Harnessing socio-cultural constraints on athlete development to create a form of life

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Abstract

The role of task constraints manipulation in pedagogical practice has received considerable attention in recent years, although there has been little focus on the role of socio-cultural constraints on an athlete's development to elite performance. Here, we aim to integrate ideas from a range of scientific sub disciplines to consider why certain behaviours and cultures (socio-cultural constraints) may exist in sport performance and coaching. Using recent conceptualisations of affordances in ecological dynamics, we explore how socio-cultural constraints may influence an athlete's development and relationship with a performance context. We also highlight how workplace practices eminating from the industrialisation of the nineteenth-century in countries like the UK may have influenced coaching practice and organisational behaviours from that time on. In particular, features such as strict work regimes and rigid role specification may have reduced personal autonomy, de-skilled performers and induced a 'body as machine' philosophy within sporting organisations. These traits could be considered counter to expert performance in sports where creativity and adaptive decision-making are important skills for athletes to possess. We propose that ecological dynamics is a theoretical framework that enhances the understanding of the influencential nature of socio-cultural constraints on the development of athlete performance. Key ideas suggest that sport pedagogists and practitioners could develop methodologies which help design practice landscapes rich in information to encourage athlete autonomy to search for relevant affordances which invite functionally relevant actions for competitive performance with physical, psychological, emotional and social dimensions. Future research is needed to explore a range of sports to identify and clarify the relationship between socio-cultural constraints and expertise acquisition.

Key Words: Ecological dynamics, affordance landscapes, socio-cultural constraints, learning design, expertise acquisition

1.0 Introduction

Expertise in sport is multidimensional and emerges from the rich, continued interactions of an athlete with a range of task and environmental constraints in performance, simulated in practice (Davids, Button & Bennett, 2008). Ecological dynamics is a powerful theoretical framework to understand how sport practitioners can support athlete development, predicated on these complex and dynamic interactions, emanating from person-environment relationships (Davids, Handford & Williams, 1994). A key principle of ecological dynamics, relevant for the challenge of athlete development, is the interacting influence of task and environmental constraints on an athlete's ability to become attuned to the opportunities for action invited by objects, surfaces, features, terrains, and other people, in a performance setting, (known as affordances in ecological dynamics) (Davids, Güllich, Shuttleworth & Araújo, 2017). An increasingly functional relationship with a performance environment is the basis of expertise from an ecological dynamics rationale (Araújo & Davids, 2011). These ideas suggest that athletes who have been trained to select from a rich and diverse range of affordances available in a competitive performance environment, will be better prepared to perceive information, adapt their actions, make decisions and interact skillfully with ecological constraints of competition.

James Gibson (1979, p.119) argued that "the affordances of the environment are what it offers the animal". For example, in rugby league, a ball offers kicking by players when travelling on the ground or intercepting with their hands when moving through the air; a slow player invites a quicker player to run past him/her, or a hard pitch offers sidestepping on. Recently, Gibson's initial conceptualisation of affordances has been revisited to emphasise the invitational characteristic of affordances to individuals with the relevant experiences, skills and capacities (Withagen, de Poel, Araújo & Pepping, 2012; Rietveld & Kiverstein, 2014; Bruineberg & Rietveld, 2014; Withagen, Araújo & de Poel, 2017). Here, we elucidate what these refinements imply for making sense of the variety of socio-cultural practices that are embedded in what the philosopher Ludwig Wittgenstein termed forms of life (Wittgenstein, 1953), which consist of behaviours, skills, capacities, attitudes, values, beliefs, practices and customs that shape the communities we live in. The features of a form of life subsequently shape how we live (Rietveld & Kiverstein, 2014; Bruineberg & Rietveld, 2014).

Extrapolating these ideas, we contend that there are current examples of 'forms of life' identifiable in sport (e.g. related to ski-ing in Northern Europe, soccer in Brazil, cricket in South Asia, and rugby union in New Zealand). These forms of life in specific sports demonstrate how influential specific socio-cultural and historical constraints have been in developing sporting excellence. They can explain why certain performance styles are

developed in certain regions and why they are valued and exploited to establish dominance in elite sport. Athletic sprinting in Jamaica, for example, is ingrained in the sporting culture and has a history and tradition of excellence, strongly influenced by the G. C. Foster College for Physical Education and Sports where the country's athletic coaches are educated in a Jamaican 'way of sprinting' (Moore, 2015). In these sporting cultures a form of life can be highly influential in how sport practitioners construct and design the micro structure of practice, that could have positive or negative effects on athlete performance. However, the notion of different countries or regions being associated with a particular 'style' or 'way' of practicing and performing in a sport is rather simplistic, lacks theoretical substance and requires conceptual clarification in order to help us understand the basis for performance development. For example, to enhance athlete development, is it feasible for one country to simply imitate a way of practicing or performing associated with another (highly successful) nation in a sport (Harris, 2017)? Simply imitating the traditional practices of another nation may present performance challenges without first exploring, understanding, and embracing the form of life that influences the factors that lead to another nation's success in competitive sport.

Here we contend that differences in quality of performance and playing styles are substantively based on a specific 'form of life', often developed under specific historical, socio-cultural constraints in particular geographical locations in the world. Forms of life are predicated on highly specific customary, habitual, highly developed, yet responsive, modes of performing, competing, training and practising which result in the preference to design specific types of affordance landscapes in athlete development programmes. Exploiting the invitational nature of affordances when designing affordance landscapes in practice task designs (Withagen et al., 2012; Withagen et al., 2017), should aim to make effective skilled action more likely to emerge. In these affordance landscapes, specific practice task designs guide developing athletes in their search for functional relationships with performance environments founded on skill, expertise and talent (Davids et al., 2017). Although recent clarifications of Gibson's conceptualization have made valuable contributions to the literature on affordances, little is known in sport domains about how a form of life can help sport practitioners to harness local socio-cultural practices to influence affordance utilisation and the acquisition of sporting expertise. Understanding more about this issue can help sport pedagogists to identify and exploit key socio-cultural constraints to enhance the quality of athlete development in specific sports (Uehara, Button, Falcous & Davids, 2016; Araújo et al., 2010). First, we provide a brief historical case into why 'forms of life' and associated behaviours and customs may exist and influence sport expertise.

2.0 Historical Influences on Sport Performance and Coaching: The case of UK Rugby Football League

As with any social phenomenon, the extent to which history influences socio-cultural practices cannot be ignored. In the case of sport coaching in the United Kingdom, for example, industrialisation during the nineteenth-century influenced social structures and trends, which in turn influenced workplace practice and behaviours from that time onwards, shaping training methods in later years (Lyle, 2002). Increasing industrialisation during the 1800s was successful, in part, to the production line ethos, which was later strongly influenced by the American mechanical engineer Fredrick Winslow Taylor's systematised approach to industrial efficiency. During a lecture on industrial efficiency in 1907, Taylor (2008, p. 215) provided insights into the work place practices that contributed to his systematic management methods. His advice was straightforward:

> Managers should not allow employees to think for themselves but make sure they simply carry out tasks as instructed, our scheme does not ask any initiative in a man. We do not care for this initiative. All we want of them is to obey the orders we give them, do what we say, and do it quick. That scheme of giving minute instructions to every man, that is assigning him a task, having that task all planned for everyone [Emphasis added].

Of interest is how these ideas filtered into cultural practices in institutional programmes in education and sport affecting the development of individuals. One sport with a relevant socio-cultural-historical backdrop to provide insights into how coaching behaviours and practice design shape how players acquire performance skills, is British rugby football league. Historically, rugby football league's roots originated in the north of England, where playing regions had been built on the key industries of the Victorian era (1837 to 1901). The writings of sport historian Tony Collins (2006, p. 149) provide insights into how these strong social-cultural-historical roots may have influenced the values of rugby league players, suggesting that 'the attitudes of rugby league players were, therefore, shaped and defined by the world of industrial labour, which was intensely physical, often aggressively oppositional to management and, above all, almost absolutely masculine'.

It is understandable that the reductionist nature of Taylor's methods and the attitudes and behaviours associated with industrial labour were manifested in other parts of society at that time, including the sport domain (Kiely, 2012). This process of perfidious filtration had strong connections to coaches and trainers applying 'production line principles' to design systematic training programmes aimed to enhance athlete performance (Smith & Davids, 1992). A stronger focus on enhanced athlete performance was perhaps down to

the increasing professionalisation of sport performance through structuring practice and training requirements during the early 1900s (Day & Carpenter, 2015). The sporting forms of life that adopted ideas from Taylorism and the industrial workplace in the commodification of athletes, were applied to the design of sports performance programmes, where strict work regimes and rigid role specification reduced personal autonomy and induced a 'body as machine' philosophy (Smith & Davids, 1992). Taylor's legacy is still evident in the sport domain today, where 'reproductive style' coaching approaches that favor the decomposition of movement into anatomical units to 'reproduce' skilled actions are still common (Davids, Güllich, Shuttleworth, & Araújo, 2017). In rugby league, for example, when learning the "6 O'clock pass" performers are required to: (i) point the ball to 6 O'clock, and (ii), pass over the front foot (Rugby Football League Level 2 Coaching Manual, 2014). These traits were valued in the socio-cultural contexts of the Victorian era in the UK but run counter to attributes considered conducive to team sport performance, in contemporary society, where, autonomy within collaborative efforts, creativity and adaptive decision-making are viewed as important skills for athletes to possess (Memmert, Baker & Bertsch, 2010; Araújo & Davids, 2015). As discussed next, socio-cultural constraints shape the way that an athlete develops a relationship with the available affordances to invite functional actions and behaviours during competition.

3.0 Sporting Forms of Life, Affordances and Athlete Performance

A key tenet of Gibson's (1979) theory of affordances is the relational nature between affordances and an ecological niche. Within an athlete performance context, this is especially related to an individual's current available experience, abilities and capacities, captured in their intrinsic dynamics (dispositional tendencies) in a constraints-based framework (Schöner, 1994; Vallacher, van Geert & Nowak, 2015). Gibson (1979), and more recently, Rietveld and Kiverstein (2014, p. 326) suggested that affordances are not simply action opportunities offered by the environment, but are dependent on the 'abilities available in a particular ecological niche'; important to this point is how an ecological niche can be 'shaped and sculpted by the rich variety of social practices humans engage in'. Rietveld and Kiverstein's (2014) conceptualisation of affordances connotes the mutuality of the athlete-environment relationship which is embedded in forms of life. The theory of affordances embedded in forms of life provides a powerful rationale for the application of this key idea by sport practitioners to consider the (socio-cultural and historical constraints in) environments which shape expectations and beliefs on how athletes should behave, perform in competition, develop and learn (for example, Taylorism and systematic workplace practices may have influenced the same employee's view of performing, developing and

144 training, who then went on to coach and play team sports). This conceptualization is important for considering
145 how to maximise the design and resourcefulness of practice environments and the socio-cultural practices that
146 athletes engage in around the globe in different societies, and communities with distinct social, physical and
147 geographical locations. It can provide a lens for practitioners to understand the potential for transfer of
148 (successful) practices and methods from one cultural context to another.

149 Forms of life are recognisable within coaching values, practice, and behaviours across sports, which are
150 constructed by the relationship between wider social values and key individuals involved in specific sports (Day
151 & Carpenter, 2015). An individual who transitions between social contexts (i.e. communities, workplaces and
152 the coaching arena) is influenced by normalised social values which continuously influence the relational nature
153 between affordances and the ecological niche (Bronfenbrenner, 1979). Consider a form of life in British rugby
154 league, where 'percentages, position and possession have been the prevailing mind set of late' (Woods, 2017, p.
155 7). The players being considered almost as mere machinery in the greater strategical planning of the high
156 performance sports organisation. The consequences of this form of life are exemplified by the perceptions of ex-
157 Great Britain Rugby League International Phil Clarke (2016, p. 11), warning against the normalisation of
158 'machine-like' behaviours in athletes:

159 > I worry that we are stifling the talents of more players by getting them to play like robots [Emphasis
160 > added]. The obsession with completion rates discourages players from taking a risk. We need to
161 > radically alter that thinking and encourage players not to worry about being wrong and losing the ball,
162 > mistakes will happen.

163 This account is consistent with the occupational ideals of Taylorism, prevailing assumptions of
164 managerialism and the socio-cultural-historical insights into rugby league provided earlier. This process-
165 oriented approach that adopts a dualist stance (i.e., seperating mind and body) can be embedded in the socio-
166 cultural practices that are manifested through a sports or teams coaching practices and behaviours (Lombardo,
167 1999), where coaches design practice tasks based on the decomposition of complex individual or team skills
168 (Chow, Davids, Button & Renshaw, 2016). Although structure and organisation may have benefits during
169 athlete learning, over exposure to practice landscapes that reduce opportunities for action and promotes
170 systematic and predictable behaviours, can affect an athlete's responsiveness to relevant affordances. This
171 perspective is exemplified by ex-Great Britain international Phil Clarke (2016, p. 7/10) who describes a
172 common structured playing style:

> The 'structured' play of who stands where, runs into which hole in their opponents' defensive line, passes behind which team-mate, it's a bit like watching a driverless car …. There is a bigger danger that the shift away from autonomous thinking in attack will become boring - if it hasn't already. Worse still, we are in danger of damaging young players by encouraging them to copy this style of play [Emphasis added].

Withagen et al. (2017) have argued against this mechanistic conception of human behaviour, instead favouring the role of agency (i.e. individuals can make their own way in the world) to better understand how affordances can be designed to invite or solicit functional behaviours. The notion of agency does not mean athletes should be 'programmed' to respond to certain affordances, but should 'unreflectively' interact with the affordances available in a performance environment that invite their actions (Rietveld, 2008). Importantly, advocating that athletes have agency and can, therefore, act autonomously in their performance environment, prioritises the person-environment relationship as the important scale of analysis in regards to developing human movement behaviours (Withagen et al., 2017). This idea implies that sport pedagogists, and the socio-cultural practices they influence, must support the autonomy needed by athletes during competitive performance. They can develop the autonomy of athletes by facilitating their active exploration of a landscape of available affordances during practice, which helps them to perceive and pick up action opportunities which exist in a performance environment (Araújo, Davids & Hristovski, 2006). This re-conceptualisation proposes a significant role for coaches as 'designers' of affordance landscapes, as part of a comprehensive 'form of life' in high performance and elite development programmes, which simulate critical aspects of competitive performance environments. Although this approach to expertise acquisition is theoretically coherent, within professional rugby league, experiential knowledge of experts has pointed to the existence of a form of life that is more consistent with mechanistic and reductionist approaches in line with traditional working practices.

A challenge for sport pedagogists is to develop evidence-based methodologies which help them move away from mechanistic and reductionist approaches that force athletes to seek putative 'common optimal movement templates' in training (Brisson & Alain, 1996). Rather, sport pedagogists and practitioners could work collaboratively guided by a universal principled theoretical framework with other practitioners (e.g., strength and conditioning specialists, psychologists, trainers, coaches, performance analysts, skill acquisition specialists) in a 'Department of Methodology'. The aim of a Department of Methodology could be for group members to collaboratively design practice landscapes rich in information (i.e. visual, acoustic, and haptic)

based on a powerful and comprehensive theory of human behavior to guide implementation of methods, encouraging the exploration of affordances utilised to shape and guide performance behaviours with physical, psychological, emotional and social dimensions (Davids, Araújo, Hristovski, Passos & Chow, 2012). Collaborative work in a Department of Methodology, based on an ecological dynamics rationale, could lead to an agreed understanding of when, how, why and, by whom, particular fields of a landscape can be searched during practice. If sporting forms of life provide athletes with opportunities to explore practice landscapes varying in informational constraints, providing what Bernstein (1967, p. 204) called 'repetition without repetition' (i.e., athletes exploring and discovering multiple performance solutions to achieve the same goal directed task), they are more likely to develop the functionality required to continuously co-adapt their behaviors to a range of evolving environmental and task constraints (Seifert, Button & Davids, 2013; Pinder, Davids, Renshaw & Araújo, 2011). Individuals who improve their situation in a performance setting by unreflectively responding to relevant affordances (solicitations of the environment) are considered to have an optimal grip on the situation (e.g. simultaneous attunement to multiple relevant affordances) (Rietveld & Kiverstein, 2014; Bruineberg & Rietveld, 2014), the basis of autonomous behaviors in sport performance contexts. The notion of skilled intentionality (an individual's tendancy towards an optimal grip) can provide sport practitioners with a suitable conceptual framework to understand how to support athletes' to become attuned to a field of affordances, underpinning their agency in competitive sport. Skilled intentionality is founded on the intertwined relationship between emotion, cognition, perception and action of athletes who are challenged by sport practitioners to adapt to dynamic constraints of specific fields of an affordance landscape. The aim is to support each athlete in gaining an optimal grip on the relevant affordances in a landscape to develop a functional relationship with the performance environment (Araújo & Davids, 2011).

The phenomenological notions of skilled intentionality, optimal grip, and field of affordances applied to athletes, signify that they: (i) have developed high levels of functionality to adapt to varied challenges in performance settings, enhancing their decision making capacities and the autonomy needed to interact with teammates and opponents; (ii) have adapted to the relevant physical conditioning to function at high levels throughout competition, and (iii), have developed the resilience and emotional regulation strategies needed to flourish in competitive performance. Consequently, an athlete's concerns and abilities are constantly evolving, signifying that their functionality towards an optimal grip on a field of affordances is adaptable to varied situations (Rietveld & Kiverstein, 2014; Bruineberg & Rietveld, 2014), through their ability to develop a functional relationship with dynamic performance environments (Araújo & Davids, 2011). This point is

demonstrated by the experiential knowledge of Castleford Tigers Head Coach, Daryl Powell (2017, p. 4) (At the time of writing Castleford Tigers were top of the British Super League table, having scored 149 more points than their closest rivals (BBC, 2017)).

> For me, you should have your own philosophy and culture as a coach – and at Castleford we believe *that we're different*. I like the way we play and I'm excited by it – I'm coaching them, so I should be. If you're not excited about what you're doing, you should be doing something else. We have a way of *playing, but we're always* tweaking it. If teams *expect something from us then we'll* throw something else at them. *We're hard to coach against and we won't change that.* As a coaching group we like to be inventive and I know the players enjoy playing the way we do [Emphasis added].

This extract suggests the existence of a form of life (philosophy and culture embedded in a methodological framework) that refuses to subscribe to conventional styles of play, discussed earlier by Phil Clark. Consequently, the team has a different way of playing that exploits evolving practice landscapes that require players to use information to continuously co-adapt their actions to the movements of opponents and teammates in achieving task goals (Chow et al., 2016). Being embedded in a form of life of this nature means that players become sensitive to and utilize (rapidly appearing and dissolving) affordances in dynamic performance contexts that are not effectively simulated under the narrow task constraints of traditional socio-cultural practices (i.e. styles of play). These ideas imply how transitioning of teams between performance states of stability and relative instability, can emerge to underpin successful performance in sports such as rugby league.

4.0 Conclusions and Future Research

We argued that the social, cultural, and historical contexts in which athletes develop an increasingly functional relationship with a performance context are important constraints on expertise which are relevant to understand in sport. This category of constraints is currently lacking in substantive empirical research, especially with respect to their effects on expertise in sport (Uehara et al., 2016), although there are strong theoretical and philosophical ideas which implicate their importance in shaping behaviors. An important challenge for sport practitioners is to elucidate the role of socio-cultural constraints in the design of affordance landscapes to enhance the development of sport expertise. In tackling this challenge, high performance sport can use a powerful theoretical and methodological framework to guide sport practitioners in exploring socio-cultural

constraints to facilitate an athlete's utilization of the multitude of available affordances to suport skilled action. The role of ecological dynamics in this task will focus attention on the person-environment relationship, leading to a better understanding of the relationship between socio-cultural constraints and the emergence of an athlete's skilled behaviours (Araújo, 2010).

To address these challenges Bronfenbrenner's proposed bioecological model of human development provides methodological guidance for identifying relevant socio-cultural constraints that affect the development of athletes (Bronfenbrenner, 1979), and looks beyond the athlete's immediate environment (although important) to explore the wider socio-cultural constraints that influence skilled behaviour (Gabbard & Krebs, 2012). The evolution of the bioecological model of human development (Rosa & Tudge, 2013) does not provide a universal explanatory theory of skilled behavior (Araújo et al., 2010). However, adopting the model can provide methodological guidance to analyse the relationships that evolve between an athlete's exposures to a multitude of constraints (e.g., person, process, context, time), the influence these constraints have on affordance utilization, and the socio-cultural practices that are embedded in sporting forms of life (Krebs, 2009). To explore these relationships a mixed methods research approach can be employed to detail a form of life in a specific sport, establish the relationships between a form of life and an athlete's capacity to utlize available affordances, and analyse the task-specific relations between athletes and dynamic practice and competition settings. An ecological dynamics examination of the person environment relationship will allow a functional analysis to identify how perception and action can be harnessed to pick up and utilize affordances by individuals (Warren, 1988).

References

Araújo, D., Fonseca, C., Davids, K., Garganta, J., Volossovitch, A., Brandão, R., & Krebs. R. (2010). The Role of Ecological Constraints on Expertise Development. Talent Development & Excellence, 2(2),165–179.

Araújo, D., & Davids, K. (2015). Towards a theoretically–driven model of correspondence between behaviours in one context to another: Implications for studying sport performance. International Journal of Sport Psychology, 46, 268–280.

Araújo, D., Davids, K., & Hristovski, R. (2006). The ecological dynamics of decision making in sport. Psychology of Sport and Exercise, 7(6), 653-676.

Araújo, D., & Davids, K. (2011). What Exactly is Acquired During Skill Acquisition? Journal of Consciousness Studies, 18(3), 7–23.

Araújo, D., Davids, K., Bennett, S.J., Button, C., & Chapman, G. (2004). Emergence of sport skills under constraint. In A.M. Williams & N.J. Hodges (Eds.), Skill Acquisition in Sport: Research, Theory and Practice, London: Routledge, Taylor & Francis.

BBC Sport Rugby League. (2017). Retrieved from http://www.bbc.co.uk/sport/rugby-league.

Bernstein, N. A. (1967). The control and regulation of movements.London: Pergamon Press.

Bruineberg, J., & Rietveld, E. (2014). Self-organization, free energy minimization, and optimal grip on a field of affordances. Frontiers in Human Neuroscience, 8(599), 1-14.

Brisson, T. A., & Alain, C. (1996). Should common optimal movement patterns be identified as the criterion to be achieved? Journal of Motor Behavior, 28, 211–223.

Bronfenbrenner, U. (1979). The ecology of human development. Experiments by nature and design. Cambridge, MA: Harvard University Press.

Buekers, M., Ibáñez-Gijón, J., Morice, A., Rao, G., Mascret, N., Laurin, J., & Montagne, G. (2017). Interdisciplinary Research: A Promising Approach to Investigate Elite Performance in Sports. Quest, 69(1), 65-79. doi:10.1080/00336297.2016.1152982.

Collins, T. (2006). Rugby League in Twentieth Century Britain: A Social and Cultural History. London: Routledge.

Chow, J.-Y., Davids, K., Button, C., & Renshaw, I. (2016). Nonlinear Pedagogy in Skill Acquisition: An Introduction. Routledge: London.

Clarke, P. (2016, May 5). Creativity is being coached out of rugby league. Sky Sports. Retrieved from http://www.skysports.com/rugby-league/news/12532/10269065/phil-clarke-creativity-is-being-coached-out-of-rugby-league.

Davids, K., Button, C., & Bennett, S. (2008). Dynamics of skill acquisition: A constraints-led approach. Champaign, IL: Human Kinetics.

Davids, K., Handford, C., & Williams, M. (1994). The natural physical alternative to cognitive theories of motor behaviour: An invitation for interdisciplinary research in sports science? Journal of Sports Sciences, 12, 495–528. doi:10.1080/02640419408732202.

Davids, K., Güllich, A., Shuttleworth., R., & Araújo, D. (2017). Understanding Environmental and Task Constraints on Talent Development, In J. Baker, S. Cobley, J. Schorer & N. Wattie (Eds.), Routledge Handbook of Talent Identification and Development in Sport. Abingdon: Routledge.

Davids, K., Araújo, D., Hristovski, R., Passos, P., & Chow, J. Y. (2012). Ecological dynamics and motor learning design in sport. In N. Hodges & M. Williams (Eds.), Skill Acquisition in Sport: Research, theory and practice. Abingdon, UK: Routledge.

Day, D., & Carpenter, T. (2015). A History of Sports Coaching in Britain: Overcoming Amateurism. London: Routledge.

Gabbard, C., & Krebs, R. (2012). Studying environmental influence on motor development in children. Physical Educator, 69, 146-149.

Gibson, J. J. (1979). The theory of affordances. In R. E. Shaw & J. Bransford (Eds.), Perceiving, acting, and knowing: Toward an ecological psychology. Hillsdale, NJ: Lawrence Erlbaum Associates.

Glazier, P. (2015). Towards a Grand Unified Theory of sports performance. Human Movement Science. doi.org/10.1016/j.humov.2015.08.001.

Harris, B. (2017, June 15). All Blacks-lite: Wallabies take inspiration from their rivals across the Tasman. The Guardian. Retrieved from https://www.theguardian.com/sport/2017/jun/16/all-blacks-lite-wallabies-take-inspiration-from-their-rivals-across-the-tasman.

Ibáñez-Gijón, J., Buekers, M., Morice, A., Rao, G., Mascret, N., Laurin, J., & Montagne, G. (2017). A

scale-based approach to interdisciplinary research and expertise in sports. Journal of Sport Sciences, 35(3), 290-301. doi:10.1080/02640414.2016.1164330.

Kiely, J. (2012). Periodization Paradigms in the 21st Century: Evidence-Led or Tradition-Driven? International Journal of Sports Physiology and Performance, 7, 242-250. doi: 10.1123/ijspp.7.3.242.

Krebs, R. J. (2009). Bronfenbrenner's bioecological theory of human development and the process of development of sports talent. International Journal of Sport Psychology, 40(1), 108-136.

Lombardo, B. (1999). Coaching in the 21st century: Issues, concerns and solutions. Sociology of Sport Online, 2(1). Retrieved from http://physed.otago.ac.nz/sosol/v2i1/v2i1a4.htm.

Lyle, J. (2002). *Sports Coaching Concepts: A Framework for Coaches' Behaviour*. London: Routledge.

Memmert, D., Baker, J., & Bertsch, C. (2010). Play and practice in the development of sport-specific creativity in team ball sports. High Ability Studies, 21(1), 3-18.

Moore, R. (2015). *The Bolt Supremacy: Inside Jamaica's Sprint Factory*. London: Yellow Jersey Press.

Phillips, E., Davids, K., Renshaw, I., & Portus, M. (2010). Expert Performance in Sport and the Dynamics of Talent Development. Sports Medicine, 40, 271–283.

Pinder, R,. Davids, K., Renshaw, I., Araújo, D. (2011). Manipulating informational constraints shapes movement reorganization in interceptive actions. Attention, Perception & Psychophisics, 73(4), 1242-1254.

Powell, D. (2017, February 3). In G. Walker, Castleford boss Daryl Powell promises flair and urges Super League sides to 'fight back' against Aussie style. Mirror. Retrieved from http://www.mirror.co.uk/sport/rugby-league/castleford-boss-daryl-powell-promises-9750729.

Rosa, E. M., & Tudge, J. R. H. (2013). Urie Bronfenbrenner's theory of human development: Its evolution from ecology to bioecology. Journal of Family Theory & Review, 5, 243–258. doi:10.1111/jftr.12022.

Rietveld, E. (2008). Situated normativity: The normative aspect of embodied cognition in unreflective action. Mind, 117, 973-1001.

Rietveld, E., & Kiverstein, J. (2014). A rich landscape of affordances. Ecological Psychology, 26, 325-352.

Rugby Football League. (2014). Certificate in coaching rugby league level 2. Leeds: Coachwise Ltd.

Schöner, G. (1994). Dynamic theory of action-perception patterns: The time-before-contact paradigm. Human Movement Science, 13, 415-440.

Seifert, L., Button, C. & Davids, K. (2013). Key properties of expert movement systems in sport: An ecological dynamics approach. Sports Medicine, 43, 167-172.

Smith, L., & Davids, K. (1992). Uncertainty and Resourcefulness in Performance Environments: A Theoretical Note. European Work and Organisational Psychologist, 2(4), 331-344.

Taylor, F. W. (2008). "Report of a lecture by and questions put to Mr F.W. Taylor: a transcript". Journal of Management History, 14(3), 214-236. doi: 10.1108/17511340810885657.

Uehara, L., Button, C., Falcous, M., & Davids, K. (2016). Contextualised skill acquisition research: a new framework to study the development of sport expertise. Physical Education and Sport Pedagogy, 21(2),153-168.

Vallacher, R., van Geert, P. & Nowak, A. (2015). The intrinsic dynamics of psychological process. Current Directions in Psychological Science, 24, 58-64.

Warren, W. H. (1988). Action modes and laws of control for the visual guidance of action. Advances in Psychology, 50, 339-379.

Withagen, R., de Poel, H. J., Araújo, D., & Pepping, G. J. (2012). Affordances can invite behaviour: Reconsidering the relationship between affordances and agency. New Ideas in Psychology, 30(2), 250-258.

Withagen, R., Araújo, D., & de Poel, H.J. (2017). Inviting affordances and agency. New Ideas in Psychology, 45, 11-18.

Wittgenstein, L. (1953). Philosophical investigations. Oxford, UK: Blackwell.

Woods, D. (2017, February 7). Super League returns: English clubs should forget NRL and turn on the style in 2017. BBC. Retrieved from http://www.bbc.co.uk/sport/rugby-league/38862223.