Online Attentional-Focus Manipulations in a Soccer-Dribbling Task: Implications for the Proceduralization of Motor Skills

Paul Ford
Research Institute for Sport and Exercise Sciences
Liverpool John Moores University, U.K.

Nicola J. Hodges
School of Human Kinetics
University of British Columbia
Vancouver, Canada

A. Mark Williams
Research Institute for Sport and Exercise Sciences
Liverpool John Moores University, U.K.
and Learning Systems Institute
Florida State University, Tallahassee

ABSTRACT. A focus of attention on the step-by-step control of a skill has been shown to be detrimental to experts’ performance but to have no significant effect on novices’ performance (e.g., S. L. Beilock, T. H. Carr, C. MacMahon, & J. L. Starkes, 2002), contrary to the results of manipulations of the direction of attentional focus (e.g., G. Wulf, M. Höß, & W. Prinz, 1998). In previous studies, researchers have not separated the focus of attention from the nature of the instruction provided or the skill level of the participants. In the present experiment, 10 skilled and 10 less skilled soccer players dribbled a ball after receiving instructions directing attention to an internal, skill-relevant feature (foot); an internal, skill-irrelevant feature (arm); or a skill-irrelevant task (word-monitoring). Performance was evaluated in relation to a no-attentional-focus control condition. For skilled performers, an internal focus on the arms and feet interfered with performance. For less skilled performers, an internal, yet skill-relevant, focus of attention (foot) did not degrade performance, whereas attention to the arms and word monitoring had a detrimental effect. No significant differences were observed across the three attentional manipulations when the skilled performers used the non-dominant foot. The results generally supported the deautomization of skills hypothesis.

Key words: expertise, focus of attention, instructions, soccer

Instructions can be an effective means of conveying goal-related information, and educators commonly use them to teach and refine motor performance at all levels of skill (Hodges & Franks, 2002, 2004; Swinnen, 1996). It has been shown, however, that instructions that direct performers’ attention to body-related features involved in an action can actually have a detrimental effect on performance and learning, particularly in comparison with an externally directed attentional focus (for a review, see Wulf & Prinz, 2001). Attentional-focus manipulations may also be mediated by the skill level of the performer and the nature of the attentional focus induced (e.g., Beilock, Bertenthal, McCoy, & Carr, 2004; Beilock, Carr, MacMahon, & Starkes, 2002; Gray, 2004; Perkins-Ceccato, Passmore, & Lee, 2003). In the present experiment, we examined the performance of skilled and less skilled soccer players under manipulations designed to direct attention to internal, body-related features of the movement that differed with respect to their relevance to the skill.

Wulf and her colleagues (e.g., Wulf, Höß, & Prinz, 1998; Wulf, Lauterbach, & Toole, 1999; Wulf & Weigelt, 1997) performed a series of experiments in which they examined the effects of instructions on the acquisition of motor skills. The results of those experiments showed that instructions that direct performers’ attention to their movements (i.e., internal focus) are less effective than are those that direct attention to the effects of their movement on the environment (i.e., external focus). For example, Wulf and Weigelt found that instructions that incidentally prompted an internal focus of attention on the feet while performers were moving on a ski-simulator were detrimental to performance (i.e., during practice) and learning (i.e., in retention). Those instructions continued to have a negative effect on performance even after an extended period of practice on the skill. Direct manipulations of attentional focus in subsequent research (e.g., Wulf et al., 1998; Wulf et al., 1999) confirmed the hypothesis that attention to the external effects of the action (i.e., ski apparatus, golf club) results in faster and more accurate movements during practice and retention than does attention to body-related, internal features (e.g., feet, arms). Wulf, McNevin, and Shea (2001) forwarded the constrained-action hypothesis to explain those results. They assumed that when performers focus attention on their body...
movements, they consciously intervene in the control processes underlying those movements. The effect is expected to be similar for skills that are novel or well learned. For example, Wulf and her colleagues (e.g., McNevin & Wulf, 2002; Wulf, Weigelt, Poulter, & McNevin, 2003) have shown that both static and dynamic balance, which are already acquired skills, were worse under conditions in which an internal focus was encouraged (e.g., monitoring the arms) than in conditions that encouraged an external focus (e.g., monitoring an external object).

Similar, yet qualified, suggestions for attentional-focus effects have been made by Beilock et al. (2004; Beilock et al., 2002). They proposed that attention to components of well-learned skills would be detrimental to performance. As learning progresses, the need to attend to the step-by-step processes involved in skilled performance diminishes because the components of the skill become proceduralized in long-term memory (see Anderson, 1982, 1983). By refocusing attention on those proceduralized components, which normally run under reduced levels of conscious control (i.e., more automatically), skill processes are brought back into working memory, where the skill becomes decomposed into smaller units (see also Beilock & Carr, 2001; Masters, 1992). Therefore, a decrement in performance is observed when skilled individuals are required to refocus attention on specific components of the skill. That decrement is known as the deautomatization of skills hypothesis.

In experiments involving golf putting (Beilock et al., 2004; Beilock et al., 2002) and soccer ball dribbling (Beilock et al., 2002), those authors examined the performance of both skilled and less skilled performers under conditions in which participants’ attention was focused on a skill-relevant aspect of the skill (i.e., the arm or foot in golf and soccer, respectively) or on a skill-irrelevant task (i.e., word monitoring). For the skilled performers, a decrement in performance was observed when attention was directed to a skill-relevant component of the action compared with their performance in word-monitoring and practice conditions. As predicted, the less skilled performers were not affected by a skill-relevant attention condition. Participants in the soccer-dribbling task actually showed some benefits from focusing on the foot in comparison with a no-attentional-focus control condition. However, the control condition was always performed first (i.e., as a practice session), potentially engendering an order effect and preventing clear conclusions regarding the positive or negative effects of the attentional manipulations.

Beilock et al. (2002) also compared the performance of skilled and less skilled soccer players who dribbled with their nondominant foot. They predicted that the skill focus manipulation would no longer be detrimental to skilled players’ performance in comparison with their performance with the dominant right foot. Beilock et al. hypothesized that dribbling with the nondominant foot would be attention demanding and governed by declarative knowledge structures. As predicted, the skilled players who dribbled with their nondominant foot were more affected by the word-monitoring condition than by the skill-focus condition; they performed in a manner similar to that of the less skilled performers.

Perkins-Ceccato et al. (2003) obtained further support for attentional-focus interactions with skill level. They compared skilled and less skilled golfers performing a golf chip shot. The authors compared individuals under internal (i.e., form-related) and external (target-related) focus of attention conditions. Although those attentional manipulations did not affect accuracy, the skilled golfers performed with less variability after receiving external-focus instructions than they did under internal-focus instructions, whereas the less skilled golfers performed more consistently under internal-than under external-focus instructions. Those findings support the proposal that focus of attention effects are skill dependent. However, Perkins-Ceccato et al. did not include a control group and did not manipulate the skill-relevant nature of the focus. Therefore, it is difficult to draw strong conclusions about the effectiveness of those attentional manipulations. Although consistency is an important index of skill in golf when accuracy is also high, at low levels of skill an absence of variability in outcome success could also be perceived as a negative result, indicative of a failure to explore for the motor solution (see Hodges & Franks, 2000, 2002; Vereijken, 1991; Wulf & Weigelt, 1997).

In the present experiment, we compared skilled and less skilled soccer players on a soccer-dribbling task under procedures similar to those adopted by Beilock et al. (2002). Participants were required to dribble a ball under conditions in which they had to pay attention to the feet, the arms, or to verbally presented words. We included two internal-focus conditions to directly examine the importance of the skill-relevant nature of the attentional-focus instruction in comparison with just the direction of the attentional focus in determining performance. Attention was directed internally to body-related features of the skill, but also differentially to either a skill-relevant component of the action (i.e., the foot) or a skill-irrelevant component of the action (i.e., the arm). We chose those conditions for two reasons. First, if Beilock et al. are correct in their predictions, then only when performers have achieved a high level of skill will it be disruptive to focus attention on a skill-relevant feature (foot). The predictions for the arm condition were less clear, because the arm would not appear immediately relevant to soccer dribbling. Therefore, it is unlikely to be a previously controlled component of the skill and should not interact with skill level or disrupt performance. It could be argued, however, that all individuals are skilled in running and balancing; hence, a requirement to focus on the arms (i.e., a component of skill that is not normally controlled) will disrupt performance.

Second, different internal-focus conditions have not previously been examined, although different external focus of attention conditions have been shown to interact with the distance of the effect or feature from the body.
For example, McNevin, Shea, and Wulf (2003) showed that in a balance task, attending to lines that were farther from the feet was more effective for performance than was attending to lines that were nearer to the feet, even though both encouraged an external focus. Because of the omission of differential internal-focus conditions in previous studies, it has been presumed that an internal focus on the body is generally harmful for performance. On the basis of the findings of McNevin et al. for an external focus of attention, we have reason to believe that the distance of the feature from the main effector may similarly affect the internal-focus conditions. For example, in soccer dribbling, the arm is farther away from the main effector; hence, one may predict that a focus on the foot will be more disruptive for performance than will a focus on the arm. On the basis of the work of Wulf and her colleagues, one could hypothesize differential effects of those internal-focus manipulations—for example, that attention to the foot will be more harmful than attention to the arms—but one would not expect those effects to interact with skill level. In contrast, Beilock and colleagues would predict that the skill-relevant nature of the attentional focus should interact with skill level. Only for the skilled performers will attention to both the foot and the arm interfere with performance (i.e., the deautomization hypothesis), whereas for the less skilled performers, they would expect that only attention to the arm would be disruptive.

For the word-monitoring condition, Beilock et al. (2002) found that only less skilled performers were adversely affected by that task, whereas skilled performers were not. We therefore predicted that the skilled performers’ performance would be less effective under the internal-focus conditions than in the word-monitoring condition. The word-monitoring condition is also the only attentional-focus manipulation in which attention is directed externally away from the body. One could argue that that feature was the primary cause of skill-based interactions in previous work, even though it was irrelevant to the skill. Perkins-Ceccato et al. (2003) found that an internal focus of attention was disruptive for skilled performers in comparison with an external focus, whereas the reverse was true for less skilled individuals. Comparisons of the word-monitoring condition with the two internal-focus conditions allowed us to examine that proposal. An interaction with skill level would be observed if the conditions are primarily mediated by the direction of the attentional focus (i.e., internal vs. external).

Finally, in view of the reversal in findings reported by Beilock et al. (2002) for the comparison between the skilled performers’ nondominant and dominant feet, but no difference between less skilled performers’ feet, we examined both the dominant and nondominant feet of the skilled soccer players. If Beilock et al. are correct in their predictions, then the performance of the skilled players who dribble with their nondominant foot will be like that of the less skilled players with respect to the attentional-focus manipulations, as previously detailed.

We included control conditions in which no change in attentional focus was required throughout our testing protocol. We report the effects of the various conditions relative to those of the control condition. One can infer the type of attentional focus that performers normally adopt when performing the skill through an absence of differences in movement times between the control and the relevant attention condition.

**Method**

**Participants**

Participants were men and were right-foot dominant. They provided informed consent before taking part in the experiment. We selected and subdivided participants into two groups on the basis of their skill and experience levels. The first group \( n = 10 \) comprised skilled soccer players (mean age = 21.1 ± 1.37 years). The skilled group had 13.4 ± 2.17 years of competitive soccer experience and currently played at varsity or semiprofessional levels. The second group \( n = 10 \) comprised less skilled soccer players (mean age = 22.5 ± 3.98 years). The less skilled participants had played only recreational soccer from an early age. All procedures were conducted according to the ethical guidelines of Liverpool John Moores University.

**Task and Apparatus**

Participants were required to dribble a ball around a series of six pylons that formed a slalom course. They were required to dribble under one of four conditions (i.e., control and three experimental conditions). In all three experimental conditions, participants were required to monitor auditory tones or words administered via a VHS tape player. The pylons were 1.5-m-high sticks placed 1.5 m apart, for a distance of 9 m. Participants were required to dribble a standard size 5, regulation soccer ball through the course twice (i.e., up and back down), such that the total distance covered was 18 m. The experiment was conducted indoors, on a carpeted surface. Photoelectric timing gates (MTE, Zug, Switzerland, Model MARK9) were located at both the start and finish lines. Those were connected to a timing meter (Griffin Education, Loughborough, U.K., Model AV803/2395) that recorded movement times. We used a video camera mounted on a tripod to record each trial and to enable any errors to be recorded.

**Auditory Tape Construction**

We closely based the auditory tape construction on the method used by Beilock et al. (2002). Four VHS recordings of 36-s duration were produced for the internal-focus conditions. The four tapes corresponded to the four internal-focus trials and were administered in a random order for each participant. A single tone occurred randomly on the tapes, once every 6 s. The occurrence of those tones was temporally aligned with the occurrence of the target word thorn in the word-monitoring condition. On each of the four
tapes in the word-monitoring condition, a single-syllable concrete noun (e.g., *sword*) was presented at a random time point once within every 2-s interval. We recorded and edited the words by using the Media 100 video-editing software (Marlboro, MA). Start tones were placed at the beginning of all recordings.

**Procedure**

Participants completed a consent form, a demographic questionnaire detailing their soccer experience, and a questionnaire that enabled us to measure footedness. Only individuals with a right-foot preference were tested. We instructed participants that their aim in the task was to dribble a soccer ball quickly and accurately through the slalom course. The ball was placed on the start line, and participants stood behind the line. Warm-up trials were then completed. In the first warm-up trial, participants jogged with the ball through the course and the experimenter alerted participants to any errors. The participants completed a minimum of three and a maximum of five warm-up trials, all of which were timed. Those trials were stopped once the participants dribbled without error and had achieved consistency in their performance times across consecutive trials. Participants then performed under one of the four conditions: (a) internal, skill-relevant focus (foot); (b) internal, skill-irrelevant focus (arm); (c) word-monitoring (word); and (d) no attentional manipulation (control). We designed the arm and foot conditions to replicate those used by Beilock et al. (2002). In all experimental conditions, participants were required to monitor their foot, arm, or words and to respond verbally to a target word or tone. Participants performed two trials in each condition, making a total of eight experimental trials. The four conditions were administered in a predetermined random order. Whereas the order of conditions differed across participants within a skill group, the same ordering of conditions was applied across both skill groups. For each participant, the order of the trials was randomized, with the constraint that a trial from one condition could not directly follow another. Before each trial, the experimenter instructed participants about the requirements of the condition.

**Internal, skill-relevant focus (foot).** At the start of each trial, participants were instructed that they should continuously monitor their feet, attending to the side of the foot that was in contact with the ball. Participants were not required to look at their feet but to be aware of which side of the foot was in contact with the ball. During the trial, a single tone was presented at random. Upon hearing the tone, participants were required to indicate verbally whether the outside or inside of the foot was in contact with the ball. For each trial, the experimenter recorded the number of tones and errors.

**Internal, skill-irrelevant focus (arm).** At the start of each trial, participants were instructed that they should monitor their arms throughout the trial, paying attention to the arm closest to the pylon directly ahead of them. They were not required to look at their arm or at the 1.5-m-high pylons. During the trial, a single tone was presented at random. Upon hearing the tone, participants were required to indicate verbally whether the left or the right arm was nearest to the pylon ahead of them. For each trial, the experimenter recorded the number of tones and errors.

**Word-monitoring.** In the word-monitoring condition, participants dribbled the ball through the slalom course, attended to auditory words, and identified the target word *thorn*. During each trial, participants heard a range of single-syllable concrete nouns (e.g., *sword*) spoken from a tape player. Participants were required to monitor continuously the words and to repeat the target word aloud each time it was heard. For each trial, the experimenter recorded the number of target words and any errors.

**Control condition.** At the start of the control condition, participants were instructed to dribble quickly and accurately through the slalom course.

We instructed participants that the trials would be timed. Because only error-free trials could be used, however, we emphasized accuracy as the primary constraint. Trials in which there was an error in dribbling performance were repeated. We defined the four following errors: (a) The participant knocked over a pylon or moved it off its line on the outward part of the course. (b) The ball struck an external object (e.g., the wall). (c) The participant missed the start or finish gate. (d) The participant dribbled the ball with the foot that was not specified at the start of the trial. Repeated trials were run at the end of the predetermined block of eight trials. The intertrial interval was approximately 60 s. During that break, we required participants to count backwards from 100 in sixes. We designed that manipulation to limit interference from previous trials on subsequent performance.

The less skilled participants used only their right foot for all trials. The skilled participants were tested on two occasions. On the first occasion, skilled participants used only their dominant right foot, whereas on the second occasion they used only their nondominant left foot on all trials (the order of the conditions was reversed). At least 1 week separated those two sessions. The start and finish lines were reversed for the set of trials undertaken with the left foot in comparison with trials undertaken with the right foot.

**Data Analysis**

The primary dependent measure was the time taken to complete one error-free trial (in seconds). We derived that measure to the nearest 0.1 s by using photoelectric timing gates. When participants passed the timing gate located at the start line, the clock began timing, and when they passed through the timing gate located at the finish line, the clock stopped timing. Accuracy data were also collected, corresponding to failures to respond to words or tones, incorrect response to tones, and errors in dribbling performance. For movement times and errors in execution, we calculated difference scores between the mean of two error-free trials in the control condition and the mean of two error-free trials in...
each of the attentional-manipulation conditions. That calculation enabled us to normalize across participants for speed and to examine any decrement (or facilitation) as a function of attention condition. Subsequently, we based all statistical analyses on comparisons of the difference scores for the three attentional-focus conditions (i.e., foot, arm, and word).

Because only the skilled participants were tested twice, with both their dominant and nondominant feet, we subdivided the analysis into two sections. In the first section, we report differences across the two skill groups with respect to the attentional-focus conditions. In the second section, we present differences as a function of side of foot (i.e., dominant and nondominant foot) for only the skilled participants with respect to the attentional-focus conditions.

On the basis of our initial predictions, we specified in advance preplanned orthogonal contrasts in relation to the three attentional-focus conditions. First, we compared the means of the two internal-focus conditions with that of the word-monitoring condition. Second, we compared the two internal-focus conditions with each other. We examined skill level and side-of-foot interactions with respect to those two contrasts. We set the alpha level required for significance at \( p < .05 \). As a measure of effect size, we also present Cohen’s \( f \) values (\( f \) values of .10, .25, and .40 refer to small, medium, and large effect sizes, respectively).

**Results**

**Movement Time**

**Skill Group Comparisons**

The difference scores between the mean of two error-free trials in the control condition and the mean of two error-free trials in each of the attention-manipulation conditions are presented in Figure 1. Positive scores indicate an overall detriment (i.e., slowing) in performance in comparison with control conditions in which no attention instructions were given. The actual mean movement times (MTs) for participants in each of the four conditions are presented in Table 1.

Primarily because the data were normalized with respect to MTs on control trials, we observed no differences as a function of skill level (\( F < 1 \)). The relative effects of the attention manipulations did not differ as a function of skill level. Although the comparison of the word-monitoring condition with the two internal-focus conditions was not significant (\( F < 1 \)), there was a significant difference between the two internal focus of attention conditions, \( F(1, 18) = 9.62, p < .01, f = .39 \). Performance times were faster in the skill-irrelevant (arm) attention condition than in the skill-relevant (foot) attention condition. That finding shows that an internal focus of attention did not have a general effect. In support of the findings of Beilock et al. (2002), that effect showed a significant interaction with skill level, \( F(1, 18) = 4.86, p < .05, f = .26 \). As can be seen in Figure 1, only the less skilled group showed a difference between those two internal-focus conditions, with poorer performance being observed when attention was directed to the arm rather than the foot. There was no significant skill-level interaction involving the word-monitoring condition, \( F(1, 18) = 1.63, ns, f = .16 \), although the skilled participants did demonstrate a trend toward better performance than their less skilled counterparts did in this condition.

**Side-of-Foot Comparisons**

Only the skilled players performed the dribbling task with their nondominant foot. Again, because we normalized the trials with respect to control trials, there was no significant side-of-foot effect, \( F(1, 9) = 1.41, ns, f = .09 \). Neither of the contrasts comparing across conditions were significant. Contrary to the findings for skill level, there were no differences between the two internal-focus conditions as a function of side of foot (\( F < 1 \)). However, there was a significant interaction effect involving side of foot when we compared the two internal-focus conditions with the word-monitoring condition, \( F(1, 9) = 5.34, p < .05, f = .27 \). As can be seen in Figure 1, the skilled performers demonstrated a greater decrement in performance for the dominant foot in the two internal-focus conditions compared with that in the word-monitoring condition; for the nondominant foot, however, there were no differences across attention conditions (detrimental effects were observed relative to the control in all conditions).

**Performance Errors**

**Skill Group Comparisons**

The errors in dribbling performance across skill group and condition are presented in Table 2. There were 39 errors in total. Most were primarily errors in using the nonspecified foot to dribble the ball. We calculated the mean number of execution errors per person as a function of condition and computed a difference score with reference to the control condition to enable comparisons with the MT data. Because of the small number of errors and low within-group and within-condition variability, we recommend some caution when interpreting the results.

There were no significant differences between the skilled and less skilled soccer players for any of the effects or comparisons. All \( F \)s < 1, except for the contrast between the word-monitoring condition and the two internal-focus conditions, \( F(1, 18) = 3.06, ns, f = .18 \). There was a general trend for more errors in performance to be observed in the internal-focus conditions, irrespective of the type of focus or skill level. That finding would be predicted in the constrained-action hypothesis but not in the deautomatization hypothesis.

**Side-of-Foot Comparisons**

We observed results similar to those found when comparing across skill level when we evaluated the performance of only the skilled soccer players as a function of dominant or nondominant foot. The only significant comparison was between the word-monitoring condition and the mean of the two internal-focus conditions, \( F(1, 9) = 10.79, p < .01, f = .23 \). The number of errors was higher in the two internal-
focus conditions, regardless of foot, $F(1, 9) = 1.10, ns, f = .10$, and those conditions did not differ from each other. All other $F$s < 1.

Secondary Task Performance

In Table 3, the average numbers of tones and words heard by participants during the attentional manipulation conditions are displayed. The frequency of response errors was generally low (approximately 5% of the total number of responses). The response errors were distributed across the skilled and less skilled participants, although the less skilled participants generally tended to make more errors.

Discussion

In this experiment, we examined the effects of two internal focus of attention conditions on the performance of skilled and less skilled soccer players during a dribbling task. The two conditions differed with respect to the type of internal focus, either soccer-skill relevant (toward the foot) or not soccer-skill relevant (toward the arms). If an internal
focus generally interferes with performance, as predicted by the constrained-action hypothesis, those conditions will have similar detrimental effects on performance, and one would not expect any interactions as a function of skill group or side of foot. According to the deautomization of skills hypothesis, however, one would expect skill-based and side-of-foot interactions as a function of attentional-focus condition. Specifically, only the skilled performers will be negatively affected by attention conditions that require a focus on the foot, because only for the skilled performers has that feature of skill become proceduralized.

Movement times across the skilled and less skilled performers yielded data in support of the deautomization hypothesis. Whereas the skilled performers were negatively affected by internal-focus manipulations on both the arm and the foot, the less skilled performers showed detrimental effects in performance only when attention to the arm was required (i.e., a feature not directly relevant to dribbling and, hence, to soccer skill, but important for running and balance generally). McNevin and Wulf (2002) have shown that a focus of attention on the body when balancing can affect performance. In contrast to our current results, however, they

---

**TABLE 2. Frequency of Performance Errors as a Function of Group, Side of Foot, and Condition**

<table>
<thead>
<tr>
<th>Error type</th>
<th>Control</th>
<th>Word monitor</th>
<th>Internal skill</th>
<th>Internal nonskill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pylon fell</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ball struck object</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Wrong foot</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Gate missed</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

**Skilled, dominant foot**

| Pylon fell       | 1       | 0            | 0              | 0                 |
| Ball struck object | 1       | 1            | 1              | 1                 |
| Wrong foot       | 1       | 2            | 2              | 3                 |
| Gate missed      | 0       | 0            | 2              | 1                 |

**Less-skilled, dominant foot**

| Pylon fell       | 0       | 0            | 2              | 1                 |
| Ball struck object | 0       | 0            | 0              | 1                 |
| Wrong foot       | 1       | 1            | 2              | 3                 |
| Gate missed      | 0       | 0            | 0              | 3                 |

**Skilled, nondominant foot**

| Pylon fell       | 2.55    | 0.60         | 2.70           | 0.47              |
| Ball struck object | 2.85    | 0.37         | 2.95           | 0.22              |
| Wrong foot       | 2.55    | 0.51         | 2.55           | 0.51              |
| Gate missed      | 2.75    | 0.44         | 2.75           | 0.44              |

**Note.** Internal skill = internal focus, skill-relevant task; internal nonskill = internal focus, skill-irrelevant task; word monitor = word-monitoring task.

**TABLE 3. Between-Participants Mean (M) and Standard Deviation (SD) of Number of Tones and Target Words Heard Per Trial by Participants in the Two Internal-Focus Conditions and the Word-Monitoring Condition as a Function of Group and Side of Foot**

<table>
<thead>
<tr>
<th>Group</th>
<th>Internal skill</th>
<th>Internal nonskill</th>
<th>Word-monitor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Skilled, dominant foot</td>
<td>2.55</td>
<td>0.60</td>
<td>2.70</td>
</tr>
<tr>
<td>Less-skilled, dominant foot</td>
<td>2.85</td>
<td>0.37</td>
<td>2.95</td>
</tr>
<tr>
<td>Skilled, nondominant foot</td>
<td>2.55</td>
<td>0.51</td>
<td>2.55</td>
</tr>
</tbody>
</table>

**Note.** Internal skill = internal focus, skill-relevant task; internal nonskill = internal focus, skill-irrelevant task; word monitor = word-monitoring task.
did not show that that finding may depend on the nature of the feature attended to (i.e., arm or foot) as well as on the type of task, that is, whether balance is the primary or secondary component of the task. On the basis of the findings of McNevin et al. (2003), we hypothesized that differential effects for the two internal-focus conditions could be mediated by the distance of the feature from the main effector. There was no evidence that attention to the arm (i.e., a far feature) was better than attention to the foot (i.e., a near feature), however, even for the skilled participants who were negatively affected by both internal-focus manipulations.

Despite support for the deautomization hypothesis from the comparison between the two skill groups, there were no Skill × Attention Condition interactions involving the two internal-focus conditions for errors in execution; nor was support obtained when we compared the skilled participants’ MT data across the dominant and nondominant feet. In terms of execution errors, there was evidence that both internal-focus conditions produced more errors than the word-monitoring condition did, irrespective of skill (although the difference was significant only when side of foot was compared). That finding is more in keeping with the constrained-action hypothesis. Attention to a task that was external to the body but irrelevant to the skill resulted in fewer performance errors than did conditions that required attention to the body. Because of the relatively small number of performance errors, however, we recommend caution in interpreting those data, particularly in view of the relatively large effect sizes observed for MT between the two internal-focus conditions as a function of skill level.

The internal focus of attention conditions also failed to differentiate across skill when the MTs for the skilled participants were compared across their skilled (i.e., dominant) and less skilled (i.e., nondominant) feet. In this experiment, the nondominant-foot trials always followed the dominant-foot trials, thereby potentially presenting an order effect. Despite that possible practice effect, the skilled performers’ mean dribbling performance times with the nondominant foot were slower than those for their dominant foot in all conditions (see Table 1). That difference was confirmed when we compared the two no-attentional-focus control conditions for the dominant and nondominant feet, t(9) = 5.20, p < .01, d = 2.07. Therefore, although a different skill level was observed under nondominant-foot trials (at least quantitatively), there was no evidence that the nondominant foot was being controlled in a qualitatively different manner than the dominant foot.

There was approximately a 3-s time difference between the MTs for the skilled group’s nondominant foot and those for the less skilled group’s dominant foot. For the skilled performers’ nondominant foot, that pattern of results may be indicative of an intermediate performance level. The finding that the word-monitoring condition disrupted only performance with the nondominant foot suggests that at intermediate skill levels, performance is generally attention demanding (irrespective of the focus of attention and the feature attended to). Investigators need to address that issue explicitly in the future by comparing a range of participants (not only skilled and less skilled) so that a better understanding of the change in control strategies as a function of practice and skill can be gained. It is also worth noting that the participants in this experiment were likely more skilled than those used by Beilock et al. (2002). The skilled, male players in this experiment had played competitive soccer for over 10 years and were currently competing at a professional or university level in the United Kingdom, where soccer is the national sport. In comparison, the women players in the study by Beilock et al. played soccer at a Canadian university and were arguably of lower skill level.

The design in this experiment did not allow us to examine the type of control strategy that might characterize high performance skill. To do that, we would have had to at least include an external, soccer-skill-relevant, focus of attention condition, perhaps toward the ball or pylons. It is important to manipulate that variable so that one can examine whether attentional effects are mediated primarily by the skill-relevant nature of the attentional focus, the direction of the attentional focus, or by interactions between the two. In addition, it is important to note that we have shown only temporary instructional effects. The possibility remains that with practice, the control strategies used by the less skilled players will become more like those of their skilled counterparts, such that an internal focus toward the foot begins to interfere with performance, particularly in comparison with external-focus and control conditions (see Wulf & Prinz, 2001). The time course of those changes requires further examination. Beilock et al. (2002) found that the nondominant foot of skilled players was controlled differently than their dominant foot, suggesting that that process is not achieved over a few days or weeks of practice.

In summary, instructions that induce a focus of attention on features of performance involved in a skill interfere with the subsequent performance of that skill. That interference occurs irrespective of whether those features are related directly (i.e., the foot in dribbling a ball) or indirectly (i.e., the arm that is involved in running and balance) to the skill. For low skill individuals, because the foot is still a controlled component of skill, attention to that feature does not cause problems for skill execution. Those results support the suggestion that the feet require, or at least are characterized by, conscious attention for movement control at low levels of skill (see Beilock et al., 2004; Beilock et al., 2002). Although that focus is likely to be preferred or naturally adopted by less skilled performers, the possibility remains that the focus on the feet may not be the best method for effective performance. Because of the temporary nature of the instructional manipulations in this experiment, it is possible that practice that encourages an external, skill-relevant focus will prove to be a more effective attentional-focus method in the long term. Further experiments to examine that proposal and to determine the control strategies and the type of focus that characterize and are optimal for both performance and learning are
required. In addition to considering the direction of attentional focus, in future studies investigators should consider the distance of the feature from the main effector and the skill-related nature of the attentional focus.

REFERENCES

Submitted January 15, 2004
Revised August 18, 2004