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NOTE

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ABSTRACT

The potential performance benefit of an external focus of attention remains unexamined for skilled junior performers, especially those executing ballistic, whole-body continuous movements. Skilled junior skiers (M_{age} = 14.09) completed slalom runs under external focus, internal focus, and control focus conditions. Repeated measures ANOVA revealed no significant difference between attentional foci on performance times. Our data challenges the commonly held belief regarding the superiority of an external focus. Instead, we offer researchers and practitioners a more nuanced discussion concerning possible distance effects (proximal vs. distal) associated with external foci in skilled junior performers executing ballistic, whole-body movements.

Lay summary: Skilled skiers completed slalom runs while focusing on rotating their skis (external), ankles (internal), and performing to their best ability (control). We uncovered no significant differences between conditions. We argue that the external focus failed to support automated processing because the attentional cue was too proximal for our skilled performers.

IMPLICATIONS FOR PRACTICE

- Encouraging skilled junior performers to adopt a proximal external focus while executing ballistic, whole-body continuous skills does not necessarily benefit performance.
- Skilled junior performers may benefit from a (more) distal external focus when developing motor skills that are not automated.
- Due to the lack of performance benefits and potential risk associated with an internal focus, practitioners are discouraged from promoting this type of focus with their athletes.

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The content of instructions (and feedback) received from coaches or instructors has previously been shown to have distinct effects on movement effectiveness and movement efficiency (Wulf, 2013). Instructions can induce an *internal* focus (IF), by directing a performer's attention to bodily movements involved in skill execution, or an *external* focus (EF), by encouraging a performer to focus on desired movement outcomes/effects (Wulf, 2013). To illustrate, a golfer who focuses on their shoulder movement or arm

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swing is adopting an IF, whereas if the golfer focused on ball trajectory or the pendulum-like swing of the club head, they would be adopting an EF (cf. Bell & Hardy, 2009). Furthermore, focusing on ball trajectory would be a distal EF (d-EF) where attention is directed on a movement effect more remote from the body. Focusing on the pendulum-like swing of the club head would be a proximal EF (p-EF) where attention is placed on a movement effect closer to the body.

Wulf et al. (1998, Experiment 1) first reported the impact of these subtle attentional differences using a ski simulator where participants were tasked with making rhythmical right to the left as far as possible slalom-type movements. Novice participants were instructed to exert force on either the outer wheels of a ski simulator (EF) or on their outer foot (IF). Participants in the EF group displayed superior amplitude scores than their IF counterparts, reflecting an increased distance of side-to-side movements for participants who focused on the outer wheels of the ski simulator. Wulf et al. (2001) subsequently proposed the Constrained Action Hypothesis (CAH) to explain the motor learning benefits and changes in movement execution from an EF of attention. According to their theorizing, an EF should encourage enhanced movement execution because movements are controlled by a (more) unconscious neural network. An EF has been argued to optimize motor learning as fast, reflexive control processes that maintain attention on task outcomes are heightened. This avoids self-regulatory processing where the performer interferes in their own movement execution. Self-regulatory processing is heightened under an IF and encourages greater conscious control which limits automaticity. The interference that results from an IF hampers movement execution by "freezing" the motor system's degrees of freedom, therefore hindering performance and slowing learning.

To date, well over 120 papers have been published examining attentional foci and motor performance-related outcomes. A meta-analysis of this body of research provided support for the benefits of an EF over an IF, revealing it to be a reasonably robust effect present across both novice and skilled performers (Chua et al., 2021). Researchers have utilized a range of experimental tasks covering skills fundamental to both team and individual sports as well as subjective and objectively scored sports. However, there remains relatively limited insight regarding the optimal focus of attention for ski racers. This gap in the knowledge base is unfortunate because effective ski slalom racing is characterized by a unique and skilled blend of balance and rhythmical ballistic requirements that although are whole-body movements, place emphasis on coordinative and responsive leg strength. To our knowledge, the findings from two ski-related studies (Rushall et al., 1988; Wulf et al., 1998) may at first sight offer guidance. On the one hand, while Wulf et al. utilized a ski slalom task, this was a lab-based and overly simplified mockup of the slalom racing (and used novice participants). On the other hand, Rushall et al.'s investigation of thought content instructions used (elite Canadian) cross-country, not slalom, skiers. Also, the nature of the instructions tested were akin to self-talk incorporating self-affirmations and mood words which are different to the types of instructions found in the CAH inspired focus of attention literature.

Alternatively, practitioners working with competitive slalom ski racers, and in search for evidence-based guidance, might turn to the pocket of focus of attention studies examining skilled performers' execution of whole-body continuous movements. Unfortunately, here an ambiguous picture emerges. For instance, Winkelman et al. (2017) reported no

differences in 10-metre sprint performance of experienced sprinters between IF, EF, and control focus (CF). Similarly, Stoate and Wulf (2011) revealed no difference in swimming performance between an EF and CF for trained swimmers undertaking a 25-yard sprint. However, Freudenheim et al. (2010) did report improved swimming performance for undergraduate intermediate swimmers undertaking a 16-metre sprint under an EF.

Practitioners working with competitive slalom ski racers might next turn to focus of attention studies examining performers' execution of whole-body movements. Here, inconsistency is present. For instance, Porter et al. (2013) revealed an IF produced the least effective standing long jump performance in a group of US College long jumpers, whereas a distal EF (d-EF) proved better to both a proximal EF (p-EF) and (CF). Abdollahipour et al. (2015) reported that experienced gymnasts jumped higher and received fewer point deductions when attempting a whole-body airborne gymnastic move while adopting an EF. Using a discrete task, Chan et al. (2019) tasked skilled resistance-trained males with attempting conventional deadlifts under an IF, EF, or while executing a counting control task. Only the mean velocity of center of pressure in the anterior-posterior direction produced a significant difference, with the control condition producing better performance than an EF. Using balance-oriented tasks, Wulf (2008) reported no difference in expert acrobats' performance of balancing on a rubber disk between EF and IF conditions, and Chua et al. (2018) revealed no difference in pirouette performance between EF and IF conditions for skilled dancers.

There are caveats with the previous research on attentional focus that might better contextualize this mixed level of support for the benefits of an EF. First, for researchers to examine the phenomenon they have adapted sporting skills to their lab-based setting, using more simplified (and less familiar) versions of the "real" field-based motor tasks. Unfortunately, data from such tasks also have limited generalizability, lacking ecological validity, to the nature of competitive sport. Second, much research has recruited from adult and older adult populations, failing to examine junior sporting populations adequately. Third, and of particular relevance to the present study, the limited existing research utilizing explosive continuous motor tasks carried out by skilled performers has also reported better performance under control conditions and reported no difference between an EF and IF. For example, Porter and Sims (2013) tasked elite track and field athletes to complete sprints in three attentional conditions: EF, IF, and CF. Participants ran the last half of their 18.28 m sprint significantly faster under the CF leading the authors to recommend that skilled performers should not be instructed to adopt an EF when executing a whole-body movement. Similarly, Stoate and Wulf (2011) suggested an EF may be unnecessary when movements are controlled automatically, after uncovering no difference in swimming performance between an EF and control condition with expert swimmers.

Taken together the existing findings suggest that the benefits of an EF may not materialize for highly skilled performers executing explosive, whole-body, and continuous motor skills. While skill level has been found not to moderate the effects of attentional focus (e.g. Chua et al., 2021), this was based on the analysis of secondary data obtained from almost exclusively adult novice or expert performers, largely ignoring junior athletes. In fact, only 10% of motor performance studies using behavioral outcome measures have sampled 4–17-year-olds (Chua et al., 2021). This is removed from

the developmental journey of most athletes within their chosen sport and represents an untapped line of research activity. Put plainly, only a handful of studies have tested the effect of attention focusing instructions on whole-body skills (e.g. Abdollahipour et al., 2015; Porter et al., 2013; Wulf, 2008) and none of these studies have considered their influence on whole-body skills for skilled *junior* performers. Here we address this limitation and employ a whole-body, continuous (ski slalom) motor task in a field-based setting. We recruited a group of competitive skilled skiers from a UK club to complete slalom runs under different (external, internal, and control) attentional foci. Drawing from the CAH, we hypothesized that the EF would produce the fastest performance times and the IF would produce the slowest performance times.

Method

Participants

Fourteen competitive skilled junior skiers (10 males) volunteered for the study (M_{age} = 13.77; $SD = 4.42$), however only 11 (M_{age} = 14.09; $SD = 4.74$) were included in our analyses due to incomplete data sets. That is, three skiers had inappropriately completed the slalom course (e.g. missed gates) on both trials used to create the respective condition mean and as such, they only had values for two of the three experimental conditions. Participants all were members of a competitive ski club, attended indoor advanced squad training sessions at the club, and regularly competed at national and occasionally international standard competitions. The sample was primarily White British ($n = 12$; 92.30%) and had skied for an average of 9.31 years ($SD = 5.14$). Participants reported being highly active; they participated in skiing training sessions on average 3.54 hours ($SD = 1.27$) per week and in other recreational activities or sports for 7.38 hours ($SD = 5.14$) per week. A post-hoc G*Power analysis indicated the study was adequately powered at $\beta = 0.93$ (η^2_p = 0.052, $\alpha = 0.05$, $N_{sample\ size}$ = 11, N_{groups} = 1, and $N_{measurements}$ = 3).

Design

Participants completed two slalom runs in each experimental (repeated measures) condition: EF, IF, and CF. We recorded the time taken to complete each slalom run (milliseconds) and created a mean time per condition which served as our dependent variable. We recorded all times using a competition appropriate timing system – the TAG HEUER Chrono-printer 540 timing system.

Task

The 135.05 m course was on an indoor artificial "real" snow slope maintained at $-3°C$. The first half of the course was angled at 15° and the second half at 10°. The lead coach designed and judged the slalom course as easy-to-moderate in difficulty. Participants triggered the laser start gate at the top of the slope upon starting their attempt and finished after navigating 17 poles and crossing the finish line. The course schematic is available in the supplementary materials.

Procedures

The first author approached the club committee of a successful UK skiing club and arranged for club racers to participate. We secured ethical approval from the Department of Sport and Physical Activity Ethics Committee at Edge Hill University and obtained informed consent from participants and a parent/guardian where required prior to commencing the study. We gave participants a short break after a scheduled evening training session and then instructed them to complete a single un-timed attempt to familiarize themselves with the course. We next tasked participants to individually complete two runs in each attentional focus condition. To ensure the relevance of the attentional instructions, we collaborated with a qualified race team coach (cf. Winkelman et al., 2017). The IF instruction was "Focus on rolling your ankles through the turns," the EF instruction was "Focus on rolling your skis onto their edges through the turns," and the CF referred to ability, "Focus on performing the slalom to the best of your ability." We counterbalanced experimental conditions across participants and categorized participants into one of six possible orders (EIC, ECI, ICE, IEC, CEI, and CIE). We randomly placed three participants in the first two orders and two participants in each of the remaining four orders. We separated each trial with a 5-minute break. The first author delivered the attentional instructions to participants from their left hand-side below the starting gate; all participants reported understanding the instructions. After their last trial we also asked participants to indicate the number of trials they used the attentional focus on across each condition. Coaches provided no feedback or timings until after the study. We debriefed participants fully upon study completion.

Results

From a descriptive perspective, the EF ($M = 15463$ ms; $SD = 1104$) produced the fastest performance followed by the CF ($M = 15557$ ms; $SD = 1288$) and IF ($M = 15558$ ms; $SD = 1267$). To test our a priori hypothesis we subjected the data to a single way repeated-measures ANOVA. Mauchly's test of sphericity was satisfied ($p > .05$). The omnibus effect from the ANOVA revealed a nonsignificant effect of attentional focus on slalom performance time, $F(2, 20) = .55$, $p = .58$, $\eta^2_p = .052$.[1] The manipulation check revealed that participants reported adopting the prescribed focus on 89% of trials. The data that support the findings of this study are not publicly available due to ethical restrictions imposed by the club committee.

Discussion

Our aim was to investigate the effect of attentional focus on skilled competitive junior athletes' performance of a ballistic, whole-body continuous skill in a legitimate field-based setting. Although the means trended in the hypothesized directions, results ran contrary to our a priori hypotheses and showed no significant differences in slalom course completion times across the attentional conditions. While our results run counter to the predictions of the CAH, they are congruous with previous research utilizing non-ballistic whole-body continuous skills such as sprinting (Winkelman et al., 2017) and swimming (Stoate &

Wulf, 2011). The findings also extend the knowledge base by sampling competitive *junior* performers executing a *ballistic*, whole-body continuous skill.

We believe the most parsimonious explanation for why the EF failed to benefit skiers' performance time is due to the precise nature of the instructions. We suggest the EF directed skiers' attention to a proximal (i.e. closer to the body) rather than distal (i.e. further from the body) part of movement. Specifically, the EF (i.e. rolling skis onto their edges) referred to a proximal aspect of movement that had already become autonomized. For skilled performers with an automatic movement pattern, distal cues have been found to be more favorable because they are more clearly discernible from the self (e.g. for kayakers; Banks et al., 2020; for a summary, see Chua et al., 2021). Wulf (2008) has previously suggested that expert performers move to higher-level representations of movement execution and an EF can in fact (re)direct attention to movement features that have become coordinated and automated. This is especially the case for proximal foci as attentional cues that are closer to the body have had time to become learnt and incorporated into a higher order movement pattern. Reinforcing proximal foci can disrupt automatic processing for expert performers because they hold an implicit understanding of the movement and do not require or benefit from step-by-step movement execution cues (Winkelman et al., 2017).

Previous research by Wulf and colleagues can be assimilated to support our argument. Singh and Wulf (2020) tasked skilled and low-skilled volleyball players with continuously passing to a target and reported elevated volleyball shot accuracy under a *d-EF* for *skilled* players, and a *p-EF* for *low-skilled* players. Of note, the EF in the present study may also have provided information related to a lower-level feature of the skiing turn movement that had already become autonomized. Collectively, this suggests that skilled junior performers executing ballistic, whole-body continuous skills may benefit from a focus more discernible from the self, and a more critical application of the CAH to skilled performers and their tasks is encouraged. For example, coaches and practitioners may want to consider aspects of skills that might be more fully automatized to avoid reinforcing such elements. Instead, more success might be achieved by developing cues targeting less well learnt elements or by bolstering "distance" within instructional cues.

Future research is needed to identify how the content of verbal instructions and cues that encapsulate the conceptual breadth within the CAH can best support skilled performers undertaking ballistic, whole-body continuous skills. In addition to the distance element of attentional focus cues, other considerations beyond the CAH could include inducing holistic attentional focus (e.g. "smooth" or "explosive;" Becker et al., 2019) that describes the general feeling of a movement, and/or emphasizing intentional or directional characteristics of movement (e.g. Barillas et al., 2022; Winkelman, 2018). That is, an EF cue can have differential effects depending on movement trajectory and whether the content is force-specific or velocity-specific, and whether the cue encourages a focus which is moving "toward" or "away" from oneself. Lastly, the "real" snow slope in the present study enhanced ecological validity compared to lab-based studies, however researchers should consider the possible difference between environmental conditions (e.g. indoor vs outdoor snow, slushy vs icy snow settings) on performance and may wish to include kinematic data to evaluate the execution of performers' movements under different attentional foci. This would contribute to our understanding of the

impact of attentional instructions on different aspects of movement performance and help critically assess the propositions of the CAH.

From a practical perspective, our findings highlight the complexity and challenge that practitioners face when developing suitable attentional cues for skilled performers in the real-world and the potential benefit of considering distance effects and less autonomized skill elements when phrasing instructions and feedback. We suggest practitioners should avoid directing skilled junior performers' attention to internal and external proximal cues that have had sufficient time to become autonomized (during ballistic, whole-body continuous skills); instead encouraging a more d-EF incorporating cues that have not become fully autonomized (cf. Stoate & Wulf, 2011).

In summary, we conducted one of the first studies of attentional focus with a sample of skilled junior performers incorporating a ballistic, whole-body continuous motor skill. Although the lack of differences in slalom ski performance times across our experimental conditions (IF, EF, and CF) contradict the CAH, they are not isolated and highlight the importance of considering automatized skill elements and distance effects when working with skilled junior performers executing whole-body skills. The results add to the small number of studies exploring skilled performers executing continuous skills and support the continued need for research to identify the optimal content of attentional focus cues for accomplished athletes. Indeed, future work should explore the interaction between skill level and distance effects of external focus of attention cues more closely (Banks et al., 2020). We encourage researchers undertaking such work to utilize field-based designs where ecological validity is strong.

Note

1. We also calculated the consistency between trials for participants. From a descriptive perspective, the EF ($M = 38$ ms; $SD = 54$) produced the most consistent performance followed by the CF ($M = 249$ ms; $SD = 486$) and then IF ($M = 1544$ ms; $SD = 4697$). We calculated the consistency between trials by subtracting trial 1 from trial 2 and then squaring this difference score for each condition for each participant to avoid the presence of negative values.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

References

Abdollahipour, R., Wulf, G., Psotta, R., & Palomo Nieto, M. (2015). Performance of gymnastics skill benefits from an external focus of attention. *Journal of Sports Sciences*, *33*(17), 1807–1813. https://doi.org/10.1080/02640414.2015.1012102

Banks, S., Sproule, J., Higgins, P., & Wulf, G. (2020). Forward thinking: When a distal external focus makes you faster. *Human Movement Science*, *74*, 102708. https://doi.org/10.1016/j.humov.2020.102708

Barillas, S. R., Oliver, J. L., Lloyd, R. S., & Pedley, J. S. (2022). Kinetic responses to external cues are specific to both the type of cue and type of exercise in adolescent athletes. *Journal of Strength and Conditioning Research*, *37*(3), 597–605. https://doi.org/10.1519/JSC.0000000000004307

Becker, K. A., Georges, A. F., & Aiken, C. A. (2019). Considering a holistic focus of attention as an alternative to an external focus. *Journal of Motor Learning and Development*, *7*(2), 194–203. https://doi.org/10.1123/jmld.2017-0065

Bell, J. J., & Hardy, J. (2009). Effects of attentional focus on skilled performance in golf. *Journal of Applied Sport Psychology*, *21*(2), 163–177. https://doi.org/10.1080/10413200902795323

Chan, A., Robertson, G. E., & Lajoie, Y. (2019). Effects of attentional focus and dual-tasking on conventional deadlift performance in experienced lifters. *International Journal of Kinesiology and Sports Science*, *7*(4), 9–21. https://doi.org/10.7575/aiac.ijkss.v.7n.4p.9

Chua, L. K., Jimenez-Diaz, J., Lewthwaite, R., Kim, T., & Wulf, G. (2021). Superiority of external attentional focus for motor performance and learning: Systematic reviews and meta-analyses. *Psychological Bulletin*, *147*(6), 618–645. https://doi.org/10.1037/bul0000335

Chua, T. X., Sproule, J., & Timmons, W. (2018). Effect of skilled dancers' focus of attention on pirouette performance. *Journal of Dance Medicine & Science: Official Publication of the International Association for Dance Medicine & Science*, *22*(3), 148–159. https://doi.org/10.12678/1089-313X.22.3.148

Freudenheim, A. M., Wulf, G., Madureira, F., Pasetto, S. C., & Corrêa, U. C. (2010). An external focus of attention results in greater swimming speed. *International Journal of Sports Science & Coaching*, *5*(4), 533–542. https://doi.org/10.1260/1747-9541.5.4.533

Porter, J. M., & Sims, B. (2013). Altering focus of attention influences elite athletes sprinting performance. *International Journal of Coaching Science*, *7*(2), 41–51.

Porter, J. M., Anton, P. M., Wikoff, N. M., & Ostrowski, J. B. (2013). Instructing skilled athletes to focus their attention externally at greater distances enhances jumping performance. *Journal of Strength and Conditioning Research*, *27*(8), 2073–2078. https://doi.org/10.1519/JSC.0b013e31827e1521

Rushall, B. S., Hall, M., Roux, L., Sasseville, J., & Rushall, A. C. (1988). Effects of three types of thought content instructions on skiing performance. *Sport Psychologist*, *2*(4), 283–297. https://doi.org/10.1123/tsp.2.4.283

Singh, H., & Wulf, G. (2020). The distance effect and level of expertise: Is the optimal external focus different for low-skilled and high-skilled performers? *Human Movement Science*, *73*, 102663. https://doi.org/10.1016/j.humov.2020.102663

Stoate, I., & Wulf, G. (2011). Does the attentional focus adopted by swimmers affect their performance? *International Journal of Sports Science & Coaching*, *6*(1), 99–108. https://doi.org/10.1260/1747-9541.6.1.99

Winkelman, N. C. (2018). Attentional focus and cueing for speed development. *Strength & Conditioning Journal*, *40*(1), 13–25. https://doi.org/10.1519/SSC.0000000000000266

Winkelman, N. C., Clark, K. P., & Ryan, L. J. (2017). Experience level influences the effect of attentional focus on sprint performance. *Human Movement Science*, *52*, 84–95. https://doi.org/10.1016/j.humov.2017.01.012

Wulf, G. (2008). Attentional focus effects in balance acrobats. *Research Quarterly for Exercise and Sport*, *79*(3), 319–325. https://doi.org/10.1080/02701367.2008.10599495

Wulf, G. (2013). Attentional focus and motor learning: A review of 15 years. *International Review of Sport and Exercise Psychology*, *6*(1), 77–104. https://doi.org/10.1080/1750984X.2012.723728

Wulf, G., Höß, M., & Prinz, W. (1998). Instructions for motor learning: Differential effects of internal versus external focus of attention. *Journal of Motor Behavior*, *30*(2), 169–179. https://doi.org/10.1080/00222899809601334

Wulf, G., McNevin, N., & Shea, C. H. (2001). The automaticity of complex motor skill learning as a function of attentional focus. *Quarterly Journal of Experimental Psychology Section A*, *54*(4), 1143–1154. https://doi.org/10.1080/713756012