The Impacts of an External Focus of Attention Compared to an Internal Focus of Attention on Optimal Motor Learning and Performance in Athletes and Performers

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Introduction

Numerous studies have demonstrated that an external attentional focus enhances motor learning (ML), performance, and movement efficiency compared with an internal attentional focus (Abdollahipour, et al., 2017; McKay, et al., 2015; Wulf and Lewthwaite, 2016; De Giorgio, et al., 2018; Perreault & French, 2015; Pascua, et al., 2015, Land, et al., 2014). All participants lacking any prior experience in specific ML and performance tasks (e.g., bowling, free throw shooting in basketball, throwing with non-dominant hands, golfing, putting, dart-throwing, ski simulations, balance tasks in ballet) had enhanced performances, improved accuracy, and more efficient motor movements when they adopted an external focus (EF) compared to an internal focus (IF) or in control groups with no directive feedback (Abdollahipour, et al., 2017; McKay, et al., 2015; Wulf and Lewthwaite, 2016; De Giorgio, et al., 2018; Teixeira da Silva, et al., 2017; Perreault & French, 2015; Pascua, et al., 2015, Land, et al., 2014; Lohse, Jones, Healy, & Sherwood, 2014; Duke, Cash, & Allen, 2011; Russell, et al., 2014). The following provides the literature on the current understandings as to why an EF enhances ML and performance compared to an IF, the findings illustrating the efficacy of an EF compared to an IF, and the suggestions for future research for adopting an EF compared to an IF.

Findings and Suggestions for Application and Future Research

Effective instructional methods with the understanding of the factors that optimize ML increases the rate of ML and expedites the achievement of higher levels of performance (Abdollahipour, et al., 2017; De Giorgio, et al., 2018). An individual’s focus of attention plays a significant role during their ML (Land, et al., 2014). Athletes who use an EF experience a greater task focus (i.e., a reduced self-focus, ensuring an optimal task focus, where goals and actions connect; goal-action coupling) compared to athletes who use an IF, making them less susceptible to distractions and choking under pressure (Land, et al., 2014). Focusing on the effects of one's movement on the environment (i.e., an EF) prevents the self-referential focus (i.e., an IF) associated with choking, resulting in improved performances and enhanced accuracy (Land, et al., 2014; Abdollahipour, et al., 2017; McKay, et al., 2015). An IF disrupts the automaticity that is associated with optimal performances and unconscious rapid processing, interfering with efficient muscular activation, resulting in poorer performances (Wulf & Lewthwaite, 2016; Abdollahipour, et al., 2017).

According to Abdollahipour, et al., (2017), an IF and non-autonomy supportive environments interfere with a clear task focus, cause self-referential processing, and non-optimal motivational conditions, limiting task-related functional connections and goal-action coupling, resulting in poorer ML and performance (Menon, 2015). According to Bernardi, et al., (2013), the process for developing the proper neural connections to support optimal ML and performance is optimized under EF conditions and autonomy-supportive environments (ASE), resulting in functional connectivity associated with task-specific neural connections in the specific brain regions that are seen in skilled performers (Abdollahipour, et al., 2017).

Abdollahipour, et al., (2017) examined the role that an EF with the additive benefits of an ASE played in optimal ML and inattentional blindness (i.e., greater task focus) in a bowling task with thirty-six child participants (21 females, 15 males; mean age of 8.5 ± 1.3 year). The findings were statistically significant and revealed that participants who adopted an EF of attention and had ASE had greater throwing accuracy compared to the control and no-choice conditions confirming their hypothesis that an EF of attention and ASE independently contribute to superior bowling performance compared with both an IF and control conditions (Abdollahipour, et al., 2017). Future studies should examine the effects of an EF and ASE on long-term ML and performance, the impacts on intrinsic motivations, and the effects of an EF and ASE on children in other ML and performance environments (Abdollahipour, et al., 2017; Wulf & Lewthwaite, 2016).

According to Land, et al., (2014), an EF primes the associated motor performance, optimizing the sensorimotor representations that link actions to their effects, resulting in optimal ML and performance in following associated tasks. Land, et al., (2014) investigated the preceding, exploring the effects of adopting an EF compared to an IF on the development of representation of structures of ML in long-term memory. Participants (i.e., ten females; mean age-26.7; with no golf putting experience) were randomly assigned (RA) to train under specific instructions associated with an IF (e.g., focusing on the swing of their arms) or an EF (e.g., the velocity of the ball) over the course of three days; their representational structures were examined using a structural dimensional analysis of movement representations (SDA-M); and a questionnaire (i.e., a Likert scale; 1-not at all, 5-very much so) was used to determine the extent to which each participant adopted their attentional focus strategies (Land, et al., 2014). The findings were statistically significant and consistent with other research, such that the EF group demonstrated significantly greater accuracy and performance consistency in putting during the retention tests compared to the IF group (Land, et al., 2014). The results of the SDA-M analysis indicated that the learners who adopted an EF had more elaborate cognitive representations (i.e., better reflecting the biomechanical demands of the task), and were comparable to the representations of expert golfers (Land, et al., 2014; Wulf, 2013). The findings are explained in the following.

An IF during ML is found to hinder the ability of the motor system to make accurate associations between the movement and its effect, leading to less elaborate sensorimotor representations (Land, et al., 2014). In contrast, an EF enhances the integration of effector and perceptual processes brought about by focusing on the sensory consequences of the movement, facilitating the cognitive association between an action and its effect, leading to the development of more elaborate sensorimotor representations, as the motor system becomes more sensitive to the perceptual consequences of the motor action (Land, et al., 2014). The preceding indicating that once the association between an action and its effect has been integrated within the representation, the anticipation of the movement effect becomes an effective retrieval cue in associated tasks further aiding in ML and performance (Hommel & Elsner, 2009; Land, et al., 2014).

According to Land, et al., (2014), future studies should track the development and retention of the cognitive representations long-term (e.g., months or years) to confirm the findings and determine whether the benefit of an EF persists compared to an IF, as the findings also revealed a narrowing of the gap in ML between the EF group and the IF group in the retention tests indicating that skills developed with an IF may be comparable to the performance of the skills developed with an EF over an extended period of training. Pascua, et al., (2015) supported the preceding findings by examining how an EF and enhanced expectancies (EE) facilitated ML, including addressing whether combining them would "double" the learning advantage.

Participants (i.e., 52 undergraduate students; 21 men and 31 women; with a mean age of 21.5 years, *s*: 1.22) were recruited to learn how to throw with their non-dominant arm in four RA experimental groups: One group (EF/EE) was provided with both treatments, three other groups received only one of the treatments (i.e., EF or EE) or none (i.e., control) (Pascua, et al., 2015). Participants in the EF and EF/EE groups were instructed to direct their attention to the center of a target (i.e., adopt an EF) and the EE and EF/EE groups were provided with bogus social-comparative feedback, suggesting to them that their performance was above average, then they were assessed using a retention test and a transfer test that involved a novel target distance with no feedback (Pascua, et al., 2015; Schmidt & Lee, 2020). Participants rated their self-efficacy (i.e., on a scale from 1-not confident at all to 10-extremely confident) on how confident they felt about being able to achieve certain scores before each practice phase and measured their positive and negative feelings using the Positive and Negative Affect Schedule, at the end of practice, and before the retention tests and transfer tests on day two (Pascua, et al., 2015). Regression analyses were performed to determine whether self-efficacy ratings or positive affect would predict retention and/or transfer performance (Pascua, et al., 2015).

The data was analyzed using analysis of variance across the various trials and groups, and accuracy scores were averaged across all ten trials, the transfer tests, and the retention tests for each group (Pascua, et al., 2015). The findings were consistent with the other literature, such that individuals who received EF instructions in the EF and EF/EE groups focused more on the target than on the movement, improved their throwing performance, and continued to improve in the retention tests and transfer tests while the other groups experienced decrements in performance, reflecting the significant relationship between an EF and improved performance (Pascua, et al., 2015). Additionally, self-efficacy and positive affect were highest among the EF and EF/EE groups, reflecting a correlation between EF, EE, increased self-efficacy and positive affect (Pascua, et al., 2015).

Perreault & French (2015) further contributed to the preceding findings after examining fourteen boys and fourteen girls aged nine to eleven who were RA to an EF feedback group and an IF feedback group (Perrault & French, 2015). Participants received general instructions and a task demonstration prior to completing 100 modified free throws over two days, while receiving feedback about the task based on their group (i.e., EF or IF feedback) (Perrault & French, 2015). A full 24-hours later participants completed a retention test (i.e., 20 additional free throws) to reflect their level of performance and ML after their respective feedback (Perrault & French, 2015; Schmidt & Lee, 2020).

Consistent with other findings the participants in the EF group performed significantly better than the participants in the IF group (Perreault & French, 2015). The preceding was attributed to participants in the IF feedbck group experiencing more self-evaluative thoughts during practice and retention tests (RT) (i.e., 57%), compared with participants who had received EF feedback (i.e., 7%) (Perreault & French, 2015). Future studies should continue to examine the benefits of an EF on improved ML and performance, as well as the relationship between an IF and self-evaluation and its decrements on performance (Perrault & French, 2015).

De Giorgio, et al., (2018) added to the literature on the efficacy of an EF and optimal ML and performance in children and examined how using an EF can mitigate attentional limitations present in children. Children have limited attentional capacities, as they are experiencing many cognitive changes in their development reducing their ability to manage their attention (De Giorgio, et al., 2018). Applying methods that provide children with mechanisms for optimizing their limited attention is integral to optimal ML and performance (De Giorgio, et al., 2018). De Giorgio, et al., (2018) proved that using EF strategies, such as target recognition (i.e., optimizing the child's propensity to visual search) with strategically placed patterns of color, designed to increase attention and memory retention (e.g., white, red, yellow, magenta, black, blue), on the children's soccer shoes maximized their limited attention, resulting in optimal ML and performance (De Giorgio, et al., 2018; Dzulkifli & Mustafar, 2013).

Participants (i.e., 34; seven-year-olds) coming from the same soccer club were RA to a control group (i.e., black soccer shoes) and the experimental group (i.e., colored shoes), and completed various tasks (e.g., passing, ball management, receiving the ball, scoring) on artificial grass in the morning, after a standard warm-up (De Giorgio, et al., 2018). The findings were consistent with other studies and revealed a statistically significant difference between the experimental group (i.e., EF) and the control group (De Giorgio, et al., 2018). The colored shoes effectively acted as an EF, preventing the constraining processes associated with adopting an IF of attention, resulting in improved ML (De Giorgio, et al., 2018).

Teixeira da Silva, et al., (2017) confirmed the preceding findings, such that an EF improved the performance of the pirouette en dehors (from fourth position) in 10-year-old ballet students. Teixeira da Silva, et al., (2017) had 38 participants who were RA to an EF group (i.e., focus on spotting a point on the wall in front of them for as long as possible) or an IF group (i.e., focus on their head relative to the wall in front of them for as long as possible). Participants completed 15 practice trials of a task that involved rotating as far as possible while balancing on one foot and receiving either the EF or IF feedback (Teixeira da Silva, et al., 2017) Two days later, participants completed retention and transfer tests (i.e., left pirouette) without receiving any feedback (Teixeira da Silva, et al., 2017).

The findings were consistent with other studies, such that the EF group resulted in superior motor learning and performance compared to the IF group (Teixeira da Silva, et al., 2017). Consistent with the findings in Pascua, et al., (2015), the participants completed self-reported questionnaires reporting their experience from the various tasks, and the EF group reported a greater sense of competence and satisfaction with their performance, while the IF group experienced more nervousness and concerns about losing their balance and not performing well (Teixeira da Silva, et al., 2017). While the preceding studies clearly indicate an EF enhances ML and performance compared to an IF, no studies to date have explored the role an EF plays in equestrian sports (Abdollahipour, et al., 2017; McKay, et al., 2015; De Giorgio, et al., 2018; Perreault & French, 2015; Pascua, et al., 2015, Land, et al., 2014).

Equestrian sports are a unique sport in that the rider is not the only athlete executing the performance, and a part of the athlete's role in effective ML and performance is a high attunement to the feel of the horse and the feel of their body in relation to the horse to optimally influence the horse (i.e., achieve harmony and have optimal performances) (Hogg, 2015; Harris, 2014). Harmony between the horse and rider is contingent on a rider's ability to develop a "feel" for horses (i.e., the most important quality of an equestrian athlete) (Hogg, 2015). "Feel" is a psychological and physical construct, developed as the rider learns to intuit and synchronize with the horse, allowing seamless nonverbal communication, maximizing the rider's ability to achieve optimal performance with their horse (Hogg, 2015). Further, a rider's ability to manage their psychological and physiological state directly effects their horse's performance (Wixcey, 2015).

The preceding implicates more of an IF compared to an EF (Abdollahipour, et al., 2017). Future research should explore the role that an EF compared to an IF plays in optimal ML and performance in equestrian sports. The literature clearly indicates optimal ML and performance when performers adopt an EF and reflects a clear gap in literature for ML and performance in performance tasks that demand IF features, such as those required to optimize the complex dynamic between horse and rider in equestrian sports (Harris, 2014; Hogg, 2015; Wixcey, 2015).

References

Abdollahipour, R., Nieto, M. P., Psotta, R., & Wulf, G. (2017). External focus of attention and autonomy support have additive benefits for motor performance in children. *Psychology of Sport and Exercise. 32.* 17-24. http://dx.doi.org/10.1016/j.psychsport.2017.05.004

De Giorgio, A., Sellami, M., Kuvacic, G., Lawrence, G., Padulo, J., Mingardi, M., & Mainolfi, L (2018). Enhancing motor learning of young soccer players through preventing an internal focus of attention: The effect of shoes colour. *PLoS ONE 13(8).* 1-15. https://doi.org/10.1371/journal. pone.0200689

Duke, R. A., Cash, C. D., & Allen, S. E. (2011). Focus of attention affects performance of motor skills in music. *Journal of Research in Music Education. 59.* 44-55. http://dx.doi.org/10.1177/0022429410396093.

Dzulkifli, M. A. & Mustafar, M. F. (2013). The influence of colour on memory performance: A review. *Malays Journal of Medical Science. 20.* 3–9. Available: http://www.ncbi. nlm.nih.gov/pubmed/23983571 PMID: 23983571

Harris, S. (2014). T*he united states pony clubs manual of horsemanship: Book 3: Advanced horsemanship HB – A levels. (2nd edi).* John Wiley & Sons, Inc.

Hogg, R. C. (2015). *Equestrian partnerships: A qualitative investigation between horse and rider in elite equestrian sports.* [Dissertation, Charles Sturt University]. Retrieved from: https://researchoutput.csu.edu.au/ws/portalfiles/portal/9316481/80409

Kal, E. C., Van der Kamp, J., & Houdijk, H. (2013). External attentional focus enhances movement automatization: A comprehensive test of the constrained action hypothesis. *Human Movement Science. 32.* 527–539.

Land, W. M., Frank, C., & Schack, T. (2014). The influence of attentional focus on the development of skill representation in a complex action. *Psychology of Sport and Exercise. 15.* 30-38. http://dx.doi.org/10.1016/j.psychsport.2013.09.006

Lohse, K. R., Jones, M., Healy, A. F., & Sherwood, D. E. (2014). The role of attention in motor control. *Journal of Experimental Psychology: General. 143.* 930-948. http://dx.doi.org/10.1037/a003281.

McKay, B., Wulf, G., Lewthwaite, R., & Nordin, A. (2015). The self: Your own worst enemy? A test of the self-invoking trigger hypothesis. *Quarterly Journal of Experimental Psychology. 68.* 1910-1919. http://dx.doi.org/10.1080/ 17470218.2014.997765.

Menon, V. (2015). Salience network. In A. W. Toga (Ed.), *2. Brain mapping: An encyclopedic reference.* 597-611. London, United Kingdom: Academic Press: Elsevier.

Neumann, D. L., & Brown, J. (2013). The effect of attentional focus strategy on physiological and motor performance during a sit-up exercise. *Journal of Psychophysiology. 27.* 7-15. http://dx.doi.org/10.1027/0269-8803/a000081.

Northoff, G., Heinzel, A., de Greck, M., Bermpohl, F., Dobrowolny, H., & Panksepp, J. (2006). Self-referential processing in our brain a meta-analysis of imaging studies of the self. *Neuro Image. 31.* 440-457. http://dx.doi.org/10.1016/ j.neuroimage.2005.12.002.

Pascua, L. A., Wulf, G., & Lewthwaite, R. (2015). Additive benefits of external **focus** and enhanced performance expectancy for **motor learning**. *Journal of Sports Sciences. 33(1).* 58-66. DOI: 10.1080/02640414.2014.922693

Perreault, M. E. & French, K. E. (2015). External-**focus** feedback benefits free-throw **learning** in children. *Research Quarterly for Exercise & Sport*. *86(4).* 422-427. DOI: 10.1080/02701367.2015.1051613

Russell, R., Porter, J., & Campbell, O. (2014). An external skill focus is necessary to enhance performance. *Journal of Motor Learning and Development. 2.* 37-46. http://dx.doi.org/10.1123/jmld.2014-0038.

Schmidt, R. A. & Lee, T. D. (2020). *Motor learning and performance: From principles to application.* Human Kinetics.

Schücker, L., Anheier, W., Hagemann, N., Strauss, B., & Vo€lker, K. (2013). On the optimal focus of attention for efficient running at high intensity. *Sport, Exercise, and Performance Psychology. 2.* 207-219. http://dx.doi.org/10.1037/a0031959.

Teixeira da Silva, M., Thofehrn, L. H., & Chiviacowsky, S. (2017). External focus of attention enhances children's learning of a classical ballet pirouette. *Journal of Dance Medicine & Science. 3.* 179-185.

Wixcey, H. (2015). *The use of Pre-Performance Routines in Equestrian Athletes.* [Dissertation, Cardiff Metropolitan University]. Retrieved from: doi:http://hdl.handle.net/10369/6866.

Wulf, G., & Lewthwaite, R. (2016). Optimizing performance through intrinsic motivation and attention for learning: The OPTIMAL theory of motor learning. *Psychonomic Bulletin & Review. 23.* 1382-1414. http://dx.doi.org/10.3758/ s13423-015-0999-9.

Wulf, G., & Lewthwaite, R. (2016). Optimizing performance through intrinsic motivation and attention for learning: The OPTIMAL theory of motor learning. *Psychonomic Bulletin & Review. 23.* 1382-1414. http://dx.doi.org/10.3758/ s13423-015-0999-9.

Wulf, G., & Su, J. (2007). An external focus of attention enhances golf shot accuracy in beginners and experts. *Research Quarterly for Exercise and Sport. 78.* 384-389. http://dx.doi.org/10.1080/02701367.2007.10599436.