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On the advantage of an external focus of attention: A benefit to learning or performance?

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ABSTRACT

Although there is general agreement in the sport science community that the focus of attention (FOA) has significant effects on performance, there is some debate about whether or not the FOA adopted during training affects learning. A large number of studies on the focus of attention have shown that subjects who train with an external FOA perform better on subsequent retention and transfer tests. However, the FOA in these studies was not experimentally controlled during testing. Therefore, the current study used a dart-throwing paradigm in which the FOA was experimentally manipulated at both acquisition and testing over very short and long training times. Performance at test, in terms of accuracy and precision, was improved by adopting an external focus at test regardless of the focus instructed during acquisition, in both Experiment 1 and 2. Although an effect of acquisition focus during testing in Experiment 2 provides some evidence that FOA affects learning, the current data demonstrate a much stronger effect for performance than learning, and stronger effects of attention on precision than accuracy. Theoretical implications of these results are discussed, but in general these data provide a more nuanced understanding of how attentional focus instructions influence motor learning and performance.

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1. Introduction

Coaches, athletes, physical therapists, and performers have known for a long time about the paradoxical effects of attention on performance; introspection, anecdotal evidence, and early experimental data suggest that when attention shifts to *how* a movement needs to be executed, rather than *what* needs to be done, performance suffers as a result (Baumeister & Showers, 1986; Carver & Scheier, 1978; Kimble & Perlmuter, 1970; Martens & Landers, 1972; Masters, 1992; Schneider & Fisk, 1983). One of the first experimental demonstrations of this phenomenon was a study conducted by Baumeister (1984) who showed, in an experiment using a complex visuo-motor task, that directing attention internally (to the motion of the hands) led to worse performance than focusing attention externally (to the motion of the apparatus being controlled). Three follow-up experiments showed that similar decrements in performance were produced by increasing the pressure to perform (e.g., through incentives, audience presence, and the presence of competitors; Baumeister, 1984).

Wulf and Weigelt (1997) studied skill acquisition in novice subjects learning how to use a ski-simulator in a similar experiment. One group of subjects was given explicit instructions about when to exert pressure during the movement in order to maximize the amplitude of side-to-side displacement of the simulator platform. (The goal in riding a ski-simulator is to make oscillatory movements as quickly as possible with the largest possible amplitude, simulating slalom skiing.) The second group of subjects was not given these explicit movement instructions and instead had to discover proper movement form on their own. Both groups started out with similar levels of performance, but after three days of training the group that had been given explicit movement instructions was doing significantly worse than the self-discovery group. Another series of experiments (Wulf, Höβ, & Prinz, 1998) manipulated attention through the verbal instructions given to subjects in a ski simulator task and in a dynamic balance task. In both tasks, instructions directing attention externally (to the effect of the movement on the environment) led to superior performance compared to instructions directing attention internally (to the movement of the body itself) or to control conditions (in which attention was not explicitly manipulated).

This advantage of an external focus of attention (FOA) compared to an internal FOA has since been replicated across a wide range of tasks and subject populations (for reviews see Lohse, Wulf, & Lewthwaite, 2012; Wulf, 2013). Athletic skills such as golf, darts, tennis, soccer, and volleyball have all shown an advantage for an external FOA compared to an internal FOA and often an advantage over control conditions when no specific instructions are given (with internal FOA and control groups performing comparably; Bell & Hardy, 2009; Maddox, Wulf, & Wright, 1999; Marchant, Clough, & Crawshaw, 2007; Wulf, Lauterbach, & Toole, 1999; Wulf, McConnel, Gärtner, & Schwarz, 2002; Wulf & Su, 2007). Many studies have also found an advantage for an external FOA in more rudimentary tasks such as balance (Vuillerme & Nafati, 2007; Wulf, McNevin, & Shea, 2001; Wulf et al., 1998), leaping ability (Porter, Ostrowski, Nolan, & Wu, 2010; Wulf, Dufek, Lozano, & Pettigrew, 2010), and simple force production (Lohse, 2012; Lohse & Sherwood, 2012; Marchant, Greig, & Scott, 2009). Furthermore, the advantages of an external FOA have also been demonstrated in clinical populations, such as patients recovering from stroke, Parkinson's disease, or musculoskeletal injury (Fasoli, Trombly, Tickle-Degnen, & Verfaellie, 2002; Landers, Wulf, Wallman, & Guadagnoli, 2005; Laufer, Rotem-Lehrer, Ronen, Khayutin, & Rozenberg, 2007; Wulf, Landers, Lewthwaite, & Töllner, 2009).

A common finding in studies on FOA is that the advantages of an external FOA are not immediate, but often emerge only later in practice or on delayed retention and transfer tests (e.g., Lohse, 2012; McNevin, Shea, & Wulf, 2003; Wulf & McNevin, 2003; Wulf et al., 1998, 2001). This result has led some researchers to posit that an external focus of attention does not only improve performance, but could improve learning as well (Lohse, 2012; Wulf, 2007; Wulf & Prinz, 2001). Thus, adopting an external focus of attention during training could expedite the learning process.

On the surface, this supposition is confirmed by experimental studies using retention and transfer tests. However, there is often a great deal of difficulty in discriminating an effect on performance from true effects on learning (a problem not unique to FOA research; Tolman & Honzik, 1930). Because learning is not a directly observable phenomenon, it must be inferred from changes in performance over time. Thus, to concretely demonstrate learning, experimenters must be certain that factors other