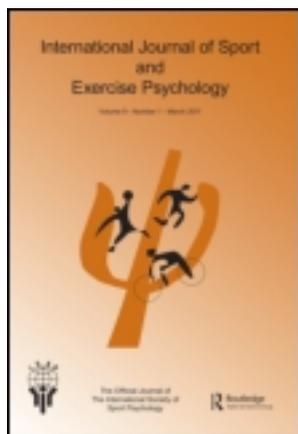


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A distal external focus enhances novice dart throwing performance

Brad McKay^a & Gabriele Wulf^a

^a Department of Kinesiology and Nutrition Sciences, University of Nevada, Las Vegas, USA

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A distal external focus enhances novice dart throwing performance

Brad McKay and Gabriele Wulf*

Department of Kinesiology and Nutrition Sciences, University of Nevada, Las Vegas, USA

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The present study examined the effectiveness of distal versus proximal external foci of attention as a function of performers' preferences for a certain focus. We used a dart throwing task, and participants were instructed to direct their attention either to the target (distal focus) or the flight of the dart (proximal focus). Participants were asked to select their preferred focus after one trial under each focus condition without knowledge of results. Subsequently, all participants performed two 24-trial blocks, one under each condition, with focus order (preferred first *vs.* non-preferred) counterbalanced. Significantly more participants preferred the distal compared to the proximal focus. Also, dart throwing accuracy was generally enhanced when participants adopted a distal focus, regardless of focus order or preference. The present findings provide further evidence that the "distance" effect in attentional focus is a general phenomenon that does not depend on individual preferences.

Keywords: attentional focus; distance effect; motor skill; dart throwing

As many studies have demonstrated, a performer's focus of attention influences the effectiveness and efficiency of his or her movements (for a review, see Wulf, 2007). More specifically, focusing on one's body movements (internal focus of attention) has been demonstrated to be less effective for performance and learning than directing attention to the intended movement effect (external focus). External focus advantages have been shown for a variety of motor skills, age groups, and skill levels. In dart throwing, for instance, instructions directing the attention of novices externally (i.e., to the flight of the dart) have been found to result in superior performance than instructions directing attention internally (i.e., to the hand/arm) (Marchant, Clough, & Crawshaw, 2007). According to the constrained action hypothesis (e.g., McNevin, Shea, & Wulf, 2003; Wulf, McNevin, & Shea, 2001), internally focused attention results in a more conscious type of movement control and disrupts the smooth execution of movements. In contrast, externally focused attention allows the motor system to take advantage of automatic control processes. Evidence for this view has been provided by studies demonstrating (a) reduced attentional demands (Wulf, McNevin et al., 2001), (b) faster, reflex-based movement adjustments (e.g., McNevin et al., 2003), and (c) greater movement efficiency such as reduced muscular activity (e.g., Lohse, Sherwood, & Healy, 2010), when an external focus is adopted (for a review, see Wulf & Lewthwaite, 2010).

While an external focus has consistently been shown to be more effective than an internal focus, some studies have also found that a more *distal* external focus is superior to a proximal external focus (Bell & Hardy, 2009; McNevin et al., 2003). That is, focusing on a movement

*Corresponding author. Email: gabriele.wulf@unlv.edu

effect that is more remote from the body has been found to result in superior learning and performance. In the first study demonstrating this effect (McNevin et al., 2003), participants learned to balance on a stabilometer platform under one of four focus conditions: An internal focus (i.e., keeping feet horizontal), a proximal external focus (i.e., keeping markers horizontal that were touching the feet), and two distal external focus conditions (i.e., keeping markers horizontal that were about 25 cm away from the feet). While all external focus groups outperformed the internal focus group on a retention test, the distal external focus groups demonstrated superior learning relative to the proximal external group. This finding suggested that a more distal external focus facilitates movement automaticity to a greater extent than a more proximal focus, presumably because it is more easily distinguishable from the body movements than a proximal one. Recently, Bell and Hardy (2009) demonstrated the distance effect with a golf chipping task, where shot accuracy in experienced golfers was enhanced by a focus on the ball trajectory (distal) compared to the club head (proximal).

The present study followed up on those findings in various ways. One purpose of our study was to try to replicate the distance effect, that is, the advantages of a distal relative to a proximal external focus for motor performance, with a different task. Currently, evidence for this effect is limited to just a few studies and tasks (i.e., stabilometer, golf). We used a dart throwing task to examine the generalizability of the distance effect. Specifically, we compared the effectiveness of a more distal focus (i.e., bull's eye) to that of a proximal one (i.e., trajectory of the dart) in novice dart throwers.

A second, and arguably more important, purpose of the present study was to examine which type of external focus (distal or proximal) performers would prefer, and whether using their preferred versus non-preferred focus would affect their performance. Previous studies have investigated individuals' preferences for internal versus external foci, and the effects of a preferred versus non-preferred focus on performance and learning (e.g., Marchant, Clough, Crawshaw, & Levy, 2009; Weiss, 2011; Wulf, Shea, & Park, 2001). Those studies have shown that most participants seemed to prefer an external over an internal focus (Marchant et al., 2009; Wulf et al., 2001). Furthermore, the effectiveness of an external focus for performance and learning appeared to override performer preferences. That is, individuals who preferred and used an external focus outperformed those who preferred and used an internal focus. Also, when performers were asked to adopt a non-preferred focus, a non-preferred internal focus resulted in performance decrements, while the adoption of a non-preferred external focus did not (Weiss, 2011). No studies appear to have examined learner preferences for *different external foci*. Therefore, we wanted to determine whether more learners would prefer a distal over a proximal external focus. Such a finding would extend previous findings demonstrating performers' sensitivity to the effectiveness of different foci (provided a distal focus was actually more effective than a proximal focus).

A potential problem in previous studies was that performer preferences may have been based on feedback about the outcome of their actions. That is, individuals may have preferred the focus (i.e., external) that resulted in more effective performance. There are some indications for this supposition. In one study (Weiss, 2011), asking participants for their preference, simply based on focus instruction they could choose from, did not seem to yield clear preferences for either focus. However, providing learners with the opportunity to try out different foci, especially over an extended period and with performance feedback, resulted in greater preferences for a (more effective) external focus (e.g., Marchant et al., 2009; Wulf, Shea et al., 2001). In the present study, we asked participants to indicate their preference for a certain attentional focus after providing them the opportunity to try out each focus strategy only once and with no knowledge of results (KR). This way, participants had a chance to compare different foci, but their decision about which one they preferred was not biased by knowledge of the movement

outcome. Rather, their preference would presumably reflect a more genuine feel for what might be an effective focus.

Thus, we were interested in (a) the effectiveness of distal versus proximal external foci in dart throwing, and (b) novice performers' sensitivity to the differential effectiveness of those foci, if any (as indicated by the number of participants who preferred either focus). To examine these issues, all participants performed two sets of trials – one with a proximal focus (i.e., dart) and one with a distal focus (i.e., bull's eye) – with half of the participants using their preferred focus first (after two initial trials without KR), and the other half using their non-preferred focus first. Although these issues were of secondary interest, we also examined (c) whether the order in which the preferred and non-preferred focus were used would affect performance, and (d) whether participants who preferred the more effective focus would outperform those who preferred the less effective focus.

Method

Participants

Thirty-six university students (18 female; mean age: 21.3 years) participated in the study. All participants gave their informed consent before beginning the experiment, and all were naive to the purpose. Participants were asked to report their previous experience with dart throwing in an open-ended questionnaire. About 22% ($n = 8$) reported having little experience, with answers such as “practically none” to “once or twice.” Most participants ($n = 23$, or 64%) reported some experience, with answers ranging from: “I might have played a dozen times or so” to “I’ve played in bars and when I was a kid, but not very frequently.” Only a few participants ($n = 5$, or 14%) had played “regularly in the past,” but none reported any regular experience within the past year. Therefore, we believe it is fair to characterize participants in the present study as novices.

Apparatus and task

The task required participants to throw darts at a dartboard. The dartboard was 38 cm (15 in) in diameter, with nine concentric rings, each 2 cm in width, and 2 cm diameter bull's eye in the center. The dartboard was installed so that the bull's eye was 1.73 m above the floor and participants stood 2.36 m from the dartboard. The task was to throw regulation-sized darts at the bull's eye on the dartboard. A dart that struck the bull's eye received a score of 10 points, and so forth, with a dart that struck the outermost ring receiving a score of 1. Shots that missed the board entirely were given 0 points.

Procedure

At the beginning of the experiment, all participants were asked to throw two darts, one under each focus condition. All instructions were provided by the first author. During the first throw, all participants were asked to adopt a proximal focus. Specifically, they were asked to focus on the flight of the dart. Their goal was to look at the bull's eye and try to score as high as possible while holding in their imagination the path of the dart. For the second throw, participants were asked to adopt a distal focus and were instructed to focus on the bull's eye. Specifically, they were instructed to focus on the bull's eye and try to hit it. As soon as the participant released the dart, a 40 cm × 40 cm cardboard cut-out was placed in front of him or her to occlude her view of the dartboard and prevent knowledge of the accuracy of their throws. To insure that the cardboard cut-out effectively occluded the participants' vision, they were asked following each throw

if they saw the dart hit the dartboard, or if they were able to predict where it hit. According to participant feedback, the occlusion technique was 100% effective (no data were collected pertaining to actual accuracy). Following the second throw, participants were asked which of the two foci they preferred.

Once participants had declared their preference, they completed 24 trials under each focus condition. The order of focus condition (preferred *vs.* non-preferred) was counterbalanced among participants. Specifically, among those participants who preferred a proximal focus (dart), approximately half (5) performed with that focus first, whereas the remaining participants (4) performed the first block with a distal focus. Similarly, among those who preferred a distal focus (27), about half (14) were instructed to adopt that focus on the first block, while the other half (13) performed with a proximal focus first. The importance of focusing in accordance with the instructions was stressed at the beginning of each 24-trial block, and the participants were reminded of their current focus condition after every sixth trial (“remember, focus on the bull’s eye” or “remember, focus on the flight of the dart”). Participants performed three throws in a row; the experimenter removed the darts from the board and returned them to the performer, and so forth. The experimenter also recorded the accuracy scores after each set of three trials.

Dependent variable and data analysis

Focus preference and dart-throwing accuracy were the dependent variables of primary interest in the present study. To determine if more participants preferred one focus over the other, a chi-square analysis was performed. Possible differences between groups (i.e., those with a preference for proximal *vs.* distal focus) in their level of experience were examined by assigning a score of 1, 2, or 3 to each participant based on their level of experience (see the Participants section) and performing a Mann-Whitney *U* test. The accuracy scores were summed for each block of 24 trials and analyzed in a 2 (focus: distal *vs.* proximal) \times 2 (focus preference: distal *vs.* proximal) \times 2 (preference order: preferred focus first *vs.* second) mixed analysis of variance with repeated measures on the first factor. To determine if changes in performance occurred within trial blocks (e.g., reductions in error), a 2 (focus-preference group) \times 2 (block) \times 24 (trials) repeated-measures ANOVA was conducted.

Results

Focus preference

Following the performance of two dart throws without KR, more participants preferred a distal focus on the bull’s eye ($n = 27$) relative to a proximal focus on the dart ($n = 9$). A chi square analysis revealed that this difference in the number of participants was significant, $\chi^2(1, 35) = 9.00$, $p < .05$. The average level of dart throwing experience did not differ between the dart preference ($M = 1.67$, $SD = 0.71$) and bull’s eye preference groups ($M = 2.0$, $SD = 0.56$), $U = 87.0$, $p > .05$.

Throwing accuracy

Levene’s test for equality of variances was conducted to ensure the data did not violate the assumption of homogeneity of variance. The variance in accuracy did not differ between the dart focus condition, $F(2, 32) = 2.6$, $p > .05$, or the bull’s eye focus condition, $F(2, 32) < 1$. Dart throwing performance was generally more accurate with a distal ($M = 6.84$, $SD = 1.25$) relative to a proximal external focus ($M = 6.26$, $SD = 1.5$), independent of participants’ initial focus preference (see Figure 1). The main effect of attentional focus was significant, $F(1, 32) = 7.86$,

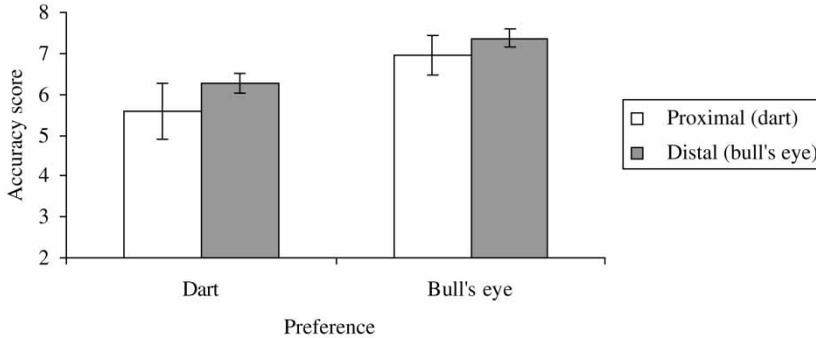


Figure 1. Performance in each focus condition by participants with initial preferences for focusing on bull's eye (Distal focus) and dart-flight (Proximal focus). Note: Error bars represent ± 1 SE.

$p < .01$, $\eta_p^2 = .20$. Also, participants who reported a preference for the distal focus performed more accurately overall ($M = 7.14$, $SD = 1.20$) than participants with an initial preference for the proximal focus ($M = 5.96$, $SD = 1.5$), $F(1, 32) = 6.79$, $p < .05$, $\eta_p^2 = .18$. The interaction of focus and preference was not significant, $F(1, 32) < 1$. Throwing accuracy was independent of whether participants adopted their preferred focus first ($M = 6.88$, $SD = 1.46$) or second ($M = 6.79$, $SD = 1.27$), $F(1, 34) < 1$. Also, there were no interactions of preference order with preference, $F(1, 32) = 1.09$, $p > .05$, or focus, $F(1, 32) = 3.16$, $p > .05$, and no interaction of preference order, focus, and preference, $F(1, 32) < 1$. Finally, there were no significant changes in performance across trials in either Block 1, $F(11, 23) = 1.6$, $p = .20$, or Block 2, $F(11, 23) = 1.2$, $p = .34$.

Discussion

Previous research has consistently found advantages of an external compared to an internal focus of attention (for a review, see Wulf, 2007). For instance, for dart throwing, adopting an external focus (e.g., flight of the dart) has been demonstrated to be more effective than an internal focus (e.g., hand) (Lohse et al., 2010; Marchant et al., 2007, 2009). The present results extend these findings by showing that a distal external focus was more effective than a proximal external focus for novice performers. When participants were instructed to focus on the bull's eye of the dartboard, their throwing accuracy was significantly enhanced compared to the adoption of a more proximal focus on the dart. Thus, these results replicate previous findings showing superior performance and learning with a more distal focus in skilled golfers (Bell & Hardy, 2009) and balance learning (e.g., McNevin et al., 2003).

The effectiveness of an external focus has been attributed to the fact that it promotes movement automaticity, in contrast to internally focused attention which disrupts automatic performance (constrained action hypothesis; Wulf, McNevin et al., 2001; Wulf, Shea et al., 2001). Along the same lines, a distal focus is presumably even more effective than a proximal one because attention is directed at a movement effect that is more easily distinguishable from the body movements (McNevin et al., 2003). Aside from the physical distance from the body, a more distal focus may also promote control at a higher hierarchical level (Vallacher, 1993; Vallacher & Wegner, 1987) and trigger the whole action pattern necessary to achieve the movement goal (Wulf, 2007). In the present study, focusing on the bull's eye of the dartboard may have elicited a more global and effective movement pattern (motor program) than focusing on the trajectory of the dart, which may have directed more attention to the details of the action.

The majority of participants (i.e., 27 vs. 9) also preferred the distal focus. While previous studies have shown that performers tend to prefer (and perform more effectively with) external compared to internal foci (bull's eye vs. arm in dart throwing, Marchant et al., 2009; markers on platform versus feet in balancing on stabilometer, Wulf, Shea et al., 2001), the present findings demonstrate a preference for (and more effective performance with) a distal compared to a proximal external focus. Moreover, participants' judgments were made after only one trial with each focus. While in previous studies preferences for a certain type of focus were usually determined after participants had the opportunity to try out and compare the effectiveness of different foci (i.e., internal vs. external) (e.g., Wulf, Shea et al., 2001), the present results indicate that participants were able to make this decision after relatively little exposure to each focus. Also, they made that decision without knowing the outcome of their actions. This suggests that individuals may either have a good feel for how they performed, as has been shown in previous studies (e.g., Chiviacowsky & Wulf, 2002), or that they are sensitive to how their performance can be enhanced. In future studies, participant interviews might provide more insight into the underlying reasons for their decisions.

Interestingly, not only did significantly more participants prefer a distal focus, but those who preferred to focus distally also performed significantly more effectively than those who preferred to focus proximally. These differences were present under both focus conditions. That is, independent of which focus participants preferred, those who expressed a preference for focusing on the bull's eye were more accurate under both distal (bull's eye) and proximal (dart) focus conditions, compared to those who preferred focusing on the dart. These findings suggest that individual differences in the preference for a certain focus do not differentially affect performance (see also Wulf, Shea et al., 2001). While the possibility remains that participants' focus in either focus condition was somewhat biased toward their preferred focus, it is also clear that participants adhered to the instructed foci, as otherwise no differential effects of distal versus proximal foci would have been found. Even though the two preference groups did not differ significantly in their experience level, it is possible that participants who indicated a preference for the distal focus were perhaps more attuned to their performance (i.e., better at interpreting their intrinsic feedback), even in the absence of KR. At any rate, these findings suggest that individual differences in the preference for a certain focus do not differentially affect performance (see also Wulf, Shea et al., 2001).

Researchers may build on the present findings by examining the relationship between expertise and the most effective external foci. In the present study with novices – similar to previous studies (e.g., McNevin et al., 2003) – a distal focus resulted in more effective performance or learning than a proximal focus. Yet, there are also indications that a more proximal focus might be advantageous for novices learning complex, multiple degree-of-freedom skills such as hitting a golf ball (Wulf, McNevin, Fuchs, Ritter, & Toole, 2000). Wulf and Prinz (2001) speculated that, for beginners, directing attention to a proximal movement effect (e.g., movement of the golf club) might be more effective, because this effect is more directly related to the body movements and can be associated more easily with the motor commands that produced the effect. In contrast, for expert performers, it might be more effective to direct attention to a more distal effect (e.g., ball trajectory or target) that elicits the appropriate action (Bell & Hardy, 2009). Aside from the physical distance of the focus from the body, or the hierarchical level of control (Vallacher, 1993; Vallacher & Wegner, 1987), it is also possible that it is difficult for novices to adopt certain foci, such as the anticipated trajectory of a dart or ball. In one study, for example, novices found it more difficult to adopt an external focus on the flight of the ball in kicking than experts (Ford, Hodges, Huys, & Williams, 2009). Thus, it remains to be examined which factors determine the optimal attentional focus as a function of task and level of expertise.

Further evidence for the notion that a distal external focus enhances movement automaticity and efficiency compared to a more proximal focus would be desirable. While faster movement adjustments with a distal focus, thought to reflect greater automaticity, have been demonstrated previously (McNevin et al., 2003), potential differences in movement efficiency (e.g., in muscular activity) as a function of the distance of the external focus have yet to be examined. Neuroimaging studies might also provide further insights into the neural correlates of attentional focus. Recent brain imaging studies have shown reduced brain activation and more efficient connectivity among central motor networks, as skills become more automatic (e.g., Poldrack et al., 2005; Wu, Chan, & Hallett, 2008; Wu, Kansaku, & Hallett, 2004). In one study, novices who adopted an external focus of attention in dart throwing (bull's eye), rather than an internal focus (throwing technique), had similar electroencephalogram patterns to experts; specifically, externally focusing participants had reduced alpha power, indicative of more efficient neural processing (Radlo, Steinberg, Singer, Barba, & Melnikov, 2002). It would be interesting to see whether those effects are enhanced with a distal attentional focus.

The present results have both specific and general implications for applied settings. First, and somewhat obviously, novice dart-throwers can benefit from a focus on the bull's eye. Although some participants in the present study preferred to focus on the flight of the dart, they performed more effectively with instructions to focus on the distal (bull's eye) target. An interesting and somewhat counterintuitive implication of the present study pertains to the instructions coaches offer learners. Admittedly, the bull's eye focus instructions were most near what the majority of people would spontaneously do if left on their own to practice dart throwing. Coaches may be inclined to offer additional instructions – perhaps pertaining to movement form, and perhaps pertaining to appropriate dart trajectory. In both cases, instructions directing attention internally (Marchant et al., 2007) and proximally are less effective than simply directing attention to the distal goal of the movement, at least in terms of performance. Thus, while coaches can further a novice player's development with well-crafted cues, misguided (internal) cues may fail to provide any benefit to the learner, and in some instances may retard development. More generally, given that the "distance" effect has now been replicated using different tasks, practitioners may want to direct performers' attention to more distal rather than proximal effects of their movements (although the optimal external focus may depend on the skill level and complexity of the task; see above).

References

- Bell, J.J., & Hardy, J. (2009). Effects of attentional focus on skilled performance in golf. *Journal of Applied Sport Psychology, 21*, 162–177.
- Chiviacowsky, S., & Wulf, G. (2002). Self-controlled feedback: Does it enhance learning because performers get feedback when they need it? *Research Quarterly for Exercise and Sport, 73*, 408–415.
- Ford, P., Hodges, N.J., Huys, R., & Williams, A.M. (2009). Evidence for end-point trajectory planning during a kicking action. *Motor Control, 13*, 1–24.
- Lohse, K.R., Sherwood, D.E., & Healy, A.F. (2010). How changing the focus of attention affects performance, kinematics, and electromyography in dart throwing. *Human Movement Science, 29*, 542–555.
- Marchant, D.C., Clough, P.J., & Crawshaw, M. (2007). The effects of attentional focusing strategies on novice dart throwing performance and their task experiences. *International Journal of Sport and Exercise Psychology, 5*, 291–303.
- Marchant, D.C., Clough, P.J., Crawshaw, M., & Levy, A. (2009). Novice motor skill performance and task experience is influenced by attentional focusing instructions and instruction preferences. *International Journal of Sport and Exercise Psychology, 7*, 488–502.
- McNevin, N.H., Shea, C.H., & Wulf, G. (2003). Increasing the distance of an external focus of attention enhances learning. *Psychological Research, 67*, 22–29.
- Poldrack, R.A., Sabb, F.W., Foerde, K., Tom, S.M., Asarnow, R.F., Bookheimer, S.Y., & Knowlton, B.J. (2005). The neural correlates of motor skill automaticity. *Journal of Neuroscience, 25*, 5356–5364.

- Radlo, S.J., Steinberg, G.M., Singer, R.N., Barba, D.A., & Melnikov, A. (2002). The influence of an attentional focus strategy on alpha brain wave activity, heart rate, and dart throwing performance. *International Journal of Sport Psychology*, 33, 205–217.
- Vallacher, R.R. (1993). Mental calibration: Forging a working relationship between mind and action. In D.M. Wegner & J.W. Pennebaker (Eds.), *Handbook of mental control* (pp. 443–472). Englewood Cliffs, NJ: Prentice Hall.
- Vallacher, R.R., & Wegner, D.M. (1987). What do people think they're doing? Action identification and human behavior. *Psychological Review*, 94, 3–15.
- Weiss, S. (2011). The effect that reinvestment of conscious processing has on participants switching focus of attention. *Research Quarterly for Exercise and Sport*, 82, 28–36.
- Wu, T., Chan, P., & Hallett, M. (2008). Modifications of the interactions in the motor networks when a movement becomes automatic. *Journal of Physiology*, 586, 4295–4304.
- Wu, T., Kansaku, K., & Hallett, M. (2004). How self-initiated movements become automatic: A functional MRI study. *Journal of Neurophysiology*, 91, 1690–1698.
- Wulf, G. (2007). *Attention and motor skill learning*. Champaign, IL: Human Kinetics.
- Wulf, G., & Lewthwaite, R. (2010). Effortless motor learning? An external focus of attention enhances movement effectiveness and efficiency. In B. Bruya (Ed.), *Effortless attention: A new perspective in attention and action* (pp. 75–101). Cambridge, MA: MIT Press.
- Wulf, G., McNevin, N.H., Fuchs, T., Ritter, F., & Toole, T. (2000). Attentional focus in complex motor skill learning. *Research Quarterly for Exercise & Sport*, 71, 229–239.
- Wulf, G., McNevin, N., & Shea, C. (2001). The automaticity of complex motor skill learning as a function of attentional focus. *The Quarterly Journal of Experimental Psychology*, 54, 1143–1154.
- Wulf, G., Shea, C., & Park, J.-H. (2001). Attention and motor performance: Preferences for and advantages of an external focus. *Research Quarterly for Exercise and Sport*, 72, 335–344.
- Wulf, G., & Prinz, W. (2001). Directing attention to movement effects enhances learning: A review. *Psychonomic Bulletin & Review*, 8, 648–660.