, the pattern of findings across these studies is the same. The results show that experts are not affected by the distraction task as their motor skills are automatic and do not require much attentional focus capacity in order to perform well. However, novices are affected by distractions while performing a motor task as they require more attentional focus capacity.

A focus manipulation of interest is to instruct participants to direct their attention towards a movement or skill (Beilock & Carr, 2001). Beilock and Carr (2001) and Beilock, Carr, MacMahon, and Starkes (2002) found that experts performed worse when they used skill-focused attention. A series of research studies were conducted with a similar attentional focus manipulation to investigate skill-focused attention. For instance, Shea and Wulf (1999) categorised focus styles into internal focus versus external focus. Internal focus was defined similarly to skill-focused attention, such that attentional focus was directed towards bodily movements (e.g. hand movements when
swinging a golf club) (Wulf, Lauterbach, & Toole, 1999). External focus was defined as a type of attention directed away from bodily aspects and towards environmental aspects of a movement (e.g. focusing on swinging the golf club like a pendulum) (Wulf, Lauterbach, & Toole, 1999). The body of studies predicted that external focus would lead to better performance compared to internal focus.

Previous research has established the beneficial effects of external focus in learning and retention tests (Shea & Wulf, 1999; Wulf, Lauterbach, & Toole, 1999; Wulf, Hob, Prinz, 1998; Wulf, McNevia, & Shea, 2001). Participants are separated into different groups and are assigned different attentional focus styles. The findings show that external focus produces better performance in both the learning phase and testing phase. The proposed theoretical explanation for the benefit of external focus is that it promotes an automaticity aspect of motor movement (Shea & Wulf, 1999). However, this explanation contradicts the well-established belief that motor automaticity needs to be acquired through repeated practice in order to benefit performance (Keele, 1973; Shiffrin & Schneider, 1977). While external focus is said to promote automaticity, Wulf, McNevin, and Shea (2001) state that internal focus disrupts automaticity and prevents the development of motor skills in novices. A similar explanation is provided by Beilock and Carr (2001) for the negative effects of secondary distraction tasks.

There are conflicting ideas on how to classify attentional focus into external focus, internal focus, and skill focus. For example, in terms of internal focus, Beilock, Carr, MacMahon, and Starkes (2002) instructed participants to say ‘stop’ when they finished the follow through of a putting swing and noticed that the clubhead stopped. On the other hand, Wulf, Lauterbach, and Toole (1999) told participants to focus on the different aspects of their elbow and wrist. One could argue, that the internal focus manipulation used by Beilock, Carr, MacMahon, and Starkes’ (2002), could be classified as external focus since the participants were focusing on the equipment (i.e., golf club). However, both internal focuses are concerned with skill mechanisms and have produced similar results. The current study will use a similar manipulation to Wulf and colleague's in order to replicate their results and compare with other manipulation methods.

Research has found contradicting results with respect to verbal instruction methodologies. For example, Fremd (2013), Goodhead (2013), and Denny (2009) did not find any differences in performance between the internal focus group and external focus group. However, some research demonstrates that novices benefit from internal focus compared to external focus (Peh, Chow, & Davids, 2011; Uehara, Button, & Davids, 2008; Perkins-Ceccato et al., 2003; Lawrence et al., 2011). The current study will construct a hypothesis according to the main line of research on internal focus versus external focus since this will be a second attempt at reproducing the beneficial effect of external focus. It is expected that external focus will produce the best outcome compared
to other focus manipulations. The notable difference in methodology compared to study one is the learning versus performance approach. It was noted in study one that individual ability varies quite considerably and may be a methodological issue contributing to higher error variance. That is, different rates of learning between individuals may have masked the effect of external focus in study one. Therefore, in the current study, all participants will go through a brief practice phase before their training phase to reduce initial variations in performance within each individual. In addition, instead of using a between-participants design, the current study will use a within-participants design to deal with differences across groups. Although the theoretical implication changes from motor learning in the first study to testing motor performance in this second study, the putting outcome should not be affected as it is believed that both novices and experts will benefit from adopting an external focus (Wulf, 2007; Wulf & Su, 2007), and also improve the performance both in learning period and retention test phase (e.g., Wulf, Hob, & Prinz, 1998; Wulf, Lauterbach, Toole, 1999).

The effect of distraction should closely resemble previous studies (Beilock, Carr, MacMahon, & Starkes, 2002; Beilock, Wierenga, & Carr, 2002). The addition of a distraction (i.e., auditory tone monitoring task) should negatively impact participants’ performance compared to the initial practice condition with no distraction. It is possible that the practice effect may be larger than the effect of distraction and may produce a null effect. However, previous studies have shown that an auditory tone distraction task affects novices’ performance negatively after they perform a task without any distractions (Beilock, Bertenthal, McCoy, Carr, 2004). Thus, it is hypothesised that putting performance will be worse with a distraction compared to putting performance without a distraction. Therefore, when comparing across the three focus conditions (i.e., internal focus, external focus, and distraction), external focus should produce the best putting performance compared to internal focus and distraction.

Method

Participants
Thirty-nine first year psychology students from the University of Queensland participated in the study for course credit. They comprised of 11 males and 28 females with a mean age of 18.66 years ($SD = 2.86$). All participants reported little to no golfing experience. The most experienced participant had only two months of practice on a driving range once a week. All participants were right-handed.

Design and Procedure
The experiment was conducted in a quiet tutorial room with one participant at a time. The participants were asked to putt golf balls on an artificial mat. There were two main experimental tasks; the first task was to stop the golf ball on top of a marked target spot and the second task was
to putt the golf ball into an elevated golf hole. These performance measures were adapted from previous studies (Beilock & Carr, 2001; Beilock, Carr, MacMahon, & Starkes, 2002) that used the exact distance from the target to measure performance. The task of sinking golf balls into an elevated hole is to enhance the ecological validity of the experiment. Ideally, if the results can translate into the real world, the task of hitting a golf ball towards a target and into a hole should produce the same pattern of results. The putting task was done under four conditions; the practice condition (i.e., single-task), the internal focus condition, the external focus condition, and the distracted condition (i.e., dual-task).

Practice. In the practice condition, participants could putt on their own with no instructions or comments on how to putt a golf ball or how to direct their attentional focus. The purpose of this condition was to give participants the opportunity to familiarise themselves with the putting task and to reduce some of the practice effect in other experimental conditions. Every participant performed in the practice condition before the internal or external focus conditions.

Internal focus and external focus. The verbal instructions used in these two conditions were adapted from Wulf, Lauterbach, and Toole (1999). In the current experiment, participants in the internal focus condition were instructed to focus on the movement of their hands. Participants in the external focus condition were instructed to focus on the movement of the clubhead. The amount of instructional information provided in the internal focus condition was reduced (from study one) to equal the amount of instructional information provided in the external focus condition. The verbal instructions for both the internal and external focus groups were adapted from study one to compare results across different research designs (i.e., comparing the between-participants design with the within-participants design) and to compare its effect with the distracted method.

In previous research (Wulf, Lauterbach, & Toole, 1999), the instructions for internal focus groups were overloaded with details compared to the instructions for external focus groups. While participants in the internal focus group are told to focus on the angle of their elbow during the backswing and downswing (e.g. bend right elbow, straighten left arm for backswing, straighten both arms for downswing, etc), participants in the external focus group are only instructed to swing the club in a pendulum motion. The current experiment accounts for this confound by asking participants in the internal focus group to focus on only one bodily movement (i.e., their hands). The instructions in the external focus group were also modified to focus on the locality of attention (i.e., the clubhead) rather than movement mechanics (i.e., swinging the club in a pendulum motion). Therefore, the current study avoids the potential confounds of information overload and physical changes in movement due to verbal suggestions.

Distracted condition. Participants in the distraction condition were asked to perform an auditory tone-monitoring task at the same time as the putting task. The tone-monitoring task was
adapted from Beilock, Carr, MacMahon, and Starkes (2002). The task requires participants to respond verbally to a target tone by saying the word ‘tone’. There were two types of tones; high pitch (600 hertz) and low pitch (200 hertz). Each tone played for half a second at random intervals with an average of five tones every ten seconds. The target tone was a high pitch, which played once for every three low pitch tones.

In each condition, participants performed a set of 30 putts with the marked spot as a target and another set of 30 putts with the hole as a target. Thus, each participant performed 240 putts in total. The experiment lasted an average of one hour and fifteen minutes. At the end of the putting task, participants were asked a few questions about their perceived ability and perceived attentional focus.

The design of the current experiment is a within-participants design with four conditions. Each participant first participated in the practice condition and then participated in the three training conditions (i.e., internal, external, and distracted) in a counterbalanced order. The order of tasks (i.e., putting to a marked spot versus putting to a golf hole) was also counterbalanced across participants.

**Materials**

Participants were provided with a generic right-handed putter. The artificial putting matt was 90 × 300 centimetres in size. The target spot was positioned in the middle of the matt, 240 centimetres away from the starting position. The target hole was slightly elevated (seven centimetres from the floor) at the other end of the matt, 260 centimetres away from the starting position. The hole was a standard 10.80 centimetres in diameter. The distance of the golf ball from the target was measured using a standard measurement tape. Putting performance and demographic information were recorded in hard copy data sheets before being transferred into a spreadsheet computer software program for statistical analysis.

**Measures**

**Putting performance.** There were two performance outcomes from the putting task. First, distance performance was recorded as the distance from the golf ball to the marked spot target. This was measured from the middle of the golf ball to the centre point of the marked spot in centimetres using a measuring tape. The results were recorded as an average of the 30 putts in each condition. Second, the hole performance was recorded as the total number of putts out of 30 attempts in which the ball went into the hole.

**Perceived ability.** After participants completed each putting condition, the experimenter asked them to report in which condition they think they performed the best. They could select one condition for the distance task and one condition for the hole task. No feedback about participants’ putting performance was provided at this point.
**Perceived attentional focus.** At the end of the internal focus and external focus conditions, participants were asked to rate how many putts they actually focused on according to the instructions. The perceived focus scores were recorded as a number of correct-focus putts out of 60 for each attentional focus condition (i.e., 30 putts for distance task and 30 putts for hole task for the internal and external focus conditions). A manipulation check for the distracted condition was used to record the number of times participants did not respond to the target tone.

**Results**

**Putting performance**

Putting performance in each condition was analysed using an average performance of the 30 putts. A one-way repeated-measures ANOVA was conducted to compare distance performance (i.e., the average distance to the target) between the three attentional focus conditions. Lower values indicate better performance (i.e., the average distance is closer to the target). Figure 3 illustrates the mean putting, distance performance for each condition. An initial data analysis of the practice condition indicated that the difference in performance was due to the fact that the practice condition was performed first. Therefore, the improvement in performance from the practice condition to the distracted condition (i.e., single-task versus dual-task respectively) was mainly due to a practice effect. The analyses reported here will focus on the three counterbalanced focus conditions in which the practice effect is similar and averaged out between each condition. The practice condition is included in Figure 3 for comparison purposes; it is not included in the statistical analyses.
The findings revealed a non-significant main effect of focus conditions (internal, external, and distracted), $F(2, 76) = 0.11, p = .866, \eta^2_p < .01$. The average putting performance was not statistically different (internal focus, $M = 23.43, SD = 4.02$; external focus, $M = 23.05, SD = 4.09$; and distracted tone, $M = 23.24, SD = 4.46$).

To test for a practice effect, performance in the practice condition was compared to each of the three counterbalanced attentional focus conditions. A Bonferroni adjustment was applied for all three comparisons at the alpha level .017. Findings revealed that the practice condition ($M = 25.30, SD = 4.70$) performed marginally worse compared to the internal focus condition, $t(38) = 2.47, p = .018$ and distracted condition, $t(38) = 2.45, p = .019$. Furthermore, performance in practice condition was significantly worse compared to the external focus condition, $t(38) = 3.20, p = .003$. Therefore, the findings suggest an overall improvement in putting performance after the practice session.

The same statistical analyses were conducted to test hole putting performance. The outcome measure was the average number of putts holed in each condition, providing a performance score out of 30. A one-way ANOVA was used to analyse the means from the three attentional focus conditions. Figure 4 illustrates the mean hole putting performance scores for each condition.
The results from an ANOVA revealed a non-significant main effect of attentional focus, $F(2, 76) = 1.00, p = .374, \eta^2_p < .03$. There were no significant differences in putting performance between the three attentional focus conditions (internal focus, $M = 13.77$, $SD = 5.85$; external focus, $M = 14.90$, $SD = 4.76$; and distracted condition, $M = 14.59$, $SD = 4.23$). A practice effect was also found for the hole putting task. A Bonferroni adjustment was applied for all three comparisons at the alpha level .017. Performance in the practice condition was significantly worse compared to performance in the external focus condition, $t(38) = 3.28, p = .002$, and distracted condition, $t(38) = 3.24, p = .003$, however, there was no significant difference in performance between the practice condition and internal focus condition, $t(38) = 1.68, p = .101$.

**Perceived ability**

The perceived ability of participants was recorded by asking participants to choose one condition in which they thought they performed the best. One condition was chosen for each of the putting tasks. The frequency distribution is presented in Table 1 and includes both actual and perceived performance. In the putting to a marked target task, participants perceived that they performed better in the external focus condition (17 out of 39), whereas findings of actual performance indicated that participants performed better in the internal focus condition (13 out of 39). Chi-square goodness of fit determined that participants’ perceptions matched their actual performance, $\chi^2(3, N = 39) = 7.07, p = .070$. In terms of accurate perceptions, 19 out of 39
participants accurately perceived their performance in the putting to a marked target task. Chi-square goodness of fit determined that the distribution of correct responses significantly differed from chance (four choices, correct rate by chance at 25%), \( \chi^2(1, N = 39) = 10.89, p = .001 \).

Table 1

<table>
<thead>
<tr>
<th>Putting condition</th>
<th>Perceived best</th>
<th>Best performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Putt to marked spot</td>
<td>Putt to golf hole</td>
</tr>
<tr>
<td>Practice</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Internal focus</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>External focus</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>Distracted tone</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Totals (N = 39)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the hole putting task, participants believed that they performed better in the external focus condition (17 out of 39) and findings of actual performance indicated that participants did, in fact, perform better in the external focus condition (15 out of 39). Chi-square goodness of fit also indicated that the distribution of participants’ perceptions was in line with their actual performance, \( \chi^2(3, N = 39) = 6.15, p = .105 \). For the hole putting task, 19 out of 39 participants accurately identified their best performance. Chi-square goodness of fit revealed that the distribution of correct responses was significantly higher than chance, \( \chi^2(1, N = 39) = 10.89, p = .001 \).

**Perceived attentional focus**

For both the internal and external focus conditions, participants were asked to report how many putts they actually focused on based on the instructions. The scores were ranged from 0 to 60, with 60 representing perfect focus for all putts. Participants reported that they were able to focus accordingly most of the time; participants in the external focus group reported focusing in 46.54 out of 60 putts (SD = 8.07) and participants in the internal focus group reported focusing in 42.36 out of 60 putts (SD = 9.79). In addition, participants reported that they were able to focus externally more than internally, \( t(38) = 2.80, p = .008 \).

In the distraction condition, the rate of missed target tones was recorded for each participant. Out of 39 participants, 13 missed at least one target tone during the distraction condition. Within the 13 participants, the average number of tones missed was 1.08 (SD = 0.28). Roughly, there were about 90 target tones presented in the distraction condition. The number of target tones presented to each participant varied according to their pace of putt.
Discussion

The current study used two different measures to capture putting performance, with the aim of examining the effect of attentional focus on motor skills. It was hypothesised that external focus would produce better performance compared to other types of focus, including internal focus and distracted focus. Although there is a trend in the literature that participants perform better in external focus conditions, the current study found that this result was not statistically significant. It was also found that among the three different styles of attentional focus, there were no statistical differences in performance. These results were obtained after participants had the opportunity to practice putting by themselves in the practice condition. While the practice effect is evident in both of the measures, the present study did not aim to investigate the practice effect. Therefore, the study lacks a retention test after manipulations. While participants showed a clear improvement in performance after the practice condition, it may be due to a temporary effect of attentional focus from the manipulations.

According to previous research (Shea & Wulf, 1999; Beilock & Carr, 2001), external focus should lead to better performance than internal focus. The current study found a weak trend, in which participants performed better with external focus in both putting tasks; however this result was not statistically significant. This pattern of results does not indicate a weak attentional focus effect. In order to interpret the trend of performance in the external focus condition, there needs to be an explanation for the observed superior performance in the distracted condition compared to the internal focus condition. Based on previous research, motor performance under an internal and distracted focus should be worse compared to the practice condition. However, there is no evidence that compares the effects of internal focus and distracted focus. The performance of a novice should be worse in a distracted condition in which they have to perform a dual-task compared to an internal focus condition in which they have to perform a single task (Kahneman, 1973). However, the findings from the current study do not follow this trend as participants in the distracted condition performed slightly better than participants in the internal focus condition for both the putting tasks. It is likely that the non-significant effect of attentional focus observed in the current study is a legitimate lack of effect, rather than a result of other factors (e.g. a practice effect) masking the effect of attentional focus.

Perceived attentional focus was measured to examine how well participants could follow the focus instructions. As a self-report measure was used, it is possible that participants reported focusing most than they actually did (more than two-thirds of all the putts). Interestingly, the finding revealed that participants reported focusing significantly better in the external focus condition compared to the internal focus condition. Therefore, there seems to be a preference for external focus compared to internal focus in novice golfers. Although not directly related to the
theoretical explanation of attentional focus, this preference may explain the superior performance observed in the external focus condition. Since participants were able to focus externally, it may be that participants felt less cognitive load in following instructions during the experiment, which led to better task performance. The issue of cognitive load in internal focus versus external focus will be explored in later experiments by intentionally increasing the cognitive load of external focus cues. If external focus is superior due to less cognitive load, the beneficial effect of external focus should diminish with additional cognitive load.

Results showed that approximately half of the participants correctly identified their best actual performance. It should also be noted that performance scores were not provided to participants during the experiment; although participants could see the outcome of each putt. Therefore, even without any prior experiences in golf motor skills, novices can be insightful about their own performance in different situations. Their knowledge of results may contribute to their attentional focus if they decide to keep practicing the golf motor skill. It may lead to a different outcome in skilled performers since they are already familiar with an attentional focus style. This may reflect an expectancy effect, whereby performers anticipate a good outcome in a particular situation or with a specific focus.

The current study included two different measures of putting performance; the distance between the golf ball and target and the number of putts into a regular size golf hole. Both measures were equally sensitive in capturing the putting performance of novices, as both measures showed improvements in performance after the practice condition. When comparing the external validity of the two measures, it could be argued that putting to the golf hole is more ecologically valid compared to putting to a marked target. Therefore, the experimental task of putting the golf ball into the target hole should translate to the skills necessary for sinking a golf ball in a hole. This measure enhances the practical implications of previous studies that have used a similar measure (e.g., Beilock & Carr, 2001; Beilock et al., 2002; Beilock et al., 2004; Gray, 2004). For the purposes of this thesis, the following studies will utilise the distance to target measure to keep the experimental methods consistent with previous literature.

The current study failed to replicate the effects of attentional focus on motor performance found in previous studies. Simply focusing on the clubhead versus focusing on one’s was not sufficient to elicit differences in performance between the internal and external focus groups. Interestingly, a deterioration effect of the distracted auditory tone was not found when compared to the initial practice condition. The practice effect had the strongest influence on performance across manipulations. Previous studies (Beilock & Carr, 2001; Beilock, Carr, MacMahon, & Starkes, 2002; Beilock, Bertenthal, McCoy, & Carr, 2004) have shown that after a practice phase, beginners’ performance deteriorates when a distraction is introduced. However, the opposite effect was found,
such that participants performed better in the distracted condition after completing the practice condition.

A potential limitation of the study is the strength of the distracted manipulation. It is possible that the auditory tone-monitoring task was not distracting enough to affect participants’ attentional capacity. This would explain the lack of a deteriorating effect in the dual-task. Nonetheless, participants in the current study performed more putts compared to previous studies (Beilock, Bertenthal, McCoy, & Carr, 2004) and some went on to perform the distracted condition immediately after the single-task condition. Participants who performed in the distracted condition last, may have gained more putting experience from the two previous focus conditions. Therefore, it is more likely that the observed improvement in performance from the practice condition to the distracted condition is due to a practice effect rather than a failure of the auditory tones to distract participants.

Future research could attempt to strengthen the focus manipulation by varying other properties of the verbal instructions. For example, research could overload the amount of verbal instructional information or embed the categorisation of outcome-focus versus mechanic-focus into instructions. Examining the different ways to manipulate attentional focus would lead to a better understanding of the effect of internal versus external focus on performance. The steep learning curve in the current study needs to be taken into account for future studies. If novices are used as participants, there needs to be a considerable amount of practice before testing or conditions need to be counterbalanced to account for practice effects. Based on the findings from the current study, the next experiment will examine the effect of attentional focus on motor performance when these factors are included. Since the current attempt to eliminate confounding factors resulted in a null effect of attentional focus, the next experiment will intentionally confound the external focus condition with more instructional information to overload participants’ cognitive capacity. If the effect of internal focus and external focus can be manipulated with a cognitive load factor, the results would provide a better understanding of the underlying mechanisms involved in the effects of attentional focus on performance. In addition, the next study will examine the effect of distraction and will account for a practice effect by counterbalancing the procedure.
Chapter 4

Study 3: Examine the effect of attentional focus style with confounding factor

The first two studies of this dissertation revealed that different types of attentional focus did not affect motor performance, especially under the theoretical framework of internal versus external focus (Shea & Wulf, 1999). No effects on golf putting performance were found when the verbal cues directing the attentional focus were simplified. Furthermore, a dual-task paradigm utilising a distraction task (Beilock, Carr, MacMahon, & Starkes, 2002) did not affect participant’s putting performance. The only significant potential effect was practice, where participants improved, at least temporarily, between subsequent experimental conditions.

The third study of this research will change the strategy by maximising the difference between each attentional focus manipulations instead of simplifying them. Specifically, the verbal cues for internal and external focuses will be intentionally confounded by cognitive load; a potential factor which could help explain the effect of attention on motor performance. Therefore, it could be argued that at least one more cognitive factor was embedded in the verbal cues of internal versus external focus, and hypothetically should contribute to a stronger effect on performance compared to previous studies. The report will be split into two parts for this experiment. The same group of participants will go through the manipulation of distraction in the dual-task method first and then on to the manipulation of internal versus external focuses.

Study 3A: Distraction method

A typical manipulation of attentional focus is the usage of a secondary task or the dual-task paradigm. Beilock and Carr (2001); Beilock, Carr, MacMahon, and Starkes (2002); Beilock, Wierenga, and Carr (2002) used an auditory tone monitoring task to occupy participant’s attentional focus capacity while performing a golf putting task. Beilock, Wierenga, and Carr (2002) found that novice golfers performed worse in the dual-task condition compared to the single putting task condition, which is in contrast to expert golfers who showed an improvement (although statistically non significant) in the dual-task condition. This may be because in the dual-task condition, the high cognitive load reduced the novices’ attentional capacity and consequently led to the decrement in performance. In the second study of the current research, we used the same task order as in Beilock, Wierenga, and Carr’s (2002) study where participants performed the single-task condition first and then the dual-task condition. This task order was not a problematic confound since the hypothesis worked against the potential confound of the practice effect. Nevertheless, the second experiment did not find the same effect as in Beilock, Wierenga, and Carr’s (2002) study. Participants seemed to improve substantially to mask the effect of secondary task on performance, if there was any.
Even though the task order between the single- and the dual-task condition were the same, our second study had an unbalanced amount of practice between the participants since the dual-task condition was counterbalanced between two other experimental conditions. Therefore, the amount of putts that participants had after the first single-task condition would not be the same across participants. Some participants would have performed the dual-task right after the single putting task while others would have performed it last, after having gone through two more putting conditions. The current study will re-examine this effect of dual-task impairment on novice’s performance by eliminating other attentional focus manipulation and only focus on the single-versus dual-task putting. Since the practice effect was considerably large in the previous study, the current study will take the effect into account by counterbalancing the order of putting conditions. In addition, there will be no initial familiarisation putting phase for participants. Since a familiarisation phase would have the same putting condition as the single putting task (participants perform the putts on their own without any instructions or comments), including a familiarisation phase prior to the two counterbalancing conditions would introduce differential amounts of putts in the single putting tasks before the dual-task condition. Therefore, participants will directly start with the experimental conditions. Since the current study is a second attempt at reproducing the effect of distraction on motor performance, the same secondary task manipulation (monitoring auditory tones) as previous studies will be used (Beilock et al, 2002; Beilock et al., 2004). However, the distracting strength of this secondary task may be problematic, as previous studies found that the task did not have an effect on performance. Nevertheless, for the purpose of reproducing the effect of distraction on motor performance, the current experiment will use the same manipulation as the one in previous literature (auditory tone monitoring) to investigate changes in experimental procedure that could have undermine this effect. Thus, the hypothesis is generated in accordance with previous literature, where it is predicted that novice participants will perform worse in the distracted dual-task condition compared to single task condition without distraction.

**Method**

**Participants**

Twenty-eight people (16 females, average 20.93 years old; S.D. = 6.24) participated in the experiment. They were recruited voluntarily from a pool of first year psychology students at the University of Queensland. Course credit was given as an incentive for their participation. Most participants reported little to no experiences in golf (the highest was two mini-putt experience, more than one year ago). Two participants reported slightly more experience with having been to a golf range or out for a round of golf in the past, however, they did not play continuously for a considerable period. No participants had official golf lessons from a professional.

**Design and Procedure**
The main task was to putt golf balls on a flat artificial putting mat and attempt to make the ball stop as closely to the marked target as possible. Each participant went through four attentional focus conditions: control, distracted condition, internal focus overload, and external focus overload. The experiment was separated into two phases; first the performance comparison of control versus distracted conditions, then after a short break, they performed the internal and external focus overload. This section will report findings from the first half of this study, the distracted manipulation. The experimental conditions in this phase was held as closely as possible to Beilock, Carr, MacMahon, and Starke’s (2002) study, except for the order of the conditions, which was counterbalanced across participants (in the previous study it was not counterbalanced as the control condition was always performed first). This is because the second study of this dissertation found the practice effect to be highly influential, hence, the current study will attempt to account for the practice effect by counterbalancing the order which the control and distracted conditions are presented. There will be no practice session before the two experimental tasks because the practice session would essentially be the same as the control condition (i.e. no further instructions given regarding attentional focus during putting task). This could mean that some participants would be performing an equivalent of two control conditions where as others only one, leading to potential confounding differential practice effects. The details of the procedure in the control and distracted conditions are as follows.

**Control condition.** No instructions were given regarding putting mechanisms or how to direct attentional focus. The only instruction was the task objective of putting the golf ball as close to the marked target as possible. Participants were left to complete the putting task on their own without any further instructions or comments about their skill or performance.

**Distracted condition.** This condition required participants to perform a secondary task of monitoring an auditory target tone concurrently with the putting task. Participants had to respond verbally (by saying the word ‘tone’) once they have heard the target tone. There were two types of tones, high pitch and low pitch (played at 600 and 200 hertz respectively). Each tone played for half a second long at random intervals with an average of five tones per 10 seconds. The target tone was the high pitched tone which was played randomly at the ratio of 1:3 to the low pitch tone.

**Materials and Measures**

Participants were provided with a generic right-handed putter. The artificial putting mat was 90 × 300 centimetres in size. The marked spot for the target was placed in the middle of the mat at one end about 40 centimetres away from the edge of the matt. There were five starting points ranging from 160 to 240 centimetres away from the target placed at different angles on the opposite side. Each condition consisted of 40 puts. Participants performed the putting task at their own pace and were allowed to have a break at any time. None of them requested for a break during the
experiment. A set of five golf balls were placed on the mat and participants had to putt from the closest ball to the target first and then move on to the balls that were placed further away. The five putting distances were 160 (placed on the left side of the mat 10 centimetres away from the edge), 170 centimetres (placed on right side), 210 centimetres (placed in the middle), 230 centimetres (placed on the left side), and 240 centimetres (placed on the right side). After each ball is putted, the distance left to the target was measured with a standard measuring tape by the experimenter, and then the ball was moved away for the next putt. After a set of five balls has been putted, the experimenter placed the ball on the starting points again for the next putts.

A brief interview was conducted at the beginning of the experiment to record participant’s demographic data. Putting performance and demographic information were recorded in data sheets before being transferred into computer spreadsheet for statistical analyses. Putting performance was measured in terms of distance left to the target in centimetres. This was measured by a standard measuring tape from the centre of the golf ball to the centre of the target (marked by a cross shape). Although this measure could be argued to have less ecological validity when compared to objectively counting how many golf balls were put into the hole, previous experiments have found it to be a more sensitive measure for novice golfers.

**Results**

**Manipulation check**

The number of error tone identification was recorded. Approximately 300 tones were played in the distracted condition. Participants missed an average of 0.93 target tones ($S.D. = 1.39$) within the whole 40 putts. Considering a low missed rate, the manipulation tone was successful, participants did pay attention to perform the task of monitoring auditory tones.

**Main analysis**

Putting performance was analysed from the distance left to the target in centimetres, averaged from 40 putts in each experimental condition. The analysis of putting order effect was not intended to be analysed originally, thus the performance from control versus distracted condition was averaged across putting order. However, it was discovered later that there seemed to be an effect of putting order in such a way that participants performed better regardless of putting conditions. The two $t$-test analyses are included in the appendix. This section will report a Mixed ANOVA instead to illustrate more complete results. Results from these different analyses did not contradict each other.

A $2 \times 2$ mixed ANOVA was conducted on average putting performance. Putting order was a between-subject factor with two conditions; putting in the control condition first, and putting in the distracted condition first. The within-subject factor was attentional focus with two conditions; the control condition and the distracted condition. There was no main effect of putting order, $F(1,$
The main effect of attentional focus was also insignificant, $F(1, 26) = 0.36, p = .556$. Note that overall, the means from the control condition was slightly less ($M = 22.96, SD = 4.80$) compared to the distracted condition ($M = 23.46, SD = 5.10$).

However, the interaction was significant, $F(1, 26) = 12.26, p = .002$. This was followed up with an analysis of the simple effects of attentional focus at different levels of putting order. Pairwise comparisons showed that participants who putt in the control condition first ($M = 24.45, SD = 5.10$), performed marginally better statistically in the later condition (distracted condition; $M = 21.96, SD = 4.35$), $t(13) = 2.05, p = .050$. Similarly, participants who putt in the distracted condition first ($M = 24.96, SD = 5.48$), performed better statistically in the later condition (control condition; $M = 21.43, SD = 4.13$), $t(13) = 2.90, p = .008$. These findings suggested that participants improved in later putting conditions regardless of the manipulation of attentional focus. Figure 5 illustrated this interaction.

![Figure 5](image.png)

**Figure 5.** Means of putting performance as a function of attentional focus and putting order. Error bars represent standard errors.

**Study 3B: Internal focus versus external focus overload**

The theoretical definition of internal versus external focus is different in terms of the location of the focus (Shea & Wulf, 1999). Internal focus is defined as attention that is directed towards bodily aspect of the movement while external focus is attention that is directed towards other objects, equipment, or environmental aspects of the movement. In theory, external focus is superior as it enhances the automaticity of the movement in both novice and experts (Shea & Wulf, 1999; Wulf, McNevin, & Shea, 2001). The internal and external focuses were applied many times.
on a balancing task such as ski simulator or stabilometer (e.g., Wulf & Weigelt, 1997; Wulf, McNevin, & Shea, 2001). However, the most relevant motor skill to the current study would be a golf chipping task (Wulf, Lauterbach, & Toole, 1999), which would be similar to the golf putting movement used in this study.

Wulf, Lauterbach, & Toole (1999) used verbal instructions to direct participants’ attention to either internal or external focus. For the internal focus condition, participants were instructed to focus on the angle of their left and right elbow, making sure that it is straight at the address position. Then they had to focus on bending the right and straightening the left arms… during backswing, straightening both again for the downswing through to the impact, and then bending the left and straightening the right arms… for follow through. In contrast, in the external focus condition, participants were only told to swing the club like a pendulum motion. The clear confounding factor is the amount of information embedded in these instructions. The participants in the internal focus condition needed to focus on many aspects of the movement while those in the external focus condition had to only focus on one aspect. This systematic difference creates a potential confound of cognitive load, especially when the external focus condition is predicted to produce a better performance. It could be argued then that the worse performance in the internal focus condition was due to cognitive overload when compared to the external focus condition, which was subjected to a significantly lower amount of information. Although other previous research on internal versus external focus did not have this cognitive overload issue (the majority of which are balancing tasks), it is problematic in golfing tasks. Wulf, Lauterback, and Toole’s (1999) golfing task was the only study that provided detailed information on the actual verbal instruction while other study that utilised golf putting tasks (e.g., Wulf & Su, 2007) did not provide as much details.

This experiment will attempt to tease apart this issue by manipulating the confounding variable of cognitive overload. The verbal instructions given for the external focus condition will be intentionally overloaded with more information than the internal focus condition. This pattern of manipulation will allow for an analysis of prediction in the opposing direction. Assuming that cognitive overload of attentional capacity has a deteriorating effect on performance; the internal focus condition would produce better performance than the external focus condition if cognitive overload has a stronger effect on motor performance. On the contrary, if the effect of internal versus external focus on motor performance is larger than that of cognitive overloading, then the performance in the external focus condition would be superior to the internal focus condition.

This method of contradicting hypotheses is preferred to having a 2×2 factorial design (attentional focus [internal versus external] × information overload [overload versus not overload]) in order to avoid confusion for the participants when going through the experimental conditions. Especially when this experiment intentionally utilises a within-participant design to reduce
individual difference in learning and putting performance, if there were to be different number of verbal cues in multiple conditions (e.g. six cues in the internal overload condition versus one cue in its internal counterpart) there would inevitably be carry-over effect amongst the four factorial conditions. The chance of interference of verbal cues from previous conditions would be reduced if there were less experimental tasks to conduct. Therefore, if the confound of information overload holds, then it would be predicted that the external focus overload condition will impair putting performance.

Method

Participants

Participants were the same group as in study 3A. After going through the experimental condition in study 3A, they continued to putt in the experimental task of 3B. Altogether, both 3A and 3B took approximately one hour and fifteen minutes to complete.

Design and Procedure

After the first two conditions were completed in 3A, the experimental task of 3B began right after to compare the effect of internal versus external focus. An information sheet with basic putting mechanics in several bullet points was provided before the participants began the putting task in both conditions. This information sheet was provided in order to control for the amount of information about putting mechanics given to participants so that they would be exposed to the same amount of information before conducting the internal and external focus conditions. Therefore, the only difference between the two conditions would be the direction of attentional focus as instructed. In addition, the order which the two conditions were presented was also counterbalanced across participants.

Internal focus condition. Participants were asked to focus on one aspect of the skill, the movement of their hands. This instruction was made to be very similar to what was used in previous research as possible (focus on bodily movement aspect of the skill; Shea & Wulf, 1999). However, compared to Wulf, Lauterbach, and Toole (1999), the verbal cue for internal focus was greatly simplified and excluded suggestions on golf swing mechanics. Participants were reminded of the focus after every fifth putt.

External focus overload condition. Participants were told to memorise and attend to six key points from the putting information sheet. These six key points were selected to comply as closely as they can with the definition of external focus (Shea & Wulf, 1999). The points were selected from a generic coaching material provided in the information sheet. This is so that the amount of initial information given to the participants was kept constant, thus new information would not appear in the six external cues on top of the original putting information. The current selection also attempted to follow characteristics of cues used in previous research. Table 2 shows
the actual verbal cues used to direct external focus in previous research. The table only compares studies that utilise multiple external focus cues. The major concern was to select the cues in such a way that they do not direct attention towards bodily movement or mechanics. Furthermore, the cues were kept as short and concise as possible since participants had to recite them later for the manipulation check.

Table 2
Comparison of multiple cues used for external focus manipulation. Note that the table arrangement does not represent each cue’s counterparts, rather it represents the order given to participants.

<table>
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<tr>
<td>Keep it simple.</td>
<td>Position the ball between your feet and in front of you.</td>
<td>Focus on the center of the dart board.</td>
<td>Do not think about your body parts or body mechanics while throwing.</td>
</tr>
<tr>
<td>Square stance to target.</td>
<td>Swing the head of the club straight back, no further back than it goes forward on follow-through.</td>
<td>Slowly begin to expand upon perspectives of the dart board.</td>
<td>Do not think about what you should be doing in so far as technique is concerned.</td>
</tr>
<tr>
<td>Swing in a straight line.</td>
<td>It is better for the club to have a shorter follow-through than a longer one.</td>
<td>Then refocus to the center of the dart board, expanding the center and making it as large as possible.</td>
<td>Do not focus on the mechanics of your body movements.</td>
</tr>
<tr>
<td>Short swings for short putts, long swing for long putts.</td>
<td>Accelerate the club head straight through the ball.</td>
<td>Toss the dart when so focused.</td>
<td>Instead your focus should be on the effects that these movements.</td>
</tr>
<tr>
<td>Swing in a pendulum motion.</td>
<td>Finish with “face” of the club head pointing straight in the direction of the target.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long follow-through.</td>
<td></td>
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</table>

Since the external focus verbal cues were selected from the information sheet provided, it is somewhat restricted compared to generating new verbal cues. However, the verbal cues were complied as carefully as they can to not refer to bodily aspects of putting mechanics. Specifically, the six verbal cues selected from the information sheet were, ‘Keep it simple’, ‘Square stance to target’, ‘Swing in a straight line’, ‘Short swings for short putts, longs swing for long putts’, ‘Swing in a pendulum motion’, and ‘Long follow through’. Participants were reminded of the cues after
every fifth putt in the same manner as the internal focus condition. Participants were told that the six verbal cues were simplified versions of the instruction from the information sheet.

The aim of this intentional systematic difference between the internal and external focus conditions was to examine the effect of cognitive overload of the attentional focus cues. The previous studies of this dissertation did not find the effect of attentional focus when verbal cues were modified to deal with potential confounds. Therefore, the current study attempted to include previously identified cognitive load issues in order to replicate the effect of attentional focus on motor performance. However, the manipulation was conducted in such a way that the verbal cues overloaded the information of the external focus condition instead of the internal focus condition, so that the hypothesised effect of cognitive load operates against the effect of internal versus external focus. If the cognitive load manipulation were to have an effect on motor performance, then the pattern of results will show a better performance in the internal focus condition compared to the external focus condition, which is opposite to what the internal versus external focus theory predicts.

For the purpose of the manipulation check, after the internal focus condition was completed, participants were asked to indicate the number of putts in which they were actually able to focus on the movement of their hands. This measure was recorded in the number of putts out of 40. In the external focus condition, participants were asked to recite the six key points after every block of ten putts. The number of correctly memorised points out of six was recorded and averaged for each participant. For the distracted condition, the experimenter recorded the number of missed target tones during the whole task as a basic indication of whether the participants were paying attention on the tones or not.

Results

Manipulation Check

For the internal focus condition, participants reported being able to focus on the movement of their hands at an average of 30.47 putts out of 40 (S.D. = 5.72). In the external focus overload condition, participants almost had a perfect recall of the six key points. On average, participants recited 5.43 points out of six (S.D. = 0.41). The manipulation was successful, participants were focusing accordingly in the internal focus condition and were able to memorise six key points for the external focus overload condition.

Main Analysis

The same analysis was conducted in the same manner as in phase 3A. The initial overall performance analyses collapsing across putting order is included in the appendix. This section will report a 2 × 2 mixed ANOVA on average putting performance. Putting order was a between-subject factor with two conditions; putting in the internal focus condition first, and putting in the
external focus overload condition first. The within-subject factor was attentional focus with two conditions; the internal focus condition and the external focus overload condition. There was no main effect of putting order, $F(1, 26) = 0.44, p = .512$. The main effect of attentional focus was also insignificant, $F(1, 26) = 0.09, p = .763$, as well as the interaction, $F(1, 26) = 1.73, p = .200$. For the interest of the main hypothesis, overall means from the internal focus versus external focus overload conditions were very similar ($M = 21.16, SD = 4.31$; and $M = 21.38, SD = 4.59$, respectively). Figure 6 illustrates the mean distance left to target from these experimental conditions.

![Figure 6](image)

**Figure 6.** Means of putting performance as a function of attentional focus and putting order. Error bars represent standard errors.

**Overall performance improvement**

In addition to the two main analyses, practice effect was examined across the experimental phases, from control versus distracted to internal versus external (3A to 3B). An overall performance in each phase was calculated by averaging the scores from the two experimental conditions (from 80 putts in 3A compared against 80 putts in 3B). The score from study 3A was averaged from performance in the control and distracted conditions, and the score from study 3B was averaged from the internal focus and external focus overload conditions. A repeated-measure $t$-test revealed that participants performed significantly better in study 3B ($M = 21.27, S.D. = 4.01$) compared to study 3A ($M = 23.20, S.D. = 4.15$), $t(27) = 4.08, p < .001$.

**Discussion**

The current study hypothesised that participants would do better in the control condition compared to the distracted condition and would do better in the external focus overload condition.
compared to the internal focus condition. These hypotheses were made in accordance to the theoretical framework in previous literature. The current findings revealed that there were no statistical differences in putting performance between the control and distracted conditions. Furthermore, there were no differences in performance between the internal focus and the external focus overload conditions.

The pattern of results, however, was in the predicted direction. From the first phase (3A) of the study, participants performed slightly worse in the distracted condition. In comparison to the second study of this dissertation where there were no counterbalancing procedures, the effect of practice was so large that it was evident even in the dual-task (distracted) putting condition. Therefore, the current study partially succeeded in terms of taking the practice effect into account by utilizing the counterbalancing method. When the order of putting conditions was counterbalanced across participants, overall results showed a slight decrement in performance (although statistically non-significant) in the distracted condition compared to the control condition. However, when compared to previous literature (Beilock, Wieranga, & Carr, 2002), the effect of dual-task (distracting auditory tones) was not large enough to produce significant results. Contradictory to previous research (Beilock, Wieranga, & Carr, 2002) the effect of dual-task on motor performance does not seem to be as great as the practice effect. Previous studies could produce the dual-task effect even when the practice effect worked in the opposite direction of the hypothesised results. The participants in the current study did not significantly perform worse in distracted condition when the practice effect was taken into account. This raises the issue of whether the auditory tone distractor was demanding enough as an attentional focus manipulation or not.

The findings from the experimental phase 3B, however, did not support the prediction of the beneficial effect of external focus. Since the overall performance from the two focus conditions were almost identical (both approximately 21 centimetres away from target), this finding is subjected to many interpretations. For example, it could be argued that the insignificant finding was a result of the inclusion of overloading the attentional capacity with extra verbal cues. Therefore the information overload might have offsetted the beneficial effect of external focus. Nonetheless, this argument would be more persuasive if participants had performed better in the internal focus condition, since it would be an indication of an information overload effect.

In addition, the nature of this experiment could present a theoretical issue when comparing results to previous literature. Many previous studies in the internal versus external focus line of research (e.g. Wulf, Lauterbach, & Toole, 1999; Wulf, 2007; Wulf & Su, 2007) have found the benefit of external focus to be evident in motor learning. With the performance testing nature of the current study, it could be argued that the verbal cues manipulation used in this study was not strong.
enough to elicit an immediate effect on putting performance. Since participants did not go through the practice period with one particular style of attentional focus, the absence of a learning component in the current study could have led to an incomparable methodology with previous studies. However, it should also be noted that, even with motor learning practice periods and retention tests, many studies showed performance differences from early training phases (e.g. Wulf, Lauterbach, & Toole, 1999; Wulf, McNevin, & Shea, 1999; Wulf & McNevin, 2003). Therefore, it is arguable that the beneficial effect of external focus should be evident even with a performance testing (with or without practice), similarly to the initial effect seen in the early learning phase.

The author acknowledges that the above conclusions are weak since they are based on findings that bear no statistical significance. Furthermore, by constructing the focus cues according to a generic set of coaching instructions, this could have potentially introduced extra embedded information on top of the attentional focus locality. However, previous studies were also subjected to a similar issue but were still able to produce the desired pattern of results (e.g. Wulf, Lauterbach, & Toole, 1999; Wulf & Su, 2007). Specifically, the cues in the external focus condition could have embedded suggestions on swing mechanisms (e.g. swing like a pendulum), while the internal focus condition provided no suggestions on the overall concept of a golf chipping swing. This inconsistency in embedded information of the cues is problematic since it can be argued that the effect on performance could be due to other aspects of the verbal cues. For example, it could be that by simply telling participants to swing like a pendulum, a smoother and rhythmic swing was executed, which potentially could be beneficial to performance. Specifically, in the current study, the verbal cue, ‘Swing in a straight line’ could be interpreted as suggesting participants to change their bodily movement to achieve a straight swinging line and potentially change the mechanics of the performance in a beneficial way. Nonetheless, the current study included an additional factor, which was the amount of information provided in each condition. There were six cues given in the external focus condition, which should have worked against the supposed beneficial effect of external focus. The results, however, did not show any statistical difference in performance. Therefore, the most conservative interpretation would be that no matter the underlying performance factor or manipulation (e.g., location of attention, amount of information, embedded information), there is no significant effect on golf putting performance.

Given the within-subject design of the current study, even though statistical error due to individual differences is minimized, the issue of carry-over effects still needs to be acknowledged. Since the nature of the external focus manipulation (cognitive overloading) led to more cues, those who performed this condition first may have lingering effects from the cues, which could have carried on to the next conditions. Specifically, differential amounts of putting information (since the external cues were selected from a set of coaching instructions) may have been carried over to the
second internal focus condition. Even though this would not have confounded the overall results with the counterbalance procedure put in place, it could have still affected the findings in the sense that the overall error was increased. The order of manipulated conditions could have led participants to interpret the cues differently on their own, due to the different emphasis on the cues at different order. These could eventually contribute to the non-significant findings in the current study.

Another note on the methodology is the measurement issue. The measure for putting performance in the current study was the exact distance left to target in centimetres, which is different to Wulf, Lauterbach, and Toole’s (1999) study where concentric circles were used with a point system. From the face value, measuring the exact distance to the target seems to be a more sensitive measure compared to scoring from a dart-board style system. This measurement issue was discussed in the second study of this dissertation where, it was found that the exact distance to the target was a very sensitive measure, at least in terms of capturing the practice effect. Therefore, this measurement procedure should not be problematic in the current study. If the attentional focus manipulations have an effect on performance, the difference should be evident with this measure.

Although the effect of attentional focus was not found statistically in the current study, the findings are quite informative for practical applications in the coaching and learning context. Learners at the novice level are not affected very much by the different focus locations. This lack of attentional focus effect on performance in novices could be related to motor automaticity. As explained by Beilock and Carr (2001), Beilock, Carr, MacMahon, and Starkes (2002), focusing on the skill mechanics (‘skilled-focus’ type of attention) is detrimental to performance due to the disruption of motor automaticity. Therefore, it could be that the participants in the current study may have not had enough practice to develop motor automaticity to a level that can be disrupted. Consequently, the next study in this series of research will aim to develop novices’ skills to somewhat improve and then attempt to manipulate their attentional focus to disrupt their performance. Even though it would be impossible to improve novices’ skills to resemble that of the experts, the pattern of findings should change slightly accordingly to the improvement of skills if the explanation of motor automaticity holds. It can be expected that different manipulations of attentional focus will not affect the novice initially, but once the novices had had some practice and had improved their skills, their performance should be affected by these manipulations. This future research would also bridge the gap between the development of skills from the two extremes; novice and experts and provide some insight on how attentional focus changes once skills improve.
Chapter 5

Study 4: Training experiment

The manipulation of attention used in the current study will be based on the manipulations used in the distraction line of attentional focus research (Beilock & Carr, 2001; Beilock, et al., 2002; Beilock, Weirenga, & Carr, 2002, Beilock et al., 2004; Gray, 2004). This is a slight move in the focus of our research as we drop the investigation of attention manipulation through verbal instructions (i.e., Wulf’s internal versus external; Wulf, McNevin, & Shea, 2001; Wulf & McNevin; 2003). This is because the past three studies examining this line of research (manipulating internal and external focus of attention) did not produce any differential effects on golf putting motor skills. These findings were obtained both through replication and modification of previous methodology. As such, it is decided that for the general purpose of this research, the author will move on to examine other methods of manipulating attentional focus. In the previous study, distracted manipulation seemed to produce a similar pattern of results to previous literature, therefore, the research direction will pursue and extend this line of research.

The experimental method of comparing novices against experts is typically used to determine the cognitive processes involved when motor skills are developed. The extreme ends of the skill levels (novices vs. experts) are often investigated to demonstrate the differences in the effect of attentional focus. With this methodology, the missing information is the gap between the skill levels of novices and experts. From a learning and coaching viewpoint, it is very interesting to investigate how novices develop into the beginner-intermediate level, how these skills are quickly acquired and more importantly, whether there are any changes in the cognitive process that may enhance the learning experience. It is the aim of the current study to inspect this initial skill development of novices and whether skill acquisition has any influence on the effect of attentional focus on motor performance.

One of the cognitive components linking attention and motor performance is the automaticity of motor movements. It has been established that a skilled movement becomes automatic in nature after a period of repeated practice (Keele, 1973). This concept has been defined in different ways, such as, a motor program (Keele, 1973), schema (Schmidt, 1975; cited in Newell, 1991), or pre-structured motor command (Summers, 1981). Nevertheless, the focal idea is similar; a motor movement can become automatic with practice and this automaticity is characterised as requiring little to no attentional focus capacity (see also, Shinar, Meir, & Ben-Shoham, 1998). Therefore, attentional focus manipulations would affect novices’ performance negatively when attention is distracted from the task at hand, as they require a lot of attentional capacity to perform. On the other hand, this distraction of attentional focus should not affect experts’ performance since they do not require as much attentional capacity to perform.
Interestingly, not only does attentional capacity allocation affect motor performance, the locality of the attentional focus can also affect performance too. Beilock and Carr (2001) claimed that ‘skill-focused’ type of attention is detrimental to motor performance as it interferes and disrupts motor automaticity. The skill-focused attention is the type of focus that directs attention towards one self or the movement mechanics of a particular skill (Beilock & Carr, 2001; Beilock, Carr, MacMahon, & Starkes, 2002). Although the actual disruption of motor automaticity has not been directly tested, it has been shown that directing participants’ focus to their own movement is detrimental to performance (Beilock & Carr, 2001; Beilock, Carr, MacMahon, & Starkes, 2002; Beilock, Bertenthal, McCoy, & Carr, 2004). A similar concept, proposed by Wulf, Hob, and Prinz (1998); Shea and Wulf (1999), is internal focus and has also been producing the same pattern of results. Although named differently from ‘skilled-focused’ attention, the theoretical explanation is the same; focusing internally is to focus on one’s bodily movement, which also leads to an interference with motor automaticity. The negative effect of focusing on one’s movement ties into the distracted attention issue as well, in the sense that if performers were distracted from the task at hand, they would not have the opportunity to direct their attention internally or have a skill-focused type of attention. This theoretical argument can be seen in earlier literature under the concept of reinvestment (Masters, 1992; Masters, Polman, & Hammond, 1993).

The overall concept of reinvestment is that the automaticity of skills can be undone or disrupted through conscious control (Masters, 1992; Masters, Polman, & Hammond, 1993). More specifically, Masters and Maxwell (2004) operationalised reinvestment as, ‘manipulation of conscious, explicit, rule based knowledge, by working memory, to control the mechanics of one’s movements during motor output’ (pp. 208). This explanation reiterates the importance of the link between motor automaticity and locality of attention. Although the current study will mainly follow the manipulation of secondary tasks used by the distracted line of research (Beilock & Carr, 2001; Beilock, Carr, MacMahon, & Starkes, 2002; Beilock, Bertenthal, McCoy, & Carr, 2004), the theory of reinvestment potentially unites the different manipulations and could be used to explain the effect of attentional focus on acquisition of motor skills. This is because the reinvestment theory fits with the overall concept of skill development (Anderson, 1993; Fitts & Posner, 1967; Shiffrin & Schneider, 1977) regarding the nature of skill learning where novices tends to rely on the conscious control of declarative knowledge while experts’ skills become automatic and procedural in nature. Therefore, it potentially explains the effect of attentional focus on different stages of motor skill development. Speculatively, the distraction or secondary task should only worsen performance of novices (at the declarative stage of skill development) while having no effect on experts (at the procedural and automatic stage of skill development). In addition, novices, at some
point along the skill development timeline, should advance to rely on procedural knowledge and this switch in cognitive processes should be evident through the manipulation of attentional focus.

It has been demonstrated in previous literature (Beilock & Carr, 2001; Beilock, Carr, MacMahon, & Starkes, 2002; Beilock, Bertenthal, McCoy, & Carr, 2004) that attention affects motor performance through motor automaticity. That is, experts develop their skills to the point that the movement process is automatic in nature, which requires less attention capacity to perform at the optimum performance. Beilock and Carr (2001) found that experts’ performance in a dual-task condition only suffers when they are put under pressure. They claimed that the experts require less attentional focus capacity to perform the task, which is why loading the attentional capacity through utilizing the secondary task alone was not enough to decrease experts’ performance.

Beilock, Wierenga, and Carr (2002) hypothesised that if experts’ skills can be reverted back to the initial novice-like state, consequently, their cognitive processes regarding the amount of required attentional capacity would also be similar to that of novices’. They tested this claim by examining experts’ initial performance when they were supplied with novel golf equipment. It was shown that when the experts familiarising themselves with the new equipment, the secondary distraction task was detrimental to their performance, similar to those of novices. These studies demonstrated that the effect of attentional focus on motor performance is dependent on skill level according to motor automaticity.

Experiments supporting the explanation of motor automaticity is typically done by comparing the performance of experts and novices (e.g., Beilock & Carr, 2001; Beilock, Wierenga, and Carr, 2002). Apart from the series of research done on golf putting tasks, this effect is also found in other sport skills. Gray (2004) found that novice baseball players were affected negatively by the extraneous dual task but experts were not. Beilock, Carr, MacMahon, and Starkes (2002) extended their study to the soccer dribbling task and found a similar pattern of findings. Experts were able to dribble faster in the dual-task condition compared to other conditions (?), while novices performed worse in the dual-task condition. In addition to finding this effect in various sport skills, different types of secondary tasks also produce the same pattern of results. Beilock and Carr (2001) used a word monitoring task where participants had to listen to a series of words during the golf putting task and respond verbally to the target word when it was presented. Beilock, Carr, MacMahon, and Starkes (2002) used a similar dual-task method except that participants had to monitor tones instead of words. More interestingly, Beilock, Bertenthal, McCoy, and Carr (2004) achieved the same pattern of results by simply telling participants to perform as fast as they can. It was suggested that by applying a time constraint, performers did not have enough time to direct their attentional focus on the movement of their skill, which is essentially the same as having a secondary dual-task to direct their attention elsewhere.
The current study will train novices in golf putting skills and examine the effect of attentional focus on their putting performance. Once the novices develop their putting skills to a certain point, their movement should become somewhat automatic in nature and influence the pattern of dual-task effect on putting performance. This training research design will show the developing trend of attentional focus effects when novices improve their motor skills. Since the previous studies of this series of research did not find the effects of attentional focus with the tone monitoring task, the current study will utilise multiple manipulations to distract participants’ attentional focus. There will be a tone monitoring task to compare the effects of previous study (Beilock, Carr, MacMahon, & Starkes, 2002); a word memorising task (a modification from Beilock & Carr, 2001) to attract the attention of participants to a set of words they have to remember; and a speeded condition similar to Beilock, Bertenthal, McCoy, and Carr (2004). According to previous literature and potential theoretical explanations (i.e. reinvestment theory; Masters, 1992), it is expected that the tone monitoring task and the word memorising task would impair putting outcome at the beginning of the training period. Then, after the participants have developed their skills to possess some level of automaticity, this effect should be attenuated. Note that at the face value, speeded instruction does not have as much attentional capacity occupying quality as the distraction tone or word memorising task. Consequently, the theoretical explanation cannot be readily applied since it is arguable that there is no actual manipulation of attentional focus. As such, the prediction regarding its effect on putting outcome will be based on a previous finding (Beilock, Bertenthal, McCoy, and Carr, 2004); the speeded instruction will impair performance at the novice skill level, and this effect should be attenuated or reversed once the skill level has improved (Beilock et al, 2004). If the results obtained are as predicted, it would strengthen the current evidence of attentional focus effect on the development of motor skill.

Method

Participants

There were 9 participants in total (six females) who were recruited from a publicly advertised paid-participants scheme by the University of Queensland. Their age ranged from 18 to 29 years old ($M = 22.89$, $S.D. =3.66$). No participant had prior experience with golf putting activities. Most participants do exercise and conduct in other types of physical activities on a regular basis, namely, basketball, jogging, gymnastics, badminton, and pilates. However, these skilled experiences should not be transferable to or interfere with the acquisition of golf putting skill. In terms of background experiences, participants had the same level of golf putting skills at the beginning of the experiment. All participants are right-handed. In addition, they were compensated monetarily. The compensation was paid in total of 90 Australian dollars for attending
7 one-hour sessions. They received 10 dollars at the end of each session and 30 in the last session. The experiment took two and a half weeks.

**Design and procedure**

Participants had to perform a golf putting task for seven sessions over a period of two and a half weeks. There were on average, a two day break between each session but the participants were allowed to choose their own experimental day as long as the 7 sessions were distributed evenly. Participants were not allowed to attend two sessions consecutively, and were not allowed to have more than a three day break in between. In each putting session, participants performed 160 putts in total on a flat artificial putting mat. The objective is to putt a golf ball from the starting point and attempt to stop the ball as closely as possible at the marked target. A session lasted approximately one hour.

The participants were provided with generic instructions about golf putting movements at the beginning of each session. This golf putt instruction was printed one-sided on an A4 size sheet of paper. There was only one type of golf putting instruction that was provided and the experimenter did not comment on nor give any pointers about the participants’ movement or skills. The total of 160 putts in each session was divided into 16 blocks of 10 putts each. Participants were informed of their performance at the end of each block but not the overall performance at the end of each session.

There were two types of putting sessions; first was the testing session where participants had to perform the putting task in different attentional focus conditions, and second was a practice session where participants perform the putts on their own without any intervention. The order of testing and practice were alternated between days; testing was conducted in the first, third, fifth, and seventh sessions, and practices were conducted in the second, fourth, and sixth session.

**Testing session.** These sessions consisted of four attentional focus manipulations. Participants performed four blocks of putts (40 putts in total) in each focus condition in a counterbalanced order across the putting blocks. The four attentional focus conditions are as follows:

- **Control condition.** Participants performed the putting task on their own without any instructions or additional tasks.

- **Distracted tone condition.** Participants were asked to perform the golf putting task concurrently while monitoring a series of auditory tones played from a computer. The tone monitoring task required participants to response verbally by saying the word ‘tone’ to the target tone. There were two types of tones, high pitch and low pitch (played at 600 and 200 hertz respectively). Each tone was played for half a second long at random intervals with an average of
five tones per 10 seconds. The target tone was high pitched which was presented randomly at the ratio of 1:3 to the low pitch tone.

Word memory condition. During a block of putting, a set of five English words was played at a constant interval and the set was repeated until participants finished the last putt of the block. On average, the set of words was repeated three times during a block of putts. At the end of each block, participants were asked to recite as many of the five words as they can, in any order. This memory task was done so that participants needed to attend to the set of words in order to memorise them (Chun & Turk-Browne, 2007), therefore, participants’ attention would be directed away from the golf putting task. There were four different sets of words for each putting block, an example of a set is ‘deluge, faction, lurch, muse, statute’.

Speeded condition. Participants were told to perform the block of 10 putts as fast as they can. They were carefully explained that they should not rush the swing itself, but instead speed up the preparation time between each putt. This task was found by Beilock, Bertenthal, McCoy, and Carr (2004) to have a similar effect as distracting participants’ attention away from the task at hand, since they do not have enough time to attend to their own movement.

Practice session. There were no additional attention-related instructions; participants performed 16 blocks of putts on their own. If the participant wished to revise the putting instructions, the same information sheet was given to the participant for a brief period. Their putting performance was provided at the end of each block. There are no additional comments from the experimenter.

The number of sessions and putts were chosen based on previous research (Beilock, Wierenga, & Carr, 2002; Brickner & Gopher, 1981; Rochester et al., 2010; Sacco et al., 2006). The amount of training required to show a particular attention or automaticity effect varied depending on the task of interest, ranging from two sessions within a single day (tracking and letter typing task; Brickner & Gopher, 1981) to three weeks (gait training in Parkinson patient; Rochester et al., 2010). Specific to the current study, it was claimed that after 650 trials of golf putting tasks (Beilock, Wierenga, & Carr, 2002) distributed over three days, performance of novice golfers in putting, under laboratory conditions, improved to a similar level to that of experts. The current study will increase this number to a total of 1,120 putts distributed over seven sessions. This increased number of putts was because the current study has more attentional focus manipulations, which requires more number of putts to calculate the average performance. Also, the testing phase was done regularly during the experimental period, which resulted in a longer distribution of putting sessions over two and a half weeks. This was to allow for an interruption of the testing session in between. Pilot testing from two experienced golfers (single handicap) revealed that their performance on the putting task was similar to the participants’ performance in the last session.
Furthermore, this performance also corresponded with a similar putting task conducted in Beilock, Wierenga, and Carr (2004).

**Materials and measures**

A generic right-handed putter was provided for the participants. The artificial putting mat was $90 \times 300$ centimetres in size. The marked spot for the target was placed in the middle of the mat $240$ centimetres away from the starting point. There were five starting points ranging from $160$ to $240$ centimetres away from the target and placed at different angles on the artificial mat. Five golf balls were placed at a time for participants to putt consecutively at their own pace. The experimenter measured then took the golf balls out of the way for the next putts. After the set of 5 balls were putted, the balls were placed back at the starting points by the experimenter.

Putting performance was measured in terms of actual distance in centimetres left to the target. A standard measuring tape was used to measure the distance and data was recorded on a laptop computer. The average performance scores were calculated automatically on a spreadsheet software in order to provide immediate feedback right after a block of putts. Other measures included manipulation checks such as counting the number of times that participants missed the target tones in distracted condition, number of words that participants can recite after a block of putts in the words memory condition, and the time it takes to complete a block of putts in the speeded condition.

**Results**

**Manipulation check**

There were three manipulation checks for each attentional focus condition (auditory tone monitoring, word memory, and speeded condition). In a session, participants performed 40 putts in each of the focus condition. On average, these 40 putts took $11.67$ minutes to complete ($S.D. = 1.37$; including control condition). Number of times participants missed the target tone was recorded to be on averaged of $0.84$ tone ($S.D. = 1.62$) from a total of approximately $300$ tones played during the 40 putts. For the word memory task, participant were asked to recite the set of five words after each block of 10 putts, thus four different sets were recited for 40 putts. On average, participants forget $0.53$ words per four sets ($S.D. = 0.26$). In the speeded condition, participants putt at the rate of $23\%$ faster compare to the control condition. From the total of 40 putts, speeded condition took an average of $9.81$ minutes to complete ($S.D. = 1.79$).

**Putting performance in different attention conditions**

Averaged scores in each focus condition were calculated from the four blocks of putts. For each participant, there were four testing sessions with four focus conditions each. Therefore, the analysis will be comparing the mean performance from the four focus conditions (control, distracted, memory, speed) in each of the four testing sessions (first, third, fifth, and seventh
Performances from practice sessions are not included in this analysis since there was already a control condition for comparison in the testing session.

Figure 7 illustrates the putting performance as a function of putting sessions and focus conditions. Findings from a $4 \times 4$ within-participants ANOVA revealed a significant main effect of training sessions, $F(3, 24) = 57.63, p < .001, \eta^2_p = .89$. Bonferroni adjustment for three pairwise comparisons ($\alpha = .017$) was applied to examine the performance trend. Findings showed that the training effect was as expected, participants performed better in the later putting sessions compared to the earlier ones. First session performance ($M = 30.61, S.D. = 4.47$) was significantly worse compared to the third ($M = 22.50, S.D. = 2.94$), $t(8) = 11.07, p < .001$; the fifth session ($M = 20.32, S.D. = 1.98$) was significantly better compared to the third session, $t(8) = 3.25, p = .012$; and the last session ($M = 18.47, S.D. = 2.17$) was significantly better than the fifth, $t(8) = 3.91, p = .004$.

A main effect of putting conditions was also found, $F(3, 24) = 12.36, p < .001, \eta^2_p = .68$. This finding is illustrated in Figure 8. Pairwise comparisons were conducted based on the theoretical background, Bonferroni adjustment for three pairwise comparisons ($\alpha = .017$) was applied. Each attentional focus condition was compared against the control condition. Putting performance in the word memory condition ($M = 22.45, S.D. = 2.65$) was not significantly different
from the control \((M = 22.96, S.D. = 2.64), t(8) = 0.70, p = .503\). The overall performance of the distracted condition \((M = 21.71, S.D. = 2.65)\) was significantly better compared to the control condition, \(t(8) = 2.61, p = .031\). While the speeded condition \((M = 24.79, S.D. = 2.57)\) produced worse performance compared to the control, \(t(8) = 3.43, p = .009\). There was no significant interaction between the training sessions and focus conditions, \(F(9, 72) = 1.36, p = .225, \eta^2_p = .15\).

![Figure 8](image)

Figure 8. Overall putting performance from each focus condition, averaged across four training sessions. Error bars represent standard error.

The training effect was also calculated with all seven sessions including the practice session. Figure 9 shows the putting performance averaged per session from the first session through to the seventh. A one-way ANOVA was conducted with the overall performance from each session. Results revealed a significant main effect, \(F(6, 48) = 44.91, p < .001, \eta^2_p = .85\). Pairwise comparisons comparing the performance of a session to its consecutive one showed an improving trend until it seemed to reach a plateau in the sixth \((M = 18.55, S.D. = 3.12)\) and seventh \((M = 18.47, S.D. = 2.17)\) session, \(t(8) = .153, p = .882\).
Discussion

It was predicted that the effect of practice will interact with the attentional focus manipulation. Specifically, it was expected that the three attention manipulations would be detrimental to novice’s performance during the earlier sessions and this negative effect would reduce or reverse in pattern during later sessions. The findings of the current study did not support this notion, as there was no interaction between training sessions and focus conditions. The effect of attentional focus on performance statistically remained the same at the beginning and after practice. The overall effect of attentional focus was predicted to have a similar pattern to the control condition. However, the current findings showed that the three manipulations all had different patterns of effect. The distracted tone task had a non-significant beneficial trend to putting performance while the speeded condition was detrimental, and the word memory task did not seem to have any effect on the performance compared to control condition.

To be extremely conservative, the only interpretation from the current results is that different focus manipulations operate differently and the effect on motor performance may not have anything to do with attention at all. For example, the distracted tone task could have helped participants get into a consistent putting rhythm and thereby aided their performance. On the other hand, the speeded instruction task might have made participants felt rushed and hurried their putting

Figure 9. Average putting performance from all putting sessions (including practice and testing sessions). Error bars represent standard error.
swing, which consequently could have hindered their performance. It could also be argued that, according to the attentional focus theoretical explanation, the three manipulations varied in attentional capacity requirements. For instance, rushing participants in the speeded condition could have required more attentional capacity compared to memorising a set of words, which is why the speeded condition was more detrimental to putting performance. However, this argument is less likely, as the pattern of results was reversed in the distracted tone task and participants actually performed better in the distracted tone condition. Therefore, to argue that the distracted tone required less attentional capacity does not explain its beneficial effect when comparing performance to the control condition.

Arguably, the speeded instruction condition is the most interesting manipulation of attention since it was claimed, counterintuitively, that speeded instruction enhances performance of experts (Beilock, Bertenthal, McCoy, & Carr, 2004). It could be argued that the results of the current study contradicts previous literature (Beilock, Bertenthal, McCoy, & Carr, 2004) since it was found that speeded instruction worsened overall performance regardless of skill level. If it were to be teased apart and focused on the effect of speeded condition when the participants were trained, then it can be argued that the results from the current study contradicts what was found in Beilock, Bertenthal, McCoy, and Carr’s study (2004). However, this interpretation is only applicable if there was an interactive effect of other manipulations in the current study. For example, according to the hypothesis, secondary tasks should show an interactive pattern with skill level in that they worsen initial performance but the effect is alleviated as participants have more practice. If the other two manipulations (distracted tone and word memory task) followed this hypothesised pattern, and only the speeded instruction worsened performance across all sessions, then it could be argued that the finding from the speeded condition potentially contradicts the previous study. However, since the interaction was not found with any manipulation, and different manipulations exhibited different patterns of overall effect, it is more appropriate to interpret the findings more conservatively. As stated earlier, it is more likely that the attentional focus manipulation independently affect motor performance outside the scope of effect through attentional focus.

Admittedly, the current study comprised of a low number of participants. However, this is not a basis for dismissing the current results for statistical reasons, as the finding of the overall practice effect suggests that the current study is adequate to capture the statistical results if the actual effect was considerably large. As expected, it was found that participants’ putting performance improved steadily over the sessions. This is an indication that the current study’s measurement was sensitive and reliable enough to measure putting performance. If the effect of attentional focus was to be regarded as an occurrence caused by statistical chances, then the practice effect must also fall into the same category. However, as a clear pattern emerged in both the
analyses of the training sessions alone and of all the seven sessions, it is not likely that these findings are due to statistical error.

Amount of practice could potentially pose another issue in this study. Previous studies (e.g., Beilock & Carr, 2001) suggested a theoretical explanation that attentional focus affects performance according to the level of motor skill in terms of automaticity. Therefore, in the current study where participants were trained from scratch, one potential issue could be that the amount of practice in the study was not enough for participants to develop automaticity in their movement. If this was the case, current findings support this notion in the sense that there was no interaction between the focus condition and the putting sessions. The effects of attention manipulation did not depend on the amount of practice given to participants. However, this reasoning does not explain the overall beneficial effect of distracted tones. If participants had not acquired automaticity, then the distraction or putting more cognitive load (secondary task) on attentional focus should be detrimental to performance. Furthermore, in the previous research by Beilock, Wierenga, and Carr (2002), it was found that participants’ performance became similar to experts with an amount of practice of only 650 putts in total. In contrast to the total amount of 1,120 putts in current study, the issue of inadequate practice should not be a methodological problem.

In comparison to the large amount of research studies conducted in the past on attentional focus and motor performance (e.g., Beilock & Carr, 2001; Beilock, Carr, MacMahon, & Starkes, 2002; Beilock, Bertenthal, McCoy, & Carr, 2004), it can be concluded that the effect of attentional focus may not be as reliable as previous research suggested. Different focus manipulations could affect motor performance outside the operation of attentional focus. Furthermore, the effect of attentional focus seemed to be much weaker compared to the practice effect. This can also be seen in the past series of studies of the current research project. Practice effect is reliably evident in every study even when the methodological design was different. This notion of a larger practice effect is important for practical implications. Instead of wasting time and effort to train novices cognitively (for example training to control the allocation of focus), it could be more efficient to just simply train the physical skill, at least during the initial period of skill acquisition.

In this series of research projects, the results thus far has led the author to believe that there must be other psychological factors affecting the performance rather than the path through motor automaticity. Anecdotally, it seemed that participants held some expectation regarding their performance in each of the focus conditions. Although there was no mentioning of the purpose of the research or the hypothesised performance from each condition, participants could have figured out how each condition should affect the performance on their own. Even if they were not attempting to guess the purpose of the experiment, they could have been affected by the expectation from their previous performance, especially in the current study where they had to perform in
multiple sessions over time. The performance from earlier sessions could have shaped how each participant expected their outcome to be. This is quite likely since the previous studies in this research project found that participants do have considerably good insight of their own performance. Once they realised that they perform exceptionally good or bad in a particular focus condition, this expectation could affect their later performance accordingly. This factor of participants’ expectation could contribute to statistical variation among each participant and render the results non-significant. Therefore, future research should take participants’ performance expectations into account by factoring it in as a variable of interest. This methodological modification could potentially clear the issue of extra contributing factors affecting motor performance, other than attentional focus.
Chapter 6

The first four studies did not find a reliable effect of different attentional focus styles on golf putting performance. Therefore, another variable was considered as a potential contributor affecting the performance. Participants’ expectancy was selected mainly due to the participants’ comments during study four (training study). It was found that each participant had his or her own idea of a focus style that would produce a better outcome. It is possible that they derived this information from their own experiences during the practice trials or past experimental trials, such as in the fourth study in which participants had the opportunity to reflect on their performance from each training session. Although actual performance scores were not provided to participants, visual feedback was still present since participants were aware of how far away a golf ball stopped from the target. Hence, the inconsistency in participants’ own expectations of how well they performed could have increased the error variance and consequently masked the true effect of attentional focus. For this reason, the expectancy effect was included in the following studies. This chapter will review the expectancy effect and report on study five.

Expectancy effects in previous research has been mainly studied in the framework of subject expectancy; for example the Hawthorne effect (Landsberger, 1958; Adair, 1984; McCarney et al., 2007), demand characteristics (Rosenthal & Rosnow, 2009; AuBuchon & Calhoun, 1985), placebo effects (Shapiro, 1970; Paterson, 2005), and Pygmalion effects (Eden, 1984; Kierein & Gold, 2000). Although the terminology varies depending on the context, the key premise remains the same; participants’ expectation about the outcome of the study influences the way they behave in an experiment. Later research on experimenter expectation (Rosenthal, 1994) also utilised a similar concept. Although termed experimenter’s expectancy, the theoretical explanation is still based on the same principle, in that participants behave accordingly to the experimenter’s expectation about the outcome of an experiment.

Earlier research tends to be on the topic of interpersonal expectations, particularly the therapeutic effects of psychotherapy. Tambling (2012) suggested that a client’s expectation of therapy could be separated into process expectations and outcome expectations. While the process expectations refer to clients’ expectations about procedures, therapist roles, or what will happen in the therapy session, the outcome expectations are related to the hope that the session will reduce symptoms or improve the efficacy of the therapy. The following chapter will review studies in a psychotherapy setting that is related to outcome expectation. The therapist-client setting is a type of expectancy effect which is similar to expectancies in the sporting context (e.g., coach-athlete settings).
**Expectancy Effects in Psychotherapy**

The premise of interpersonal expectancy effect is that the outcome expectation influences or changes the behaviour of clients. Vogel, Wester, Wei, and Boysen (2005) asked psychology students about their anticipated intention to express emotional distresses and help-seeking behaviour to counsellors. They found that participants who reported positive attitudes towards expressing their emotional distresses were more inclined to seek out professional help compared to others. Similarly, in a study evaluating the Milwaukee Psychotherapy Expectations Questionnaire (Norberg, Wetterneck, Sass, & Kanter, 2011), participants who had negative expectations about the outcome of therapy were less likely to participate in psychotherapy compared to participants with positive expectations.

Apart from expectations about therapy outcomes, research also shows that positive outcome expectations increase the likelihood of clients forming a strong alliance with their therapists. Patterson, Uhlin, and Anderson (2008) stated that clients established a strong, collaborative, and productive relationship with their therapists when they expected that counselling techniques would enhance their relationship with others. For the negative counterpart, Westra, Constantino, and Aviram (2011) investigated situations in which the relationship between the client and therapist turned adversarial. They found that a ruptured alliance negatively impacted the outcome expectation which in turn mediated the post-treatment outcome.

Research has also looked at positive expectations versus negative expectations. Frank (1968) investigated positive expectations in therapy, in terms of hopefulness, and claimed that more hopeful patients tended to recover faster or have a better outcome compared to those who were more hopeless. The relationship between a therapist and client (Joyce & Piper, 1998) is also directly affected by client expectations. Joyce, Ogrodniczuk, Piper, and McCallum (2003) reported that both patient self-ratings and therapist ratings of the therapeutic alliance is associated with the patient’s pre-therapy expectations regarding their improvement. This positive therapeutic alliance contributes to the actual beneficial outcomes of therapy. Although evidence suggests that client expectations affect the outcome of therapy, attempts to directly manipulate expectations have not yet been successful. For example, Tinsley, Bowman, and Ray (1988) conducted a comprehensive review of the literature and found that different manipulations of expectations such as complicated experimental interventions, printed documents, and verbal interventions, failed to manipulate clients’ expectations about the effectiveness of therapy. The only interventions that had clear effect on participants’ expectations were audio/video-taped methods or participants’ past experiences in therapy.

It is clear from the evidence in psychotherapy research that clients who hold positive expectations about therapy tend to experience positive outcomes. Furthermore, participants who
hold negative expectations about therapy tend to experience ineffective therapy. It is worth noting that the outcome of psychotherapies is not only based on the expectations of clients. Rather, expectations play an important role in therapy by shaping clients’ behaviour. For example, clients with positive expectations about therapy tend to be more collaborative (i.e., they have a better therapeutic alliance) and hence, are more likely to attend therapy sessions and adhere to the therapists’ suggestions. As a result of these behaviours, clients experience positive outcomes (Westra, Constantino, & Aviram, 2011; Joyce & Piper, 1998). In the sporting context, coaches and instructors have a similar role to a therapist, to the extent that they make suggestions and teach sporting skills to athletes. As evidence will suggest in the following section, there is also an expectancy effect in this sporting context. It is possible that athletes’ expectations affect their behaviour during the learning phase and subsequently their performance.

**Expectancy Effects in Sports**

Expectations in sports can manifest in individuals with different roles. Coaches may perceive athletes as having different levels of skill and expect them to perform accordingly. Judges in visual artistic sports, such as gymnastics or bodybuilding, may have different performance expectations for athletes while they score them against standard criteria. Athletes themselves may hold a perception of expected performance against their actual capability.

**Coaches Expectation**

The premise behind coaches’ expectancy effects is often explained with the self-fulfilling prophecy concept. The term originated in social psychology, describing a situation in which a prediction became true (Merton, 1948; Rosenthal & Jacobson, 1968). This concept has been studied extensively in classroom settings, whereby a teachers’ expectation of a student affects the teachers’ behaviour, their interaction with the student, and their rating of the students’ academic performance (Brophy, 1983; Rist, 1970; Jussim, Eccles, & Madon, 1996). In sports, coaches often hold beliefs about the performance of different athletes, creating an expectation or a prediction of the performance outcome.

Coaching behaviour specific to providing feedback has been examined extensively. It was found that coaches’ feedback varies depending on the coach’s expertise (Bloom, Crumpton, & Anderson, 1999), tournament date (Lacy & Darst, 1985), starting position in volleyball (Markland & Martinek, 1988) and many other factors. Therefore, it is not surprising to speculate that athletes are likely to perceive and respond to feedback differently. Solomon, Striegel, Eliot, Heon, and Maas (1996) examined differences in coaches’ feedback as a function of the coaches’ expectations of an athlete’s skill level in college basketball. They found that low expectation athletes (i.e., those who received low expectations from the coach) received less feedback overall compared to high expectation athletes. Solomon, Striegel, Eliot, Heon, and Mass (1996) offered an explanation based
on the self-fulfilling prophecy theory, whereby coaches’ expectations affect their feedback-giving behaviour. Athletes who receive feedback regularly are more likely to improve their performance compared to athletes who receive less feedback; thereby their performance reinforces the coaches’ initial expectations. From a practical point of view, some sports, such as basketball or badminton, provide the opportunity for coaches to give some amount of feedback during set breaks. However, in other sports, such as golf and tennis, coach involvement is minimal during competitive matches.

**Athletes Expectation**

Expectancy effects in athletes have been studied using the placebo effect with ergogenic aids or performance enhancing drugs. The outcome measure is typically physiological in nature, such as strength (e.g., Ariel & Saville, 1972; Maganaris, Collins, & Sharp, 2000; Kalasountas, Reed, & Fitzpatrick, 2007) and endurance (e.g., Clark, Hopkins, Hawley, & Burke, 2000; Beedie, Stuart, Coleman, & Foad, 2006; McClung & Collins, 2007). Although the placebo effect in sports has been documented extensively, there is little evidence on the potential underlying mechanisms. Some psychological variables, such as motivation, learning, and conditioning, are discussed in the literature, but one variable that is often mentioned and used interchangeably with the placebo effect is the expectancy-driven explanation (Beedie & Foad, 2009). According to the expectancy-driven explanation, expectations about the beneficial effects of drugs affects athletes’ motivation and the amount of effort they dedicate to practice or the task at hand.

A key issue with the expectancy-driven effect as an underlying mechanism is that it is difficult to tease apart whether the expectation arises from actual performance enhancement drugs or experimental manipulation. If it is due to experimental manipulation, the placebo effect may not have ecological validity. This is problematic in studies where actual drugs, such as anabolic steroids (e.g., Ariel & Saville, 1972; Maganaris, Collins, & Sharp, 2000), cannot be ethically administered since the performance enhancement from placebo drugs cannot be compared to the actual enhancement from actual drugs. Furthermore, the physiological effects of performance enhancement drugs are relatively well known to athletes, which makes it difficult to manipulate expectations about the beneficial effects of a placebo drug. For example, if coaches administered a caffeine placebo to athletes as an endurance enhancement, athletes are likely to expect an elevated heart rate due to its stimulative nature. However, if this physiological effect is not present, athletes may be sceptical about the genuineness of the drug. Furthermore, the implications of placebo drugs are limited. While it conveys an encouraging message for anti-doping campaigns (e.g., drugs are not necessary; athletes can tap into their hidden ability through psychological manipulations), deceptive placebo interventions at an individual level would certainly affect the trust between coaches and athletes.
The expectations of performance enhancement drugs are difficult to alter in actual sport settings. For example, if coaches were to apply an expectancy intervention through a placebo method, any pre-existing knowledge about performance enhancing drugs held by the athletes may affect their expectations of the placebo drug. However, if coaches were interested in improving learner’s performance, they could use easier manipulations with different movement techniques or skill mechanisms. For instance, if coaches can make learners believe that physical and mental techniques are effective and lead to better results, learners may have a better chance of improving their performance. This is especially relevant for learners who do not have previous experiences with different skill movement techniques and who have little background knowledge about acquiring novel sport skills. Therefore, the focus of this thesis is on the learners’ expectation of different psychological techniques that may improve their performance.

Unfortunately, there is little research on the expectancy effects of psychological techniques in sports. Participants’ expectancies are often regarded as experimental artefacts and are often controlled in studies that compare outcome performance of different cognitive processes during sports (e.g. Beilock & Carr, 2001; Gray, 2004; Wulf, Lauterbach, & Toole, 1999; Wulf & Su, 2007). However, there is evidence to suggest that expectancies could play an influential role in sports performance. For example, Pope and Schweitzer (2011) examined 2.5 million professional golf putts on a PGA tour using laser measurements and found that birdie putts are less successful than par putts, with par putts having an average two percent higher success rate. Their results were analysed in detail using laser measurements and controlled for factors such as distance, matching par and birdie putts on the same hole of the same tournament, and learning more information about the green after a birdie putt. Pope and Schweitzer (2011) provide an explanation for their findings using the economic perspective of Prospect Theory (Kahneman & Tversky, 1979) and its component of loss aversion. The reasoning they put forward is that a birdie putt may be regarded as an attempt to gain an under par score while a par putt may be regarded as an attempt to avoid the loss of one stroke over par. With the loss aversion model, Pope and Schweitzer (2011) suggested that golfers may have invested more effort and focus to avoid the loss of one stroke (during par putts) compared to gaining an under par score (during birdie putts) and hence were more accurate with their par putts. No matter how fitting the explanation of loss aversion in Prospect Theory is, it could also be argued, with the same set of evidence, that expectancies came into play through the previous experiences of professional golfers. For example, throughout a golf career, making par putts is much more common than making birdie putts. Therefore, it could simply be the case that when golfers putt for a par they expect to make the shot, statistically more often than a birdie, which reflects their performance through effort, focus, motivation, stress, and pressure.
While there are a few studies that have examined expectancies in sports using the placebo effect, there is little research on athletes’ expectations towards coaches’ instructions. Since the current research did not find a consistent effect of attentional focus on motor performance, the following study will add a variable of expectancy in the remaining experiments to examine whether the effect of attention on performance depends on participants’ expectancies. Study five will investigate expectancies with a verbal instruction of internal versus external focus style. The following study is also under review for publication.

**Study 5: Expectancy effect in internal and external focus**

Attentional focus has been viewed as a major cognitive component influencing sport performance (Wulf, 2007; Wulf, Hob & Prinz, 1998; Lewis & Linder, 1997). Recently, the idea of categorising attentional focus into external focus versus internal focus has been put forward by Wulf, McNevin, and Shea (2001). External focus is defined as a type of attention that is directed towards the environment and internal focus is defined as attention that is directed towards one's own bodily movements or mechanics (Wulf, Hob & Prinz, 1998; Wulf, 2007; for a recent review see Wulf, 2013). The constrained action hypothesis explains that external focus is more beneficial than internal focus since external focus promotes and encourages motor automaticity of the movement of interest, which results in better performance. On the other hand, internal focus disrupts or interferes with the automatic control of a movement due to an increase in self-directed attentional focus on bodily movements (Wulf, McNevin, & Shea, 2001; Wulf & McNevin; 2003).

The external versus internal focus effect has been supported by experiments using a variety of motor tasks, including the golf pitch shot task (Wulf, Lauterbach & Toole, 1999), balancing task on a stabilometer (Wulf, McNevin & Shea, 2001), jump-and-reach task (Wulf, Zachry, Granados, Dufek, 2006), and basketball free-throw task (Zachry, Wulf, Mercer, & Bezodis, 2005). The typical procedure used in these studies involves separating participants into different attentional focus groups, directing them towards one type of attentional focus (i.e. internal versus external) during the practice period, and testing their performance on a retention test without any cues regarding the attentional focus. The findings from these studies are the same; that external focus is more beneficial for motor performance both during the practice test and retention test, compared to internal focus.

However, some of these studies were subjected to the potential confounding variable of overloading attentional focus. For example, in the golf pitch shot study (Wulf, Lauterbach & Toole, 1999), the experimenter spent approximately ten minutes explaining the basics of a chip shot to all participants, who received the same instructions regarding stance, posture, and grip. However, participants received different attentional focus instructions regarding their swing mechanics. Participants in the external focus group were instructed to focus on the club, or specifically the
pendulum-like motion of the club, whereas participants in the internal focus group were instructed to focus on their arm movement, specifically the exact state of their arm (i.e. bent or straight) at each phase of the chip swing (i.e. address, backswing, downswing, and follow-through).

The potential confounding variable is clear; the amount of information that participants in the internal focus group had to retain was much more than participants in the external focus group. The participants in the internal focus group had to pay attention to step by step arm movements, including straightening their left arm and slightly bending their right arm during the backswing, straightening both arms during the forward swing, and straightening the right arm but bending the left arm during the follow-through. On the other hand, participants in the external focus group were only told to swing the club like a pendulum. It is possible that the internal focus condition produced poorer performance because of an overload of attentional capacity rather than motor automaticity itself. Poolton, Maxwell, Masters, and Raab (2006) explored this possibility by adding a secondary task to a golf putting task in an attempt to overload attentional capacity. They found that when instructions were minimal (e.g., there was only one aspect of movement to focus on), the internal focus task affected performance negatively when a secondary task was presented. However, there was no significant difference in performance when the secondary task was removed. Furthermore, when the instructions for both the internal focus and external focus groups included more information (i.e. six rules/steps), both groups performed worse on the putting performance.

The findings from Poolton, Maxwell, Masters, and Raab (2006) are not consistent with other studies. Merchant, Clough, and Crawshaw (2007) investigated the effect of external focus in a dart throwing performance task. The attentional focus instructions were similar to Poolton, Maxwell, Masters, and Raab (2006) as they included multiple steps for the participants to follow. Although there were no secondary tasks, since the authors were not interested in examining attentional capacity overload, the set up of the two studies were very similar. While Poolton, Maxwell, Masters, and Raab (2006) found that the internal focus and external focus groups did not significantly differ in motor performance without a secondary task, Merchant, Clough, and Crawshaw (2007) found a beneficial effect of external focus on dart throwing performance. Their findings do not support the attentional capacity overload hypothesis since participants performed better even with a large number of external cues. Apart from the series of studies produced by Wulf and her colleagues, other experiments do not seem to produce consistent findings on the effects of internal versus external focus. For example, a recent study on the volleyball jump float serve (Denny, 2010) found that external focus was no more effective than internal focus in a group of competitive, varsity volleyball players. Denny (2010) suggested that an athlete's preference for their own familiar attentional focus style is a more significant factor dictating their performance.
The current study builds upon previous unpublished dissertation studies. The author attempted to replicate the effects of external focus versus internal focus and failed to find significant effects. Different designs were used and the capacity overload factor was also incorporated. However, a superior type of attentional focus did not emerge. Due to this inconsistency, the author suspects that a demand characteristics or expectations of the performer are more significant factors influencing motor performance. Expectancy effects have been documented in the past in the areas of learning and ability (Rosenthal & Rubin, 1978). In relation to sports performance, many studies have found evidence of expectancies in both coaches and athletes. For example, the type of feedback given from coaches depends on their expectations of athletes’ athletic ability (Solomon, Striegel, Eliot, Steve, Heon, Maas & Wayda, 1996). Furthermore, placebo drugs have also been used to demonstrate the expectancies of athletes in relation to the effectiveness of performance enhancing drugs (Maganaris, Collins & Sharp, 2000; McClung & Collins, 2007).

The expectancy effect may be used to explain inconsistent findings in previous literature. For example, in Denny's (2010) volleyball study, the athletes who were trained and had experience with their preferred type of attentional focus may have had established a belief that their style of focus was superior to others. Consequently, they may have expected that a different style of focus would lead to poorer performance compared to their preferred style of focus, regardless of whether the focus was external or internal. Therefore, the increased variability and insignificant effect of external focus found may be due to individual differences in expected outcomes. The present experiment will attempt to account for differences in expectations by using a group of novice golfers. It should be the case that participants who have limited experience with golf putting have no preferred style of attentional focus. Therefore, once participants are told that either external or internal focus is beneficial, their expectations about the beneficial effects of the focus style should enhance performance. On the other hand, if the external focus versus internal focus effect prevails and is more influential on putting performance, than novice golfers should perform better with the external focus style regardless of whether they are told that a particular focus style is beneficial.

**Method**

**Participants**

The participants consisted of 24 first year psychology students at the University of Queensland (four females; mean age was 21.38 years old, $SD = 6.35$). Their participation was rewarded with a course credit. All participants reported that they had not played golf for more than three months in total, had never played competitively at any point in their lives, had never been out for a round of golf at an actual golf course, and had not received lessons from professional golfers.
Design and Procedures

The experiment was a $2 \times 2$ mixed factorial design. The between-participant factor was the expectation information given to the participants and the within-participant factor was the attentional focus cues. Half of the participants were told that the experimenter expected that the internal focus cue would be more beneficial to their performance while the other half were told that the external focus cue would be more beneficial. Each participant had to perform both internal and external focus conditions.

Participants were randomly assigned to the different expectation conditions upon arrival. A demographic questionnaire was administered asking basic information about their golfing experience. The experimenter then demonstrated how to putt a golf ball with either minimal instructions or specific comments on swing mechanics. Limited information was given to the participants to prevent them from investing too many cognitive resources on specific swing mechanics which could interfere with attentional focus cues later. After the demonstration, participants performed a practice condition with a total number of 40 putts without any verbal cues or comments from the experimenter.

After the practice condition, participants had to perform in both internal and external focus conditions consecutively. The order of the two conditions was counterbalanced. The verbal cue that was used to direct participants' attention was to focus on the "swing of the clubhead" for the external focus condition and the "swing of their hands" for the internal focus condition. From the author's point of view, with a background in competitive golfing and coaching, these cues should not suggest any differential physical mechanism of putting movement and should eliminate the potential confound of attentional focus cues favouring one movement mechanic over the other. Utilising only one cue in both types of focus conditions should also eliminate the confound of attentional capacity overload. A total of 40 putts was used in each test condition and practice condition. In total, each participant performed 120 putts in three conditions (i.e., practice condition, internal focus condition and external focus condition, in a counterbalanced order).

Depending on their assigned group, the participants received slightly different instructions before performing each putting condition. At the beginning of the first test condition (internal focus or external focus) the instruction included an explanation of what the participants had to focus on. The expectation comment was provided after the practice condition was finished. Participants in the internal expectation focus group were told that the internal focus should produce better performance than external focus. Participants in the external expectation focus group were told that the external focus should produce better performance than internal focus. The exact wording can be found in the Appendices. The verbal focus cue was provided as a reminder after the 10th putt for both the internal and external conditions; however, the expectation comment was only mentioned...
once. The participants were told to do their best at all times at the beginning of each putting condition.

**Materials and Measurements**

The putting task was done on an artificial putting mat (275 × 92 centimetres). The putting mat had five different starting points ranging from a distance of 120 to 200 centimetres away from the target that was a cross at the other end of the mat. A generic right-handed putter was provided for the participants. The putting performance was recorded as the distance between the target and the point that the ball stopped moving towards the target, measured in centimetres. The scores for each attentional focus condition were calculated as an average of the 40 putts. Lower scores in centimetres indicated a better performance (i.e. shorter distance to the target).

As a manipulation check for the attentional focus condition, the participants’ compliance with the verbal cue instruction was determined using a self-report questionnaire. At the end of the experiment the experimenter asked, “during the internal (or external) condition, how many out of the 40 putts were you actually able to focus on your hands/the clubhead?” The level of focus was then recorded in terms of the number of shots that participants perceived themselves to be following the instruction.

**Results**

The attentional focus manipulation check found that overall, participants reported that they were able to focus on their hands for 29.67 shots \((SD = 7.48)\) compared to 31.67 shots \((SD = 6)\) when they were asked to focus on the clubhead. The verbal cues seemed to be a reasonably effective manipulation of attentional focus according to the participants’ self-report data.

A 2×2 (expectation condition×focus style) mixed ANOVA was conducted on the average putting performance. Results revealed neither a significant main effect of expectation condition, \(F(1, 22) = 1.96, p = .175, \eta^2_p = .08\), nor main effect of focus style, \(F(1, 22) = 1.98, p = .173, \eta^2_p = .08\). As predicted, the effects of a different focus style depended on the participants’ expectation of the outcome; this finding was supported by the significant interaction, \(F(1, 22) = 19.93, p < .000, \eta^2_p = .48\). Figure 12 shows the interaction plotted.
Figure 10. Means of putting performance as a function of attentional focus condition in each outcome expectation instruction. Error bars represent standard errors.

Participants who were told that the internal focus would produce better performance performed better with the internal focus style \((M = 21.52, SD = 2.66)\) compared to the external focus style \((M = 23.41, SD = 3.76), t(11) = 2.51, p = .029.\) Participants who were told that the external focus style would lead to better performance, scored better in the external focus condition \((M = 22.69, SD = 4.28)\) compared to the internal focus condition \((M = 26.32, SD = 4.54), t(11) = 3.70, p = .003.\)

**Discussion**

It was predicted that the effect of different attentional focus styles would be dictated by the expectations of participants. That is, if the performer believes that one focus style is superior to the other, then their performance will reflect this belief accordingly. It was found that when the experimenter stated that internal focus would produce better performance, the participants actually performed better during the internal focus condition. And similarly, participants performed better in the external focus condition when they were made to believe that the external focus was more beneficial.
It should be noted that these findings were obtained with minimal manipulation. The experimenter only mentioned the expected performance once after the first attentional focus condition was finished. The instruction was given to the participants casually and in no way implied any pressure that they had to perform accordingly. Also, the verbal cues were chosen in such a way that both the internal and external focus would not interfere with or suggest a modification to the skill movement itself; they only directed the attentional focus on the different aspects of the movement (i.e., clubhead versus hand). Since the main effect of attentional focus style was not significant, that is the internal and external focus did not produce any difference in overall putting performance, it could be inferred from this experiment that the effect of expectation was more salient than the style of focus. If the beneficial effect of external focus was truly significant, then the results would have shown that the overall results from the external condition were better than those of the internal focus condition.

This experiment does not aim to discredit the theoretical framework of the previous research on different styles of attentional focus and the current findings should not be interpreted as implying that the constrained action hypothesis is false. It could simply be the case that these verbal attentional focus cues have not tapped into the automaticity of the skilled movement. Nevertheless, it does demonstrate how participants' expectancy, even with a minimal injection of outcome expectation, will still produce results accordingly. It could also be the case that some participants in the previous studies were able to figure out the purpose of the experiment and the findings were a result of their expectancies.

Some could interpret the results of this study in such a way that the attentional focus part of motor skill is unimportant since whatever the participants focused on produced an indifferent outcome. However, this would be a misinterpretation because of the fact that these different attentional focuses did make a difference in that they were meaningful to the participants. When an attentional focus cue was associated with a beneficial effect, it actually did improve the performance. Hence, the focus should not be on the categorization of differently types of attentional focus cues, but on the meaning of those cues to individuals.

The most important practical implication of this experiment is in the area of motor skills learning and coaching. The current findings illustrate the significance of having an individual preference. A person's belief or expectation could lead to the desired performance outcome and one can expect that elite athletes come with their own set of beliefs or expectations. The interpretation of the current findings fits with the Marchant, Clough, Crawshaw and Levy (2009) demonstration that an individual’s preference for one attentional focus leads to less effortful and more successful task performance. Coaches should keep this factor in mind during training sessions, especially in team training which involves several athletes at the same time. Each athlete could have their own
preference in regards to attentional focus style which may or may not be what is taught by their
coach. Consequently, coaches should acknowledge these individual preferences and encourage the
athletes to trust their own attentional focus style. There could be several means of achieving the
same desirable outcome. Coaches should not be restricted to only one 'school of thought' when
teaching a sportsperson, especially in the aspect of cognitive skills. The current experiment clearly
demonstrates that whichever attentional focus style is used can potentially enhance performance.
Chapter 7

A similar research study was conducted to follow up the expectancy effect found in study five. Since the expectancy effect was found in the internal versus external focus manipulation, the present study was conducted to examine whether the expectancy effect is present in the dual-task manipulation given the mixed results of the distraction manipulation from studies two, three, and four.

**Study 6: Expectancy effect in auditory tone monitoring task**

Beilock, Carr, MacMahon, and Starkes (2002) applied the distraction method using a secondary auditory monitoring task. In their study, experienced golfers had to perform golf putts from various distances while listening to a series of tones. The goal was to identify a target tone among other random, filler tones. The purpose of this distraction was to direct the golfers’ attention away from their skilled movement and to allow the motor automaticity to operate optimally. In another condition, the golfers’ attention was directed towards their movement by instructing them to say ‘stop’ out loud when they finished the follow-through of their swing. It was predicted and found that this allocation of attention with the skilled movement would disrupt automaticity, thus impairing performance.

Beilock, Carr, MacMahon, and Starkes (2002) extended their findings in a soccer dribbling task. Using a similar method, the same pattern of results emerged. They found that expert soccer players dribbled faster in a distraction condition compared to a skill-focused condition. It was also discovered that in novice players, skill-focused attention produced better performance compared to the distraction condition. These findings suggest that the execution of a well-learned-automated motor skill does not require online attentional focus. Hence, the experts’ performance was not affected by the distraction.

Beilock, Wierenga, and Carr (2002) used the same methodology with an additional task, including the use of a ‘funny putter’, which was an S-shape shaft putter. The aim was to constrain experts with the novel instrument and make their skill execution less automatic. The results supported the authors’ claims; that when the expert players used the S-shape putter, their performance suffered from the distraction condition similar to novice golfers. Beilock, Wierenga, and Carr (2002) concluded that the expert golfers’ turned their attention to focus on the skill execution when they used the funny putter which disrupted their automated skill movement.

Other attentional focus manipulations have also found supporting evidence for the effects of attentional on motor performance. Using a similar theoretical mechanism, Beilock, Bertenthal, McCoy, and Carr (2004) limited attentional focus by reducing the allotted time for movement execution. They found that when participants were instructed to execute golf putts faster, the experts’ performance benefited from the limited time while the novices’ performance suffered.
These results were interpreted in the same way as the distraction condition; that an automatic skill movement does not require much attentional focus capacity and hence motor performance is not impaired when there is a time constraint to execute a skilled movement. In the case of the speeded instruction study, the time constraints actually improved the performance of expert golfers. Interestingly, imagery also seems to be affected in the same way by time constraints. Beilock and Gonzo (2008) found that the more time available for experts to imagine their skill execution harms their performance. The authors argued that this was because skill-focused attention was reinforced during the long period of imagery, which consequently affected the motor automaticity.

One of the key issues in attentional focus studies is the categorisation of different attentional focus dimensions. While some studies manipulate attention through verbal instructions (for a review of studies, see Wulf, 2007), other studies utilise a distraction method (Beilock & Carr, 2001). The underlying mechanisms of the effect of attentional focus, however, are quite similar. One theory coined ‘constraint-action hypothesis’ (Wulf, McNevin & Shea, 2001), states that an internal focus, that is an attentional focus that is directed towards the mechanism of the movement, disrupts the automaticity of the performed movement. On the other hand, external focus, that directs attention towards the effect or external environment of the movement, enhances the automaticity and improves performance outcome. On a similar note, Beilock, Carr, MacMahon, and Starkes (2002) put forth that performance is disrupted with a skill-focused type of attention, since skill-focused attention interferes with the motor automaticity. This notion has resulted in methodologies that attempt to distract the performer’s attention away from a movement task.

The two distinct lines of research have some similarities in their experimentation. For instance, the verbal manipulation in internal focus conditions (e.g., Wulf, Lauterbach, & Toole, 1999) can be compared to the distraction manipulation in skilled-focused conditions (e.g., Beilock et al., 2002). While the goal of these manipulations are similar in the sense that they aim to direct participants’ attention towards the bodily movement or skill mechanics, the predictions of their effect on motor skills are opposite. According to the Constraint-Action Hypothesis (Wulf, McNevin, & Shea, 2001; Wulf, Shea, & Park, 2001), internal focus should impair novices’ motor learning, whereas external focus should be beneficial. The skilled-focused condition, however, should produce better performance compared to the distraction task condition (Beilock et al., 2002; Beilock, Wierenga, & Carr, 2002). While some may argue that the differential effect is being compared to a different anchoring standard (i.e., internal focus versus external focus and skill-focused versus distraction), study five in the current research showed otherwise. For example, if internal focus is comparable to skill-focus, it should be the case that internal focus performance is better compared to performance with a distraction task. This is another example of the issue concerning the categorisation of different attentional focus styles in this area of research. In the
current research, the lack of a significant attentional focus effect on motor skills in golf putting has led to a change in the direction of research to explore another cognitive factor, specifically participant expectancy.

Based on the findings from earlier studies in this dissertation, the current study proposes that the expectancy effect in novices may play a role in affecting the outcome of motor skill performance. The previous findings on the effect of attentional focus have yielded mixed results. Not only are the results non-significant, the patterns are also not reliable across experiments. Since study five found an expectancy effect with the internal versus external focus manipulation, the author speculates that an expectancy effect may play a role in a distraction or dual-task type of manipulation.

The expectancy effect has been documented in the past in the area of learning and ability (Rosenthal & Rubin, 1978). In the realm of sports performance, many studies have shown evidence of the expectancy effect in both coaches and athletes. For example, Solomon, Striegel, Eliot, Steve, Heon, Mass, and Wayda (1996) observed coaches’ behaviour in providing feedback to basketball players. They found that coaches provide more feedback to athletes who they expect are highly capable compared to those who they believe are less capable.

Many studies have examined the placebo effect using different types of performance enhancing drugs on athletes’ performance. For example, McClung and Collins (2007) found that performance on 1,000 metre time trials was almost on par for those who believed they had taken an ergogenic aid and those who actually took the enhancement drug. It should be noted that when the athletes took the drugs without knowing, there was no significant improvement in their performance. Similarly, Maganaris, Collins, and Sharp (2000) found that an anabolic steroid placebo increased weight lifting performance in the short-term. The placebo effect diminished once the experimenters revealed to the weight lifters that the administered drugs were placebos. It is clear from previous research that performers’ expectancies can affect their physical abilities and performance.

In the current study, the expectancy effect will be introduced into the research design in a factorial manner. This would allow for a prediction in such a way that if the distraction condition has a larger effect than the expectancy condition, the manipulation should affect performance regardless of expectancy provided to participants. In contrast, if the expectancy has a larger effect on performance than the distraction condition, participants should perform in accordance with the information given to them regardless of whether they are told if the distraction has a beneficial or deteriorating effect. It is predicted that the auditory distractor will have a beneficial effect when participants are told that they should perform better with the auditory distractor. In contrast, the
distractor will impair performance when participants are told that their performance will suffer with the distractor.

**Method**

**Participants**

Participants were 24 first-year psychology students at the University of Queensland (six females; $M_{age} = 19.68$ years old, $SD = 2.67$). Course credit was awarded for their participation. Every participant identified themselves as novice golf players; only three participants had received professional lessons in the past, all more than one year ago. None of them had participated in an official golf tournament, and also had not played golf in the past six months.

**Design and Procedures**

The experiment was a $2 \times 2$ mixed factorial design. The expectation manipulation was a between-participant factor, in which verbal instructions were used to suggest the beneficial effect of one attentional focus condition over another (e.g. participants were instructed that the silent condition would lead to better performance or that the distraction tone condition would lead to better performance). The within-participants factor was the attentional focus manipulation, which was either performing the putting task under a silent condition or with an auditory distractor.

Upon arrival, participants were randomly allocated to an expectation condition and instructed to complete a demographic questionnaire that asked for basic information about their previous golfing experiences. The experimenter then demonstrated how to putt a golf ball with few comments on the swing mechanics. The amount of information provided was controlled for across conditions to prevent attentional focus interference in the distraction condition. After the demonstration, participants performed 40 practice putts without any verbal instructions or comments from the experimenter.

Following the practice putts, participants completed both the silent and distracted conditions. The order of these two conditions was counterbalanced within participants. In the silent condition, participants performed 40 putts without further verbal instruction. All experiments were conducted in a closed, silent room with the door and windows closed tight to prevent unexpected surrounding noises. All environmental aspects were held constant in both conditions; however, in the distraction condition an auditory tone was played while participants performed 40 putts. A high pitch tone and low pitch tone was used in the distraction task. The participants had to monitor and respond to the high pitch tone by saying out loud the word ‘tone’ each time they noticed the tone. This distraction method was a replica of the methods used in previous research (Beilock, Carr, MacMahon & Starke, 2002). Both the frequency of tones and type of tone was randomised. On average, the ratio of high pitch tone to low pitch tone was 1:4. Each participant performed a total of 120 putts in three conditions.
Verbal instructions regarding the beneficial effect of one attentional focus over another were given before each experimental condition. After the practice condition, half of the participants were told that they would perform better in the silent condition and that their performance would be worse with the distraction tone. The other half of participants were told that the distraction tone would be beneficial to their motor automaticity and hence lead to better putting performance. The scripted instructions are listed below:

**Distractor produces better outcome.** There will be two different attentional focus conditions. You will either perform the golf-putting task in the same way as the practice block or you will perform the golf-putting task while monitoring a series of auditory tones. The tones are designed to keep your attention focused and concentrated. Research in the past has shown that keeping attentional focus on a simple secondary task allows the brain to utilise an automatic cognitive process to perform the main task. Therefore, we expect that the auditory tones will improve your performance compared to putting without the tones.

**Distractor produces worse outcome.** There will be two different attentional focus conditions. You will either perform the golf-putting task in the same way as the practice block or you will perform the golf-putting task while monitoring a series of auditory tones. The tones are designed to direct your attention away from the putting task. Research in the past has shown that keeping attentional focus on a secondary task will limit the attentional resources for the main task. Therefore, we expect that the auditory tones will impair your performance compared to putting without the tones.

The verbal instruction manipulation was kept to a minimum level. Instructions were provided only at the beginning of each experimental condition and were not repeated again during putting sessions.

**Materials and Measurements**

The putting task was done on an artificial putting mat (275 × 92 centimetres). The putting mat had five different starting points ranging from a distance of 120 to 200 centimetres away from the target that was a cross at the other end of the mat. A generic right-handed putter was provided for the participants. The putting performance was recorded as the distance between the target and the point that the ball stopped moving towards the target, measured in centimetres. The scores for each attentional focus condition were calculated as an average of the 40 putts. Lower scores in centimetres indicated a better performance (i.e. shorter distance to the target).

**Results**

The number of target tone missed-response was recorded for the purpose of manipulation check. In the distracted condition, participants listened to an approximate of 300 tones altogether.
They missed to identify the target tone at an average of 1.02 tones per condition (S.D. = 0.53). This indicated that participants paid some attention to perform the secondary task.

A 2×2 (expectation condition × distraction condition) mixed ANOVA was conducted on average putting performance. Results revealed neither a significant main effect of expectation condition, $F(1, 22) = 0.11, p = .746, \eta^2_p = .01$, nor main effect of distraction condition, $F(1, 22) = 0.15, p = .705, \eta^2_p = .01$. As predicted, the effect of a different distraction condition depended on the participants' expectation of the outcome; this finding was supported by the significant interaction, $F(1, 22) = 12.81, p = .002, \eta^2_p = .37$. Figure 13 shows the interaction plotted on a graph.

![Graph showing means of putting performance as a function of expectancy information and attentional focus conditions. Error bars represent standard errors.](image)

*Figure 11.* Means of putting performance as a function of expectancy information and attentional focus conditions. Error bars represent standard errors.

Pairwise analysis was conducted for the two planned comparisons. The first analysis examined whether participants who were told the silent condition is more beneficial than the distraction condition would perform better in the silent condition compared to the distracted condition. There was a significant difference in performance between the silent condition ($M = 20.51, S.D = 6.55$) and distracted condition ($M = 22.60, S.D = 4.49$), $t(11) = 2.26, p = .034$, such that
participants performed better in silent condition. The second analysis examined whether participants who were told the distractor tones would lead to better performance, performed better in the distraction condition compared to the silent condition. This difference was also significant with performance in the distracted condition ($M = 19.56$, $SD = 5.89$) significantly better than the silent condition ($M = 22.15$, $SD = 4.45$), $t(11) = 2.80$, $p = .010$.

**Discussion**

The aim of this study was to examine the effect of expectations on golf putting performance. It was hypothesised that participants would perform better when they were led to believe that the distraction tones were beneficial compared to putting silently. The results supported this hypothesis and showed that novice golfers performed better in accordance with their expectation. It should be noted that the main effects of distraction condition were not significant, indicating that there was no overall effect of distraction on putting performance. The non-significant main effects are inconsistent with previous research findings (Beilock & Carr, 2001; Beilock, Carr, MacMahon & Starkes, 2002), which show that novice golfers perform worse in distraction conditions. However, the distraction tone did not decrease performance in novice golfers in the current experiment. Given the current results, it is possible that the effect of distraction was not as robust as the effect of expectation. These results should not be treated as an indication that past findings are an artefact of the expectancy effect as expectancies were not manipulated in the previous studies.

Previous research suggests that the mechanism that governs the difference in performance when participants are distracted is motor automaticity (Beilock & Carr, 2001). While it is unlikely, motor automaticity may explain the effects found in the current experiment. For instance, the instructions which lead to superior performance may have contained wording that enhanced participants’ motor automaticity. This notion is similar to a priming study in which a scramble word task was used to introduce a target word that elicited motor automaticity. For example, Ashford and Jackson (2010) found that hockey players had better performance while dribbling a puck when they were primed with the word ‘smooth’. Adams, Ashford, and Jackson (2010) found a similar effect in a soccer-dribbling task, whereby participants performed better when they were primed with phrases like “movement seems to flow” and “I am at ease”. These words or phrases are assumed to encourage the motor automaticity of a task at hand. The words and phrases are similar to the beneficial effect of external focus, which enhances the development of motor automaticity (Wulf, 2007). Nonetheless, the wording used in the current study was specifically tailored to the overall performance outcome instead of skill mechanics or process movements. Participants were told that the differential outcome expectancy is based on previous research. Thus, any alternative explanation through implicit wording that may prime participants cognitively is not likely.
In addition, it is possible that the tone-monitoring task was not enough to occupy participants’ attentional capacity. Although stronger distractor manipulations are available, the auditory tone-monitoring task has shown adequate reliability for attentional focus manipulations (Beilock & Carr, 2001; Beilock et al., 2002; Beilock et al., 2004; Gray, 2004; Casteneda & Gray, 2007). The auditory tone-monitoring task was chosen mainly to compare across studies that have used a similar manipulation. This is especially relevant since previous studies have yielded an inconsistent pattern of findings. A goal of this study was to follow up previous findings and findings from study five (that the effect of verbal instructions on motor performance depends on outcome expectancy) with an additional factor of participant expectancy. Based on the current findings, the effect of an auditory tone manipulation also depends on participant expectancy.

The possibility that the distractor task was not robust presents opportunities for further research. A stronger distraction may be tested in comparison to the tone-monitoring task. If the tone-monitoring task is not an adequate distraction, it is likely that a stronger manipulation would affect motor performance outcome regardless of the expectancy effect. In contrast, if a stronger distraction is affected by participant expectancy, then it is possible that the distraction manipulation affects performance through expectancies. The strength of distractors may be compared through their effect on putting performance. The three distractor manipulations used in present study and previous studies are auditory tone monitoring (used in study six); word memory test, and speeded instructions (Beilock et al, 2004; Beilock et al, 2008). The overall results showed that only speeded instructions impaired putting performance compared to the control condition (i.e., no distraction). Therefore, it is possible that speeded instructions have the strongest degree of distraction. Consequently, future research may explore the effects of outcome expectancies with a speeded instruction manipulation. If speeded instructions impair performance regardless of the expectancy conditions it would support the alternative explanation that the current findings are a result of an inadequate distraction manipulation.

The current findings do not only emphasise the presence of participants’ expectancies in psychological experiments, but also gives rise to some interesting applied research questions. The most relevant practical setting in which the findings may be applied is in the coaching and learning context. A key area of research may be examining the expectancy effect in expert performers. It can be argued that experts have more experience in performing motor movements compared to novices, and their experiences are likely to shape their performance expectations. Future research could investigate the strength of pre-existing expectancies in experts, exploring whether they clash or conflict with the coaches’ expectations. The implication is quite clear; if pre-existing expectancies are more prominent than coaches’ expectations, than coaches should aim to tailor their lessons to encourage the pre-existing expectancies in athletes, in order to improve performance.
The expectancy effect is well-known and tends to be conducting under a carefully controlled laboratory context. While that is good research practice, it does not address the practical issue in which sportspersons are subjected to expectancy information in real-life. Expectancy information can come from coaches and instructors both intentionally and unintentionally. This current study emphasised this notion by actively manipulating the expectancy effect in a controlled laboratory context.

The current experiment demonstrated the expectancy effect with minimal manipulations of participants’ expectations. That is, only one verbal cue and one reminder was provided. The implications of the research are clear and need to be treated with caution when conducting experiments. Another interesting practical implication is in the area of learning and coaching. For example, coaches should take notice of athletes’ own expectations or beliefs about sporting techniques. Athletes can benefit from the simple encouragement or affirmation that their coach supports and encourages their belief. On the other hand, it may be detrimental to performance if coaches provide expectations that go against the athletes’ expectations.
General Discussion

The goal of the current project was to examine the effect of attentional focus on golf putting skill. The first four studies were attempts to replicate and extend previous findings. Since the pattern of results did not support the effect of attentional manipulation, the study took a change in direction to investigate other factors that could contribute to motor performance due to a different attentional focus style. This chapter will discuss the findings in two parts. First, a set of four studies investigating the attentional focus manipulations of verbal instruction and secondary task will be discussed. The methodological and theoretical issues will be addressed in relation to previous literature. Second, the last two studies in which a factor of outcome expectancy was introduced will be discussed. The practical implications and future research directions are suggested at the end of the chapter.

Summary of the first four studies

Replication; first and second study

The first study attempted to replicate the effect of attentional focus on motor performance as examined in the studies by Wulf, Hob, and Prinz (1998) and Shea and Wulf (1999). The study was a between-participants design which utilised a learning and retention test. It was hypothesised that the external focus would be the most beneficial focus for participants’ putting performance compared to internal focus. The results revealed no statistical difference in performance between the two types of attentional focus. Thus, the effect of external focus was not found in this study. A significant practice effect was found, whereby participants reliably performed better over time regardless of their assigned focus condition.

The second study had a similar purpose of replicating the effect of attentional focus. The study was a within-participants design and introduced a dual task condition in addition to the external focus condition and internal focus condition (Beilock & Carr, 2001) for comparison purposes. Based on theoretical explanations from previous literature (Beilock & Carr, 2001; Beilock, Carr, MacMahon, & Starkes, 2002), the dual-task should impair performance for novices. Therefore, the prediction of external focus being more beneficial than internal focus remained the same, in addition it was predicted that external focus would be most beneficial to novices’ performance. Thus, between the three experimental conditions, the external focus condition should produce the best outcome compared to the distracted condition or the internal focus condition. However, the results did not support the hypotheses related to the manipulation of internal versus external focus and the dual task paradigm. There were no significant differences in performance between the different styles of attentional focus. Again, the only significant pattern of results was the practice effect. Participants performed better over time regardless of the attentional focus condition.
The two studies attempted to replicate the effect of attentional focus as examined in previous literature (Wulf, Lauterbach, & Toole, 1999). Despite using similar methodologies, the findings from previous studies were not observed in the current two studies. In addition, the confounded variable of amount of information identified in Wulf, Lauterbach, and Toole (1999) was excluded. Another notable methodological issue is that the research design of within- versus between-participants did not seem to affect the performance of novices. The lack of significant effects of attentional focus on putting performance did not provide supporting evidence for the findings from Wulf, Lauterbach, and Toole (1999) and Beilock et al., (2002).

A number of contradictory findings related to different sporting tasks were observed in previous studies. For example, Denny (2009) found no beneficial effect of external focus on volleyball jump float serves among competitive players. Recent unpublished thesis dissertations have also found no significant effect of external focus. For example, Fremd (2013) found no external focus effect in track and field performance of long jump and Goodhead (2013) found that novice dart throwers performed best in the control condition, in which no instructions were given regarding attentional focus. In a similar dart-throwing task, Merchant, Clough, and Crawshaw (2007) found that external focus was more beneficial compared to internal focus. However, unlike previous studies ((e.g. Wulf & McNevin, 2003; Wulf, Weigelt, Poulter, & McNevin, 2003) external focus did not produce better performance than the control condition. While Wulf’s research suggests that external focus benefits both novices and experts, a common contradictory finding is that internal focus can be beneficial for novices during skill acquisition (Peh, Chow, & Davids, 2011). Uehara, Button, and Davids (2008) found that novices performed better in a soccer-chipping task with an internal focus which also carried through to the retention test phase. Perkins-Ceccato et al. (2003) utilised a similar golf chip-shot task to Wulf, Lauterbach, and Toole (1999) and found that novices performed better with an internal focus compared to an external focus. Lawrence et al. (2011) also found that novices learnt better with internal focus in gymnastic performance.

Although many studies contradict Wulf’s internal versus external focus, it can be argued that the findings are due to differences in the manipulations used. Take Perkins-Ceccato et al. (2003) for example, although the tasks and measures were similar to Wulf, Lauterbach, and Toole (1999), the instructions used to manipulate attentional focus were quite different. The internal focus of Wulf, Lauterbach, and Toole (1999) involved focusing on a step by step procedure of chipping a golf ball, whereas the internal focus of Perkins-Ceccato et al. (2003) involved focusing on the form and adjusting force accordingly for the chipping task. Therefore, the beneficial effect of internal focus in Perkins-Ceccato et al. (2003) may be due to the force adjustment aspect or the emphasis on focusing on one aspect of the movement. These instructions were not present in Wulf, Lauterbach, and Toole (1999). In the current thesis, the third study followed up the first two studies by
introducing a confound of amount of information included in the instructions. A second attempt at replicating the effect of distraction was also included.

**Inclusion of verbal instruction confound and further replication of distraction method; third study**

Study three was a follow up of the first two studies. Since the effect of attentional focus was not found when a potential confound was excluded, the third study intentionally confounded the manipulation of internal versus external focus. A larger number of verbal cues were included in the external focus condition. The reason for this was to create a hypothesis that worked against the established theory that external focus is the most beneficial style of focus. It was predicted that the confounding variable would be detrimental to the novices’ performance. Therefore, if external focus leads to better performance than internal focus, it would be conclusive that the type of attentional focus truly affects motor performance in the domain of internal versus external focus. It was found that there was no significant difference in putting performance between the internal focus condition and external focus with extra cues condition. At this point, it was decided that verbal instructions do not have a reliable impact on novices’ putting skills as seen in three failed attempts of replication with different methodological designs.

The third study also included a distraction method in the beginning phase of the experiment. Participants performed a golf-putting task in a control condition against the distracted condition (auditory monitoring task). It was found that participants performed worse in the distraction condition, which supports previous research that utilised a similar auditory tone monitoring task (Beilock & Carr, 2001; Beilock et al, 2002; Beilock et al, 2004; Castaneda & Gray, 2007; Gray, 2004). This finding was explored further in the fourth study using a training method.

**Training method; fourth study**

The concepts of attentional focus and motor performance were revisited in study four since the previous attempts to find effects with different methodologies were unsuccessful. The most notable theoretical concept that links attention to performance is motor automaticity (Beilock & Carr, 2001, Beilock et al., 2002, Beilock et al., 2004; Wulf, McNevin, & Shea, 2001; Wulf, Shea, & Park, 2001; Wulf, 2007). It is possible that the effect of attention was not found because novices had not acquired a high level of motor automaticity in putting skill. Since supporting evidence was found for the distraction method (i.e. novices’ performance was impaired by a secondary task), the fourth study aimed to follow up this notion by training novices to acquire motor automaticity and to examine the effects of the secondary task. The rationale for this motor automaticity is that the effect of attention on motor performance should be different at the initial skill level compared to after a period of practice.
Study four trained participants across seven sessions during a period of roughly two weeks and tested different attentional focus styles along the way. Three different methods of focus manipulation were used; two were based on previous literature and one was constructed based on the same theoretical concept of attentional focus capacity. The main findings did not support the hypothesised interaction that attentional focus would affect motor performance differently according to the training period. Overall, the effects of the different focus manipulations contradicted each other. The distraction method produced better performance than the control condition, while the speeded instructions produced poorer performance compared to the control. These findings contrast to previous literature (Beilock, Bertenthal, Hoerger, & Carr, 2008; Beilock & Carr, 2001), in which these manipulations affect motor performance similarly. The only consistent result observed was the practice effect, whereby participants improved steadily over time, regardless of attentional focus. Since there was no changes in the effect of secondary task on performance along the development of skill level, this study did not provide any supporting evidence for the theoretical explanation of the effect of attentional focus on motor skills through motor automaticity.

Methodological issues

Methodological issues are discussed in this section. Overall, the purpose of the first four studies was to replicate the effect of attentional focus. Therefore, attentional manipulations were replicated as closely as possible to those used in existing studies. The exception was the elimination of the potential confound in giving verbal instructions for internal focus versus external focus and the inclusion of a secondary task involving working memory in the fourth study. This presented an issue, such that current verbal manipulations may not have been constructed according to definitions in the previous literature (Wulf, McNevin, & Shea, 2001; Wulf & McNevin; 2003). For example, it is possible that the focus used in the current research (i.e., focusing on the hands versus focusing on the clubhead) did not have enough distance of the locality for the manipulation to be effective. As suggested by previous literature, further distance between internal and external focus points can lead to a greater beneficial effect of external focus (McKay & Wulf, 2012; Bell & Hardy, 2009; McNevin et al, 2003). In the case of golf putting, focusing on a location at a further distance could introduce systematic differences in where attention is directed. For instance, focusing one’s attention at a further distance from the clubhead could somehow relate to the target itself (e.g., the aiming line, half point to hole, or the hole itself). Consequently, the act of focusing on a target could be the reason for better performance in the external condition as participants have the additional step of focusing on the outcome, where participants in the internal focus condition are only focusing on the hand. Therefore, it could be argued that the focus in internal versus external conditions is simply focus on skill mechanic versus focus on target outcome. Intuitively, the motor
task, which requires some form of aiming accuracy, should benefit from directing one’s focus on the target itself. The act of focusing on the target outcome versus bodily mechanics was tested by Lohse et al (2013), who found that internal focus reduced the variability of bodily movements from trial-to-trial, while external focus reduced the variability in task outcome. A simple location of focus was selected to ensure that any differential effect was only due to the cognitive component of attention, rather than other aspects associated with the properties of focus.

Another prevalent issue to consider when using verbal instructions to manipulate attention is the use of a manipulation check. The first study attempted to quantify the subjective manipulation by using a self-report estimate of the number of putts participants could focus on. To the author’s knowledge, there are no existing objective measures to test this manipulation of attention through verbal instruction. In this dissertation, it is possible that the lack of effect was due to the weak instructions’ reminder or low compliance from participants. There is no reason to suspect that these issues were present in the current research as participants received constant reminders of the instructions. In terms of motivation, participants were not overly compensated to the point that compliance or non-compliance is an issue. It should be noted that study four included a monetary compensation; thus, the issue of motivation is still present.

The main issue with the distraction method is that a different manipulation check was used. The manipulation check was objective and ensured that participants performed the secondary task to the best of their ability. A second issue with the distraction method is the level of cognitive demand in the secondary task. Participants performed the secondary task according to the task instructions. There is the concern that the task was not as cognitively demanding as was intended. However, since the original distraction task of tone monitoring was kept constant and produced impaired performance compared to the non-distraction condition in the second study, it can be argued that the secondary task was not a problematic issue. The inconsistent findings between study three and study four may be due to the differences in methodology (i.e., performance test versus training session) or the influence of other factors altogether.

**Theoretical implications**

Across the four studies, manipulations of attentional focus were kept as similar to previous research as possible. Some manipulations (e.g., internal versus external focus) were rid of potential confounds such as the amount of information regarding verbal cues. If the effect of these manipulations was replicated, the current set of studies would provide evidence to further strengthen the previously claimed findings. However, it was the case that the manipulations did not produce any consistent differences in golf putting skill. In the first two studies, internal focus produced better performance in the first study, while external focus produced slightly better performance in the second study. Similarly, the distraction condition produced better performance
compared to the control condition in the second study, while the control condition produced better performance in the third study. Rather than using the theoretical explanation of motor automaticity to interpret these findings, they could be better explained by the methodological design. For example, the internal focus versus external focus findings may be the result of individual differences between participants. Regarding the within-subject design in the second and third study, it is possible that participants could not adhere to the instructions because of the confusion from multiple conditions. The pattern of results from distracted manipulation could be due to the fact that in the second study the design included a potential practice effect confound since the control condition was administered first as a practice session. This could explain why the control condition resulted in better performance compared to the distraction condition in the third study. The third study counterbalanced the order of conditions and found supporting evidence (marginally significant) for previous research findings, such that distraction deteriorates performance in novices. Nonetheless, findings from the third study need to be interpreted cautiously since the fourth study generated an opposing pattern of results.

The fourth study attempted to develop some level of motor automaticity in novices by training them in golf putting skill. It can be argued that the level of performance was similar to previous research (Beilock, Weirenga, Carr, 2002); thus, the development of automaticity should produce the attentional focus effect. However, the only significant findings obtained were from different focus manipulations that disregarded the effect of training. Two interesting findings were obtained. First, the fourth study produced contradicting results compared to the third study, such that the distraction tone produced better performance compared to the control condition. Second, the level of performance in the different focus conditions seemed to be based on the level of attentional demand, such that monitoring tone produced the best performance followed by word recognition (arguably involves working memory), while the worst performance was in the speeded condition where participants were told to perform as quickly as they could. These findings contradict both the results in study three and previous research that utilised a distracted task (e.g., Beilock et al., 2002; Beilock, Weirenga, & Carr, 2004; Beilock, Bertenthal, McCoy, & Carr, 2004). Hence, the explanation of the attentional focus effect thorough motor automaticity cannot be collectively explained by the current findings in these four studies.

**Alternative explanation; different domain of attentional focus**

The inconsistent findings in the current set of studies do not offer much evidence in terms of theoretical implications. While the studies closely followed the methodologies from previous research, the theory behind motor automaticity (e.g., attentional capacity, Beilock & Carr, 2001; enhancement of automaticity, Wulf, 2007) does not seem to fit with the pattern of results. Rather than the explanation of attentional focus enhancing automaticity (Wulf, 2007), perhaps these
findings can be explained through implicit versus explicit learning (Masters, 1992; Maxwell, Masters, & Eves, 2000). The general concept is that explicit cognitive processes are based on set of rules or verbal instructions that rely on working memory, whereas implicit processes are outside of conscious control, more difficult to verbalise, do not rely on working memory, and are less demanding on attention (Masters & Maxwell, 2004).

The most relevant experimental study in this area was conducted by Liao and Masters (2001) using a table tennis task. Other similar studies on learning through analogies use tasks such as baseball batting (Koedijker et al., 2011; Poolton et al., 2007); basketball freethrow (Lam, Maxwell, & Masters, 2009); and swimming (Seifert, Button, & Brazier, 2010; Komar et al., 2014). The common feature between the current research and these studies is the manipulation of attentional focus. In order to encourage implicit learning, a secondary task (e.g. counting numbers backwards; Liao & Masters, 2001) was used to occupy working memory. Similarly, an analogy learning task, whereby explicit rules or specific mechanisms are omitted, was also used as a separate experimental condition. In contrast, explicit learning was encouraged through the use of a set of specific rules in a stepwise manner for participants to perform. In terms of the current area of interest, analogy learning is evident in the study by Wulf, Lauterbach, and Toole's (1999) who use external focus by instructing participants to swing the golf club in a pendulum manner. Furthermore, explicit learning is comparable to internal focus which includes verbal cues that direct attention to bodily movements or skill mechanics. Finally, the use of a secondary task is simply a more demanding task compared to a distraction task (e.g., Beilock, Weirenga, Carr, 2002). Given these similarities in experimental manipulations, the concept of implicit versus explicit learning may offer a better explanation for the current findings. For example, it is possible that the internal focus versus external focus manipulation in study one and study two did not have an effect on putting performance due to the lack of an analogy component (i.e., the instructions were either focus on hands or focus on clubhead). On the other hand, the beneficial effects of external focus found in previous studies could be explained by implicit learning through analogies (e.g., swing clubhead like a pendulum; Wulf, Lauterbach, & Toole, 1999). The distraction method used in study four could also be explained by implicit versus explicit learning related to working memory. Although the explanation of attentional capacity in relation to motor automaticity (as offered by Beilock, Weirenga, Carr, 2002) only covers the required capacity for the putting task, the three different manipulations included in this research (i.e., distracted tone, word recognition, and speeded condition) should result in a similar pattern of results. At the very least the word recognition condition and speeded condition should have produced a similar effect as they were demanding, whereas the tone monitoring task may not have been demanding enough. The explicit
process, however, covers the specific aspects of demand on working memory that could be applied to the arguable difference in the distraction manipulation.

**Issue of motor learning versus motor performance**

The theoretical implications mentioned above need to be interpreted with caution. This is due to the fact that the current series of studies do not have a clear research design on learning versus performance testing. This is because the current research was interested in following previous research that utilised the same manipulation in an attempt to produce the same effects. Thus, there were no specific transfer-retention tests (study one and study four) to indicate whether participants were learning from the different types of attentional focus. This design limitation in addition to the inconsistent findings across the first four studies restricts the interpretation of theoretical implications. Although the findings may be explained by the theory of implicit versus explicit processes in motor skills (Masters, 1992), the current study lacks the design component to make these specific claims on motor learning. The most conservative conclusion from this series of research is that the different attentional focus manipulations did not have a differential effect on novices’ immediate motor performance.

**Changes in research direction; outcome expectancy factor**

**Summary of the fifth and sixth study on expectancy effect**

Thus far, the current research did not find any consistent pattern of results on the effect of attentional focus on motor performance. As a result, the research turned its focus to other potential contributing factors. While conducting the experiments, the author noticed that some participants preferred a particular focus manipulation compared to others, and that this preference could somehow affect their performance. For instance, those who preferred to focus externally or thought that external focus would produce better outcomes, perceived that they were able to perform better in the external condition. This focus preference has been investigated in previous research (Weiss & Friedrichs, 1986; Weiss, Reber, Owen, 2008; Weiss, 2011; Schorer et al., 2012). The effect of preferred attentional focus is also evidenced by activation of the premotor cortex when participants are asked to switch attention to an untrained focus style (Zimmermann et al., 2012). This notion could explain the inconsistent pattern of findings in the first four studies.

A recent study on expectancy effects by Pascua (2013), examined the beneficial effect of external focus through outcome expectancy in an overhand throwing task. The study included a control condition, external focus condition, positive expectancy condition, and external focus combined with positive expectancy condition. The external focus condition instructed participants to focus on the target. The outcome expectancy condition was given to participants via performance feedback, in which their performance was compared to the norm (i.e., participants were informed that they performed 20% better than average). The study found that both external focus and
expectancy produced equally better performance compared to the control condition, both in practice trials and the performance transfer test. Also, the combination of external focus and positive expectancy produced the best results compared to other conditions. This recent study provides evidence that outcome expectancy can affect motor performance to the same extent as external focus, and that the combination of the two can further enhance performance.

In the present research, participants may have had the impression, based on previous trials or instructions, that a particular experimental condition should produce better putting results compared to others. Since empirical evidence to support this speculation was not collected in the first four studies, the fifth and sixth studies factored in participants’ outcome expectancy in the attentional focus manipulation. The fifth study examined expectancy effect in the context of internal versus external focus. This was done by telling half of the participants that internal focus will produce better performance and the other half that external focus will produce better performance. It should be noted that this was not a deceptive manipulation as participants in each group were told that the outcome was expected due to previous research findings. Each group of participants went through both the internal and external focus conditions in a counterbalanced manner. The instructions for internal and external focus were held constant as in the first two studies. The author believed that this would be the most distinct verbal instruction to direct focus and control for other possible forms of information attached to the instruction. Also, the manipulation would provide a comparison to the earlier study that failed to replicate existing research findings. The findings revealed that outcome expectancy interacted with focus conditions. Participants who were told that internal focus would produce a better outcome performed better with an internal focus compared to an external focus. Furthermore, participants who were told that external focus was superior performed better in the external focus condition compared to the internal focus condition.

The sixth study was conducted with a similar design, but included a control condition and distracted condition (dual-task). Half of the participants were told that the distracted condition will lead to better performance while the other half were told that the control condition will lead to better performance. This manipulation was done similarly to the fifth study as participants were told that the expected outcome was based on previous research. The distracted or dual-task condition used an auditory tone monitoring task (Beilock, Carr, MacMahon, and Starkes; 2002) similar to studies two and three. Participants went through both conditions in a counterbalanced manner. The results illustrated the same pattern as the fifth study, such that the focus manipulation affected putting performance depending on participants’ expectations. When the participants were told that the distracted condition would produce a better outcome, they performed better in the distracted condition compared to the control condition. On the other hand, when they were told that
the control condition would produce better performance, they did better in the control condition compared to the distracted condition.

These findings do not necessarily imply that the effect of attention in previous literature was due to an experimental artefact. However, it does suggest that participants’ expectations could have played a key role in the first four studies in the current research project. That is, the non-significant results and inconsistent findings may have been a result of individual differences in outcome expectancy. In the first four studies, there was no information about the expected outcome given to participants. However, it is possible that participants acquired some level of performance expectations as a result of going through different attentional focus conditions. There is also the fact that their putting performance was evident during the putting task (i.e., participants were not masked from their own physical outcome). As such, they may have developed an outcome expectation from previous putting conditions. Since expectations can influence motor performance as demonstrated in study five and study six, the inconsistency in participants’ expectations may have led to an increase in statistical error and consequently, a lack of significant findings.

**Attention research implications**

The inconsistent findings in the first four studies in addition to the contradictory findings in the existing literature, raises a concern in terms of the validity of the categorisation and definition of internal versus external focus manipulations. The explanation given for the differential effect of internal versus external focus was based on the constraint-action hypothesis (Wulf, McNevin, & Shea, 2001; Wulf, Shea, & Park, 2001). A recent review on the subject (Wulf, 2013) still offers the same theoretical explanation and regards others’ contradictory findings as a result of methodological issues. In summary, the beneficial effect of external focus is justified as an enhancement of motor automaticity as participants reported that external focus was less demanding in attentional capacity (Wulf, McNevin, & Shea, 2001). On the other hand, the detrimental effect of internal focus is justified as the “self-invoking trigger” (Wulf, 2014, pp. 91), such that internal focus promotes self-related cognitive processing. The issue is that this particular theoretical explanation does not encompass a wide range of different focus domains that are used as manipulations. For example, Beilock and Carr (2001) offered a similar explanation using a skilled-focus manipulation, suggesting that focusing on the skill mechanism interrupts motor automaticity of experts’ movement. While the theoretical explanations are similar, they do not explain the contradictory findings by other researchers who have found that internal focus is beneficial to novices. (e.g., Beilock, Bertenthal, McCoy, & Carr, 2004; Beilock, Carr, MacMahon, & Starkes, 2002; Gray, 2004; Uehara, Button, Davids, 2008; Perkins-Ceccato et al., 2003)

The contradictory findings could simply arise from minor differences within the manipulation method. For example, three different internal focus manipulations were adapted;
Perkins-Ceccato (2003) told participants to focus on the form of movement and adjust the force; Beilock, Carr, MacMahon, and Starkes (2002) told participants to say the word stop when they finished the follow-through of the swing; and Wulf, Lauterbach, and Toole (1999) told participants to focus on the step-by-step procedure of the movement. All of these manipulations can be classified as internal focus despite producing different results. If the theoretical explanation is disregarded, it could simply be the case that novice participants performed better in Perkins-Ceccato et al. (2003) because the aspect of force adjustment was directly related to the outcome (i.e., participants would make an adjustment because of the mistake). It could also be the case that experts in Beilock, Carr, MacMahon, and Starkes (2002) performed worse when saying stop because the verbal production was an addition to their usual routine, which interrupted their putting procedure. Perhaps, participants in Wulf, Lauterbach, and Toole (1999) performed worse with internal focus because there were too many movement mechanics to think about at different steps, which produced a fragmented, non-smooth movement. These explanations are not necessarily related to the cognitive component of attentional focus or motor automaticity. The current research constructed a verbal manipulation according to the categorisation of internal versus external focus without taking into account the underlying issues of embedded information or extra attributes that arise with different types of instructions (an exception is in the third study where a confound is intentionally included). Arguably, if the effect of external focus had emerged, the current studies would have provided supportive evidence to the existing literature. Since the effect was not found, the current research instead highlights a replicability issue in this area of research. In addition, consistent with the growing concern of publication bias (Yong, 2012; Pashler & Wagenmakers, 2012; Cesario, 2014), the current research adds to the unpublished experimental data (e.g. Fremd, 2013; Goodhead, 2013), which could have increased the number of contradictory findings if published.

The most noticeable finding from study five and study six is the effect of participants’ expectancy on motor performance. This is especially true when it was discovered that the effect of attention on motor performance depends on the expectation of the performer. Research in the area of attention and performance should take this finding into consideration when constructing the methodology. This is because, even if there is no clear indication of the expected outcome, one cannot be certain that participants will not develop their own expectations during the study. Furthermore, expectations that form individually could potentially increase error variance in a study and render the effect of variables of interest insignificant. If possible, it would be more advisable to manipulate participants’ expectation and control it in such a way that it contradicts the hypothesis. Not only will this design account for participants’ expectations, but results that support the main
hypothesis would indicate that the effect of expectation was overcome by the manipulation of the variable of interest.

The above research implication can be readily applied to both attention research and sport psychology research. However, sport psychology researchers need to be more careful with the issue of outcome expectancy in expert participants. This is for the reason that sport experts are most likely to have acquired some expectations of their own through past experiences and training. Hence, any manipulation that requires changes from their usual routine will most likely interact with experts’ expectations of the outcome. For example, an expert golfer who has been putting with an internal focus throughout his/her golf career, would inevitably perceive an external focus instruction as inferior compared to his/her own mental process, and consequently form a negative expectation towards the external focus. Therefore, athletes’ preferences should be taken into account when constructing a research methodology.

**Practical implications**

The current research aims to inform the members of the sporting community, specifically those in the area of coaching and learning. However, current findings may also be beneficial to elite golfers, novice golfers, recreational golfers, coaches, instructors, and coach-performance enhancers.

**Implications for athletes.** In terms of developing attentional mental skill in athletes, the author’s personal anecdote can demonstrate this notion very well. The author’s younger brother has a very vigorous sporting background; a junior golfer since eight years old, a downhill bicycle rider for three years, a competitor in 250cc motorbike events, a Thai kickboxer for a couple of years, and a regular weight-lifter. For the past three years, he has revisited golf and trained regularly for a professional qualifying test in 2014. He consulted the author due to a built up of frustration from the inconsistencies in his performance. He claims that he often feels ‘blank’ in his mind right before taking a shot. He suspects that this feeling is the reason he loses focus during the swing and affects his performance. Upon examining his practice routine on a driving range, the author noticed that he practiced in a zombie-like manner, hitting golf balls one after the other without putting too much thought into the mental process or checking the swing mechanics periodically. The author suggested that he should develop a specific mental routine in addition to his existing physical pre-shot routine. A specific mental process was not suggested, but he was encouraged to come up with one on his own and to stick with the particular focus he prefers. The focus instruction is similar to the concept of internal versus external focus. However, the actual definition of focusing style was not provided and he was only told to come up with one particular focus that he prefers. Truthfully, the author did not have much hope, but as it turned out, his younger brothers’ performance improved on the golf course. After the decision making process and shot preparation, he focused on
turning his swing around his spinal cord, which could be classified as an internal focus according to Shea & Wulf (1999). However, the author suspects that this improvement is more likely due to outcome expectancy rather than attentional focus.

Based on the personal experience discussed above, as well as the evidence collected in the current research, the most important message for athletes is to have a preferred attentional focus style. It does not entirely matter what type of focus is utilised, as long as the focus elicits a positive expectation. It would be advisable for both novices and experts to utilise a precise attentional focus for every golf shot performed. A focus of any kind can be used as encouragement for a positive outcome expectancy and can further ensure the best performance possible. Future research on attentional focus in experts could benefit from taking personal preferences into account. According to the current findings, athletes should perform best with their usual style of focus since it should easily lead to a positive outcome expectancy. However, a newly suggested style of focus could be beneficial to the performer if it somehow produces a higher level of expectancy. For instance, it may be that an athlete is in a period of slump and that the suggested style of attentional focus is perceived as a cognitive performance enhancer. On the other hand, it could certainly hinder an athlete if he or she is sceptical about the beneficial effect of the suggested attentional focus style.

**Mental game tactics.** Admittedly, most mind games in sport involve a form of bantering with the opposition. Golf is no exception, especially since players in the same group have to be together for most of the day with spare time in between shots. Any verbal or non-verbal communication has the potential to affect a player cognitively. Based on the current research, the findings indicate that the effect of attentional focus style depends on the outcome expectation of the participant. If we extend this to other physical and mental routines, or even rituals, that players do before performing, it is possible that these pre-execution routines are actually there to encourage positive outcome expectancies. For example, routines or rituals may involve wearing a lucky shirt in the finals, tucking shirt sleeves before a golf swing, or wagging the clubhead before a tee-off. These routines certainly do not provide any actual physical advantages, but are performed for ease of mind.

If these pre-execution rituals are likely to elicit positive outcome expectancies, then it is also possible that they could produce negative outcome expectancies. For example, an opponent could comment or make a remark about the pre-execution routine to create doubt in the player and in turn reduce the magnitude of positive expectancy. For example, an opponent might comment on the number of club waggling or number of practice swings before a shot. These comments could change a player’s attentional focus in a similar way that verbal instructions direct the focus of participants in an experiment. Ultimately, it would depend on how an athlete perceives these instructions of attentional focus; whether they are viewed as beneficial or destructive.
Consequently, it would be valuable for future research to investigate the factors affecting athletes’ perceptions of focus-related instructions. For example, factors such as credibility of coaches or trust in coaches could play a major role in constructing positive expectancies. Athletes past experiences could also affect their perceptions strongly, especially in experts who may have had experimented with different focusing styles.

**Coaches and instructors.** Since it was discovered that athletes’ expectancies can be more influential than a performance enhancement technique through attentional focus, coaches need to consider outcome expectancies in an athlete and instruct accordingly. Therefore, it should be taken into account that the relationship coaches have with athletes may affect how athletes view instructions. In terms of how coaches should portray themselves, it is quite clear that they should present themselves confidently and knowledgeable with strong leadership skills. Previous literature also suggests a similar claim which found that leadership attributes of coaches significantly correlate with team performance and athletes’ satisfaction (Vallée & Bloom, 2005; Weiss & Friedrichs, 1986). The current research provides evidence that the personality of coaches could be affecting the performance of athletes through positive outcome expectancies. A coach who is respectable, confident, and knowledgeable, could potentially inject a sense of positive outcome expectancy into athletes when instructing or correcting technical skills.

More importantly, coaches need to recognise an athlete’s preference of focus style and also take into consideration that their instructions could affect attentional focus. This process should be relatively easy in novice players since they have limited experience with skill-mechanics. Therefore, shaping their cognitive process of attention could easily be done through practice. This is similar to studies five and six, in which participants were reminded that a particular focus style would be more beneficial compared to the other. Experts should have some level of experience with attentional focus either unintentionally or through trial and error. Consequently, if expert athletes strongly believe in a specific focus style, they could be sceptical about coaches’ instructions and may develop negative outcome expectancies. Therefore, coaches need to recognise these individual preferences and construct training programs accordingly. For instance, if a coach recognises that an athlete already has a comfortable cognitive routine, the coach could avoid interfering with that particular cognitive process when correcting techniques in order to preserve the usual attentional focus style. On the other hand, if an athlete seems lost and is inconsistent in their mental processes (my brother, for example), coaches can simply suggest a focus style in an attempt to associate it with positive outcomes.

**Future research directions**

From a theoretical viewpoint, it would be interesting to see whether or not the expectancy effect acts as a mediator with other cognitive components. In the current research, it seems to be
the case that the effect of attentional focus on performance depends on the players’ outcome expectation. Other mental components and routines that are associated with performance could also be mediated by expectancies. These mental components may include self-confidence (Feltz, 1988; Feltz, Short, & Sullivan, 2008; Woodman & Hardy, 2003), self-talk (Ming & Martin, 1996; Theodorakis et al., 2000; Hatzigeorgiadis, Theodorakis, & Zourbanos, 2004), etc. The experiments investigating these factors have not taken expectancy into account. If expectancy is viewed as a means for these factors to affect motor performance, it could potentially be mediating all of the above effects.

The effect of expectancy on motor performance can also be addressed in research on superstitious behaviour in sports (Bleak & Frederick, 1998). Superstitious behaviour is believed to have a beneficial effect on performance but does not possess a clear technical or skill-related function (Moran, 1996). Exploratory studies have confirmed that superstitious behaviour is prevalent among sporting communities (e.g. Schippers & Van Lange, 2006; Burger & Lynn, 2005). In terms of mechanisms underlying the effects of superstitious behaviour, it has been explained that the beneficial effect could be due to reduced anxiety (Becker, 1975), or help build confidence (Van Raalte et al., 1991). More recently, Foster, Weigand, and Baines (2006) found that the beneficial effect of superstitious behaviour was similar to pre-performance routines in basketball free-throw exercises. It is possible that the outcome expectancy effect is the underlying cause and could potentially explain the superstitious effect on performance outcomes. For example, sportspersons who believe in superstitious behaviours are more likely to hold expectations that their performance will be enhanced by performing the superstitious behaviour. Therefore, positive outcome expectations could be producing a better outcome as shown in the current studies.

This future research would also be applicable to the sporting community. When the mechanism of a psychological factor is clarified, a mental technique can be more precisely applied to enhance learning or performance. In addition, when a particular technique does not work, coaches or instructors could identify the cause and readily solve the issue. Since outcome expectancy works at the individual level (i.e., athletes), research studies that examining athletes’ perceptions of psychological techniques would be directly applicable in the real settings. Factors such as coaches’ credibility or athletes’ past experiences could affect expectations of the outcome. Future applied research on sports performance would benefit from realising the magnitude of expectancy effects when developing a performance enhancement technique.


Beilock, S. L., Carr, T. H., MacMahon, C., & Starkes, J. L. (2002). When paying attention becomes counterproductive: Impact of divided versus skilled-focused attention on novice and


Appendix A

Golf putting information sheet given to participants in study 3 (chapter 4)

To execute your putt:

1. **Simpler is better.** It has been proven that for any given skill or talent factor, simpler is easier and better to learn with precision and accuracy.
   a. A pendulum motion is the simplest and easiest motion to putt with, both mechanically and rhythmically.
   b. Of three possible motions, the two non-vertical pendulums cause putter face rotation and path curvature around the body.
   c. **A vertical pendulum** formed by the hands hanging below the shoulders provides a pure-in-line putter path motion, and keeps the putter face square to the line through impact.

2. The **pure-in-line-square** (pils) stroke has been shown to be natural (requiring no manipulations) and the simplest motion to putt with (Figure 1).
   a. A pure-in-line putter path is superior to a curving path for making a putt roll on-line.
   b. A square-to-the-line putterface angle is superior to a rotating face for making a putt roll on-line.
   c. The screen-door putting stroke, while also a natural motion (non-vertical pendulum), is almost never square and almost never on-line.
      i. Its curved path is not good for producing solid impact down a straight line.
      ii. Its rotating face angle makes producing a straight-line roll difficult.
      iii. Timing the impact of a curving and rotating putterface becomes critical (the early or late, but never on-time, syndrome)

3. The pils stroke beats the screen-door stroke in every department: **simplicity, repeatability, reliability, being in-line, and being square**.

4. An address setup position with **parallel flow-lines** makes in-line putting down your Aimline easy and absolutely natural (Figure 2).

5. A pendulum motion requires **short swings for short putts, long swings for long putts**. By using a pendulum motion with no "hit" power, the adrenaline effects from hand and wrist muscles are eliminated.

6. By moving everything together, the triangle (hands, arms, and shoulders) and putter make a **pure pendulum motion**.

7. **Shorter backswings and slightly longer follow-throughs** keep pendulum strokes stable through impact.
Appendix B
Text of instructions given to experiment participants in study 5 (chapter 6)

External focus produces better outcome

*Internal focus condition.* Try to focus your attention on the movement of your hands. Take notice of the angle, pressure, tension, etc. And try to keep your attention on the movement of your hands in every putt. Do not be alarmed if you notice that your performance drops slightly compared to other conditions; research in the past has demonstrated that focus on the bodily movement tends to disrupt the automaticity/flow of the physical skills.

*External focus condition.* Try to focus your attention on the movement of the clubhead. Take notice of the angle, impact point, stroke, etc. And try to keep your attention on the movement of the clubhead in every putt. It would be expected that your performance should be better compared to other conditions since research in the past showed that focusing attention on the effect of the movement helps with the automaticity/flow of the physical skills.

Internal focus produces better outcome

*Internal focus condition.* Try to focus your attention on the movement of your hands. Take notice of the angle, pressure, tension, etc. And try to keep your attention on the movement of your hands in every putt. It would be expected that your performance should be better compared to other conditions since research in the past showed that focusing attention on the bodily movement helps with the automaticity/flow of the physical skills in beginners.

*External focus condition.* Try to focus your attention on the movement of the clubhead. Take notice of the angle, impact point, stroke, etc. And try to keep your attention on the movement of the clubhead in every putt. Do not be alarmed if you notice that your performance drops slightly compared to other conditions; research in the past has demonstrated that focus on the effect of the movement tends to disrupt the automaticity/flow of the physical skills in novices.