

Effects of Attentional Focus on Skilled Performance in Golf

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Wulf and colleagues (e.g., Wulf, Lauterbach, & Toole, 1999) have demonstrated that the adoption of an external focus of attention is preferable for the learning of complex motor tasks. The present investigation extends the attention focus literature in two ways: (a) it compared the effectiveness of three different foci (internal, proximal external, and distal external) in a sample of skilled performers in a naturalistic environment, and (b) it examined the use of attentional foci under conditions of anxiety. Thirty-three skilled male golfers were assigned to one of three attentional focus groups and completed five blocks of ten pitch shots, three in neutral conditions and two in anxiety conditions. Results from two separate mixed model analyses of variance (ANOVAs) indicated that regardless of anxiety condition, those assigned to a distal external focus of attention performed most accurately ($p < 0.05$), whereas assignment to an internal focus of attention was associated with the least accurate performance ($p < 0.05$). Findings offer support for the constrained action hypothesis and point to the importance of skilled performers adopting a distal external focus, especially in competition.

In recent years a number of research articles have revealed that an individual's focus of attention holds an important influence over motor learning and performance (see Wulf & Prinz, 2001 for a review). A series of experimental studies by Wulf and colleagues (e.g., Wulf, Hoess, & Prinz, 1998; Wulf, Lauterbach, & Toole, 1999) have specifically examined an internal versus an external focus of attention. An internal focus is one that is directed at the performer's own body movements whereas an external focus is one that is directed towards the effect those body movements have on the environment (Wulf et al., 1998). Using a number of different sports and laboratory tasks, it has been shown that learning under external focus instructions is more effective than learning under internal focus instructions (see Wulf, 2007 for a review).

To explain the advantages of an external focus, researchers originally referred to Prinz's (1990) common coding theory (Wulf & Prinz, 2001). Prinz (1990) proposed that we perceive and plan our actions in terms of distal events (i.e., the intended outcome). Although the consistent benefits associated with an external focus are in line with this theory, Wulf and Prinz (2001) have argued that "the theory does not specifically predict the differential learning effects of external versus internal attentional foci" (p. 656). To address these issues Wulf, McNevin, and Shea (2001) forwarded the constrained action hypothesis, which proposes that individuals who direct their attention internally during skill execution interfere with automatic control processes that would normally regulate the movement. In contrast, focusing on the

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movement effect has been shown to promote use of automatic processes, which results in more effective performance and learning (Wulf et al., 2001). An accumulating body of evidence has been established in support of the constrained action hypothesis including analysis of EMG activity (see Wulf, 2007 for a review). However, of particular relevance to the present study are the findings from the frequency of movement adjustment analysis. These analyses have consistently shown higher frequency adjustments for an external focus compared to an internal focus (McNevin, Shea, & Wulf, 2003; Wulf et al., 2001). Higher frequency adjustments are reflective of faster reflex loops, an increase in active degrees of freedom, and more automated, less jerky task execution (Vereijken, van Emmerik, Whiting, & Newell, 1992).

Another explanation for the benefits of an external focus relative to an internal focus is related to the reduced cognitive demands associated with external foci. Wulf et al. (2001) used a secondary probe reaction task to investigate attentional demands under different attentional foci. Reaction times were significantly faster for participants adopting an external focus of attention compared to those adopting an internal focus of attention (Wulf et al., 2001). Totsika and Wulf (2003) provided comparable evidence when they examined the performance of a dynamic balance task under internal and external focus instructions. Participants were required to ride a pedalo while counting backward in threes thus exposing them to increased attentional load in the form of a secondary cognitive task. In accordance with previous research (e.g., Wulf et al., 1998), the external focus group outperformed the internal focus group which is, again, indicative of reduced cognitive requirements associated with an external focus.

The research conducted by Wulf et al. (2001) and Totsika and Wulf (2003) has further implications in terms of the anxiety-related research. It is well-established that anxiety can have a detrimental effect on sporting performance and there have been numerous attempts to explain these negative effects. One line of thought suggests that increased anxiety creates a distracting environment that shifts attention to task-irrelevant cues such as worry about the situation and its consequences (Wine, 1971). This worry is said to add to the cognitive load that detrimentally affects performance by exceeding some threshold for attentional capacity (Mullen, Hardy, & Tattersall, 2005). When the anxiety research is considered in conjunction with the attentional focus literature it is likely that an external focus of attention might also enhance performance under conditions of anxiety. Wulf et al. (2001) provided evidence that more attentional capacity is available for processing task-related information under an external focus in relation to an internal focus. Consequently, the facilitative effect on performance is likely to extend to settings where anxiety-related distractions occupy attentional resources because there is less chance of exceeding the attentional threshold under an external focus. However, despite the appealing theoretical implications of this research, there has yet to be a comprehensive examination of attentional focus effects under conditions of anxiety (Chell, Maynard, Bawden, & Woodman, 2003). The lack of attentional focus research using anxiety manipulations is particularly pertinent given the major threats to attentional control that come with increased anxiety during high level competition (Hardy, Jones, & Gould, 1996).

Another noteworthy contention within the attention-oriented research is that an external focus can be thought of in multidimensional terms (McNevin et al., 2003). McNevin et al.'s study involved a dynamic balance task that examined the learning effects of a distal external focus in relation to a more proximal external focus and an internal focus. The distal external focus condition required participants to attend to platform markers 26 cm away from their feet whereas the proximal external focus condition required participants to attend to markers placed immediately in front of their feet. Those assigned to a distal external focus treatment group demonstrated enhanced learning compared to a proximal external focus which in turn showed superior learning in relation to an internal focus. Furthermore, the adoption of a distal external focus resulted in higher frequency and lower amplitude responses than a proximal

external focus. On the basis of these findings it was proposed that the benefits associated with an external focus are more pronounced as the distance between the action and its effect are increased (McNevin et al., 2003).

Despite the supportive evidence provided by McNevin et al. (2003), the results related to a distal external focus have been inconsistent across studies (Castaneda & Gray, 2007; Perkins-Ceccatto, Passmore, & Lee, 2003). For example, an isolated study from Wulf, McNevin, Fuchs, Ritter, and Toole (2000) discovered counter-intuitive results whereby novice golfers showed more effective learning when they attended to the movement of the club (a proximal external focus) than those who attended to the trajectory of the ball (a distal external focus). However, Beilock, Carr, MacMahon, and Starkes (2002) proposed that effects of attentional focus vary as a function of the performer's level of expertise. As such, it is possible that the benefits associated with the proximal external focus identified by Wulf et al. (2000) would not extend to skilled participants. Perkins-Ceccatto et al. (2003) would endorse this contention as they demonstrated that highly skilled golfers performed more consistently with distal external attentional instructions (focus on the target) than with internal attentional instructions (focus on the form and force of the golf swing), whereas the opposite performance trend emerged for novice golfers. In contrast, Wulf and Su (2007) found that a proximal external focus resulted in superior pitching performance by expert golfers compared to an internal focus and a control condition. However, this study did not include a distal external focus and the authors made reference to the potential benefits of focusing on higher level (i.e., distal) effects (Wulf & Su, 2007). Given the findings of the existing research and the fact that applied practitioners are more likely to work with expert rather than novice performers (Williams, 2006); more work is required to determine the optimal focus of attention for skilled performers.

Along with the relative shortage of research related to skilled performers, the concept of a distal external focus of attention is also problematic because there is little consensus as to its exact definition, and consequently, there is a large amount of variability in its operationalization (Wulf, 2007). By and large the attention literature is divided according to those who have described a distal external focus related to (a) the flight of the ball after it has left the hitting instrument (e.g., Castaneda & Gray, 2007; Wulf et al. 2000), and (b) the task's target such as the rim of a basketball net or the flagstick in golf (e.g., Perkins-Ceccatto et al., 2003, Zachry, Wulf, Mercer & Bezodis, 2005). It could be argued that the existence of two conflicting operationalizations has contributed to the equivocal results that exist within the literature (e.g., Perkins-Ceccatto et al., 2003; Wulf et al., 2000). Consequently, it appears appropriate to offer an explicit and precise operationalization of a distal external focus that might improve the clarity of the attention-oriented literature. In their initial investigation into attentional focus, Wulf et al. (1998) defined an external focus as a situation where a performer's attention is directed to the effect of the body's movement on the external environment. As such, distal external foci that are solely outcome related (e.g., the flagstick) would not fall under the original definition. On the other hand, distal external foci related to task performance processes, such as the flight of the ball after it has left the hitting instrument (e.g., golf club), could be considered more in line with initial theorizing, because the flight of the ball is inextricably linked to the movement of the body that precedes it (Newell, 2001). Moreover, research appears to support the adoption of a distal external focus involving the flight of the ball for skilled performers (Castaneda & Gray, 2007). However, despite the apparent benefits of a distal external focus there are few studies that have simultaneously examined the effects of three different attentional foci (i.e., distal external, proximal external, & internal) in a sample of skilled performers in a non-laboratory setting.

Before discussing how the present study intends to address the aforementioned gaps in the literature, it is important to highlight one further weakness. Wulf and colleagues consistently

manipulated attentional focus through the use of explicit verbal instructions (e.g., participants are told to focus on keeping their feet level or keeping the platform level, during the dynamic balance task; Wulf et al. 1998). However, such a protocol is undermined because checks to ensure that participants actually directed their attention to the desired location have been absent (Castaneda & Gray, 2007). Accordingly, there is a need to provide a more rigorous assessment of manipulations. Building on from Marchant, Clough, and Crawshaw's (2007) initial use of post-task items, the present study employed a post-manipulation check questionnaire to ensure that all conclusions regarding the effects of attentional focus could be accurately attributed to the distinctive direction of each group's focus.

Thus, the general purpose of the present study was to determine the effects of different attentional foci on the performance of skilled golfers. A golfing task was chosen to replicate previous designs (e.g., Wulf et al., 1999, Wulf & Su, 2007). A further purpose of the study was to determine if the effects of attentional focus would hold under an anxiety-provoking environment. Due to the considerable evidence in favor of the constrained action hypothesis (Wulf et al., 2001), it was hypothesized that a distal external focus would be the most effective focus and an internal focus would be the least effective focus for skilled golfers under non-anxious conditions. The same pattern of results was predicted under anxiety-provoking conditions due to evidence linking attentional foci requiring additional cognitive resources and the anxiety-related performance failures associated with cognitive overload (Wulf et al., 2001).

METHOD

Participants

Thirty-three skilled male golfers ranging in age from 15 to 59 ($M = 37.06$ years, $SD = 17.84$) were assigned to one of three experimental treatments; an internal focus group ($n = 11$), a proximal external focus group ($n = 11$), and a distal external focus group ($n = 11$). To ensure that ability level was equally distributed across groups, a matched assignment strategy was employed using valid handicaps. All participants had an official Council of National Golf Unions (CONGU) handicap with a registered golf club not higher than 9.4 ($M = 5.51$, $SD = 3.20$). Participants were not guaranteed to receive payment for their involvement in the present study, although financial incentives were available as part of the anxiety manipulation protocol. All financial incentives as well as the experimental protocol were granted ethical approval from an Institutional Review Board.

Apparatus and Task

The task was a golf chip shot similar to that used by Wulf et al. (2000). Participants were instructed to chip from a designated position towards a target (i.e., the flagstick) from a distance of 20 m. To determine performance, 20 lines spaced at intervals of 50 cm were marked out using string from 5 m short of the target to 5 m beyond the target. A digital camera was positioned on a tripod to one side of the target so that a still picture could record the position in which the ball finished. Finally, a video camera was mounted on a tripod and positioned to the side of the participant. The task was conducted outside, on a lawn surface, at a golf course to incorporate a naturalistic environment that increased the ecological validity of the study. The area where the chip shot was struck would commonly be described as the fairway. The terrain between the ball and the target was predominantly made up of smoother; short-cut grass commonly referred to as the green. The participants used a golf club

(i.e., 50° Callaway pitching wedge) as well as a standard golf ball (i.e., Callaway HX-TOUR) with playing characteristics that would be familiar to skilled golfers.

Experimental Conditions

The respective attentional foci were induced via explicit instructions and an assigned self-talk (ST) strategy. ST was used to complement the attention instructions due to the suggestion that ST can assist in directing athletes' attentional focus (e.g., Landin, 1994). The content of the experimental treatment package differed across attentional focus groups although each different ST strategy was phonetically simple and logically related to a specific process of the motor skill (Landin). Equally, all participants were instructed to repeat the ST strategy immediately prior to skill execution either overtly or covertly depending on their preference. The explicit instructions drew heavily from Wulf et al. (2000), whereby participants were asked to concentrate on one specific aspect of skill execution. Additionally, the intervention package borrowed heavily from Beilock et al. (2002), where attempts were made to induce attentional foci by posing pertinent questions during the testing phase.

Internal Focus Group

Participants were explicitly instructed to focus on the motion of the arms during the swing and specifically to maintain the hinge in the wrists through impact. Participants within this group were also asked to repeat the phrase *wrist hinge* to further promote an internal focus. They were reminded of these instructions and their assigned ST strategy after every third shot. In accordance with recommendations from Beilock et al. (2002), internal focus group members were asked "to what extent did you maintain the hinge in your wrists during that swing?" Responses ranged from values of 1 (*not at all*) to 5 (*very much so*).

Proximal External Focus Group

Group members were explicitly instructed to focus on the position of the clubface through the swing, in particular, keeping the clubface square through impact. In addition, participants were asked to repeat the phrase *square face* prior to shot execution. Reminders of instructions and assigned ST occurred after every third shot and they were asked "to what extent did you maintain a square clubface during that swing?" after every shot. Responses were provided in an identical manner to that described previously.

Distal External Focus Group

Participants were instructed to focus explicitly on the flight of the ball after it had left the clubface and in particular the direction in which they intended to set the ball. Participants were also required to repeat the ST phrase *straight flight* immediately prior to shot execution. Similar to the other two groups, a reminder of these instructions and assigned ST was provided after every third shot. In addition, all group members were asked the question, "to what extent did you set the ball out on a desirable direction for that shot?"

Neutral Condition Phase

Participants were asked to chip towards the target as they would normally. Participants were also instructed that the results of the test would form part of an ongoing investigation and that personal data would only be available to the researchers. The neutral instructional set consisted of three blocks of 10 shots.

Anxiety Condition Phase

Anxiety was induced via a combination of social evaluation and financial incentives. Initially participants were informed that the video camera was required to record footage of the subsequent two blocks of 10 shots. A cover story was presented in which participants were informed that footage would be examined by a PGA professional to provide a qualitative evaluation of their chipping performance (Masters, 1992). The presence of a camera and evaluation apprehension has been successfully employed to heighten cognitive anxiety in previous investigations (e.g., Hardy, Mullen, & Jones, 1996). Furthermore, participants were informed that scores for the subsequent block of trials were to be recorded and published in a league table. A financial incentive accompanied these instructions because Woodman and Hardy (2001) have suggested that financial incentives act as a source of stress that contributes towards competitive worry. Borrowing from Beilock and Carr (2001), participants were told that their first thirty shots had been recorded and their average score had been noted. They were then informed that the next twenty shots would also be recorded and the participant who improved their average score the most would be awarded a prize; the largest improvement, £80, down to the fifth largest improvement, £10. Although the increase in cognitive anxiety was not measured within their study, it was felt that this would supplement our anxiety manipulation protocol.

Measures

Performance

Performance was measured according to the distance (i.e., short or long of the hole) the ball finished from the target. The score allocated to each shot was determined by the line to which it finished closest. A ball finishing closest to the line 3 m short or 3 m long of the target was allocated a score of 3. In the event that the ball finished outside of the scoring area it was allocated the maximum score of 5. The rationale behind this particular scoring system was based on both theory and pilot work. First, distance from the hole as opposed to more typical concentric circle scoring or Hancock, Butler, and Fischman's (1995) two-dimensional error measure was employed based on constrained action hypothesis related research. Such research has found that the motor control processes that occur when using an internal focus of attention are characterized by larger amplitude body adjustments and frozen degrees of freedom (e.g., McNevin et al., 2003). With regard to the present study, the disruption that occurs as a result of this variability was expected to be an erratic jerky (i.e., almost stabbing) action that produces an inconsistent application of force to each shot, which transfers to variations in the distance each shot travels. Consequently variations in direction (i.e., ball finishing left or right of the hole) should not be as apparent as variations in distance (i.e., ball finishing short or long of the hole). Second, although previous research (e.g., Perkins-Ceccato et al., 2003) has employed the ball's landing position rather than finishing position as a measure of performance, we encountered serious problems with this approach in our pilot work. For example, chalk covered golf balls did not leave a print of where they landed, and golfers felt uncomfortable executing the shot asked of them. Consequently, performance was measured according to where the ball *finished* in relation to the target. To remove subjective investigator bias from the performance measure the digital camera was used to take a pictorial record of the outcome of each shot. The pictorial record of each shot was rated by two independent judges; inter-rater reliability exceeded .95. Raters' average score was employed in subsequent analyses.

State Anxiety

Competitive state anxiety was assessed via the Competitive State Anxiety Inventory-2 Revised (CSAI-2R; Cox, Martens, & Russell, 2003). The CSAI-2R is a sport-specific,

psychometrically sound self report inventory that measures state cognitive anxiety, state somatic anxiety, and state self-confidence. Woodman and Hardy (2003) proposed that somatic anxiety has a more significant effect on the performance of tasks that threaten physical bodily harm (e.g., rock climbing or rugby), whereas cognitive anxiety has a greater effect on the performance of passive, ego-threatening tasks (e.g., golf or archery). As a result, only the cognitive anxiety subscale of the CSAI-2R was measured, which has an acceptable internal reliability coefficient of .83 (Cox et al., 2003). There are five items within the subscale and responses to each item are made on a Likert-type scale. The highest score that can be obtained is 40 and the lowest is 10, whereby higher scores reflect greater levels of cognitive anxiety.

Post Experimental Manipulation Check

All participants reported to what extent they had completed the task as the combined attention-oriented intervention package outlined. Additionally, participants were asked three specific questions designed to assess use of the respective attentional foci during task execution. More precisely, all participants answered the following items: (a) To what extent were you focused on the movements of any part of your body (e.g., legs, torso, arms, hands or head) as you executed your pitch shot? (b) To what extent were you focused on the position of the clubface as you executed your pitch shots? (c) To what extent were you focused on the flight of the ball as you executed your pitch shots? Responses to all manipulation check questions were provided via a Likert scale ranging from 1 (*not at all*) to 5 (*very much so*).

Procedure

Initial demographic details were obtained from participants, and confirmation of their handicap was used to assign participants to equally matched groups. All participants were informed that the experiment was part of an ongoing series of studies that were investigating the effectiveness of cognitive strategies on golfing performance. Written informed consent was acquired from each participant and parental consent was sought when appropriate. The neutral experimental conditions were completed immediately prior to the anxiety experimental conditions for every participant.

There were four phases to the present experiment. All participants began with the introductory phase. Immediately prior to testing the participant was taken to the hitting area and provided with an explanation of the demands of the task. This phase was used to clarify the details of the experiment including the protocol that each participant was to follow and the rationale for each piece of apparatus (e.g., digital camera). Participants were informed that they were to be assessed on their ability to hit a chip shot as close as possible to the flagstick. The instructions that the three experimental groups were given only differed in terms of the exact attentional strategies each group was to use.

In the warm-up phase each participant was given time to engage in a 10-shot warm up to become familiar with the task, the pace of the putting green, the club, and the ball. During the warm-up phase participants in each group had the opportunity to practice using their assigned strategies. A total of 10 shots were used to prevent extraneous factors such as boredom or fatigue from affecting performance, while enough time was permitted to gain familiarity with the task.

In the neutral condition phase participants completed three blocks of ten shots. After each block the participants were given the opportunity for a short break and reminded of their assigned ST cue and the importance of repeating it prior to every shot. Immediately prior to the first block of trials participants completed the CSAI-2R.

In the anxiety condition phase participants were made aware of the social evaluation and financial incentives that characterized this phase as well as a reminder of the respective instructions and ST strategies. Immediately following this explanation, participants completed the CSAI-2R for a second time. Each block of ten shots was performed in an identical protocol to the neutral condition phase. Upon the conclusion of the two anxiety-related blocks participants answered the post-experimental manipulation checks. After completion of the check items participants were fully debriefed and thanked.

RESULTS

Attentional Focus Manipulation

All 33 participants indicated that they had concentrated exactly as the instructions had required throughout the entire task. Responses to the three Likert rated attention questions were analyzed from a between-group and within-subject perspective. However, for the sake of brevity only summaries of these analyses are provided (see below). Mean scores for the participants' self reported attentional focus are presented in Table 1.

Between-Group Approach

Three separate between-group one-way ANOVAs were conducted, one for each item, which provided a test of whether or not groups differed in their use of the respective focus of attention (e.g., whether the internal focus group reported greater focus on the movements of the body compared to the two external focus groups). Where significant effects were found Tukey HSD pair-wise comparisons were used as a follow up test. Significant omnibus results were revealed for each of the ANOVAs, with the smallest effect being in conjunction with the distal external focus item, $F(2, 30) = 33.60, p < .001, \eta^2 = 0.69$. A consistent pattern also emerged concerning the follow up tests; that is, appropriate focus groups reported significantly ($p < .001$) greater use of the relevant focus of attention compared to the other groups' use of that focus. For example, the internal focus group reported significantly greater Likert-scores for focus on movements of the body compared to the scores reported by the proximal external and distal external focus groups.

Within-Subject Approach

Additional supportive evidence for the effectiveness of the attentional focus manipulation was generated from a complementary within-subject perspective. For example, a golfer assigned to the internal focus condition would be expected to use this particular focus more than either of the two external foci. Separate repeated measures ANOVAs were conducted to assess each group's use of the three foci during task execution. Significant effects were followed up using Tukey HSD pair-wise comparisons. Significant omnibus results were found for each of the repeated measures ANOVA's. The smallest effect was associated with the proximal external focus group's use of the three foci, $F(2, 30) = 27.76, p < .001, \eta^2 = 0.74$. In particular, golfers assigned to this treatment focused on the position of the clubface to a significantly greater extent than a focus on either the movements of the body ($p < .001$) or the flight of the ball ($p < .001$).

State Anxiety Manipulation

The effectiveness of the anxiety intervention was assessed using a two-way 3×2 (attentional focus group \times anxiety condition) mixed-model ANOVA with repeated measures on the second

Table 1
Central Tendency Statistics for the Performance and the Post-Manipulation Check Questionnaire Data.

	Post Manipulation Check			Performance				
	Self Reported Focus			Neutral		Anxious		
	Body	Clubface	Flight	Block 1	Block 2	Block 3	Block 4	Block 5
Int. Group	4.55 (0.52)	1.18 (0.40)	1.81 (1.07)	2.96 (0.69)	3.05 (0.71)	2.95 (0.59)	3.29 (0.47)	3.18 (0.72)
Prox. Group	1.54 (0.93)	4.81 (0.40)	2.09 (1.37)	2.23 (0.32)	2.08 (0.55)	1.98 (0.46)	2.25 (0.50)	2.01 (0.39)
Dist. Group	2.00 (1.00)	1.36 (0.67)	5.00 (0.00)	1.85 (0.58)	1.40 (0.31)	1.25 (0.32)	1.37 (0.46)	1.16 (0.34)

Note. Int. Group refers to the Internal Focus Group, Prox. Group refers to the Proximal External Focus Group, Dist. Group refers to the Distal External Focus Group. Self-reported focus is rated on a scale of 1 (*not at all*) to 5 (*very much so*). Performance recorded according to the distance in meters the ball finished from the hole. Standard deviations in parentheses.

factor, using the cognitive anxiety subscale of the CSAI-2R as the dependent variable. The mixed-model ANOVA revealed a significant main effect for the anxiety condition factor, $F(2, 30) = 50.37, p < .001, \eta^2 = 0.63$. Across all three attentional focus groups, cognitive anxiety increased from the neutral ($M = 14.14, SD = 3.23$) to the anxiety condition ($M = 20.84, SD = 5.59$). The analysis did not yield a significant focus group \times anxiety condition interaction, $F(2, 30) = 0.90, p > .05$, or a significant main effect for the group factor, $F(2, 30) = 0.32, p > .05$.

Performance

Descriptive data for pitching performance across attentional focus groups and anxiety conditions are displayed in Table 1. To test our a priori hypotheses two separate mixed-model ANOVAs were conducted; one for each anxiety condition.

Neutral Condition

A 3×3 (attentional focus group \times block) mixed-model ANOVA with repeated measures on the second factor was used to analyze performance within the neutral condition phase. Box's M statistic associated with this analysis was significant ($p < .04$) indicating a violation of the assumption of equality of covariance matrices. However, Stevens (1996) suggested that a violation of this assumption is not a serious threat to analytical errors in an orthogonal design. The mixed-model ANOVA provided evidence of a significant main effect for the block factor, $F(2, 30) = 3.80, p < .03, \eta^2 = 0.11$, and more importantly, a significant main effect for the attentional focus group factor was also found, $F(2, 30) = 39.69, p < .001, \eta^2 = 0.73$. However, a significant focus group \times block interaction was not found, $F(2, 30) = 1.67, p > .05$. The significant main effect for the block factor was followed up via Tukey's HSD pair-wise comparisons, which indicated a significant difference between the first block and the third block ($p < .05$). Inspection of the mean values for respective blocks revealed that scores improved from block 1 to block 3. However, no significant differences ($p > .05$) emerged between either the first block and the second block or the second block and third block. The significant main effect for the attentional focus group factor was also followed up using Tukey HSD pair-wise comparisons. Performance by the distal external focus group was significantly more accurate than the internal focus group ($p < .01$) and the proximal external focus group ($p < .05$). Similarly, scores recorded by the proximal external focus group were significantly more accurate ($p < .01$) than the internal focus group.

Anxiety Condition

Similar to the neutral condition, a 3×2 (attentional focus group \times block of trials) mixed-model ANOVA with repeated measures on the second factor was carried out to analyze performance in the anxiety condition phase. Results from the mixed-model ANOVA provided evidence of a significant main effect for the attentional focus group factor, $F(2, 30) = 85.61, p < .001, \eta^2 = 0.85$. However, the analysis did not yield a significant main effect for block, $F(2, 30) = 2.39, p > .05$, or a significant focus group \times block interaction, $F(2, 30) = 0.11, p > .05$. Inspection of Tukey HSD post-hoc tests and inspection of the descriptive data revealed that the distal external focus group recorded significantly better scores than the proximal external and internal focus groups ($p < .001$). Furthermore, the proximal external focus group recorded significantly better scores than the internal focus group ($p < .001$).

DISCUSSION

The main objective of the present study was to compare the effectiveness of three different attentional foci on skilled golf performance and to examine attentional focus effects under conditions of heightened anxiety. The results of the present study were consistent with our hypotheses and the work from Wulf and colleagues (e.g., McNevin et al., 2003). Chipping performance was significantly more accurate when the distal external focus was employed in comparison to both the proximal external and internal foci under both neutral and anxious conditions. In addition, the proximal focus group displayed superior chipping performance compared to the internal focus group under both neutral and anxious conditions.

The results outlined above are supportive of a constrained action hypothesis interpretation (Wulf et al., 2001) because performance was impaired in the internal focus condition and enhanced in the distal external focus condition. These results correspond closely with previous attention-oriented research. For example, Wulf et al. (2001) found that adopting an internal attentional focus had a detrimental effect on the learning of a balance task due to subtle interference in relatively automatic control processes characterized by lower frequency and higher amplitude bodily adjustments. Furthermore, McNevin et al. (2003) found the learning of the same stabilo-meter balance task was enhanced as the distance between the external focus and the body increased. These studies tested the specific predictions of the constrained action hypothesis through analysis of the frequency and amplitude of postural adjustments. The results supported the constrained action hypothesis as a distal external focus was found to engage a greater number of active degrees of freedom via higher frequency; smaller amplitude postural regulation (McNevin et al., 2003). It was not an aim of the present study to conduct frequency of movement adjustment analysis or to assess the kinematics of movement. However, the results are in line with previous research despite the fact that the present study used highly skilled rather than novice participants. Accordingly, it appears reasonable to suggest that the constrained action hypothesis may apply to skilled performance as well as motor learning paradigms. Nevertheless, future research would profit from more detailed experiments that elicit information regarding the likely mechanisms that account for differences in performance (i.e., movement adjustment analysis or more detailed scoring systems).

The present findings are in contrast with those of Wulf et al. (2000), who found support for a proximal external focus (i.e., the motion of the club) rather than a distal external focus (i.e., the ball's trajectory) in a golf pitching task. In explaining their findings, Wulf et al. (2000) reasoned that their proximal external focus was distinguishable from body movements and contained salient information related to the correct technique, whereas the distal external focus contained less functional information. An important distinguishing factor between Wulf et al.'s study and the present investigation was the sample utilized. More specifically, Wulf et al. used novice participants who had yet to establish a consistent motor pattern for golf. In contrast, the present investigation employed skilled golfers for whom task execution had become more automatic. Thus, it is possible that this issue could account for the difference in external foci findings between the two studies and if this is the case the applied implications are important to consider (Perkins-Ceccato et al., 2003). Furthermore, it could be argued from a theoretical standpoint, that the use of a distal external focus might be deemed particularly salient for skilled performers precisely because it contains less functional information and is therefore less inclined to interfere with automatic programming (Wulf & Su, 2007).

Support for the use of a distal external focus of attention has been noted elsewhere in the literature. Castaneda and Gray (2007) provided a more differentiated model of attentional

focus combining Wulf and colleagues' comparison of internal versus external focus of attention (e.g., Wulf et al., 1998) with Beilock and colleagues' comparison of skill focused attention and environmentally focused attention (e.g., Beilock et al., 2002). In an examination of baseball batting using skilled performers, positive performance effects were found for an environmental external focus compared to a proximal external focus and an internal focus (Castaneda & Gray, 2007). The environmental external condition was operationalized as concentrating on the direction the ball followed after it had left the bat, which is compatible with the distal external focus used in the present study. Therefore, irrespective of the label used to identify it, it would appear that for skilled populations, the benefits of an external focus related to the flight of the ball are generalizable to tasks outside the sport of golf. It should also be noted that Castaneda and Gray (2007) compared the aforementioned three focus conditions and a control group to a condition that required participants to focus on an irrelevant tone counting task. The irrelevant tone counting condition performed significantly worse than the distal external condition and the control condition but better than the internal and proximal external conditions. From an applied perspective these results suggest that it may be worthwhile to use irrelevant cues to prevent maladaptive attentional focus in the form of an internal or proximal external focus. However, that a control group outperformed all conditions other than the distal external focus implies that, when relevant, skilled performers should direct their attention to a distal external target, preferably to the flight of the ball, to attain optimal performance.

Given that the performance benefits associated with a distal external focus were consistent across both neutral and anxious conditions, and were in line with the existing literature (e.g., Wulf et al., 1999), the attentional focus effects appear to be a reasonably robust phenomenon. The unique findings that attentional focus effects also transpired under conditions of heightened anxiety, was considered particularly meaningful for competitive athletes. Prior to the present investigation, the benefits of a distal external focus relative to an internal focus were found for tasks that place high cognitive demands on the participants (e.g., Totsika & Wulf, 2003). In this particular case, the authors reasoned that a distal external focus promotes automatic control strategies that assist performance under conditions of cognitive load. In line with this thinking, Wulf et al. (2001) provided evidence that the cognitive demands of a distal external focus are significantly less than an internal or proximal external focus. The combination of these findings might imply that cognitive resources occupied by anxiety are less damaging to athletes with a distal external focus because adequate resources remain available, preventing their attentional capacities from being exceeded. In contrast, the proximal external and internal focus groups are at a higher risk of nearing or exceeding their attentional capacities. Consequently fewer resources are available for the pitching task; hence, performance suffers in comparison to those with a distal external focus.

From an applied perspective the present findings have a number of implications worth highlighting. Considering that golf coaches typically provide instructions that draw heavily from an internal perspective (Newell, 2001), it would be advisable to educate coaches of the negative effect of internally based teaching practices on ensuing performance, especially because internal oriented feedback and instruction is often less effective than no instruction at all (Wulf & Weigelt, 1997). Moreover, the findings from the current investigation, along with existing research (e.g., Castaneda & Gray, 2007) suggest practitioners should encourage performers to focus their attention distally wherever possible. This recommendation is deemed particularly crucial for skilled golfers participating in competitive environments where the consequences of failure are magnified and heightened cognitive anxiety is typically prevalent (James & Collins, 1997). Nevertheless, there are occasions when an internal focus of attention may not be detrimental for skilled performers (Wulf & Prinz,

2001). For example, when performers are consciously attempting to dismantle their skill and modify technical flaws; internal focus instructions may be facilitative (Beilock et al., 2002). Applied practitioners might benefit from future research examining the relative merits of different attentional foci during skill acquisition or injury rehabilitation as well as during competition.

Practitioners should also be aware of the difficulties encountered in terms of controlling the direction of attentional focus. For example, pilot work revealed that ST strategies alone were not sufficient as a mechanism to direct attentional focus. Additional qualitative data from the pilot study also suggested that experienced golfers might struggle to assume an external focus of attention because it is different from the internal cues on which they would customarily focus (e.g., keeping their head still). Practitioners would be aided by future research that identified more user-friendly methods of directing an athlete's focus such as imagery techniques or process goals that form part of a pre-performance routine (Singer, 2002). Although the present study employed detailed, focus-related instructions to alter attentional focus, some athletes may find these instructions cumbersome and time-consuming in an applied context (Lavalle, Kremer, Moran, & Williams, 2004).

A number of limitations were evident in the present study. An initial concern relates to the fact the investigation was conducted outside over a 2-day period. A naturalistic setting was used because Mullen et al. (2005) have reported concerns about the ecological validity of laboratory-based designs and as such, the present study staged the investigation in an environment with which skilled golfers would be familiar. However, testing over 2 days in a naturalistic environment meant that participants were exposed to different weather conditions and variable terrain depending on which day they were tested. To prevent inconsistent conditions contaminating the results, an equal number of participants from each attentional focus group were tested on each day so that, as much as possible, each group was subjected to similar conditions.

It is also worth noting that the performance trends identified in the present study offer limited generalizability because the participant sample was restricted to skilled golfers. Future research might endeavor to examine attentional focus effects in alternative closed skill environments (e.g., baseball pitching). However, the fact that results of the present study correspond closely to those reported by Castaneda and Gray (2007) suggests that the benefits of a distal external focus of attention might be consistent across tasks. Furthermore, compared to some previous studies, the manipulation checks employed throughout the study provided grounds for more confident assertions that observed performance effects were the result of a successful attempt to control the direction of attentional focus. These manipulation checks mark an improvement over the existing attention-oriented literature, which has thus far failed to assess the direction of attentional focus (Castaneda & Gray, 2007).

In summary, the performance data presented clearly supports the effectiveness of a distal external focus of attention for skilled golf performance under both neutral and anxious conditions. These results extend the existing research because this was the first study to demonstrate the performance benefits of a distal external focus over an internal *and* a proximal external focus in a non-laboratory task using skilled performers as participants. The present investigation is also one of only a few studies to identify performance trends for skilled performers that corroborate earlier attentional focus findings gleaned from novices (Wulf & Prinz, 2001). Potentially the most notable finding was that the significant performance differences between the three attentional focus groups also emerged under anxiety conditions. Typically, attention oriented research has not been conducted under conditions of anxiety, which is arguably where performance differentials are most important because of the association with competitive environments (James & Collins, 1997).

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