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Does the Attentional Focus Adopted by Swimmers Affect Their Performance?

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ABSTRACT

The study examined effects of attentional focus on swim speed in expert swimmers. In previous studies, an external focus directed at the movement effect has been shown to enhance automaticity, relative to an internal focus directed at the body movements (or no particular focus). The swimmers in the present study were given focus instructions related to the arm stroke in crawl swimming. All participants swam 3 lengths of a 25-yard pool, once under each of 3 conditions. In the external focus condition, they were instructed to focus on “pushing the water back”, in the internal focus conditions they were asked to focus on “pulling your hands back”, and in the control condition they were not given instructions. Swim times were similar in the control and external focus conditions, but they were significantly slower with an internal focus. Furthermore, questionnaire results revealed that most swimmers focused on the overall outcome (e.g., speed) in the control condition, whereas others indicated that they focused on specific body parts. Post-hoc analyses demonstrated that those in the latter group had slower swim times in the control condition than those with a focus on the outcome. Overall, the results provide converging evidence that a body-related, internal focus hampers performance. Moreover, when movements are already controlled automatically at a high skill level (and the focus is on the outcome), external focus instructions may be superfluous.

Key words: Expertise, Feedback, Focus of Attention, Swimming

INTRODUCTION

As many studies have shown over the past few years, an individual's focus of attention can affect the performance and learning of motor skills [1]. Specifically, instructions or feedback inducing an external focus on the intended movement effect typically result in more effective and efficient movements than those inducing an internal focus on the movements themselves, or no particular focus (control conditions). For example, in balance tasks, instructions directing attention to movements of the support surface, as opposed to the

performer's feet or no instructions, have been found to enhance balance [2]. The motor tasks for which these effects have been demonstrated ranged from various types of balance tasks [3, 4] to sport skills, including basketball [5, 6], volleyball [7], soccer [7], dart throwing [8, 9], and golf [10]. The generalizability of the external focus advantage is further demonstrated by the fact that the effects have not only been shown for young, healthy adults, but also for children [11], as well as older adults with Parkinson's disease or after a stroke [12, 13].

An external focus promotes automaticity in movement control, whereas a focus on the movements themselves tends to constrain the motor system due to the performer's attempts to exert conscious control over his or her movements (constrained action hypothesis [14]). Support for this view comes from findings showing reduced probe reaction times, or attentional demands [14], and higher-frequency, reflex-based (i.e., automatic) movement adjustments [14, 15] when performers adopt an external compared to an internal focus. Thus, an external focus appears to speed the learning process, resulting in higher performance levels and automatic control sooner [1]. In line with this view, recent findings indicate that movement efficiency is enhanced by an external focus as well [16].

Most studies examining attentional focus effects have used novices as participants; that is, participants who were asked to learn or perform novel tasks under different focus conditions [1]. Only very few studies examined the effects of different attentional foci in expert performers. In one study, Perkins-Ceccato et al. [17] used highly skilled golfers (mean handicap: 4) as participants. They found that the golfers performed more effectively with external focus instructions (i.e., focus on hitting the ball as close to target as possible), compared with internal focus instructions (i.e., focus on movement form). Bell and Hardy [10] also showed that expert golfers (average handicap: 5.5) performed more effectively when instructions induced an external focus rather than internal focus (i.e., wrist hinge), especially if they promoted a relatively distal external focus (i.e., straight ball flight) compared with a more proximal focus (i.e., square clubface) (see also McNevin et al. [15]).

Perhaps an even more interesting question is whether expert performers, whose movement execution is already automatic, would benefit from external focus instructions relative to a *control* condition that allowed them to perform under normal conditions (e.g., with their preferred attentional focus, if any). In one study, golfers with an average handicap of 0 demonstrated greater shot accuracy when they were given external focus instructions (i.e., swing of the club), relative to both control (i.e., no instructions) and internal focus conditions (i.e., swing of their arms) [18]. Performances in the latter two conditions did not differ from each other. Thus, the induced external focus improved performance even in highly-skilled golfers over and above normal conditions. In contrast, in a study with world-class acrobats a somewhat different pattern of results emerged [19]. In that study, balance acrobats performed a balance task, namely, standing still on an inflated rubber disk. In this case, the control condition resulted in a higher frequency of postural adjustments – indicative of greater automaticity [14, 15] – than both external focus (“focus on keeping the disk still”) and internal focus conditions (“focus on keeping your feet still”). That is, performance was most effective in the control condition.

Thus, the few studies that compared the effects of different attentional foci to control conditions in experts yielded somewhat inconsistent results. However, those studies [18, 19] also varied in a number of ways, including the performers' skill level (highly-skilled golfers versus top-level acrobats), task demands (complex versus relatively simple), and the compatibility with the actual tasks performed by them in “real life” (similar versus easier). It is possible that some or all of these factors contributed to the different pattern of results. For example, if the performer's capabilities far exceed the coordination demands of the task

(as in the study with balance acrobats by Wulf [19]), it is conceivable that any type of induced focus would direct attention to a lower-than-normal level of control and hamper performance [20].

In the present study, we wanted to further explore the role of attentional focus in expert performers. Specifically, our goal was to assess the influence of external (and internal) focus instructions, relative to no instructions (control condition), in an activity that could be considered highly automated due to a large number of repetitions performed over many years, that was of moderate complexity, and that was identical to that performed by participants in training and competition. We chose highly-trained swimmers and asked them to swim under three different conditions: External focus (i.e., focusing attention on pushing the water back), internal focus (i.e., pulling the hands back), and a control condition (no focus instructions). We compared their swim times (25 yards) under those conditions. In a previous study with intermediate swimmers using the same task and design [21], shorter times resulted when participants adopted an external focus, compared with the two other conditions, which did not differ. In the present study, we expected the expert swimmers to swim faster in the control and external focus conditions than in the internal focus condition. In addition, we hypothesized that the control and external focus conditions would yield similar results.

Another purpose of the present study was to gain insight into what experts focus on, if anything, under normal (control) conditions. A shortcoming of previous studies with experts was that they did not include control conditions [10, 17] or, if control conditions were incorporated, that no interviews or questionnaires were used to determine what participants focused on under those conditions [18, 19]. In the present study, we therefore used questionnaires to determine what performers focused on under no-instruction control conditions. We also included manipulation checks for the external and internal focus conditions.

METHOD

PARTICIPANTS

Thirty trained swimmers (11 men, 19 women) with a mean age of 17.5 years ($SD = 2.24$) participated in the study. The swimmers were considered experts as they had been swimming competitively for an average of 10.2 years ($SD = 3.45$), and trained an average of 8.5 times per week ($SD = 1.85$) for competition. All swimmers were either part of a local swim team, which was ranked number 26 in the nation (out of 2,679 swimming clubs), or a university swim team, whose men's team was Mountain West Conference champions for the fifth straight time, and whose women's team took second place in 2009. Participants' personal bests over 50 m and 100 m freestyle were 26.7 s ($SD: 2.61$) and 57.6 s ($SD: 5.63$), respectively. The study was approved by the university's institutional review board. Participants over the age of 18 signed an informed consent form. Those under the age of 18 signed an assent form, and their parents signed a consent form.

TASK AND PROCEDURE

The task required participants to swim 3 lengths of a 25-yard swimming pool, with 1-minute breaks between lengths. All of the participants swam one length under each of three focus conditions (control, external, internal) as fast as possible using the front crawl stroke. In the control condition, the swimmers were not given any focus instructions. In the external condition the swimmers were instructed to "focus on pushing the water back", and in the internal condition the swimmers were instructed to "focus on pulling your hands back". All

participants started in the water and were hand-timed by two experimenters. The time was recorded from when the swimmers feet left the wall to when their hand touched the wall at the other end. The time was recorded in seconds and tenths of seconds. The order of the focus condition was counterbalanced (control-external-internal, external-internal-control, internal-control-external). After the completion of the three lengths, all swimmers filled out a questionnaire related to their demographic information. In addition, the questionnaire contained manipulation checks for the external (“Were you able to focus on pushing the water back?”) and internal focus conditions (“Were you able to focus on pulling your hands back?”), as well as a question about their focus in the control condition (“What did you focus on when you were not given instructions?”).

DEPENDENT VARIABLE AND DATA ANALYSIS

The swim times recorded by both experimenters were highly correlated ($r = .99, p < .001$) and were therefore averaged. The average time taken to swim the length of the pool (25 yards) served as the dependent variable. As all the participants performed under the three focus conditions (control, external, and internal) in a counterbalanced order, order was included as a factor in the analysis of variance (ANOVA). Thus, swim times were analyzed in a 3 (control-external-internal, external-internal-control, internal-control-external) x 3 (focus: control, external, internal) ANOVA with repeated measures on the last factor.

RESULTS

MANIPULATION CHECK AND FOCUS IN CONTROL CONDITION

Only one participant indicated that she was not able to focus on pulling her hands back (nevertheless, her swim times in the three conditions were in line with the respective average swim times). All other participants indicated that they were able to follow the external and internal focus instructions (see Table 1). In the control condition, without focus instructions, most of the participants indicated that they focused on “speed”, “tempo”, “going fast”, or

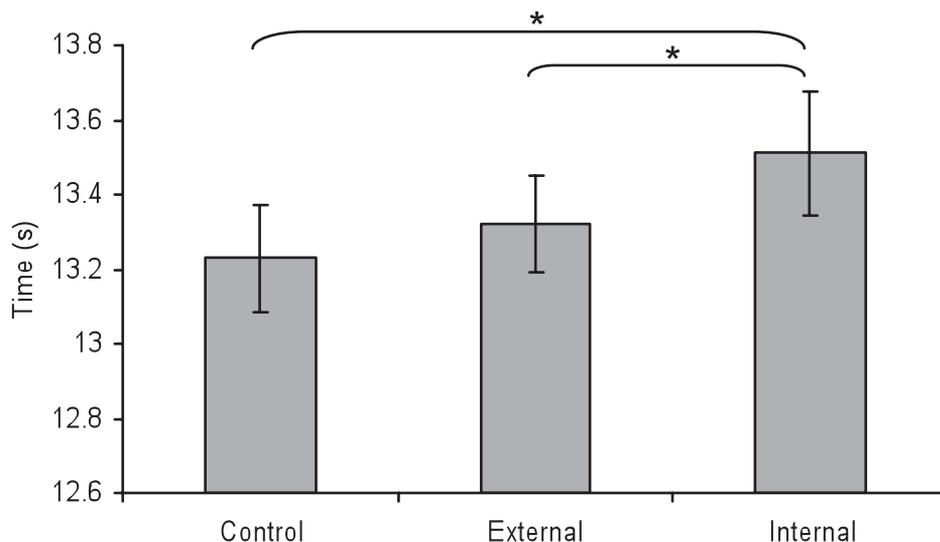


Figure 1. Swim Times in the Control, External Focus, and Internal Focus Conditions

Error bars represent standard errors; * denotes significant differences between conditions

“getting to the other side” – which one might consider external in nature, as the focus was on the overall outcome of their actions. However, several other participants reported that their focus was directed at a particular body part, such as head, arms, elbows, or hips, or that they focused on the kicking action – which could be considered internal foci (see Table 1).

SWIM TIMES

Participants swam faster in the control (13.23 s, SD = .779) and external focus condition (13.33 s, SD = .705) than in the internal focus condition (13.51 s, SD = .879) (see Figure 1). The main effect of attentional focus was significant, $F(2, 54) = 5.73, p < .01, \eta^2 = .18$. Post-hoc tests, with Bonferroni adjustments for multiple comparisons, indicated that swim times in the control and external focus conditions did not differ significantly from each other ($p > .05$), but both were significantly faster than those in the internal focus condition ($ps < .05$). The main effect of order, $F(2, 27) < 1$, and the interaction of attentional focus and order, $F(4, 54) = 1.25, p > .05$, were not significant.

Table 1. Manipulation Check Results and Reported Focus in the Control Condition

Participant	Focus on hands?	Focus on water?	Focus in control condition?
1	No	Yes	Keeping tempo up
2	Yes	Yes	Going fast
3	Yes	Yes	Nothing
4	Yes	Yes	Pulling fast, fast arms, keep kicking
5	Yes	Yes	Underwater
6	Yes	Yes	Good technique
7	Yes	Yes	Hip rotation
8	Yes	Yes	How I usually do my stroke
9	Yes	Yes	Long stroke
10	Yes	Yes	Spinning my arms
11	Yes	Yes	Getting to the other side
12	Yes	Yes	Nothing
13	Yes	Yes	Speed
14	Yes	Yes	Swimming
15	Yes	Yes	Going fast
16	Yes	Yes	Tempo, keeping head down
17	Yes	Yes	Kicking and tempo
18	Yes	Yes	Arm speed
19	Yes	Yes	High elbow, catch up
20	Yes	Yes	Catch at front of stroke; pull hands back
21	Yes	Yes	Tempo
22	Yes	Yes	Tempo and pulling lots of water
23	Yes	Yes	Going as fast as possible/beating opponent
24	Yes	Yes	Going fast/kicking hard
25	Yes	Yes	Nothing
26	Yes	Yes	Just going fast
27	Yes	Yes	Kicking faster
28	Yes	Yes	Nothing
29	Yes	Yes	Swimming hard
30	Yes	Yes	Tempo

DISCUSSION

Studies examining how the performance of experts varies as a function of their attentional focus are scarce. Extant studies have shown that, when expert performers focus on their body movement (i.e., internal focus), performance is usually degraded relative to normal or control conditions [18, 19, 22, 23]. Furthermore, an external focus on the movements effect is typically more effective than an internal focus [17, 18], especially when the distance of the external focus is increased [10]. Yet, it has been less clear how external focus instructions affect expert performance compared to no instructions, or control conditions. While in one study instructions inducing an external focus enhanced movement accuracy relative to a control condition [18], in another study automaticity in the control of balance was greater in a control condition compared with an external focus condition [19]. Because of these inconsistencies in the findings, we deemed it important to further examine the relative effectiveness of different attentional foci in expert performers.

The swimmers who participated in the present study had presumably performed several million strokes over their lifetime (with an average of 10 years of competitive swimming experience, and training 8 times per week). Therefore, this activity could be considered highly automated. Perhaps not surprisingly, swim times were fastest under control conditions. Yet, they did not differ significantly from those achieved in the external focus condition, when the swimmers were instructed to focus on the water. In contrast, instructions to focus on their hands in the internal focus condition resulted in swim times that were significantly longer than those in the two other conditions.

The manipulation check indicated that, almost without exception, participants did adhere to the instructed foci. Of course, as is the case with most manipulation checks, participants' responses were retrospective. Also, given the duration of a trial (i.e., about 13 s), it is possible that the attentional focus may not have been maintained over the entire length of the pool, or may have shifted somewhat. (Self-talk instructions may be a means to ensure that a certain focus is maintained over a longer period of time.) Despite these potential drawbacks, the observed swim times were in line with our predictions.

The generation of forces, such as those required when swimming at maximum speed, requires an optimal timing and direction of the contributing forces – based on an efficient coordination pattern between agonist and antagonist muscle groups, as well as recruitment of muscles fibers within a muscle. An increase in movement efficiency is typically acquired as a function of practice. Yet, as studies have demonstrated, an external focus also has the capacity to facilitate efficiency. An external relative to an internal focus has been shown to result in reduced muscular activity [8, 24, 25], while increasing force output at the same time [26]. In expert performers, instructions to focus externally may or may not enhance movement effectiveness or efficiency compared to normal conditions. The expert swimmers in the present study did not swim faster when instructed to focus on the effects of their movements on the water than they did in the control condition. This finding is in line with the idea that, if movements are already controlled automatically and efficiently, external focus instructions would provide no additional benefit [1, 19, 27].

In contrast, the adoption of a body-movement related, internal focus has consistently been found to be detrimental for skilled performers [18, 19, 22, 23]. It is assumed to result in a more conscious mode of control that tends to disrupt automatic control processes and hamper the fluidity and efficiency of movements (e.g., “conscious processing hypothesis” [28]; “constrained action hypothesis” [14]; “explicit monitoring” [29]). Even in novices, a focus on body movements has been found to have detrimental effects on movement effectiveness and efficiency (for a review, see Wulf [1]). This suggests that a focus on the self (“self-

invoking trigger”; [16]) generally – that is, independent of the individual’s skill level – degrades motor performance by causing a more widespread, inefficient, activation of the muscular system.

How exactly instructions directing attention to the movement effect influence experts’ performance, relative to control conditions, may depend on a variety of factors, including the complexity of the task and the performer’s skill level. If a task requires the coordination of numerous degrees of freedom (e.g., a golf swing) and/or performance is still less-than-perfect, external focus instructions may lead to enhanced performance [18]. Yet, if the task is relatively simple and/or performance is highly automated due to extensive practice (e.g., standing still on a solid surface), inducing an external focus may not be beneficial (e.g., present study; [27]), or can even be detrimental [19]. Whether external focus instructions are neutral or detrimental may also depend on the “level of control” [20, 30] they address. With practice, actions are presumably monitored at progressively higher levels of representation. In swimming, for example, a hierarchy of action goals may involve “winning a competition”, “swimming fast”, “pushing water back”, and “correct hand position” [20]. If the attentional focus corresponds to a level of control that is lower than optimal, performance will likely suffer relative to normal conditions.

To determine what expert swimmers focus on under normal (or control) conditions was another goal of the present study. The questionnaire results indicated that, while some swimmers seemed to focus internally (e.g., hip rotation, high elbow, spinning my arms) – presumably as a result of feedback from the coach – most swimmers reported that they simply focused on speed (e.g., tempo, going fast, getting to the other side) or nothing. Thus, the movements of most swimmers appeared to be monitored at a high level of control – one that corresponded to the overall task goal. The goal of “swimming fast” presumably simply triggered the actions necessary to achieve this goal. While participants’ normal focus may have been optimal for their skill level, the induced external focus – although it may have directed their attention to a somewhat lower control level – was not detrimental. However, asking the swimmers to focus on their hands was harmful. It likely disrupted the finely tuned control mechanisms that normally control their swimming motions. That is, micromanaging movements clearly degraded performance.

Yet, because some swimmers reported more of an internal focus in the control condition – mentioning words such as arms, hips, stroke, or kicking (Participants 4, 7-10, 16-20, 24, 27) – we wanted to examine how their swim times compared to those who reported focusing on the overall outcome (e.g., speed, tempo, going fast, swimming hard) or “nothing” (i.e., the remaining participants; see Table 1)¹. Therefore, we performed a 2 (group) x 3 (condition: control, external, internal) ANOVA. The results revealed that those who adopted an internal focus in the control condition actually had longer swim times (13.55 s) than those who did not (13.02 s). The differences between groups were smaller in the external (13.44 vs. 13.25 s, respectively) and internal focus conditions (13.57 vs. 13.47 s, respectively). This pattern of results was confirmed by a significant interaction of group and condition, $F(2, 56) = 3.83$, $p < .05$, $\eta^2 = .12$. Even though post-hoc tests were not able to identify the exact source of the interaction, the numerical group differences in the control condition are consistent with the overall findings, and the notion that an internal focus disrupts automaticity and results in poorer performance. These findings have important implications for implied settings. While studies exploring instructions typically used by swim coaches may not yet exist, recent interviews of nationally-ranked track and field athletes showed that 84.6% of coaches gave

¹We thank Jamie Poolton for suggesting this analysis.

instructions related to body and limb movements [31]. As a consequence, the majority of athletes (69.2%) indicated that they focused internally when competing. Assuming that most swim coaches give instructions that tend to induce an internal focus as well, there may be considerable room for improvement in swimming performance.

CONCLUSION

The present results, combined with those of Freudenheim et al. [21], are in line with the idea that the optimal focus of attention changes with practice or expertise. Whereas intermediate swimmers in the study by Freudenheim et al. [21] (i.e., students in a university swimming class) benefited from the instructions to focus on pushing the water back, relative to no instructions, this was not the case for the experts in the present study. Directing the attention of novices and moderately-skilled swimmers externally – that is, to a higher level of control than that adopted by them spontaneously or as a consequence of instructions – is typically beneficial. Yet, for experts who have already learned to monitor their actions at a high level, instructions to focus externally may be superfluous. However, under pressure to do well, performers often revert to a lower level of control [23, 32]. Whether a deliberate or instructed external focus can reduce performers' tendency to focus internally and to engage in self-regulatory activity [16], with detrimental effects on performance, is an interesting question. While a few studies have addressed this issue [10], this problem deserves more attention in future research.

Clearly, instructions or feedback that direct swimmers' attention internally do not result in optimal performance – independent of whether their skill level is intermediate [21] or high (present study). In the present study, focusing on their hands increased the swimmers' 25-yard times by an average of .18 s compared with an external focus on the water, and by .29 s compared with the control condition. While these differences may seem numerically small, it should be kept in mind that races are often won or lost by much smaller margins. In the 2008 Olympics, for example, the second-placed swimmer (21.45 s) in the men's 50 m race missed out on a gold medal by .15 s. In the women's 50 m race, the gold (24.06 s) and bronze medalists (24.17 s) were separated by .11 s, and the silver medalist (24.07 s) missed out on the win by only .01 s. Clearly, an athlete's focus of attention is a variable that should not be discounted in the preparation for optimal performance.

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