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REVIEW ARTICLE

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Motor Performers Need Task-relevant Information: Proposing an Alternative Mechanism for the Attentional Focus Effect

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ABSTRACT. Research has repeatedly suggested that an external focus of attention is far superior to an internal focus of attention in motor learning and performance. Such findings have been explained through the lens of automaticity, as focusing externally on something outside your body should promote efficient and subconscious execution of any given motor action. In this paper, I critically review evidence and propose an alternative mechanism to explain why various foci are effective. Information, and its relevance to the task at hand, are at the center of this alternative view. The strong conclusions recently put forth in favor of an external focus, and the dismissal of all internal foci, appear unfounded. Researchers and practitioners should keep exploring attentional strategies that promote task-relevant information attunement.

Keywords: attentional focus, motor learning, motor performance, information, instructions

Introduction

Recently, Chua et al. (2021) published a review that claims to cement one of the more consistent findings in sport science over the last decades: an *external focus* (EF) leads to superior learning and performance, compared to an *internal focus* (IF) of attention in motor tasks. This is often referred to as the *attentional focus effect* (Wulf, 2013). Specifically, asking participants to focus on something outside themselves—whether it is a movement effect or an external target—is more effective than asking them to focus on their body or the movement itself, according to an impressive number of studies. To exemplify, past studies suggest that a golfer about to hit a shot should direct attention externally to the club swing, rather than the internal arm swing (Wulf et al., 1999; Wulf & Su, 2007).

Despite the overwhelming literature championing EF over IF cues, expert performers and coaches themselves often use internal cues (Diekfuss & Raisbeck, 2016; Porter et al., 2010). The fact that the sport community has not embraced EF cues, at least not to the extent that certain proponents would suggest, is intriguing. One reason could be the human tendency of clinging to traditions, since an EF is still a relatively new idea in cognitive psychology (Wulf, 2016). Another option, however, may be that the evidence in support of external focus cues is unsatisfactory, and the tests of external versus internal focus described in the literature have not been fairly conducted and adequately explained (Collins et al., 2016; Montero et al., 2018).

Main mechanisms that have been proposed to explain the superiority of EF have to do with automaticity. For example, the *constrained-action hypothesis* (CAH; Wulf et al., 2001) suggests that EF works by moving the performer's attention away from one's body, toward the end goal of the task execution. It promotes an "automatic mode of control by utilizing unconscious, fast, and reflexive control processes" (Saemi et al., 2013, p. 180). Conversely, an IF should be suboptimal by promoting conscious control directed at execution itself. Based on this mechanism and the empirical evidence, EF should be superior in motor contexts, "independent of the type of task" (Abdollahipour et al., 2015, p. 1812), "whether considering tests of motor performance or learning, and regardless of age, health condition, and level of skill expertise" (Chua et al., 2021, p. 618), with "no room for internal foci" (Wulf, 2016, p. 1294).

These conclusions, and the proposed mechanism behind them, are the disputable elements that inspired this paper. By replacing the CAH with an alternative explanation, I hope to shed new light on how EF indeed should be beneficial in many cases, but also the fact that past studies have serious shortcomings.

Other scholars have provided critiques of automaticity (e.g., Christensen et al., 2016; Pacherie & Mylopoulos, 2021), and the breadth of the attentional focus effect specifically (Collins et al., 2016; Montero et al., 2018), insofar as these concepts are non-exhaustive or unsatisfactory explanations of how we reach higher levels of motor performance. Thus, I will take a more direct approach in this paper by proposing an alternative mechanism that can account for various effects of EF and IF, and illustrate that past studies have used flawed instructions. To foreshadow, I will focus on cues as sources of information and claim that task-relevant information is the main

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factor that will determine whether a cue is beneficial or not. I will review past evidence and mainly, yet not exclusively, focus on sport studies cited in Chua et al. (2021), for a few reasons. First, the majority of studies included in the review by Chua et al. have employed a sports-related task. Second, as a sport scientist it is feasible to critically assess studies related to the execution of sport skills, which also tend to have clear outcomes (i.e., assessing sport task success is relatively straightforward).

In the next section, I briefly operationalize and contextualize the concept of task-relevant information. I subsequently use this concept to provide alternative explanations to findings on the attentional focus effect.

Theoretical Underpinnings of Information and Task-relevance

Information as a construct has a special place in many branches of psychology, including two that are often seen as opponents: ecological psychology and information processing approaches. In the ecological approach to perception and action (Gibson, 1979), *specifying information* is the physical properties that allow us to make sense of the world (Wilson et al., 2018). Perception and action are tightly coupled in this view, to the extent that we can move and act intelligently, purely based on the information that the world offers us. Perceivable cues, whether they come from the sports field (e.g., the visible golf hole 100 yards away) or an instructor (telling you to focus externally on club swing) function as *constraints* (Chow, 2013; Otte et al., 2020), as they provide guidance and information about opportunities for certain actions (e.g., a full swing with an eight iron) at the expense of other action opportunities (e.g., hitting a long drive). To become skillful actors, we must *attune* to information and educate our attention to those aspects that promote our context-specific goals (Abernethy et al., 2008; Oudejans et al., 2005). In sum, the information to complete any given motor task is "out there," and we may learn to use it in more or less optimal ways.

According to information processing approaches, information must pass through various components of our cognitive capacities in our brain before we can make sense of it and use it to serve our goals (Atkinson & Shiffrin, 1968; Sternberg, 1983). The incoming information itself, however, is also important in this view since we learn to associate stimuli with certain responses (Atkinson et al., 1967). Performance is facilitated by stimuli being discriminable and compatible with our responses (Fitts & Posner, 1967; Kahneman, 1973). Following this logic, an athlete should preferably understand the meaning of an instructional cue, and the cue should be appropriate for the motor output. As argued in later sections, this may not always be the case in studies of attentional focus.

Vicente and Wang (1998), inspired by J. J. Gibson and ecological psychology, proposed that expert performance is facilitated when (1) there is a presence of task-relevant constraints, namely stimuli in the environment that are not random, but rather related to one another and task success, and (2) experts attune to these constraints. Such criteria, originally proposed to explain expertise effects in a specific aspect of information processing (i.e., memory recall; Vicente & Wang, 1998), may also be used to explain aspects of expertise in sports (Abernethy et al., 2008; Abernethy & Zawi, 2007). Becoming a better athlete involves an improvement in one's ability to pick up task-relevant information from various cues (Mann et al., 2007; Müller et al., 2006). This notion is also captured in the *Mesh* theory of cognition in skilled action, as "expert awareness will be selective, highly shaped to task demands, and may often 'roam' or 'float' as it flexibly and anticipatively seeks out important information" (Christensen et al., 2016, p. 62). Such selective attention is a skill that must be developed, and this is where the coach or instructor comes in to educate their learners' attention. Hence, the question of which attentional cues they give to their athletes via instructions is a crucial one.

Inspired by Vicente and Wang's (1998) notions of constraints, I define task-relevant information as meaningful (nonrandom) stimuli that facilitate task success. What "success" is, will naturally depend on several factors, but in this context, given the broad conclusions in Chua et al. (2021), it can entail optimal motor learning or performance in any given motor task. My claim is that motor performers will benefit from instructional cues that guide attention toward task-relevant information, regardless of whether the cues are internal or external. This claim will be used to explain several findings in the focus of attention literature, in a different way than what is often provided by its proponents. Specifically, I will discuss studies showing benefits of both EF and IF, respectively, and finally how studies have involved unequal amounts of task-relevant information in their opposing conditions.

EF and IF May Both Promote Task-relevant Information Attunement

Support for EF

The fact that EF facilitates learning and performance in many sport contexts seems indisputable. The simplest explanation for why that is, could be the fact that relevant information is often found in the external environment. Fittingly, a substantial number of studies have employed a *target-directed aiming task*, in which performers try to hit a visual target right in front of them. Such studies recently reviewed by Chua et al. (2021), and their task instructions, are exemplified in Table 1.

TABLE 1. Examples of attentional cues in target-directed aiming tasks in sports contexts, cited in Chua et al. (2021).

Task	EF instruction excerpt	IF instruction excerpt
Volleyball serve (Wulf et al., 2002, Exp. 1)	• "Toss the ball straight up. • Imagine holding a bowl in your hand and cupping the ball with it to produce a forward rotation of the ball. • Shortly before hitting the ball, shift your weight toward the target. • Hit the ball as if using a whip, like a horseman driving horses." (p. 174)	• "Toss the ball high enough in front of the hitting arm. • Snap your wrist while hitting the ball to produce a forward rotation of the ball. • Shortly before hitting the ball, shift your weight from the back leg to the front leg. • Arch your back and accelerate first the shoulder, then the upper arm, the lower arm, and finally your hand." (p. 174)
Lofted soccer pass (Wulf et al., 2002, Exp. 2)	• "Strike the ball below its midline to lift it; that is, kick underneath it. • Be behind the ball, not over it, and lean back. • Stroke the ball toward the target as if passing to another player. • Use a long-lever action like the swing of a golf club. before contact with the ball • To strike the ball, create a pendulum-like motion with as long a duration as possible." (p. 178)	• "Position your foot below the ball's midline to lift the ball. • Position your bodyweight and the nonkicking foot behind the ball. • Lock your ankle down and use the instep to strike the ball. • Keep your knee bent as you swing your leg back, and straighten your knee before contact. • To strike the ball, the swing of the leg should be as long as possible." (p. 178)
Basketball free throw shooting (Zachry et al., 2005)	"… concentrate on the center of the rear of the basketball hoop" (p. 306)	"… concentrate on the "snapping" motion of their wrist during the follow-through of the free throw shot" (p. 306)
Dart throwing (Marchant et al., 2009)	"… focus on the center of the dartboard, and toss the dart when focused." (p. 492)	"… focus on the movement of the arm as the dart is drawn back and during the throw, then focus on the release of the dart at the end of the throw." (p. 492)
Air pistol shooting (Hosseiny et al., 2014)	"… concentrate on the front sight and observe its movements toward the target … " (p. 1247)	"… focus on the appropriate muscle contraction in shoulder … " (p. 1247)
Puck shooting (Agar et al., 2016)	"Instructions, cues, and feedback … were directed at the target, puck, shuffleboard stick, and the puck's course." (p. 643)	"Instructions were focused on body position, movements of the shoulder, stepping of the foot, pushing of the arm, and position of fingers (grip)." (p. 644)
Soccer chipping (Gredin & Williams, 2016)	"When kicking the ball, next to the side of the ball, place your non-kicking shoe. Imagine holding a shovel in your kicking shoe and sharply hit the bottom of the ball with it and, as if passing the ball to another player, try to make the ball-fly spinning backwards." (p. 90)	"When kicking the ball, place your left/right foot next to the side of the ball. Lift back the heel of your right/left foot and then quickly bring your foot forward and, with the lower part of the foot, sharply kick the bottom of the ball." (p. 90)

As seen in the EF examples, the factor most often referred to is the target, which arguably contains the most critical information. From this perspective of task-relevant information, it is unsurprising that a darts study by Marchant et al. (2009), for example, found EF benefits when participants focused on the center of the dartboard. The latter cue promotes visual attunement to indispensable information in darts.

Taking the role of the devil's advocate, one could argue that the information in the IF examples is not completely irrelevant in the respective target-directed tasks. In darts for example, an internal arm focus (Lohse et al., 2010, 2014; Marchant et al., 2009) may involve useful information. While this may be true, the external information is relatively irreplaceable by comparison. Given the fact that darts and other sporting tasks involve numerous body parts, which can all provide information, and the fact that one can perform well with several different movement trajectories, the bullseye is more of an invariant (one-to-one) and a nonrandom stimulus than any moving limb. Put simply: you may move your arm in many different ways, but you better hit the target. The motor system is characterized by multiple degrees of freedom spread across the various body joints, and certain motion trajectories may show substantial variation and still allow for success under given task constraints (Latash et al., 2007; Scholz & Schöner, 1999). Indeed, expert movements are often characterized by functional *movement variability* (Bartlett et al., 2007; Orth et al., 2017), yet low outcome variability in the form of consistent results.

Despite some confusion as to *when* the EF or IF should be attended to, the consensus seems to be that the movement planning stage is the most relevant for such attentional foci (Montero et al., 2018; Wulf, 2013). In other words, the basketball shooter should primarily attend to the external target (the hoop) when *planning* and preparing for the shot at the free-throw line. This further speaks to the logic of why EF is beneficial, as most efficient planning strategies happen "backwards." We tend to start with the end goal (where we want to go), before defining sub-goals (how we shall get there). This is true during goal setting, on the sports field, and in our daily lives. We are goal-driven creatures, and the end goal is the most crucial starting point in any planning process—it is what shapes other goals and actions that go along with it. This should speak in favor of EF during target-directed sports, as EF cues seem more related to the end goal, which may promote a more efficient planning process than any IF. For the free-throw shooter, the hoop is the final destination. Directing attention toward such an EF provides an excellent starting point in the planning toward task completion.

Many target-directed sports involve discrete tasks, such as darts and basketball free-throw shooting, but the concept of planning applies to continuous tasks as well. First, a substantial amount of planning goes on *before* the performer starts executing any skill, and the attentional focus cue can affect the performer's *intentionality* (e.g., what the runner intends to do in the race that is about to start; Breivik, 2018). Second, there can be continuous planning going on throughout continuous tasks, and an EF may allow for better continuous planning by directing the performer toward continuous "end goals". In the early ski-simulator study by Wulf et al. (1998), for example, the EF instructions encouraged performers to "exert force on the outer wheels" (p. 172), located on both sides of the simulator, giving them a clearer idea of end targets throughout the trials, as compared to IF instructions that told participants to "exert force on the outer foot" (p. 172). Motor performers have the ability to *self-organize* movements based on constraints (Passos et al., 2013). EF cues may provide clear constraints and allow for functional self-organization toward end targets.

The information needed for backwards planning can also be used to explain the *distance effect* in EF research (McNevin et al., 2003; Wulf, 2013). Namely, focusing on a *distal* external target, that is further away, seems more effective than attending to something closer to you, namely a *proximal* target. For example, a relative benefit has been found for focusing on (a) the finish line, as opposed to the paddle, in kayaking (Banks et al., 2020); (b) the ball flight/direction, as opposed to the clubface, in golf (Bell & Hardy, 2009); (c) a visible cone three meters ahead, as opposed to the starting line, in standing long jump (Porter et al., 2013). In sum, distal EF cues tend to contain information that is relevant for efficient planning toward distal targets.

Support for IF

Strong conclusions aside, EF has not always proved superior in studies of attentional foci (e.g., Maurer & Munzert, 2013; Neumann et al., 2020; Perkins-Ceccato et al., 2003). And while target-directed aiming tasks are well represented in the current literature, there are tasks that may favor more internal foci. In several motor tasks, for example, one's body form or feedback (proprioception) remains particularly important for task success. Such sports are underrepresented in the focus of attention research, and include various disciplines of dance and gymnastics, ski jumping, diving, and figure skating.

A single study was found in the review by Chua et al. (2021), in which movement form was explicitly explored in a task that did not involve a visible aiming target. Here, Lawrence et al. (2011) recruited non-gymnasts (with zero experience) to perform a gymnastics floor routine. Three focus cues were used (Lawrence et al., 2011, p. 434): task-relevant IF ("… focus on exerting an equal force on their feet, keeping their arms out straight, level with their shoulders."), irrelevant IF ("… focus attention on their facial muscles and facial expressions while performing the routine."), and an EF ("… focus on their movement pathway as well as to exert an even pressure onto the support surface."). Overall, no effect of foci was found on retention and transfer of the routine. Interestingly, the EF group performed worse, while the irrelevant IF group showed improvement during acquisition. However, several aspects of this study make generalizability challenging. As noted by the authors themselves, participants received a substantial load of information packed into the task-relevant instructions. The novices who received the simpler task-irrelevant instructions (focus on facial muscles/expression), in addition to the general video instructions that all participants received, were likely less overwhelmed at the beginning of acquisition trials in this complex task. Balancing information between instructions is a major challenge which I discuss in later parts of this article.

The only study that has explicitly controlled and varied the pertinence of proprioceptive information in motor performance was conducted by Gottwald et al. (2020). Over several laboratory experiments, they found that an IF produced superior movement accuracy in a computerized aiming task, with visual information fully (Exp. 1) or partly (Exp. 2) available, and they even found more efficient muscular activity (as measured by electromyography (EMG); Exp. 3) during IF, as compared to an EF. The instructions in these experiments were well-balanced and comparable. For instance, in the first two experiments, participants were instructed to "focus on the fluid motion of their hand" (IF) or to "focus on the fluid motion of the pen" (EF). These experiments suggest a role for IF in certain (proprioceptive) tasks, but they should be followed up by more ecologically valid studies.

Yet, sport studies have also demonstrated positive effects of task-relevant IF cues on rowing ergometer performance (Neumann et al., 2020) and golf pitching (Perkins-Ceccato et al., 2003) at lower skill levels. Neumann et al. (2020) recruited participants with no formal rowing experience and found that IF instructions encouraging them to exert force via various body parts, and also to focus on breathing and overall technique, led to a greater distance and power output on the rowing ergometer, as compared to EF instructions that asked participants to focus on various ergometer components. Focus on internal force exertion seems relevant for powerful and continuous exercises such as ergometer rowing, where the body provides rich feedback throughout the trials and fatigue plays an important role (Hutchinson & Tenenbaum, 2007). Further, Perkins-Ceccato et al. (2003) found more consistent pitching performance in low-level golfers (mean handicap = 26) when using an IF, while high-level golfers (mean handicap = 4) were more consistent with EF. Interestingly, the IF manipulation involved an encouragement to "concentrate on the form of the golf swing and to adjust the force of their swing depending on the distance of the shot" (p. 596). This is a more holistic instructional approach, and thus potentially more effective (Winter et al., 2014), as compared to the commonly described IF instructions of asking golfers to focus on a subcomponent in the form of arm motion (Bell & Hardy, 2009; Wulf et al., 1999; Wulf & Su, 2007).

Finally, it should also be taken into account that a number of studies have found no differential effect of EF and IF on sports performance, especially in high-level performers (Andrade et al., 2020; Bezodis et al., 2017; Maurer & Munzert, 2013; Porter & Sims, 2013; Wulf, 2008). In one such study, Maurer and Munzert (2013) found that performance was consistently better with familiar cues, regardless of whether they were internal or external, in basketball players at the junior national team level (Exp. 1) and novice golfers (Exp. 2). This suggests an important role of individualized attunement to information. It also hints at a problem in the current attentional focus literature, as most studies do not allow participants to come up with their own cues or at least choose a cue that they would normally use. Furthermore, higher-level performers such as experienced distance runners typically report focusing on their bodies (for example by monitoring their breathing or bodily signals), although their cues may be classified by terms other than merely IF or EF (e.g., Masters & Ogles, 1998; Raisbeck et al., 2018). Advanced performers seem willing to adopt a cue as long as it can be a "source of information" (Collins et al., 2016, p. 1290) that is relevant for their individual needs. Taken together, the existing literature proposes that there is more to the IF story than what the strong conclusions by Chua et al. (2021) and Wulf (2016) suggest.

Critique of Past Studies

The information in the IF versus EF conditions has not always been fairly balanced, as will be explored in this final section.

Several EF Conditions Promote Attunement to More Specific, Task-Relevant Information than IF Conditions

Proponents of EF will often highlight the remarkable fact that only a word of difference in the task instructions can promote dramatically different effects. Arguably, however, these studies do not change a word or two. Rather, researchers often change the source of information that they want their performer to attend to. For example, Duke et al. (2011) found that temporal evenness, or timing, on the piano improved when non-pianists played with an external focus on sound, as compared to an internal focus on fingers. This was interpreted in a standard way: focusing on movement effects, especially distal ones, promotes motor performance in accordance with the CAH. I would like to propose another explanation for these findings: sound stimuli have a high temporal resolution and are uniquely suited to promote precise information about movement timing and temporal aspects of a performance (Nazzaro & Nazzaro, 1970). Auditory information has shown superior effects on movement timing, as compared to visual information, in a range of studies (Han & Shea, 2008; Lai et al., 2002; Shea et al., 2001). Sound is also likely more temporally precise than the tactile information that a focus on one's fingers will promote during piano playing. Hence, it makes sense that focusing on the most temporally precise source of information available, namely sound, will promote better timing in a motor task. But this seems more related to information than automaticity.

In sport studies, the IF task instructions will often contain more vague information than EF instructions. This is well demonstrated in golf studies. In an early study by Wulf & Su (2007), an IF condition encouraged golfers to focus on "the swinging motion of their arms" (p. 385), whereas the EF instructions were to focus on "the pendulum-like motion of the club" (p. 385). Not only does the latter cue involve a metaphor in addition to external task instructions (an issue discussed by Collins et al. (2016))—it also appears much more specific. The pendulum metaphor promotes an image in the performer's head, about *how* the club should move. The "swinging motion" of arms is not really a contributor to any specific mental picture of the movement ahead—arms can be swung in an infinite number of ways, so this instruction is less directive. In another golf study (An et al., 2013), an IF condition asked participants to "transfer your weight to your left foot as you hit the ball" (p. 5), whereas an EF condition asked the golfers to "push against the left side of the ground as you hit the ball" (p. 5). Again, weight shift can be done in numerous ways, and this concept seems more abstract than the clear mental image of pushing against a specific part of the ground. Further, pushing off the ground seems to promote more powerful movement and thus be more congruent with the outcome measure used in this study: carry distance (i.e., how far the ball was struck).

The learning benefits associated with specific rather than vague information are one of the most robust findings from educational psychology (Hattie & Timperley, 2007). Movement effects or elements in our external world (e.g., sound or the dartboard) will often have the benefit of concreteness and specificity. They are often easy to find and point to, and therefore easy to understand and attend to. And when IF task instructions are accordingly vague, this may provide a simple, unspectacular explanation for the benefits of external focus cues found in many past studies.

Many IF Conditions Promote a Distal, Potentially Detrimental Focus of Attention

As they plan their movement, participants in a typical IF condition are often encouraged to attend to distal body parts, such as arms, hands, or fingers. The alternative would be more proximal body parts, such as abdominal muscles, shoulder, and hip, which are rarely mentioned in such task instructions. This is peculiar, given the extensive literature suggesting that proximal areas are particularly important, information-rich parts of the performer's body, especially at advanced levels of motor performance (Abernethy & Zawi, 2007). In several motor tasks, the goal is to develop power by activating muscles going from proximal to distal body areas (Abernethy & Zawi, 2007; Hatsopoulos et al., 2010). When releasing the javelin, for example, the foot plant at the end of the run-up will start a kinetic chain in which legs and core muscles will initiate the throwing action, before shoulder, arm, and wrist will start moving in turn. Indeed, a good technique in several sports will often involve taking one's time to develop power in proximal body areas, before distal areas take over. In other words, proximal areas often contain the *leading joints* that transfer motion to distal, subordinate joints (Dounskaia, 2010). Functional, multi-joint movements are frequently characterized by distal limbs that stay relatively passive until influenced by proximal forces (e.g., Kim et al., 2009). Hence, a focus on proximal body parts is often encouraged by coaches in order to effectively develop power (e.g., focusing on hips in rowing, or core in volleyball spiking). Cues referring to distal body parts, on the other hand, can often be deliberately left out by coaches in athletics, since they may disrupt the most functional, proximal-to-distal movement coordination.

Thus, it is peculiar that studies have encouraged performers to "throw the javelin with all their might, while focusing on their sprint and the position of their hand" (Asadi et al., 2015, p. 4) in javelin throwing, focus on "extending your arms rapidly" (Makaruk et al., 2013, p. 57) in shot put, and "throw the discus as far as you can, while concentrating on your hand and wrist that is throwing the discus" (Zarghami et al., 2012, p. 48) in discus throwing. Firstly, the fact that focusing on isolated body elements (as one does in typical IF conditions) can lead to suboptimal coordination between body parts, has been suggested (Montero et al., 2018). Secondly, I would add that the focus on, not just any single body part, but specifically distal body parts, could promote detriment in IF task conditions. For example, extending "arms as rapidly as possible" is an instruction that may cause the shot put athlete to "rush the movement". It runs directly counter to common advice given in shot put: allow the lower and proximal body parts to do the work before arms take over as late as possible (Taylor, n.d.). In the best case, such IF instructions, as used in research, are less than optimally informative by addressing subcomponents of the task. In the worst case, they contain detrimental information.

An explicit focus on distal body parts may be helpful in order to promote tactile information attunement in fine motor skills (e.g., music playing; Stambaugh, 2019), but it may run counter to the elementary principle of proximal-to-distal sequencing in larger-scale movements. Interestingly, when responding to the critique by Collins et al. (2016), Wulf (2016) defended a choice of asking participants to focus on hands in the IF condition of a previous gymnastics study (Abdollahipour et al., 2015): "As we mentioned in the paper, we could have asked participants to focus on the chest itself, but we would expect a similar pattern of results" (Wulf, 2016, p. 1293). An intriguing and alternative idea would be that IF performance favors a proximal focus (e.g., focus on chest) over a distal focus (e.g., focus on hands) for many tasks, which would run opposite from the EF distance effect.

The Distinction Between Internal and External Foci: Future Research Directions

This article has mainly evaluated studies that directly compare IF with EF. Before concluding, however, I will briefly note that if motor performers search for task-relevant information, then IF and EF may appear in tandem. First, since most real-world sports tasks are complex and consist of more than one discrete movement, and the informational demands may change from second to second in one's perceptual environment, one should expect that athletes adopt numerous focus cues during a single performance—not a single cue as in many studies on IF versus EF. Such dynamical attention is exactly what studies have found (Bahmani et al., 2019; Bernier et al., 2016). Conceivably, an athlete may switch between IF and EF or even adopt both types of cues at the same time. A rower approaching the final part of a race, for example, may adopt both an IF (e.g., by trying to use her legs, as in Neumann et al. (2020), to maintain proximal-to-distal sequencing in the face of fatigue) and an EF (e.g., by thinking of the finish line, as in Banks et al. (2020), as a target-directed cue). Such combinations of attentional foci, and potential interaction effects, have not been emphasized in the attentional focus literature.

Second, it makes sense that athletes adopt single cues that are hard to pinpoint as either internal or external. To give an example, a common cue (no pun intended) in pool billiards and snooker is to focus on the feeling of one's hand hitting the chest at the end of the stroke. This can be regarded as a movement effect, since it is a consequence of the key action (i.e., the cue tip going through the cue ball), *if* the execution is done properly. It provides valuable information related to task success, since a suboptimal follow-through will not include any sensation of hand hitting the chest. Yet, despite being an informative movement effect and a frequently employed cue by elite performers, it is undoubtedly internal in nature. Similar internal movement effects are attended to in basketball and volleyball, as players are instructed to finish their shot (basketball) or set (volleyball) with fingers pointing toward their target. These examples speak to the questionable nature of an IF versus EF dichotomy. Studies comparing internal and external movement effects should make an interesting venue for future research.

Conclusion

Mechanisms, or explanations for why something is effective or ineffective, are powerful elements of science. While empirical evidence is undoubtedly important (and often impressive), the underlying mechanisms will often dictate how the evidence is adopted. In sports, for example, intelligent coaches may come up with their own attentional cues, preferably in collaboration with the individual athlete they work with, based on the focus of attention literature. If these coaches fully accept the validity of studies on EF versus IF, and more importantly the CAH as the proposed mechanism, they should purely direct their athlete's attention to the external environment. More than anything, they should avoid any cues that promote an explicit focus on the body or movements.

If, however, they start from the perspective of task-relevant information, the cues and training sessions may look very different. Then, the coach and athlete may together analyze their performance context and come up with cues that can guide the performer's attention to the most important aspects. The body and the environment can entail perceivable information (Prinz, 1997), and thus cues can be both external and internal as long as they are congruent with the task at hand. Such a coaching process, with information as the starting point, should promote greater diversity in cues adopted by instructors and athletes alike. In this paper, I have argued that the evidence in favor of sacrificing this diversity, by leaving "no room for internal foci" (Wulf, 2016, p. 1294), is insufficient. Rather, scholars and instructors should keep investigating how performers may attune to the most useful information, no matter its location.

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