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Editorial

Adopting an ecological perspective on skill performance and learning in sport

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The sub-discipline of motor learning frames understanding of skill performance and practice in sports, relevant for developing talent and enhancing expertise of athletes (Ribeiro et al., 2021). Research in this area has important implications for the professional support work of practitioners such as coaches, trainers and sport scientists (Woods et al., 2020). Ecological dynamics is a contemporary, transdisciplinary theory of motor learning, expertise and talent development in sport, which investigates dynamic *person-environment interactions* as the relevant scale of analysis for understanding human performance. Influenced and shaped by key ideas in biological, physical, social and anthropological sciences, an ecological perspective conceptualises athletes and sports teams as complex adaptive systems. An ecological perspective helps sport scientists to characterize the functional relationship that emerges from the continuous interactions of the individual athlete, task and environment, which is vital for understanding skill adaptation and talent development.

Complex adaptive systems in nature have inherent potential for self-organisation during interactions with the performance environment (e.g., continuous re-organisation of muscles, limbs, joints, segments leading to coordinated actions in

athletes and between teammates in a sports team) (Ribeiro et al., 2021). Evidence suggests that these inherent coordination tendencies exist from embryonic to elderly stages of human development. They can be exploited by people, during maturation, development and learning, to coordinate actions needed to resolve movement problems and challenges throughout the lifespan (Button et al., 2020). Self-organisation tendencies provide a foundation for learning complex coordination skills throughout life and for adapting movement patterns in performance contexts like sport to interact with conditions of dynamic environments.

Contemporary pedagogies have emerged from ecological dynamics, such as Constraints-Led coaching (Renshaw et al., 2019) and a Nonlinear Pedagogy (Rudd et al., 2021). These approaches to learning and development are shaping the way that sport practitioners design practice and training environments for athletes and teams (Otte et al., 2021). Research has revealed key principles for applied sport scientists which emerge from adopting an ecological perspective, including:

1. Ecological dynamics emphasises that *context is everything* in a motor learning theory that focuses on coordination (between system degrees of freedom within each learner and between the



- learner and the environment). These coordination processes can support *skill adaptation* (Araújo & Davids, 2011) which helps athletes to acquire an increasingly functional relationship with a performance environment.
2. Understanding how skill adaptation emerges from learning and development over time has clarified that coordination *variability* is an important characteristic of skilled behaviour that plays an important role in supporting skill adaptation and enhancing athlete functionality (Caballero et al., 2017).
 3. The *athlete-environment relationship* is a key focal point in understanding skill adaptation and talent development. Considering how athletes form successful (productive) relationships with their competitive performance environments provides a relevant scale of analysis for understanding skilled behaviours (Button et al., 2020).
 4. An ecological perspective promotes sport practitioners as '*designers*' of training and practice environments that provide *affordances* as opportunities which are designed to 'invite' specific actions from athletes and teams needed in competitive performance (Rudd et al., 2021).
 5. Ecological dynamics provides a transdisciplinary approach to sports science support for professional practitioners in organisations working together in a Department of Methodology (see Rothwell et al., 2020). Designing *athlete-environment centred* practice contexts is a key challenge for high-performance sport organisations. Preparation for performance requires effective collaborative efforts of teams of practitioners (including coaches, trainers, therapists, sport scientists, psychologists and performance analysts) to design information-rich learning environments. The trend for growing numbers of sub-discipline specialists within sport organisations may lead to disjointed athlete development approaches or sections working in isolation (Otte et al., 2020). Coordinating the work of these disciplinary specialists is a challenge for head coaches and managers who may face many methodical incongruencies when designing individualised training environments. An ecological perspective proposes the functional blending of various methodologies and ideas into a *Department of Methodology* (DoM; Rothwell et al., 2020). While each sub-discipline's empirical and experiential expertise is preserved in a DoM, sections can collaborate together under shared theoretical principles and a unified conceptual framework of ecological dynamics. Put simply, guided by an ecological perspective of how athletes learn, multidisciplinary staff can co-design individualised practice programmes for athletes, to promote exploration, discovery and adaptability (Otte et al., 2021).
 6. The *natural attitude* towards research on learning and athletic performance in sport, reveals the world through what Weber (2019) termed *instrumental rationality*, which considers athletes to be the subject of study. Rarely, does sport science research give athletes a voice to offer insights into their *lived experiences* of performance and preparation (Smerdu, 2015). This omission can be problematic, because as Woods et al. (2021) have argued, athletes can provide critical information to inform more effective practice and learning designs. To address this challenge, and to investigate performance behaviours through an ecological dynamics lens, mixed methods research may provide a viable way to investigate interacting personal, task and environmental constraints that continually shape performance and preparation contexts. Combining phenomenological (an ontology of human existence) qualitative interviews, observations and records with quantitative performance analysis, can result in data to facilitate an in-depth transdisciplinary perspective of athlete

performance (e.g., Seifert et al., 2017). Integrating different methodologies can elicit rich information about key constraints influencing athletes during competition and practice. A mixed methods approach can develop a greater understanding of embodied athletic experience, leading to the design of more meaningful and empowering learning environments that enhance athletic performance.

Summary

Ecological dynamics is a contemporary, applied scientific approach to studying motor learning, expertise, practice design and talent development in sports. It advocates the integration of experiential knowledge of groups of specialist practitioners and athletes, framed by theoretical understanding of athletes and teams as biophysical adaptive systems, in a coordinated DoM in sports organisations. An ecological model for sport science support and preparation for competition can facilitate contextualised training and practice designs for individual performers and groups.

Conflicts of Interest: The authors declare no conflict of interest.

References

- Araújo, D. & Davids, K. (2011). What exactly is acquired during skill acquisition?. *Journal of Consciousness Studies*, 18, 7-23.
- Button, C., Seifert, L., Chow, J.-Y., Araújo, D. & Davids, K. (2020). *Dynamics of Skill Acquisition: An Ecological Dynamics rationale* (2nd Edition). Champaign, Ill: Human Kinetics.
- Caballero, C., Davids, K., Heller, B., Wheat, J., & Moreno, F. (2019). Movement variability emerges in gait as adaptation to task constraints in dynamic environments. *Gait and Posture*, 70, 1-5. doi: 10.1016/j.gaitpost.2019.02.002
- Otte, F. W., Davids, K., Millar, S-K., & Klatt, S. (2021). Understanding how athletes learn: Integrating skill training concepts, theory and practice from an ecological perspective. *Applied Coaching Research Journal*, 7, 22-32: <https://www.ukcoaching.org/resources/topics/research/applied-coaching-research-journal>
- Otte, F.W., Rothwell, M., Woods, C., & Davids, K. (2020). Specialist Coaching Integrated into a Department of Methodology in Team Sports Organisations. *Sports Medicine - Open*, 6(1), 1-8. doi: 10.1186/s40798-020-00284-5
- Renshaw, I., Davids, K., Newcombe, D., and Roberts, S. (2019). *The Constraints- Led Approach* (Routledge Studies in Constraints-Based Methodologies in Sport) (1st Edn). London: Routledge. doi: 10.4324/9781315102351-6
- Ribeiro, J., Davids, K., Silva, P., Coutinho, P & Garganta, J. (2021). Talent development in sport requires athlete enrichment: Contemporary insights from a Nonlinear Pedagogy and the Athletic Skills Model. *Sports Medicine*, doi: 10.1007/s40279-021-01437-6
- Rothwell, M., Davids, K., Stone, J., O'Sullivan, M., Vaughan, J., Newcombe, D. & Shuttleworth, R. (2020). A Department of Methodology Can Coordinate Transdisciplinary Sport Science Support. *Journal of Expertise* 3, 55-65.
- Rudd, J.R., Renshaw, I., Savelsbergh, G.J.P., Chow J.-Y., Roberts, W., Newcombe, D. & Davids, K. (2021). *Nonlinear Pedagogy and the Athletic Skills Model: The Importance of Play in Supporting Physical Literacy*. Routledge: London.
- Seifert, L., Lardy, J., Bourbousson, J., Adé, D., Nordez, A., Thouvarecq, R., & Saury, J. (2017). Interpersonal coordination and individual organization combined with shared phenomenological experience in rowing performance: two case studies. *Frontiers in Psychology*, 8, 75. doi.org/10.3389/fpsyg.2017.00075
- Smrdu, M. (2015). First-person experience of optimal sport competition performance of elite team athletes. *Kinesiology*, 47(2), 169-178.
- Woods, C. T., Rothwell, M., Rudd, J., Robertson, S., & Davids, K. (2021). Representative co-design: Utilising a source of experiential knowledge for athlete development and performance preparation. *Psychology of Sport and Exercise*, 52. doi.org/10.1016/j.psychsport.2020.101804
- Weber, M. (2019). *Economy and society*. Harvard University Press.
- Woods, C., McKeown, I., Rothwell, M., Araújo, D., Robertson, S. & Davids, K. (2020). Sport practitioners as sport ecology designers: How ecological dynamics has progressively changed perceptions of skill acquisition in the sporting habitat. *Frontiers in Psychology: Movement Science and Sport Psychology*, 11: 654, doi: 10.3389/fpsyg.2020.0065