

**An Ecological Insight Into the Design and Integration of
Attacking Principles of Play in Professional Rugby Union:
A Case Example**

MCKAY, Jim, DAVIDS, Keith <<http://orcid.org/0000-0003-1398-6123>>, ROBERTSON, Sam and WOODS, Carl T

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2 and Integration of Attacking Principles of Play in Professional Rugby Union: A Case Example

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4 **Jim McKay¹, Keith Davids², Carl T. Woods^{3*}**

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6 ¹Queensland Reds Rugby Union, Queensland, Australia

7 ²Sport & Physical Activity Research Centre, Sheffield Hallam University, Sheffield, UK

8 ³Institute for Health and Sport, Victoria University, Victoria, Australia

9

10 *Corresponding Author

11 Carl Woods, Institute for Health and Sport, Victoria University, Melbourne Australia

12 Email: carl.woods@vu.edu.au

13 **Abstract**

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16 **Key words:** Practice design; Ecological dynamics; Synergy formation; Applied sport science;

17 professional rugby union

18 **Introduction**

19 *“My understanding of Jim’s philosophy on attack, was to create organised chaos amongst the chaotic*
20 *nature of Rugby. Predominantly, we would train 15 v 15 in game-like scenarios replicating the chaotic*
21 *nature of a game. Often, Jim would introduce extra defenders and we would play 15 v 16 or 17 to*
22 *overload the defence or sometimes we would reduce the lateral width of the field. The pressure was*
23 *on the players and key game drivers to implement our game style and execute it under the same or*
24 *greater pressure than we would face in a game. It prepared us incredibly well for games!” – Will Genia:*
25 Former Queensland Reds and Australian international Rugby Union player

26 Over the last few decades, ecological dynamics has emerged as a guiding theoretical framework for
27 learning and performance in sport (for an updated review see Button, Seifert, Chow, Araújo, & Davids,
28 2020). While many of its theoretical propositions are well established within the scientific literature,
29 there is a caveat to its praxis: namely, there is a paucity of applied work that details how expert
30 practitioners have brought life to its theoretical contentions (some notable exceptions, McKay &
31 O’Connor, 2018; Woods, McKeown, Shuttleworth, Davids & Robertson, 2019; Otte et al., 2020). In
32 light of this need, the current case example offers a unique insight into how an elite Rugby Union
33 organisation, the Queensland Reds, grounded their preparation for competitive performance within
34 an ecological dynamics framework.

35 As captured in the words of Will Genia above, this paper specifically details how the Reds designed
36 and integrated a set of game principles that afforded players with opportunities in practice to search,
37 discover and exploit their actions in attack. Importantly, this case example does not intend to offer a
38 universal solution to performance preparation in sport, but rather intends to provide other
39 practitioners with a ‘first hand’ perspective of how an ecological dynamics framework can be applied
40 in athlete preparation in high-performance sport. Prior to detailing its practical nuances, though, we
41 will provide some brief theoretical background to ecological dynamics, detailing how a coach can work
42 with players to unlock the bi-directional nature of synergy formation during practice.

43 *Bi-directional synergy formation – externally- and internally-led pathways*

44 To instantiate the discussion of bi-directional synergy formation, it is important to appreciate that
45 within ecological dynamics, ‘skill’ is viewed as the emergence of functionally adaptable performance
46 solutions that arise through the continuous interactions between individuals and the environment
47 (Araújo, Renshaw & Davids, 2020). Synergy formation refers to the exquisite coordination tendencies
48 that skilled athletes continue to develop over many years of practice and the coordination of efforts
49 by teammates in achieving tactical goals in competitive sport (Ribeiro et al., 2019). The main influences
50 that shape synergy formation in practice are external agents such as coaches, trainers and teachers,
51 guiding athlete search, as well as internal interactions between players in training which result in
52 attempts to coordinate activity by adapting and adjusting to the skilled behaviours of teammates.
53 Practice can, therefore, be conceived as a landscape in which individuals are free to search for
54 performance solutions that emerge through continuous interactions. It is the environment which
55 *affords* opportunities for action (Gibson, 1979), with the individual being free to accept or reject these
56 invitations (Seifert, Button, & Davids, 2013). Thus, in this ontology, through extended practice and
57 experience, an individual does not ‘acquire’ a reproducible model of skilled behaviour represented or
58 stored in the brain, rather, they develop a deeply embedded, more functional relationship with an
59 environmental niche (Araújo & Davids, 2011). So, how does a practitioner *design* a learning
60 environment that promotes these requisite athlete-environment interactions?

61 In answering this question, it is important to appreciate that in this ecological ontology, practitioners
62 (i.e., coaches, analysts) are responsible for *designing* practice landscapes rich with information that
63 afford multiple opportunities for athlete exploration (Button et al., 2020; Woods, McKeown, Rothwell,
64 Araújo, Robertson, & Davids, 2020; Chow et al., 2020). This perspective of practice contrasts to the
65 more traditional mechanistic perspectives situating practitioners as the providers of sequential
66 instruction and direction intended to continually reorganise some putative behavioural model.
67 Accordingly, coaches become an integral member of an interdisciplinary team of sports practitioners

68 who work *with* the athlete to identify and manipulate key constraints of practice environments
69 (Davids, 2012; Davids, 2015).

70 Whilst this appreciation is generally understood, the integration of game ‘models’ typical to
71 ‘playbooks’ of high-performance sport can create conditions in which practice evolves into an (overly)
72 regulated activity (Ribeiro et al., 2019). This is exemplified in an *externally-led* pathway, where an
73 external agent (e.g. coach, trainer, teacher) provides continual global instruction and direction to
74 prescribe how system degrees of freedom at both intra and inter-performer levels can be reorganised.
75 Such game models risk a command-driven ‘hard education’ pedagogy, disregarding the ecological laws
76 governing the perception of information and regulation of action (Buekers, Montagne and Ibáñez-
77 Gijón, 2019).

78 To combat this traditional influence, it has been suggested that ‘soft education’ practices be
79 interspersed into ‘principles of play’ (van der Kamp, Withagen, & Orth, 2019; Ribeiro et al., 2019). This
80 approach exemplifies an *internally-led* pathway, where practitioners work to unlock and exploit the
81 inherent self-organising tendencies characteristic to all neurobiological organisms, affording
82 opportunities for individual performers to locally adapt and adjust actions to changing constraints. In
83 this sense, the coach would not prescriptively organise the degrees of freedom at intra and inter-
84 performer levels, but rather design a task which promotes the emergence of local athlete-
85 environment interactions. To enact this approach, it has been suggested that coaches adopt a more
86 ‘hands off’ methodology by creating conditions that allow athletes to explore and inhabit different
87 regions of their performance landscapes (Woods et al., under review). In this perspective, a set of
88 game principles should not solely define a structure; rather, they should enable a platform by which
89 athletes are free to find solutions to unknown problems they are likely to encounter in competition
90 (Araújo et al., 2009).

91 Having provided a brief theoretical overview, from this point on, we next adopt an intentional
92 practical, first-hand, perspective. Notably, to further promote the applied nature of this paper, it is
93 written in first person by the current attack coach at the Queensland Reds, Jim McKay.

94 *Building toward a set of flexible game principles in attack at the Queensland Reds*

95 Whilst the Queensland Reds subjectively showed improvement and spirited performances in the 2019
96 Super Rugby season, the reality was that the club finished second last in the competition. Upon re-
97 joining the Reds coaching staff at the start of the 2019 pre-season, I brought with me my own coaching
98 pedagogy and distinct playing philosophy that has been gradually shaped by over 20 years of coaching
99 Rugby Union (experiential knowledge) and from completing a Master of Coaching Science (empirical
100 knowledge). However, on reflection, this distinct playing philosophy and pedagogical knowledge was
101 applied in practice design without enough due consideration and prior knowledge of either the
102 individual members of the current playing group or coaching team. It was evident leading into and
103 during the 2019 season, that we lacked a thorough knowledge of attacking principles and an ability to
104 manage opposition and situational pressure that emerged in competition. Following a robust end of
105 season attack review and reflection in 2019, we found that:

- 106 1) Players needed more clarity regarding the *framework* that shaped their intentionality in
107 attack,
- 108 2) There was a need for education surrounding *roles and responsibilities* of the players in attack,
109 especially given that the Reds were the youngest team in the competition,
- 110 3) We needed more structural organisation for the first three phases in scenarios when *we*
111 *started with possession of the ball*,
- 112 4) We could create space but lacked an ability to *exploit* it and capitalise on *opportunities* to
113 make territory and score points in *unstructured moments*,
- 114 5) We recorded almost the lowest average number of passes and offloads in the competition,
115 indicating a *stagnant ball movement*.

116 After this review, I decided that we also needed more information about opposition performance
117 tendencies and game plans. So, I set out to investigate and identify the attacking trends and features
118 applied by the leading teams in the Super League. Internally, a robust, critique of our own attack (both
119 empirically and experientially) highlighted some areas of concern. In particular, we ranked poorly on
120 the average number of passes and offloads per game. At the same time, we took encouragement from
121 a high ranking on the number of defenders beaten and attacking line breaks (ranking 2nd and 7th
122 respectively). This period of review and reflection coincided with me embarking on a return trip to
123 England that included professional development with numerous Rugby clubs and coaches, enriching
124 and growing my perspectives on the development of game principles in attack.

125 Accordingly, having deepened my knowledge of the Reds playing group, and in accord with the areas
126 of growth highlighted in our internal review of our attack, I set upon designing and refining a set of
127 attacking game principles. Indeed, Jose Mourinho (Head coach of Tottenham Hotspur FC, EPL) strongly
128 asserts that clear game principles are essential to enhancing levels of organisation and understanding
129 (Bordonau & Villanueva, 2018. P. 106). Importantly, however, given that I view my coaching pedagogy
130 through an ecological dynamics lens, it was imperative that these principles *guided the search*
131 activities of the players while in attack. I actively wanted to help the players unlock the local synergies
132 formed between each other and the defence, exploiting these interactions during performance to gain
133 territory and score. Thus, these principles were intended to support an *internally-led* pathway of
134 synergy formation, helping players to search for affordances in attack, while guiding their
135 intentionality. Specifically, I developed a bespoke framework for play in attack categorised into:

- 136 1) IN POSSESSION: *Scenarios in which we start with possession of the ball* – e.g., a structured scrum
137 and line out, and
- 138 2) REGAINED POSSESSION: *Moments when we win the ball from the opposition, thereby*
139 *transitioning from defence to attack* – e.g. turnovers and kick receipt.

140 Further, in support of a revised framework for attack, a select number of principles were identified to
141 underpin our play. While I do not wish to share the specific principles for obvious reasons, they
142 generally focused on:

- 143 1) Structural formation to help us find and move the ball into space,
- 144 2) Passing and support play, including offloading, to keep the ball moving.

145 *Piloting these game principles in attack*

146 At this point, it is necessary to mention that in addition to my role at the Reds, I was also appointed
147 the head coach of Brisbane City in 2019, who competed in the National Rugby Championship (NRC).
148 This provided an ideal ecosystem in which to pilot and implement the principles encapsulating the
149 abovementioned focus points. Encouragingly, the results were immediate, with Brisbane City reaching
150 the finals of the NRC competition in the 2019 season; an achievement not reached by the team in the
151 three seasons preceding.

152 Of particular interest were the positive attack outcomes and player feedback relating to an improved
153 framework of play in attack. For example, player X mentioned... Further, in empirical support of this
154 experientially perceived improvement, Brisbane City scored the third most tries (39) and recorded the
155 second most offloads (81) in the NRC competition in 2019. Looking more closely into player
156 comparisons across the competition ($n = 279$ players), three Brisbane City players featured in the top
157 five for total offloads. Apart from the wins, I felt this experiential and empirical evidence supported
158 the shift in our attacking mindset and training pedagogy by exemplifying the two focal points of the
159 principles of play detailed earlier.

160 *Integrating these game principles in attack at the Reds*

161 Following on from the 2019 NRC competition, and in preparation for the forthcoming 2020 Super
162 Rugby season, the next step was to integrate and educate the Reds playing group on the reasoning
163 behind these revised game principles in attack. It is necessary to acknowledge that we are currently
164 the youngest and least experienced team in the Super Rugby competition. I felt because of this, it was

165 important to accommodate a more balanced approach towards education and practice time both on
166 and off the field. Further, in addition to introducing these attacking principles and ensuing training
167 pedagogy to the players, I also had to embed them throughout the broader Rugby department of
168 support staff at the Reds in order to unify practice.

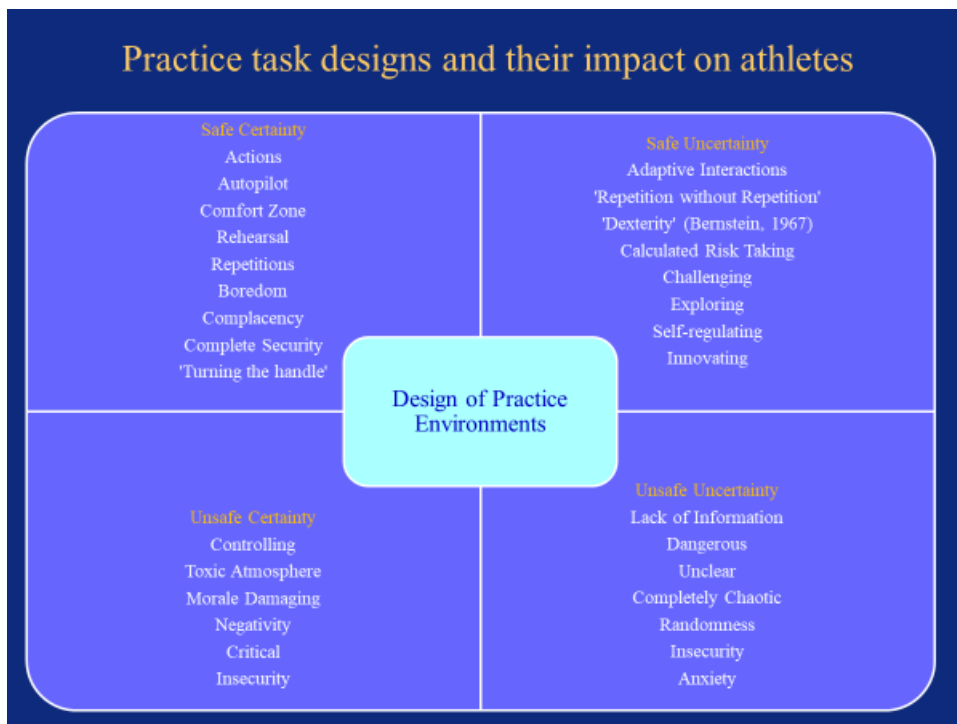
169 Moving into the 2020 pre-season, further refinements to our attacking game principles took place. Of
170 particular note, a lot of collaborative work was done between myself and the attack leaders in the
171 playing group. This rich 'coach-player' dialogue led to greater buy in and ownership of how they
172 wanted to play, as the refined principles were 'co-designed' (Woods et al., under review) between
173 myself and the players. Co-operatively, and in conjunction with the five areas of growth from the
174 previous season's review, we (myself, the other coaches, and key members of the playing group) felt
175 like we now had a bespoke attack framework that both guided the intentionality (broad framework)
176 underpinning the search of the players (externally-led), but afforded them with the freedom to
177 identify and exploit emergent affordances (internally-led) during the game. Clearly, the challenge now
178 was designing representative training activities that afforded players the opportunities to learn and
179 exploit these attacking principles, thereby deepening their knowledge of them. While this is a process
180 that is continually evolving, I will share two examples of what these training designs encapsulated.

181 *A practice ecology to deepen knowledge of attacking game principles at the Reds*

182 As a coach who views himself through an ecological lens, I see my role in training is to design practice
183 tasks that guide the search and exploration of players. Further, by acknowledging that no scenario is
184 identical, I actively design activities that create varying levels of 'safe uncertainty' and controlled chaos
185 in practice activities to promote the emergence of adaptable and creative performance solutions
186 (Figure 1). Note that the conditions of 'safe uncertainty' (top right hand quadrant) characterised the
187 way we sought to design player interactions in practice, ensuring that they felt 'safe' (i.e. empowered)
188 to explore performance solutions which may or may not be effective, under practice constraints which
189 simulated the challenges of the competitive environment (i.e. creating problems and decisions for

190 players to resolve). In this respect its important to understand what is meant by ‘controlled chaos’ in
 191 practice designs: controlled chaos is not the random variation associated with the technical definition
 192 of a chaotic system, but rather is used here to refer to ‘constrained variation’ designed in by a team
 193 of practitioners seeking to simulate the challenges of the competitive performance environment in
 194 the sport of rugby union football.

195



196

197 To help facilitate this pedagogy, I regularly manipulate (i.e. varied) constraints within practice tasks,
 198 such as time, space, opponent tactics, offence formations and interpersonal distances between
 199 players and the ball. Here, I share some specific examples of how the Reds coaching group integrated
 200 ‘continuity of attacking play principles’ into our training sessions. The overarching aim of the examples
 201 was to design practice tasks that enabled the manifestation of our attacking principles of play in order
 202 to embed learning into context. This is important, as the principles alone (i.e. considered in isolation)
 203 are somewhat limited, thus we endeavoured to foster a constant relationship between our attacking
 204 principles and the way we designed practice. The intent of this was ultimately to help players manage

205 the emerging pressures (both physically and situationally) of the competitive game environment; an
206 area highlighted above as needing improvement from the 2019 season.

207 Practice Task 1: Continuity Play

208 *Task goal and practice design*

209 A schematic of this activity design is presented in Figure 1. Working in smaller groups (with total
210 numbers ranging from 6 and beyond), this activity invited players to explore ways of performing
211 continuity skills to keep the ball in motion. Specifically, players were encouraged to explore ways of:

- 212 1) Evading opponents
- 213 2) Offloading and passing
- 214 3) Supporting play actions
- 215 4) Collectively coordinate between each other based on local interactions to continuously drive
216 synergy formation.

217 The activity consisted of two sub-groups: Group 1, the Defenders, were required to spread and space
218 themselves randomly across the playing channels, while Group 2, the Attackers, broke up into
219 foursomes and placed themselves at the top end of the first channel. The activity started with an
220 attacking foursome advancing the ball forward down the first channel, then immediately turning
221 around and working back up the second channel. The defenders could only move forward or sideways
222 within the channel. Once the first foursome reached the end of channel 1, the next foursome could
223 go, with this process being repeated. Regulation Rugby rulings governed play and were enforced
224 throughout.

225 ******INSERT FIGURE ONE ABOUT HERE******

226 *Why was this practice design used?*

227 Firstly, by working in smaller groups of four, and constraining the space to be within a 'channel', I
228 found the players were able to gain maximal exposure to ball and opponent interaction in a

229 representative manner – thereby simplifying a full game, but still faithfully preserving fundamental
230 information sources that shape player behaviours. Secondly, by allowing the defenders to randomly
231 position themselves, I actively encouraged ‘repetition without repetition’ (Bernstein, 1967), in which
232 the continuously dynamic positioning of the defenders required the attackers to adapt behaviours to
233 maintain a continuity of play.

234 A separate caveat here is that I encourage other coaches reading this to appreciate that such an
235 approach ‘looks different’ each time a repetition is performed. Thus, as long as the task intent is
236 achieved and the task is designed in a representative manner, how the repetition is performed should
237 not be a point of concern. Further, while the task goal actively encouraged players to search for ways
238 of continuing the play through offloading, passing and support play, the movement solutions available
239 to the players were not delimited to just these actions. Moreover, players were encouraged to search,
240 discover and exploit the most inviting means of advancing the ball forward as quickly as possible.
241 Lastly, in addition to the physical pressure imposed from the opposition, I sought to design in affective
242 representations. Notably, if the defence was able to generate a turnover, the foursome was required
243 to stop and start the task again, thereby adding performance pressure. While acknowledging
244 transition components are central to our attacking principles, this activity was not the place for its
245 practice, leading us to the second example.

246 Example 2: Team play

247 *Task goal and practice design*

248 This activity intended to challenge an attacking team’s capability to demonstrate continuity of ball
249 movement as they explored ways to breach the defensive line and score. This activity intent was
250 grounded in match context, with two opposing teams of up to 15 players being used on a full field.
251 However, this activity should not be confused as ‘match play’, as a few features were designed in to
252 promote the continuity of ball movement for the attacking team. For example, the activity was
253 initiated in an unstructured, yet controlled chaotic situation (e.g., a ball is randomly kicked or passed

254 into a field position favouring the attacking team). The attacking team were then challenged to
255 advance the ball up the field toward their try-line in an effort to score. In accord with our principles of
256 attack, the players were free to achieve this task goal and keep the ball in motion by exploring a range
257 of different running, passing and/or kicking actions. Importantly, transition moments from turnover
258 (i.e., attack to defence and defence to attack) were enabled in this activity, thereby encouraging the
259 game to be played in a state of continual movement and chaos.

260 In addition to these design features, I routinely manipulated certain task constraints to challenge and
261 channel the problem-solving of the team in possession of the ball. I have listed some examples of
262 these constraints and their rationale below:

- 263 • The attacking team must pass the ball at least twice on each sequence of play. I found this
264 encouraged the continuity principles of passing and support and led to an emergence of more
265 offloads.
- 266 • Without warning, manipulating the playing numbers both in attack and defence. I found this
267 channelled the attention of the players and helped them to identify when they possessed a
268 number superiority (overload) or inferiority when in attack (and thereby defence). This
269 approach, I found, encouraged a deeper situational awareness, with the players learning to
270 identify when they had an overload in attack, and focusing on how to exploit it to score.
- 271 • Varying the lateral 'space' available. I found this helped the players search for, create and then
272 exploit available space. Further, by making the field wider, the players were encouraged to
273 'stretch' the defence when attacking, creating gaps in the defensive line they could probe and
274 explore.
- 275 • Manipulate the number of phases 'allowed' to gain territory and score. I found that when
276 phase numbers were reduced, attacking players were challenged to find more creative ways
277 of gaining territory relative to when an unlimited number of phase attempts were allowed.

278 *Preliminary 'on field' results from the ecological attacking principles at the Reds*

279 While I wish to state that these game principles for attack are still being refined through practice tasks
 280 such as those listed above, I do think it is important to finish this paper with a brief insight into some
 281 of the results we have already observed at the Reds in the 2020 Super Rugby season. At the time of
 282 writing this paper, the first seven rounds of the Super Rugby competition have been completed, and
 283 given the ensuing global pandemic pausing the competition, I will only touch on empirical support for
 284 these attacking principles from these games.

285 Table 1 shows descriptive, mean, comparisons of some key indicators of our attack from the 2019 and
 286 current 2020 seasons. Of particular note, we averaged 140 passes (ranked 12th in the competition)
 287 and nine offloads (ranked 14th in the competition) per match in the 2019 season. This season, we have
 288 seen these values improve to an average of 157 passes (ranked 3rd in the competition) and 16 offloads
 289 (ranked 2nd in the competition). Of further note, we are scoring nearly 1.5 more tries on average per
 290 game relative to the 2019 season, which increased our competition ranking in this indicator from 9th
 291 to 2nd. Indeed, while these results are merely descriptive and clearly need to be interpreted through a
 292 preliminary lens, the initial ‘on field’ performance in response to our redesigned and integrated
 293 attacking principles, grounded within an ecological dynamics framework, is incredibly promising
 294 (Table 1).

295 **Table 1.** Average attacking key performance indicators comparing the Super Rugby competitions in
 296 the 2019 and 2020 (rounds 1-7) seasons.

Indicators	2019 season		2020 (rounds 1-7) season		Change in ranking
	Average	Ranking	Average	Ranking	
Points Scored	23	10th	32	4th	Up 6
Tries Scored	3.06	9th	4.57	2nd	Up 7
Line Breaks	8	7th	9.71	2nd	Up 5
Defenders beaten	26	2nd	27	3rd	Down 1
Offloads	9	14th	16	2nd	Up 12

Passes	140	12th	157	3rd	Up 9
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298 **Reflections and General Conclusions**

299 This paper has intentionally offered a case example to the sport science literature with applied
300 pedagogical insights into how an elite sporting organisation has actively sought to align its practice
301 within an ecological dynamics framework. Specifically, in response to a thorough review of their 2019
302 season, this case exemplified how the Queensland Reds went about redesigning and integrating a set
303 of attacking principles of play that guided athlete behaviours, while affording them the freedom to
304 search, discover and exploit in response to a range of dynamically changing constraints. This paper
305 does present some unique preliminary evidence to support the integration of these principles, with
306 future work being needed to more comprehensively substantiate their positive impact. Nonetheless,
307 this paper has attempted to offer a ‘first hand’ experience of an expert coach who set out to integrate
308 an ecological way of performance preparation. In doing so, it is hoped that other practitioners seeking
309 to embed an ecological dynamics framework that guides their preparation for performance model will
310 be able to draw on the perspectives and experiences described in this paper to shape their practice.

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315 Example

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317 Tableau analysis...

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319 Optapro analysis...

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