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Human Movement Science

journal homepage: www.elsevier.com/locate/humov

Influence of attentional focus on skilled motor performance: Performance decrement under unfamiliar focus conditions

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ARTICLE INFO

Article history:

Available online xxxx

PsycINFO classification:

2330

2346

3270

Keywords:

Attention

Experience Level

Familiarity

Sports

ABSTRACT

Recent studies have demonstrated that the direction of attentional focus exerts a substantial influence on motor performance. We argue that in well-learned skills, this variable might be confounded with athletes' familiarity with focus conditions. We studied the effect of familiarity and the direction of attentional focus on performance in two experiments using 2 (familiarity) \times 2 (direction) within-subject designs. A significant main effect of familiarity—that is, better performance under familiar compared with unfamiliar focus conditions—confirmed the influence of familiarity on motor performance. Results are consistent with existing concepts, but lead to different consequences when applied to sport and exercise.

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Psychological research reveals a strong interest in understanding the underlying processes that govern skilled motor performance (Ericsson, 2003). In recent years, numerous studies have demonstrated that directing attention during skill execution is a crucial factor for successful skilled performance (e.g., Beilock, Carr, MacMahon, & Starkes, 2002; Castaneda & Gray, 2007; Ford, Hodges, & Williams, 2005; Wulf, 2007a).

One line of research concentrates on the direction of attentional focus by distinguishing between *skill-focused* (on any aspect of the motor action) versus *environmental-focused attention* (on environmental aspects that are not involved directly in skill execution) (e.g., Beilock, Bertenthal, McCoy, & Carr, 2004; Beilock et al., 2002; Ford et al., 2005; Gray, 2004). With reference to stage models of learn-

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ing (Anderson, 1993; Fitts & Posner, 1967; Schneider & Fisk, 1983), this approach assumes that the effects of attentional focus depend on skill level. In early learning phases, it is proposed that explicit cognitive processes are used to control actions in a step-by-step fashion. Hence, directing attention toward skill execution should be helpful for novices. With extended practice, however, the components of the skill become more and more proceduralized and can be executed in an automatic way without constant attentional monitoring (Anderson, 1993; Fitts & Posner, 1967). It is assumed that refocusing attention on proceduralized components can then hinder skilled performance by bringing these components back into working memory and decomposing them into smaller units (Beilock et al., 2002; Ford et al., 2005; Gray, 2004; Masters, 1992; Masters & Maxwell, 2008). This explanation for suboptimal performance in well-practiced motor skills has also been called the *deautomatization-of-skills hypothesis* (Ford et al., 2005).

Assumptions based on the deautomatization-of-skills hypothesis have been confirmed using the dual-task paradigm. For example, Beilock et al. (2004, Experiment 1) examined novice and expert golfers' putting performance under skill-focused and dual-task conditions. In the skill-focused condition, participants were instructed to monitor their swing and attempt to move their club head straight toward the target. In the dual-task condition, they putted while reacting to a series of tones designed to direct attention away from skill execution. As expected, the expert golfers were generally more accurate putters than the novices. Furthermore, novice putting was more accurate under skill-focused than under dual-task conditions, whereas experts showed the opposite pattern. Similar results have been reported for a soccer dribbling task (Beilock et al., 2002; Ford et al., 2005) and a simulated baseball batting task (Gray, 2004).

For highly practiced skills, the deautomatization-of-skills hypothesis suggests that it is beneficial to focus on environmental aspects that are not involved directly in the online control of the movement (e.g., tones or word sequences in the above-mentioned studies). One conclusion for sports situations would be to focus attention on the audience or teammates, or even to try to think of extraneous information. However, another line of research suggests that it might be more beneficial to direct attention toward the effects of the movement on the environment. Studies in this field also address the direction of attentional focus, but they distinguish between an *internal focus* (on one's own body movements) versus an *external focus* of attention (on the movement effects in the environment) (Wulf, 2007a; Wulf & Prinz, 2001). In terms of the deautomatization-of-skills hypothesis, an internal focus is always skill-focused, whereas an external focus can be either skill-focused or environmental-focused but is always a focus toward a movement-induced effect.

Wulf and colleagues have performed numerous studies showing that an external effect-related focus of attention can enhance actual motor performance (see, for reviews, Wulf, 2007a,b). For example, expert golfers demonstrated greater pitch shot accuracy when instructed to use an external focus (on the pendulum-like motion of the club) compared with an internal focus (on the swing motion of the arms) (Wulf & Su, 2007, Experiment 2). This study directed attention toward skill execution in both the internal and external focus conditions. In contrast, attention can also be directed toward temporally and spatially more distal movement effects under external focus conditions (e.g., toward the trajectory of a ball or toward a target). Perkins-Ceccato, Passmore, and Lee (2003) as well as Wulf and Su (2007) have confirmed the external focus advantage for more distal external focus conditions as well.

Wulf and colleagues formulated the *constrained action hypothesis* to explain the external focus advantage (McNevin, Shea, & Wulf, 2003; Wulf, 2007a). They assumed that using an external focus promotes a more automatic mode of movement control, whereas an internal focus constrains the motor system by intervening with "normal" control processes. They supported this view with empirical data on attentional capacity (Wulf, McNevin, & Shea, 2001), frequency of movement adaptations in balance tasks (McNevin et al., 2003), and muscular activity (Zachry, Wulf, Mercer, & Bezodis, 2005).

Castaneda and Gray (2007) analyzed predictions regarding which focus condition increases the probability for successful performance based on both hypotheses (deautomatization-of-skills and constrained action) in a simulated baseball batting task performed by high- and low-skilled players. They confirmed the basic assumptions of both hypotheses. It is important to mention that the high-skilled players attained a higher batting performance when using an environmental-external focus (on the direction of the departing ball) compared to an environmental-irrelevant focus (on the frequency of a presented auditory tone). An environmental effect-related focus might be more beneficial than an

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