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Letter to the editor concerning the article "Performance of gymnastics skill benefits from an external focus of attention" by Abdollahipour, Wulf, Psotta & Nieto (2015)

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Abstract

Abdollahipour, Wulf, Psotta, & Nieto (2015) recently published data in *Journal of Sports Sciences* to show that an external focus of attention promotes superior performance effects (gymnastics jump height and judged movement form score) when compared to internal or control foci during skill execution without an implement involved. While we do not contest the veracity of findings reported, nor others that have been used to support beneficial effects of an external focus of attention, in this Letter to the Editor we comment on considerable methodological limitations associated with this and previous studies which, we suggest, have resulted in serious theoretical oversights regarding the control of movement and, most crucially from our practitioner perspective, suboptimal recommendations for applied coaching practice. Specifically, we discuss the lack of consideration towards translational research in this area, the problematic nature of attentional focus cues employed, interpretation of findings in relation to other applied recommendations and coherence with mechanistic underpinning and finally, the representative nature of task involved. In summary, while (laboratory) research evidence may appear to be conclusive, we suggest that focus of attention effects are in need of more ecologically valid and rigorous testing and consideration of current coaching practices *if* it is to optimally serve the applied sporting domain that it purportedly aims to.

Keywords: Holistic cues, Imagery, Motor control, Sports coaching, Translational research

Letter to the editor concerning the article "Performance of gymnastics skill benefits from an external focus of attention" by Abdollahipour, Wulf, Psotta & Nieto (2015)

In a recent study, Abdollahipour, Wulf, Psotta, and Palomo Nieto (2015) aimed to investigate attentional focus effects in skills that do not utilise implements (e.g., a golf club) and that are evaluated on movement quality. Specifically, the task was a gymnastics vertical jump with a 180-degree turn while airborne. In similar fashion to many previous studies (see Wulf, 2013), the research design compared performances when participants employed internal, external and control (i.e., no instruction) foci. Accordingly, support was found for the constrained action hypothesis (Wulf, McNevin, & Shea, 2001) which underpins much (if not all) of this research group's data interpretation; results showed significantly higher performance scores (i.e., fewer points deducted) and jump height when employing an external focus of attention, with no differences between the internal and control group. As such, the authors claimed "*it is now clear* [emphasis added] that the attentional focus effect is independent of the type of task, in addition to its generalisability across level of expertise, age, dis/ability etc." (pp. 1811–1812). However, following critical reflection on several factors, we believe that caution must be raised when accounting for the mechanistic explanation for these findings and when proposing implications for applied coaching practice. In short, the conclusions drawn are not as 'clear' as the authors portray.

Firstly, the authors present a lack of consideration towards translational research which encourages athletes to focus on internal cues. Instead, Abdollahipour et al. (2015) focus discussion on theory and laboratory/fundamental research findings (e.g., Kal, van der Kamp, & Houdijk, 2013; Land, Frank, & Schack, 2014; Wulf, Höß, & Prinz, 1998) that have almost ubiquitously concluded that "if attention is directed towards body movements . . . skill learning is impeded relative to instructions that direct attention to the intended movement effect" (p. 1807). Such omission is a substantial oversight when contextualising attentional

focus research within representative coaching environments and the challenges it presents. In this regard, Christina (1987) stressed over 25 years ago that applied research should not in fact be viewed as subordinate and dependent on theory-driven study; therefore suppressing its importance and contribution to theory *building*. As he explains:

> Some of us fail to realize that specialized knowledge can be developed solely by applied research at Level 2 [theory developed *for* practical settings] in places where the theory-based knowledge of Level 1 [general theory *of* motor control] is not adequately advanced. . . . If we are fortunate enough to develop a new idea or hypothesis, or discover some new information from our applied research either at Level 2 or Level 3 [solution-focussed without intention of theory building], its contribution to fundamental motor learning knowledge can be evaluated by subjecting it to the rigor of controlled laboratory testing of basic research at Level 1. [There are pros and cons to the progression from applied to basic research, or the other way round. However,] in this way applied research can contribute to basic research. (pp. 37–38)

Indeed, elite-level athletes report beneficial effects from focussing on aspects of the movement (e.g., Bernier, Trottier, Thienot, & Fournier, 2015; Carson, Collins, & MacNamara, 2013; MacPherson, Collins, & Morriss, 2008; Nyberg, 2015; Orlick & Partington, 1988; Robazza & Bortoli, 1998) and, sport psychologists often employ explicit movement imagery techniques to enhance competitive performance (e.g., Carson, Collins, & Jones, 2014; Collins, Morriss, & Trower, 1999; Martindale & Collins, 2012; Wang & Zhang, 2015). Accordingly, failure to contextualise the study within current coaching/sport psychology practices, or to explain *why* athletes' perceptions are apparently wrong, surely limits the paper's ability to serve its purpose in a purportedly applied discipline.

Furthermore, individual preferences for internal foci are clearly apparent in the literature. For example, Maurer and Munzert (2013) highlight the 'familiarity' of task instructions as a factor which can influence levels of automatisation in high-level athletes. In their study of skilled basketball players, free-throw executions were more successful when implementing individually-preferred (i.e., inter-individually different) familiar versus unfamiliar foci irrespective of direction (internal or external). Moreover, 18 out of 23 players expressed a preference for an internal self-focus (e.g., fluent leg–arm co-ordination), indicating that such attentional strategies may have become essential subroutines, or sources of information (MacPherson, Collins, & Obhi, 2009), for achieving whole skill activation; that is, a *highly-associated* pattern of network activation or chunking (cf. Paivio, 1971, 1986). While the issue of preference has been addressed in other attentional focus literature with non-elite populations (e.g., Weiss, Reber, & Owen, 2008; Wulf, Shea, & Park, 2001), it has been assessed using experimenter-determined internal or external foci and *not* by providing participants autonomy to select their own attentional strategies.

Such relevance also extends to the onset of instructed attentional focus "after the half turn," where it is possible that experienced gymnasts would prepare aspects of the execution prior to ground take off in airborne skills. For example in the study by Bernier et al. (2015) one elite-level ice skater reported "during the approach to the jump, actually, I'm doing the jump in my head: I have the same sensations in my body, and I feel like I'm doing it in my upper body and hips [i.e., a whole body/holistic internal focus]." Once again, the internal focus condition in Abdollahipour et al. (2015) presents not only a task-irrelevant focus, but has the potential to be unfamiliar in that it may conflict with useful imagery that is ordinarily employed (cf. our comments in the previous paragraph).

Secondly, the nature of the instructions are problematic in their categorisation (i.e., internal and external) and operationalisation of focus. The internal focus, "While airborne,

focus on the direction in which your hands are pointing after the half turn" (p. 1809), surely constitutes a task-irrelevant instruction (cf. Winter & Collins, 2013). By comparison, the external focus instruction, "While airborne, focus on the direction in which the tape marker is pointing after the half turn" (p. 1809), is a clear outcome focus that directly facilitates the task. As such, and as was the case made by Winter and Collins, the paper presents an unfair comparison between an entirely irrelevant and an outcome-creating focus. This is, in fact, not uncommon within the attentional focus literature. For example, Beilock, Bertenthal, McCoy, and Carr (2004) asked participants to focus on the putter path direction during a golf putt, which has subsequently been found to account for only 17% of outcome variance amongst elite-level golfers (cf. Karlsen, Smith, & Nilsson, 2008). Similarly, Bell and Hardy (2009) asked golfers to focus specifically on the wrist hinge angle through impact; that is, a subcomponent at the end of a complex kinematic chain and during the fastest moment (and therefore most likely to be under higher subconscious control) during the action (cf. a European Tour golfer's comments about not attending to small movement components but instead to larger and grosser ones; Carson et al., 2013). Accordingly, it is hardly surprising that the foci most likely to generate the required outcomes are the ones that win out. In simple terms, such investigations are comparing apples with oranges.

Indeed, and in the absence of explicit instructions for the control condition (participants were left to their own devices), manipulation checks or even enquiry into participant perceptions, we are left unsure exactly what is being contrasted with what. It is entirely possible, reflecting the inter-individual preferences discussed above, that participants in the control condition used an almost random mix (between individuals) of internal and external foci.

Thirdly, the authors advise that identifying an appropriate external focus might be a challenge for athletes and coaches during skill execution when an implement is not involved;

that is, in contrast to target-oriented sports where a clear trajectory end-point can be discerned (e.g., archery). Consequently in such practical situations, it is explained that the athlete can employ a metaphor instead (cf. Wulf, Lauterbach, & Toole, 1999), which serves the *same purpose* as an external focus of attention because it provides "a mental image of the movement goal that the performer can try to produce without directing attention to body movements per se" (p. 1812). To exemplify such metaphoric thinking, the authors draw on the work of Guss-West and Wulf (2015) to describe how ballet dancers report the use of images to inform positions or moves, for instance "stretching like a star in all directions" when performing an arabesque, "climbing up a corkscrew" during a pirouette or "jumping over a lake" while performing a grand jeté. Indeed, the use of metaphor has been widely encouraged amongst sport practitioners as an effective execution strategy (e.g., Overby, Hall, & Haslam, 1998; Ruiz & Hanin, 2004). Crucially, however, we raise doubt over the mechanistic equivalence that metaphors share with an external focus of attention. According to the constrained action hypothesis:

> when attending to body movements, the performer constrains his or her motor system by using conscious control processes that interfere with automatic control mechanisms. In contrast, when attention is directed at the intended movement effect, automatic–that is, unconscious, fast and reflexive–processes are utilised, with the result that motor performance is enhanced (Abdollahipour et al., 2015, p. 1807)

When a metaphor is used, the athlete often reports translation of the entire visual image (although metaphors need not only be visual) into kinaesthetic, and sometimes auditory, sensations, or "interpretive descriptors" (Hanin & Stambulova, 2002, p. 401); thus supporting the optimal use of multisensory information in guiding a most vivid and, crucially, personally meaningful motor plan (cf. Ernst & Banks, 2002; Holmes & Collins, 2001). Therefore, it is difficult to explain how a metaphor is *not* consciously controlled by drawing attention

172 towards the movement form in a way that holds personal meaning to the individual (i.e., what
173 the experience would be like when executed). We suggest that one rationale for using a
174 metaphor, and indeed holistic thoughts, is to consciously raise awareness towards the *entire*
175 movement as opposed to an individual component part. In this regard, the cue is more a
176 *source of information* about the holistic execution and/or sensory consequences of the
177 movement (MacPherson et al., 2009). Consequently, metaphoric/holistic thoughts serve to
178 enhance memory recall of a whole skill and, buffers against the onset of maladaptive
179 cognitions during execution (Winter, MacPherson, & Collins, 2014). Indeed, focusing on
180 individual movement components *has* been shown to be almost inevitably detrimental to
181 performance when compared to holistic rhythm-based cues (e.g., MacPherson et al., 2008;
182 Mullen & Hardy, 2010). Accordingly, the crucial factor in this debate appears to be on *what*
183 and *how* an internal focus is applied, and is dependent on the movement's organisation and
184 level of establishment within an individual's long-term memory (see Carson & Collins,
185 2015).

186 Fourthly, the authors state in their final remarks that "for *sequences* [emphasis added]
187 of ballet or gymnastics moves, series of external focus cues, or metaphors, *might* [emphasis
188 added] be an effective way to enhance overall performance" (p. 1812). Not only does this
189 conclusion hold less strength compared to a previous comment that "it is now clear that the
190 attentional focus effect is independent of the type of task" (pp. 1811–1812), it is also
191 inconsistent with the experimental task demands reported. As with much of the research
192 reported in this area (e.g., An, Wulf, & Kim, 2013; Land et al., 2014), executions do not
193 accurately represent the level of difficulty/context experienced within the performance
194 domain (in this case a single skill element versus a sequence of elements lasting several
195 minutes). As such, for the sample described (i.e., "experienced gymnasts," p. 1809), the task
196 is undoubtedly simple enough as to be completed entirely under automated control

(Christensen, Sutton, & McIlwain, in press). Therefore, *any* request to focus attention on what is happening will almost inevitably prove disruptive. Furthermore, challenges experienced during competitive performances are somewhat different to those in practice; in fact, it has been suggested that some form of performance problem is almost inevitable during competitive trampolining/acrobatics (Hauw & Durand, 2007). According to Hauw and Durand's study, "results suggest a complementary conception of performance as being linked to the ability (a) to cope with problems surging up in the course of action and (b) to make sensible adjustments throughout its unfolding" (p. 182). Similarly to freeskiers in Nyberg (2015), trampolinists retain an awareness of their action sequence during on-line skill execution. These thoughts may not be computationally demanding but they may serve as an 'attentional check' and are undoubtedly internal in nature. We are led towards the initial challenge of asking an experienced driver to provide a commentary on his/her actions or even to respond verbally to a simple request such as "what gear are you in?" Once again, the point of comparison seems somewhat loaded to generate the answer required.

In highlighting these concerns, we acknowledge that such issues are nothing new in sport science research. For example, Goginsky and Collins (1996) showed how a series of methodological decisions in the design of mental practice studies could lead to outcomes supportive of one or the other of two competing paradigms at the time. Even a change in control group design led to different results. We are not suggesting that this is in any way deliberate or Machiavellian. Rather that, especially in environments which carry (or at least are supposed to carry) applied implications, a more careful and context-valid set of parameters should be applied to investigative design.

In fact, there appears to be considerable confusion around certain aspects of focus; illustrative perhaps of the inevitable shades of grey when addressing human behaviour. In a recent response, for example, Wulf herself illustrates this confusion:

> Clearly, elite athletes are typically acutely aware of their body movements. . . . Adopting an external focus does not mean that the performer is not aware of her or his body movements. (How would that even be possible?) It simply means the performer is focusing on the intended movement effect – while *preparing for the execution* of a ballistic skill (e.g., throwing or hitting a ball) or *during the execution* of a continuous skill (e.g., balancing, swimming, cross-country skiing). Adopting an external focus is related to the *planning* of the movement, but has nothing to do with the processing of intrinsic feedback or bodily awareness, or lack thereof. (Wulf, 2015, p. 4)

Does this mean that an internal focus is/should be only associated with movement preparation? Or should we accept the first statements that performers will, of course, be aware of what is happening to their body during movement execution (how could they not be?). It seems to us that various combinations of external and internal focus (of particular types as suggested by much of the literature cited in this letter) will be appropriate, for different tasks, different purposes, with different individuals at different levels and (most crucially) for different purposes. Any black and white statement on whether an internal or external focus is required seems, to us at least, impossible to call. Perhaps a more beneficial direction for research would be to delineate the circumstances under which varying proportions of foci would be optimal; as reflected in the approaches by Brick, MacIntyre, and Campbell (2014) in endurance activity (i.e., discriminating between different types of internal focus) and Carson and Collins (2011) when implementing refinements to already learnt and well-established skills (i.e., explaining that a narrow internal focus is essential to initiate the refinement process).

In summary, we have raised several issues pertaining to the study by Abdollahipour et al. (2015). We would also, however, generally extend these to other research seeking to explore attentional focus effects. Our concern is not with the veracity of findings reported,

247 rather, on methodological limitations which, we suggest, have resulted in serious theoretical
248 oversights regarding the control of movement and, suboptimal recommendations for applied
249 coaching practice. Specifically, we have discussed the lack of consideration towards
250 translational research in this area, the problematic nature of attentional focus cues employed,
251 interpretation of findings in relation to other applied recommendations and coherence with
252 mechanistic underpinning and, the representative nature of task involved. While (laboratory)
253 research evidence may appear to be conclusive, our arguments suggest that focus of attention
254 effects are in need of more rigorous testing and consideration of current coaching practices *if*
255 it is to optimally serve the applied sporting domain that it purportedly aims to.
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