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# Harnessing the power of attention: exploring ‘focus of attention’ theories, practice, and myths.

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## Introduction

Where are we directing an athlete’s attention when giving verbal instructions? This extract from a conversation with Olympic Canoe Slalom Coach, Craig Morris gives a valuable and interesting insight into the influence of instructions on focus of attention.

*“In the end I came to thinking that if the athlete's intentionality is to win, then how a performance looks is largely irrelevant. What’s important is that it’s functional and it’s stable. A few heavy jolts led me to that, mostly from athlete feedback. I remember at a big event I was doing a video review of a run with one of the athletes. When I paused the video, the athlete said to me “When I went around that gate, I thought, Craig's gonna hate that stroke, the shape of it, the position under the chin etc”.*

*I recall initially being pleased and thinking, “Oh, I'm getting through to my athletes, nice! They are listening to my coaching. The subsequent athlete response however, had a profoundly lasting effect on my coaching, “Effective though, wasn't it?”*

*The thing is, it was undeniably “effective”. So if it’s effective, then how important is it for them to focus on their body position and hands when negotiating gates on an Olympic slalom course amidst very dynamic and turbulent water? I’ve come to realise that we must be very careful about having too narrow a, or even any, significant technical model. Because if you have it as a coach, it’ll inevitably become an information constraint for the athlete. A boundary on their attention, their interaction. So for example, when paddling, the athletes were often evaluating their action against information I had predetermined for how something should look rather than paying attention to, and actually seeing and feeling, the task relevant information in the environment. The information of what a wave is or is not inviting them to do, or what the wind’s effect on a pole means for action, thus restricting their ability to interact with these things more freely as they emerge. So effectively, I was overly constraining what information they picked up by guiding their attention to something that wasn't conducive with what I have come to view as skilled performance.”*

## **The myth: Every instruction is a good instruction.**

If you immerse yourself in any environment where physical movements are being practised under the supervision of an instructor or coach, you will no doubt hear endless verbal instructions that are referencing body movements. Whether in a Physical Education setting with a teacher directing an adolescent to *bend their knees* to support a softer landing when jumping, a sports coach instructing an elite athlete to *snap the wrist* when shooting a basketball, or a medical doctor teaching a trainee how to *grip a needle with the fingers* when learning to suture.

Some scientists believe that these verbal instructions are fundamental to skill learning, and it is our job as coaches and educators to use them effectively to help guide individuals towards a predetermined technique or technical model. This concept of using instructions to hone in on an optimal technique is supported by what is termed the ‘cognitive’ or ‘**information processing**’ account of skill learning, where learning is a result of ‘computer-like’ processing, and movements are pre-planned, stored in memory, and drawn upon when needed (Broadbent, 1958; Schmidt, 2003). However, others believe that contrary to skilled movements being pre-programmed via the brain, movement is instead more spontaneous and continuously (re)organised based on the ever-changing relationship between the individual, the task, and what is happening in the environment (Davids et al., 2008; Kelso, 1995). Within this ‘**ecological dynamics**’ model of skill learning, there is not one correct way to move, but instead, skilful movement is conceptualised as the ability to be adaptive and repeat successful outcomes (repetition without repetition), rather than repeat exactly the same movement techniques. The focus is on biomechanical flexibility, rather than biomechanical correctness. The role of the coach is to facilitate what scientists term ‘self-organisation’ of the motor system by cultivating environments that support movement exploration. Instructions are used to influence what an individual pays attention to and will subsequently either help or hinder dynamic self-organised performance.

But whichever side of the fence you sit on, verbal instructions are commonplace in teaching and coaching, and unlikely to lose their value any time soon. Regardless of the mechanisms at play underpinning the role of instructions to support learning, what many do not realise is that sometimes the instructions we provide can actually do more harm than good if we do not consider the language being used and where the learner’s attention is likely to be focused. Not all instruction is good instruction, and the literature would suggest that even in a relatively simple task such as balancing, instructing a rehabilitation patient to “keep their feet level” while balancing on a balance board has been shown to constrain actions and inhibit performance (for a review, see Park et al, 2015). Fascinatingly, just slight alterations to the language, which instead directs the patient to “keep the board level” can improve performance (e.g., smaller, and more frequent movements, both indicative of enhanced balance performance).

## Focus of attention definitions

External focus	Directing attention towards the effects of our movements on the environment (e.g., typically this would be towards a bat, racket, club, or ball). This might also include perceptual information relevant to the task (e.g., the movement of an opposition player in a hockey game). External focus of attention can be proximal (i.e., aspects in the environment nearer to the body), or distal (i.e., aspects in the environment further away from the body).
Internal focus	Directing attention towards our body movements (e.g., the pendulum motion of the arms during a golf putt or the raised position of the leg during an arabesque).
Somaesthetic	A somaesthetic focus of attention is a subset of internal focus of attention. It is what is being experienced or 'felt' in the body. There are four main types: nociception (pain), equilibrioception (balance), mechanoreception (vibration, touch, and pressure), and proprioception (positioning and movement).
Holistic focus of attention	Focus on a holistic quality of a movement (e.g., being 'explosive' during an athletics triple jump or rebound in basketball).

## The origins of this topic of interest

It was Dr Gabriella Wulf who first noticed the consequences of changing focus of attention whilst she was learning to windsurf. When she focused externally on moving the board to turn, she found that her movements were more effective compared to when she focused her attention internally towards moving her feet to make the turn (Wulf, 2007). In the first scientific study of this nature, Wulf et al. (1998) tested this phenomenon in two different tasks: (1) a ski-simulator task where participants were instructed to focus on the slalom motion of either their feet (internal focus) or the ski-simulator wheels (external focus), and (2) a balance board task where participants had to focus on keeping either their feet level (internal focus) or the board level (external focus). In both instances, the external focus of attention (i.e., on the simulator wheels or balance board) led to better performance outcomes (in this case, movement amplitude and balance, respectively).

Since these early studies, we now understand far more about the mechanisms that underlie the impact of focus of attention on performance and learning. The most prominent theory is an information processing theory, the *constrained action hypothesis* (Wulf et al., 2001), which

proposes that directing attention internally to the bodily mechanics of a movement, can disrupt what is usually automatic movement planning/execution. Just like if you were to walk down the stairs (a skill you probably do every day without thinking about it), whilst consciously thinking about what you were doing with your feet, you might find that your movements become quite ‘constrained’ and awkward. More recently, scientists have begun to consider these attentional mechanisms together with psychological factors such as motivation. This is based on the idea that the processing that goes on to organise our movements is also likely affected by an individual’s psychological state. Specifically, Wulf and Lewthwaite’s (2016; 2021) *OPTIMAL theory* (optimising performance through intrinsic motivation and attention for learning) suggests that practice environments that provide individuals with greater autonomy (i.e., choice), and stronger beliefs that practise will benefit performance (i.e., enhanced expectancies), will lead to better performance outcomes when combined with an external focus of attention. Wulf and Lewthwaite explain this with the idea that enhanced performance when adopting an external focus of attention will increase our self-confidence to continue to perform a skill and subsequently provide us with greater expectancies for future performance. For example, in a standing long jump task, placing physical markers such as cones on the floor to ‘target’ (i.e., an external focus of attention), combined with enhanced autonomy (e.g., providing the participants or athletes the choice over where to place the cones), can enhance jump distance and subsequently self-efficacy; with this relationship continuing in a cyclic fashion.

The benefits of an external attentional focus are now well established within academic research circles (see Chua et al., 2021; Gottwald et al., 2023; and Wulf, 2007; 2013), with positive outcomes including movement accuracy, movement efficiency, strength, power, and movement form (for a review, see Wulf, 2013). Similarly, the attentional focus phenomenon has been tested in many domains, including sport (for reviews, see Wulf, 2007; 2013), strength and conditioning (see Grgic et al., 2021), clinical rehabilitation settings (see Park et al., 2015), and the military (e.g., Amini & Vaezmousavi, 2020).

## **Current scientific directions**

Whilst early evidence demonstrated overwhelming support for an external focus of attention, more recent literature has begun to question the rigidity of the constrained action hypothesis (Wulf et al., 2001) and *OPTIMAL theory* (Wulf & Lewthwaite, 2016; 2021). For example, scientific papers (Toner & Moran, 2015; 2016; Wulf, 2015), have sparked interest in what we should focus on if we have to relearn a skill or correct a technical error (e.g., an athlete not following through sufficiently on a golf swing or forehand tennis drive). One example of this is scientists’ debate surrounding reasons for Tiger Woods’ performance slump in 2015, around the time he was adjusting his swing pattern. Whilst Toner and Moran argued that this process was a necessary phase in technique refinement, Wulf was doubtful that Tiger Woods would ever return to form once his attention was directed to his body movements in this reflective manner. Toner and Moran propose that there may indeed be a time and a place to pay attention to the body via what they term a ‘somaesthetic awareness’ based on Shusterman’s (2011) view that reflective body consciousness has pragmatic value when re-learning movements or

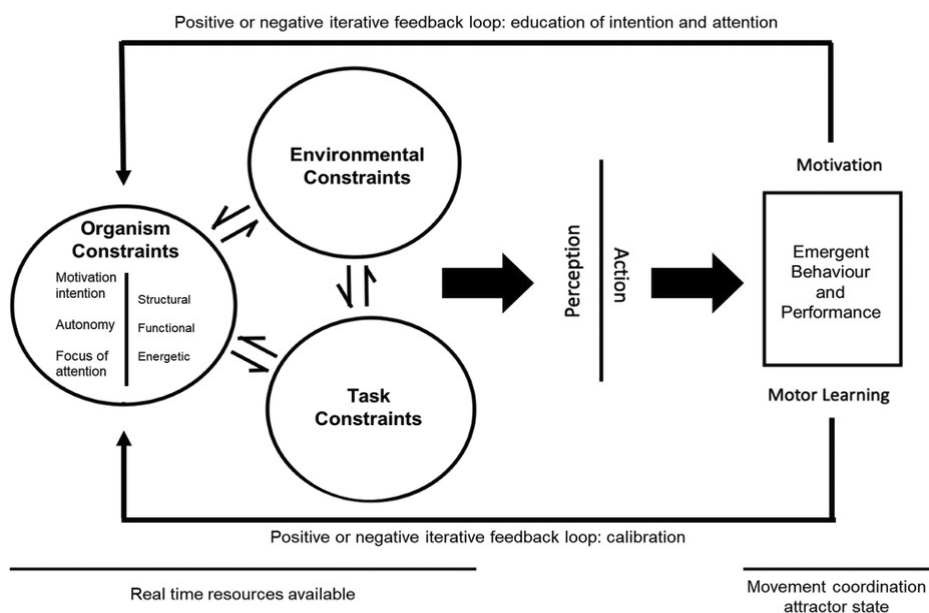
correcting errors. This would also be consistent with Carson and Collins' (2011; 2014; 2016) non-linear Five-A model of technical refinement, which presents a practical approach to skill refinement, involving stages of analysis, awareness, adjustment, (re)automation, and assurance.

In line with debate surrounding the benefits of somaesthetic awareness, Gottwald et al. (2023) present a useful critique of the attentional focus literature, highlighting instances where an internal focus, which promotes somaesthetic awareness, has been identified as having potential value in complex practical environments. This includes: in more real-world non-laboratory sporting environments (e.g., Anderson et al., 2022); when focusing on body movements is more aligned with criteria for successful skill execution (e.g., Gottwald et al., 2020); or for use in retraining movement form (e.g., Moore et al., 2019).

## An alternative explanation for the attentional focus effect

With existing theoretical approaches lacking in the flexibility required to fit complex practical environments, and ecological dynamics approaches gaining prominence in the literature, a more recent Ecological Dynamics Account of Attentional Focus (Gottwald et al., 2023) is timely. The authors propose a more flexible approach to explain the varying functions of attentional focus (see Figure 1). In this manner, directing attentional resources towards task relevant information in the environment can support a participant or athlete to identify more opportunities for action, improving decision making, and allowing the self-organisation of more accurate/efficient movement. For example, in a far aiming task such as golf, this might be the target hole and changing surface conditions leading up to it. In a team sport it might be scanning to become aware of, and influence, the movements of team and opposition players. In a proprioceptive task, this might be the arm motion relative to the torso in an artistic gymnastics floor routine. These nuances cannot be explained by either the constrained action hypothesis (Wulf et al., 2001) nor OPTIMAL theory (Wulf & Lewthwaite, 2016; 2021) alone.

Figure 1. An ecological account of focus of attention (Gottwald et al., 2023).



## **So what: Practical recommendations for coaching**

The myth that any instruction is a good instruction is likely false. This means that coaches should carefully consider what attentional focus is promoted by the instructions they give. The aim of any instruction may need to be twofold to ensure it is ‘good’ instruction. Firstly, and in line with established convention, coaches may need to provide corrective information to help address technical/performance issues. Secondly, but perhaps equally importantly, coaches need to provide instructions which are worded in a way where they direct athletes’ attentional focus to task relevant information. This latter aim is supported by an increasingly large body of research which advocates for task-specific focus of attention prescription (Gottwald et al., 2023). The matching of attentional focus and task relevant factors should benefit self-organisation for movement by prioritising perceptual information, which is easier to detect as well as contextually relevant (i.e., key body and/or environment constraints).

### *Performance in aiming tasks*

If a ‘task’ constitutes an athlete performing successful shots at a target, the most relevant information would be the target (e.g., hoop for a basketball shot). In such instances, and in line with seminal work by Wulf and colleagues (for review see Wulf, 2013), coach instructions should advise athletes to adopt an external focus towards the centre of the hoop. Based on the proposals of the Ecological Account of Attentional Focus (Gottwald et al., 2023), such an attentional focus should enable athletes to identify the most relevant environmental information for movement self-organisation (e.g., appropriate ball force, angle, and release parameters) as well as efficiency, by directing valuable cognitive resources further away from less relevant internal bodily information. Plentiful evidence has been observed to support the adoption of an external focus for optimal performance in aiming-type motor tasks (Chua et al., 2021).

### *Performance in form tasks*

If a ‘task’ constitutes an athlete performing aesthetic/form aspects with high precision, the most relevant information would be the body (e.g., having the back leg higher than the head during a spiral in figure skating). In these instances, coaches may need to advise athletes to adopt an internal focus of attention towards their leg position relative to their head. Based on the proposals of the Ecological Account of Attentional Focus (Gottwald et al., 2023), such an internal attentional focus should enable athletes to identify the most relevant bodily information for movement self-organisation (e.g., leg in relation to head location) as well as efficiency, by directing cognitive resources away from less relevant external environmental information. The evidence-base in support of internal foci for form-based tasks has received less exhaustive investigation compared to pairings of external foci with aiming tasks, but is rapidly growing (see, Gottwald et al., 2020; 2023; Lawrence et al., 2011; McKay et al., 2023).

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## *Performance in endurance, strength, and power tasks*

If a 'task' primarily comprises endurance (e.g., distance running), strength (e.g., weightlifting 1 rep max), or power (e.g., high jump) components, the adoption of either external (e.g., "shortest path through the environment" or "upward motion of the dumbbell") or holistic foci of attention (i.e., "feeling of the movement as a whole") may be desirable for optimal performance (Schücker & Parrington, 2019; Freudenheim et al., 2010). Specifically, external foci may facilitate movement self-organisation and efficiency relative to the environment. This can ultimately benefit time/speed/force. Holistic foci may offer a practical alternative with similar benefits when a skill does not feature a clear 'external' component to focus on (Zhuravleva et al., 2023). However, if a strength or power task wishes to ultimately achieve muscle growth as its measure of performance (e.g., bodybuilding), then an internal focus of attention (e.g., "focus on the squeezing of your biceps while doing your biceps curls") may be desirable to increase mind-muscle connections (Grgic & Mikulic, 2021); this internal focus-instigated neural drive directed to desired muscles would produce overall less efficient movement with lower peak strength/power outputs, but result in overall greater muscle activation which should benefit muscle growth in the long-term.

## *Modification of technique and long-term development*

Contrary to common 'either-or' approaches to focus of attention, modification of technique should be seen as a process in terms of the attentional foci adopted. The focus of attention which produces the change in technique may be different to the usual focus adopted for optimal performance. Firstly, in instances where a task usually performs optimally with an external focus (i.e., aiming, endurance, strength, and power tasks) but communicating the required technical changes to an athlete without referring internally to the body is impractical or impossible, somaesthetic awareness of kinaesthetic/kinetic body processes elicited via internal focus instructions should help athletes quickly identify task-relevant changes to their technique. Importantly, once the desired technical changes are beginning to take place, coaches should endeavour to move away from the temporary internal focus used to achieve change, and gradually guide athletes towards an external focus which would produce optimal performance (Moore et al., 2019; Singh & Wulf, 2020). Secondly, if it is possible to achieve the initial technique change within external-favouring tasks (aiming/endurance/strength/power) via externally focussed instructions or task/environmental constraints manipulation in practice design, then this may be optimal given the plentiful evidence suggesting that the skill learning of individuals at lower skill levels benefit from external foci similarly to experts (Chua et al., 2021). Lastly, tasks which usually perform optimally with internal or holistic foci (i.e., form tasks) benefit from an internal attentional focus during technique modification and subsequent performance when competing.

## **Summary:**

Subtleties in the language that coaches use to give instructions can have a significant effect on a participant's performance and learning. Using language that supports a focus of attention toward the effects of a movement or toward task relevant information is more effective for



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learning. Like most principles, although the use of an external focus of attention is most often more effective, it is not as absolute as suggested by early motor learning research. There are times when an internal focus is needed.

## Have a go:

1. What is the intention of the practice session?

When planning your coaching sessions, think about what the *intention* is for the participants or athletes. Is it to score a goal or is it to achieve desired form? Then think about where they might find the information that supports them to solve that movement skill. Where and on what might you need to direct their *focus of attention*?

2. Do you need to give detailed verbal instructions? Less is often more.

Could you use practice design principles such as constraints-led approach (CLA) or Space, Time/Task, Environment, People (STEP)? For example, in aiming tasks you could make the target bigger or brightly coloured, and encourage your participants to choose the distance and challenge level. Practice design can work well for disrupting poor technique if you can design the practice so that the poor technique will not be effective.

Would cues and analogies be more effective? For developing a holistic focus of attention these work well, especially if the participant can choose the cues and analogies that work for them. For example, ‘exploding past the line.’

Could you use questioning to help the athlete discover solutions themselves? Ask the athlete what they think they might need to pay attention to. For example, an ice climber might need to listen to the sound the ice makes when they hit it with an axe to become aware of how stable and strong the ice is before pulling on it.

3. Gathering information about where you and your participants are focusing attention.

As a coach you could ask your participants to ‘think aloud’ and tell you what they are noticing during a practice activity. You can ask your participants to use a smartphone and headphones to record as they are active, then listen back with them (ideally with a video of the same activity).

You can use your smartphone and headphones to record *your coaching and verbal instruction* during the session and listen back to the instructions you give. When you give instructions, where are you trying to focus *your participants’* attention? Are you using internal technique-based instructions or promoting an external focus of attention? Could you be clearer and more intentional with which focus of attention you are encouraging with your instructions?

It is also useful to become more aware of where *your* focus of attention is as a coach when observing. If you find that you are giving predominantly internal focus, form/ technique-based instructions it may be because of where you are focussing your attention in your observations.

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Using your smartphone and earphones, you can record what you are paying attention to by ‘*thinking aloud*’ either while observing or before you give instructions. When you listen back, pay attention to where your focus of attention was. Was it on the participant’s body/ technique, their interaction with the task, other participants, the environment, or toward task relevant information that they may be paying attention to? Challenge yourself to become more intentional about where you place your attention as well as the language that you use to support your participant’s focus of attention.

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