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CHAPTER NUMBER 30**Attentional Focus and Putting Performance at Different Levels of Skill Development**

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ABSTRACT

This research investigated how golfers at different levels of skill development focused their attention while putting. Groups of elite, experienced, and novice golfers completed a block of 20 straight putts from the same position 2.4 m to the hole. They then described what they focused their attention on while putting, and rated their effectiveness in focusing attention as well as their putting performance. Average number of putts holed, distance from the hole, and angle of error were calculated and compared between groups. Novices were significantly less accurate than elite golfers on all three measures, and less accurate than experienced golfers in distance and angle of error. Elite and experienced golfers did not differ significantly in putting accuracy. There were no significant differences between groups in self-ratings of putting performance or effectiveness of focusing attention. Elite golfers were more likely to focus attention externally than other groups. The association between external focus and putting accuracy needs to be investigated experimentally and the extent to which novices benefit from using this attentional focus strategy needs to be determined.

Keywords: attention, focus, putting, skill development

INTRODUCTION

The ability to focus attention on the task at hand distinguishes highly successful athletes from others in a wide range of sports, including golf (Krane & Williams, 2006). McCaffrey and Orlick (1989) found differences between touring golf professionals and club professionals, the former having greater depth of concentration, a plan to focus attention which they executed during a tournament, and strategies to cope with distractions and regain a task focus. Orlick (2000) later

claimed that the ability to adapt and refocus in the face of distractions is the main mental skill distinguishing outstanding athletes from others. Although concentration is widely acknowledged as important, there is still much to learn about how elite golfers focus their attention during performance, particularly while putting. Differences in attentional focus between elite golfers and those at other levels of skill development may well have implications for coaching.

Many coaching practices have been influenced by skill acquisition theories. The cognitive processes of novices in the early phases of skill acquisition have long been regarded as overt, slow, effortful, unrefined, and under conscious control (Schneider & Shiffrin, 1977), with explicit, rule-based knowledge utilized in skill execution (Anderson, 1982). In contrast, the cognitive processes of experts are covert, fast, smooth, efficient and automatic, and their knowledge is implicit and abstract. Novices are thought to benefit from focusing internally on the correct execution of skills, whereas consciously monitoring and controlling the execution of well-learned skills is likely to disrupt experts' automatic processes and impair their performance. Indeed, such conscious processing provides an attentional explanation of why experts sometimes choke under pressure (Baumeister & Showers, 1986; Masters, 1992).

The importance of an external focus in skill execution is apparent in Wulf's (2007) research. Although such a focus is widely recommended for experts, Wulf (2007) argues that it also benefits novices and questions the need for instructions that direct their attention to the coordination of movements. Her recommendation is that athletes at all levels of skill development should focus on the effects of their movements, rather than the movements themselves (Wulf & Prinz, 2001).

Previous research on golf putting has tended to analyze the distance the ball finishes from the hole, but this measure confounds the two essential requirements of good putting – accuracy of the initial line (aim) and the precision of rolling the ball at the proper speed (Pelz, 2002). The aim or direction is critical yet many golfers underestimate the true break of a putt (Pelz, 1994). The force to be imparted on the ball also needs to be anticipated in relation to the speed and contours of the putting surface (Fairweather *et al.*, 2002). The line and length must both be correct if the putt is to be holed. Measuring the angle of error might therefore provide useful additional information in evaluating putting accuracy.

The purpose of this research was to identify how golfers at different levels of skill development focus their attention while putting. The study also investigated whether groups of elite, experienced and novice golfers differed significantly on various measures of putting accuracy. Those measures included objective data such as the number of putts holed, distance from the hole, and angle of error, as well as subjective ratings of putting performance.

METHOD

Participants

The 19 elite golfers (6 females, 13 males) aged from 16 to 34 years ($M = 22.58$, $SD = 4.14$) were either professional golfers or amateurs who had competed at national or international level. Handicaps ranged from 0 to 4 ($M = 2.0$) for the females and plus 2 to 1 ($M = +.46$) for the males. The 16 experienced golfers (5 females and 11 males) aged from 19 to 41 years ($M = 25.94$, $SD =$

6.46) had played golf at least 10 times per year over the past 3 years and competed up to regional or state level. Handicaps ranged from 7 to 25 ($M = 13.6$) for the females and 1 to 21 ($M = 5.45$) for the males. The 17 novice golfers (6 females, 11 males) aged from 17 to 41 years ($M = 21.35$, $SD = 6.02$) had no prior experience in golf or minigolf. They were undergraduate psychology students who received course credit for participation. Ethics approval and informed consent were obtained before participants were tested.

Apparatus

The research was conducted on an external synthetic putting green measuring 11 m x 8.3 m. Participants used their own putter or selected a left- or right-handed Odyssey #2 centre-shafted putter with Optima TS golf balls for the straight flat putt of 2.4 m to a standard cup 108 mm wide. A Sony Mini DV Handycam (DCRHC42) with 0.6 x wide conversion lens was suspended 3.4 m above the cup on a telescopic boom pole mounted on a 1.4 m tripod. The camera captured digital images of the ball's finishing position within a 5 m x 3.75 m surface area, enabling its distance from the hole and angle of error to be calculated (Neumann & Thomas, submitted).

Procedure

All participants completed 20 putts in each of four experimental conditions, three of which used dual-task procedures to covertly manipulate attentional focus. In these three conditions, participants putted while shadowing lists of words that were internally relevant, externally relevant, or irrelevant to golf. Data for only the single putting task condition are reported here. The order of conditions was counterbalanced across participants within groups. After providing baseline measures of reaction time on the secondary task, participants were given 10 balls to practice the 2.4 m putt. They were instructed that their primary task was to make each putt, leaving the ball as close as possible to the hole if it missed. After completing the block of 20 putts, they were asked to indicate what they had focused their attention on while performing the putting task, and rated (a) how effective they were in focusing their attention, and (b) their putting performance. Self-ratings were obtained on a 7-point scale ranging from 1 *incompetent* to 7 *excellent*.

RESULTS

Putting Accuracy

A series of univariate ANOVAs examined the group differences in putting accuracy shown in Figure 1. The first revealed a significant group effect in the number of putts holed, $F(2, 49) = 3.74$, $p < .05$, $\eta_p^2 = .13$, with elite golfers ($M = 14.05$, $SD = 4.10$) holing more putts than novices ($M = 10.71$, $SD = 3.26$). There were also significant differences between groups in distance from the hole, $F(2, 49) = 12.74$, $p < .001$, $\eta_p^2 = .34$, with the putts of elite ($M = 135.29$ mm, $SD =$

125.49) and experienced golfers ($M = 149.15$ mm, $SD = 112.63$) finishing closer to the hole than the putts of novices ($M = 367.36$ mm, $SD = 201.64$). Finally, groups differed in angle of error, $F(2, 48) = 6.48$, $p < .01$, $\eta_p^2 = .21$, with the putts of elite ($M = .96^\circ$, $SD = 1.90$) and experienced golfers ($M = 1.22^\circ$, $SD = 0.92$) having less angle of error than the putts of novices ($M = 2.60^\circ$, $SD = 1.24$). Elite and experienced golfers did not differ significantly on any of the measures of putting accuracy.

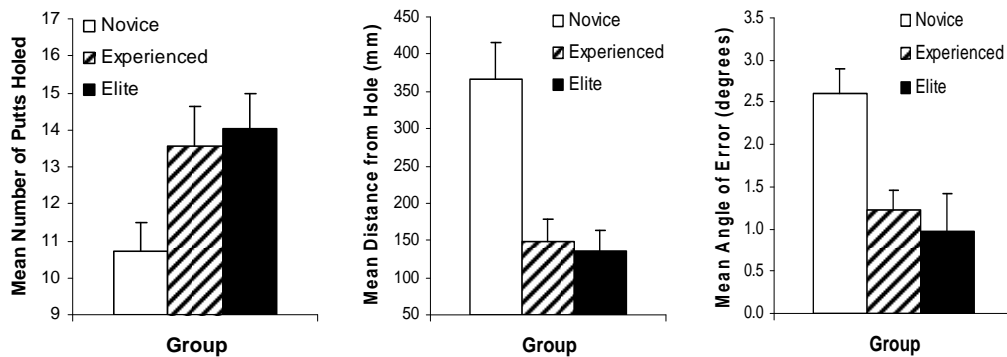


Figure 1 Mean putting accuracy (with standard error bars) of novice, experienced and elite golfers, as measured by the number of putts holed, distance the ball finished from the hole, and angle of error.

Self-Ratings

Figure 2 shows the self-ratings for each group. Separate univariate ANOVAs revealed no significant differences between elite ($M = 4.95$, $SD = 1.39$), experienced ($M = 5.25$, $SD = 1.18$), and novice golfers ($M = 4.47$, $SD = 1.37$) in self-ratings of putting performance, $F(2, 49) = 1.46$, $p = .24$, $\eta_p^2 = .06$. There were also no significant differences between the groups of elite ($M = 5.58$, $SD = 0.69$), experienced ($M = 5.50$, $SD = 0.89$), and novice golfers ($M = 5.24$, $SD = 1.03$) in self-ratings of how effectively they focused attention while putting, $F(2, 49) = 0.74$, $p = .48$, $\eta_p^2 = .03$.

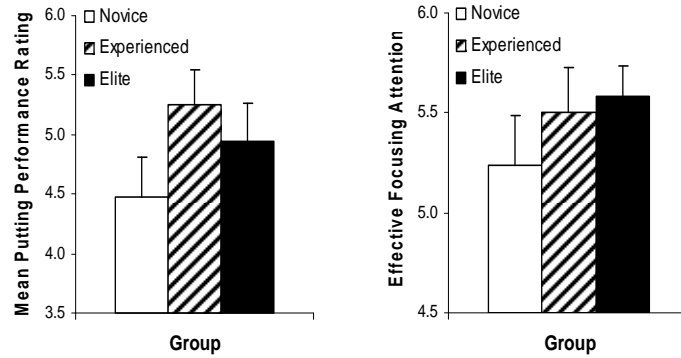


Figure 2 Participants’ ratings of their putting performance and how effectively they focused their attention while putting.

Self-reported Focus of Attention

Analysis of participants’ descriptions of their attentional focus while performing the putting task identified 32 themes. These were further classified into the six categories of *Internal*, *External*, *Outcome*, *Performance*, *Secondary Task*, and *Other*, as shown in Figure 3.

Internal													External						
Posture / stance	Alignment	Head (still/down)	Hands/grip	Technique	Force	Rhythm	Tempo / speed	Stroke (smooth)	Swing path	Follow through	State / anxiety	Breathing	Aim	Target / hole	Line / path	Break	Length	Speed / pace	Ball

Outcome			Performance			Secondary Task			Other		
Hole putt	Finish close	Missed putts	Score	Standard	Improvement	Target word	Words	Putting	Routine	Adjustment	Other

Figure 3 The 32 themes classified into six categories to describe participants’ self-reported attentional focus while putting.

Two raters independently coded the multiple components of participants' responses using the classification framework. The two raters initially agreed in 156 of their 191 coding decisions (81.68%), and reached full agreement after discussion. For example, they agreed after discussion to code *keeping my stroke on the correct path for the putt* as swing path (Internal) rather than line/path (External); *my putt speed* as tempo/speed (Internal) rather than speed/pace (External); and *hitting it a little firmer* as force (Internal), but *not over hitting* as length (External).

Table 1 shows how frequently the attentional focus of elite, experienced and novice golfers was coded in each category. About half of the elite golfers reported focusing internally, particularly on their stroke, but most of the group reported focusing externally on cues such as the target, the line of the putt, and the speed of the green. Experienced golfers, on the other hand, were just as likely to report an internal focus (particularly on their stroke) as an external focus. The same pattern was evident for novices, although their reports identified fewer internal or external cues. About one-third of each group reported focusing on holing the putt, and this outcome focus was more frequent than focusing on performance. None of the participants reported focusing on the secondary task as it was not used in this condition. The Other category included responses from about one-third of the novices who reported focusing on their putting without any further details.

Table 1 Focus of attention reported by elite ($n = 19$), experienced ($n = 16$), and novice golfers ($n = 17$).

	Internal	External	Outcome	Performance	Secondary Task	Other
Elite	11	20	6	2	0	1
Experienced	11	14	4	2	0	2
Novice	5	6	5	3	0	11

Note. Numbers show the frequency of responses, not participants, classified in each category.

DISCUSSION

Novices differed significantly from elite golfers on all three measures of putting accuracy. Their putts also finished significantly further from the hole with a greater angle of error than those of experienced golfers. There were no significant differences in putting accuracy between elite and experienced golfers. This might provide some support for Ben Hogan's claim that "Putting is a different game" (cited in Pelz, 2002, p.1). However, although there were substantial differences in the mean handicaps for these two groups, there was some overlap with several low markers included in the experienced group. Close inspection of the data also revealed within group variability. Interestingly, elite golfers showed the greatest variability in angle of error. One professional golfer "lipped out" 9 of his 20 putts and recorded a very high error score because the ball was repeatedly deflected from its original path. One value of measuring angle of error in addition to the number of putts holed and distance from the hole is that it shows that elite golfers are better than novices in both aspects of putting – line and length.

Although they were less accurate in putting, novices did not differ significantly from experienced and elite golfers in self-ratings of their putting performance. The subjective data suggest the groups set different standards in evaluating their putting performance. The standards appear to be referenced to the individual's own estimated skill level. Similarly, there were no differences between groups in self-ratings of how effectively they focused their attention, suggesting that participants were equally able to focus their attention as they wanted to in performing the putting task.

All groups reported instances of internal and external focus, but elite golfers were more likely to report focusing attention externally than the other groups. It is possible that the covert manipulation of attention in the three dual-task conditions may have affected attentional focus and performance in the single putting task condition. However, the sequence of conditions was counterbalanced across participants within groups, so there should have been no systematic effects.

This study has revealed an association between an external focus and high levels of putting accuracy. The causal effect of this association needs to be investigated experimentally to determine whether putting performance is improved by focusing attention externally. Further research is also needed to determine whether novices benefit from using experts' attentional focus strategies (Singer, 2002).

APPLICATION

Researchers should measure angle of error in addition to the number of putts holed and distance from the hole as this measure captures a crucial component of putting accuracy and would provide useful information on whether golfers tend to push or pull putts. Coaches should consider Wulf and Prinz's (2001) recommendation that athletes, including novices, focus externally on the effects of movements rather than internally on the movements themselves. Their research challenges traditional coaching practices, as does the related work of Masters (1992) and colleagues which indicates skills learned implicitly are performed better under pressure than those taught explicitly.

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