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

9  
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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

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

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

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

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

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

88 Indeed, elite-level athletes report beneficial effects from focussing on aspects of the  
89 movement (e.g., Bernier, Trottier, Thienot, & Fournier, 2015; Carson, Collins, &  
90 MacNamara, 2013; MacPherson, Collins, & Morriss, 2008; Nyberg, 2015; Orlick &  
91 Partington, 1988; Robazza & Bortoli, 1998) and, sport psychologists often employ explicit  
92 movement imagery techniques to enhance competitive performance (e.g., Carson, Collins, &  
93 Jones, 2014; Collins, Morriss, & Trower, 1999; Martindale & Collins, 2012; Wang & Zhang,  
94 2015). Accordingly, failure to contextualise the study within current coaching/sport  
95 psychology practices, or to explain *why* athletes' perceptions are apparently wrong, surely  
96 limits the paper's ability to serve its purpose in a purportedly applied discipline.

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

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

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

122 focus on the direction in which your hands are pointing after the half turn” (p. 1809), surely  
123 constitutes a task-irrelevant instruction (cf. Winter & Collins, 2013). By comparison, the  
124 external focus instruction, “While airborne, focus on the direction in which the tape marker is  
125 pointing after the half turn” (p. 1809), is a clear outcome focus that directly facilitates the  
126 task. As such, and as was the case made by Winter and Collins, the paper presents an unfair  
127 comparison between an entirely irrelevant and an outcome-creating focus. This is, in fact,  
128 not uncommon within the attentional focus literature. For example, Beilock, Bertenthal,  
129 McCoy, and Carr (2004) asked participants to focus on the putter path direction during a golf  
130 putt, which has subsequently been found to account for only 17% of outcome variance  
131 amongst elite-level golfers (cf. Karlsen, Smith, & Nilsson, 2008). Similarly, Bell and Hardy  
132 (2009) asked golfers to focus specifically on the wrist hinge angle through impact; that is, a  
133 subcomponent at the end of a complex kinematic chain and during the fastest moment (and  
134 therefore most likely to be under higher subconscious control) during the action (cf. a  
135 European Tour golfer's comments about not attending to small movement components but  
136 instead to larger and grosser ones; Carson et al., 2013). Accordingly, it is hardly surprising  
137 that the foci most likely to generate the required outcomes are the ones that win out. In  
138 simple terms, such investigations are comparing apples with oranges.

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

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

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

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

166 When a metaphor is used, the athlete often reports translation of the entire visual image  
167 (although metaphors need not only be visual) into kinaesthetic, and sometimes auditory,  
168 sensations, or “interpretive descriptors” (Hanin & Stambulova, 2002, p. 401); thus supporting  
169 the optimal use of multisensory information in guiding a most vivid and, crucially, personally  
170 meaningful motor plan (cf. Ernst & Banks, 2002; Holmes & Collins, 2001). Therefore, it is  
171 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

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

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

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

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

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

244 In summary, we have raised several issues pertaining to the study by Abdollahipour et  
245 al. (2015). We would also, however, generally extend these to other research seeking to  
246 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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