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

An ecological insight into the design and integration of attacking principles of play in professional Rugby Union: A case example

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Abstract

This is an exciting era for applied research in high-performance sporting environments. Specifically, there are growing calls for researchers to work with coaches to produce 'real-world' case examples that offer first-hand experiences into the application of theory. Whilst ecological dynamics has emerged as a guiding theoretical framework for learning and performance in sport, there is a caveat to its use in the field. Namely, there is a general paucity of applied research that details *how* expert coaches have brought life to its theoretical contentions in practice. In light of this, the current paper offers a unique insight into how a professional Rugby Union organisation set out to ground their preparation for competitive performance within an ecological dynamics framework. More directly, this paper details how the Queensland Reds designed and integrated a set of attacking game principles that afforded players with opportunities in practice to search, discover and exploit their actions. While this paper offers insight specific to Rugby Union, its learnings are transferrable to coaches in other sports looking to situate their practice design within an ecological dynamics framework.

Key words: Practice design; ecological dynamics; case example; applied sport science

Introduction

Over the last few decades, ecological dynamics has emerged as a guiding theoretical framework for learning and performance in sport (Button, Seifert, Chow, Araújo & Davids, 2020). While many of its theoretical propositions are established in the scientific literature, there is a limitation to this work; namely, there is a paucity of applied research that details *how* expert coaches have brought life to its theoretical contentions (some notable exceptions, McKay & O'Connor, 2018; Woods, McKeown, Shuttleworth, Davids, Robertson, 2019). In light of this need, the current paper offers a unique insight into how a professional Rugby Union organisation grounded their preparation for competitive performance within an ecological dynamics framework. More specifically, this paper details how the Queensland Reds designed and integrated a set of game principles that afforded players with opportunities in practice to search, discover and exploit their actions while in attack. This case example does not intend to offer a universal solution to performance preparation in high-performance sport, but rather to provide other coaches with a first-hand perspective of how an ecological dynamics framework can be applied to support athlete preparation. To frame this case example, a brief theoretical background to ecological dynamics will be provided, focusing on what it actually *means* for sports coaches in the field.

What does ecological dynamics mean for sports coaches?

At its core, ecological dynamics offers a framework to explain learning and performance (Button et al., 2020). Specifically, it blends ideas that primarily reside within ecological psychology (Gibson, 1979) and constraints on dynamical systems (Kelso, 1995; Newell, 1986) to situate concepts like skilled behaviour and learning as emergent properties of functionally adaptable relationships formed between an athlete and the constraints of his/her environment (Seifert, Button & Davids, 2013). Sports coaches working within this theoretical framework are, therefore, encouraged to reconceptualise their role in performance preparation; progressing away from the conveyers of declarative knowledge *about* how something should be done (by prescribing a pre-planned pattern of ball movement, for example), and moving towards the *designer* of practice activities that athletes

can interact with (Woods, McKeown, Rothwell, Araújo, Robertson, & Davids, 2020). In this sense, athletes are afforded exploratory freedoms during practice and competition, deepening their knowledge *of* a performance environment. What this means for the coach, is that to foster the development of this relationship, they need to guide the attention of the athlete toward important features of the environment of use to (re)organise action through carefully designed practice tasks that *show athletes where to look, but not what to see*.

Founded on ideas from Brunswik (1955), in ecological dynamics, these propositions are captured within the notion of *representative learning design*. Representative learning design indicates that practice tasks should faithfully 'represent' (or simulate) the informational constraints experienced by athletes in competition (Araújo, Davids, & Passos, 2005; Araújo Davids, & Hristovski, 2006). This ensures the behavioral 'fit' between practice and competition environments, leading to a greater learning transfer (Seifert, Button, & Davids, 2013). Accordingly, when designing representative learning activities, coaches should consider sampling the informational constraints players experience during competition (such as the movement of teammates and opposition, and/or task objectives and intentions) to ensure they can be appropriately designed into practice tasks. This concurrently emphasizes an important pedagogical consideration for coaches within an ecological dynamics framework – that of using a constraints-led approach to guide the attention of players, in favour of continued and prescriptive verbal instruction. Importantly, however, the constraints-led approach should not be viewed as another game-centered approach, as its theoretical roots within ecological dynamics encourage coaches to place the individual-environment interaction at the core of their learning designs (we encourage interested readers to consult Renshaw, Araújo, Button, Chow, Davids, and Moy (2015) for greater distinctions between the two pedagogical approaches).

While these propositions are generally understood by those in the field, the integration of tactical game 'models' typical to 'playbooks' of high-performance sport can indirectly counteract the foundations of ecological dynamics by over-constraining the actions of athletes (Ribeiro, Davids,

Araújo, Guilherme, Silva & Garganta, 2019). While such models are perceived to provide a tactical advantage, their rigid and pre-planned nature can disregard the interaction of (task, performer, and environmental) constraints that shape skilled actions, thereby hindering performance (Buekers, Montagne & Ibáñez-Gijón, 2019). To combat the overly constraining nature of game models in high-performance sport, coaches can use game principles, which guide the attention of athletes, not (overly) constrain movement solutions (Ribeiro et al., 2019; Buekers et al., 2019; van der Kamo, Withagen & Orth, 2019). For example, in Rugby Union, where a game model may constrain passing interactions around a global pattern of ball movement deemed to speed up an attack (pre-planned movement 'solution'), a more principled guidance of attention would simply encourage players to look for opportunities to move the ball with speed. How the players achieve this principled intention is then based around the interaction of his/her action capabilities (i.e., what the athlete can do) and the dynamical constraints of the environment (i.e., what the opposition is doing). Moreover, the *search* becomes the goal of the practice task, not the repetition of some pre-planned model of behaviour. To enact this more principled approach in practice, it has been suggested that coaches adopt a more 'hands off' methodology by designing tasks and game principles that promote exploration, creativity, problem-solving and adaptability (Orth, van der Kamp, & Button, 2019).

Having detailed what an ecological dynamics framework *means* for sports coaches, the next part, and primary aim of this paper, is to describe *how* a coach may go about integrating it into practice. To address this, the paper now adopts an intentionally practical, first-hand perspective. Notably, the following sections unpack a case example from professional Rugby Union, written in first person by the current attack coach at the Queensland Reds. Moreover, the following sections blend qualitative perspectives from players with self-reflections made by an expert coach, to elaborate on how an elite Rugby Union team sought to evolve their preparation for performance model in the 2020 Super Rugby season. Further, this qualitive information is supported descriptive data relating to team performance indicators, extracted from commercial providers to pragmatically show how changes

made to the team's approach on performance preparation may have manifested into on-field performances.

How concepts in an ecological dynamics framework are brought to life

Building toward a set of attacking principles at the Queensland Reds

Whilst the Queensland Reds subjectively showed improvement and spirited performances in the 2019 Super Rugby season, the reality was that the club finished second last in the competition. Upon re-joining the Reds coaching staff at the start of the 2019 pre-season, I brought with me my own coaching pedagogy and distinct playing philosophy that has been gradually shaped by over 23 years of coaching Rugby Union and from completing a Master of Education (Sports Coaching). The primary intentions of my coaching philosophy, grounded in a non-linear pedagogy, are aptly described by an ex-international Rugby Union player I coached:

> *"My understanding of Jim's philosophy on attack was to create organised chaos amongst the already chaotic nature of Rugby. Predominantly, we would train 15 v 15 in game-like scenarios replicating the chaotic nature of a game. Often, Jim would introduce extra defenders and we would play 15 v 16 or 17 to overload the defence or sometimes we would reduce the width of the field. The pressure was on the players and key game drivers to implement our game style and execute it under the same or greater pressure than we would face in a game. It prepared us incredibly well for games!"*

While I had a clear understanding of my coaching and playing philosophy, it was evident on reflection that I applied it in the 2019 (pre)season without enough due consideration and prior knowledge of the individual members of the current playing or coaching group at the Queensland Reds. Accordingly, it was apparent leading into and during the 2019 season that we lacked a thorough knowledge of attacking principles and an ability to manage opposition and situational pressure that emerged in competition. Moreover, a robust critique and review of our own attack

(both empirically and experientially) at the end of the 2019 season highlighted some areas of concern, four of which being:

1) Players needed more clarity regarding the *framework* that shaped their intentions in attack,
2) There was an increased need for education surrounding *roles and responsibilities* of the players in attack, especially given that the Reds were the youngest team in the competition,
3) We could create space but lacked an ability to *exploit* it and capitalise on *opportunities* to make territory and score points in *unstructured moments*,
4) We recorded almost the lowest average number of passes and offloads in the competition, indicating a *stagnant ball movement*.

After this review, I decided that we also needed more information about opposition performance tendencies and game plans. So, I set out to investigate and identify the attacking trends and features applied by the leading teams in Super Rugby and the northern hemisphere. This period of reflection coincided with me embarking on a return trip to England that included professional development with numerous Rugby clubs and coaches, enriching my perspectives on the development of game principles in attack at the Queensland Reds.

Having deepened my knowledge of the Reds playing group, and in accord with the areas of growth highlighted in our internal review of our attack, I set upon establishing and refining a set of attacking game principles. Indeed, Jose Mourinho (Head coach of Tottenham Hotspur FC) strongly asserts that clear game principles are essential to enhancing levels of organisation and understanding (Bordonau & Villanueva, 2018). Importantly, however, given that I view my coaching pedagogy through a more ecological lens, it was imperative that these principles *guided the search* activities of the players while in attack. I actively wanted to help the players unlock the synergies (i.e., interactions and relationships) formed between each other and the defence, exploiting them during performance to gain territory and score. Thus, these principles were intended to support the players search in

attack, not by telling them what actions they had to perform in a pre-planned model. To educate and train these principles, I developed a bespoke framework in attack categorised into:

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

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

1) Structural formations to help us find and move the ball into space,
2) Passing and support play, including offloading, to keep the ball alive and moving.

Piloting these game principles in attack

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

Of particular interest were the positive outcomes and affirming player feedback relating to an improved framework of play in attack. For example, a then player at Brisbane City stated:

> *"Jim provided us with a clear and simplified attack system of play and focussed on a few key points. Players could draw upon their already established skill sets and improve dramatically. Jim started with smaller 8 v 8 sided games and then focussed on 15 v 15 activities with multiple phases, with each team competing against each other. Jim would constantly change the width of the game, duration and number of players on each team*

– which would all aid in creating fatigue amongst the players. By doing so, players were given the best chance to compete, and to test their skills under pressure. XX managed to draw upon senior players and game drivers to dive deeper into the concept of 'Brisbane City Attack'. By doing so, Brisbane City attack helped us win multiple games."

In support of this insight, Brisbane City scored the third most tries (39) and recorded the second most offloads (81) in the NRC competition in the 2019 season. Looking more closely into player comparisons across the competition (*n* = 279 players), three Brisbane City players featured in the top five for total offloads performed in the competition. Apart from the wins, I felt this experiential and empirical evidence supported the shift in our attacking mindset and training pedagogy by exemplifying the two focal points of the principles of play detailed earlier.

Integrating these game principles in attack at the Queensland Reds

Following on from the 2019 NRC competition, and in preparation for the forthcoming 2020 Super Rugby season, the next step was to integrate and educate the Reds playing group on the reasoning behind these revised game principles in attack. It is necessary to acknowledge that we are currently (at the time of writing this paper) the youngest and least experienced team in the Super Rugby competition. I felt because of this, it was important to accommodate a more balanced approach towards education and practice time both on and off the field. Further, in addition to introducing these attacking principles and training pedagogy to the players, I also had to embed them throughout the broader professional Rugby department of support staff at the Queensland Reds in order to unify practice.

Moving into the 2020 pre-season, further refinements to our attacking game principles took place. To give credit, concerted discussions took place with the head coach, helping to solidify a deeper level of understanding, commitment and unification to proceed. Of particular note, a lot of collaborative work was done between myself and the attack leaders in the playing group. This rich coach-player dialogue led to greater buy in and ownership of how they wanted to play, as the

refined principles were 'co-designed' (Woods, Rothwell, Rudd, Robertson & Davids, under review) between myself and the players. Co-operatively, and in conjunction with the four areas of growth from the previous season's review, we (myself, the other coaches, and key members of the playing group) felt like we now had a bespoke attack framework that guided the intentions underpinning the search of the players, but afforded them with the freedom to identify and exploit emergent affordances (opportunities for action; Gibson, 1979) during the game. Clearly, the challenge now was designing training activities that afforded players the opportunities to learn and exploit these attacking principles, thereby deepening their knowledge *of* them. While this is a process that is continually evolving, I will share two examples of what these practice designs encapsulated.

Practice designs to deepen knowledge of attacking game principles at the Queensland Reds

As a coach who views himself through an ecological lens, I see my role in training is to design practice tasks that guides the search and exploration of players. Further, by acknowledging that no scenario is identical, I actively design activities that create varying levels of 'safe uncertainty' and controlled chaos in practice to promote the emergence of adaptable and creative performance solutions (Figure 1). Note that the conditions of 'safe uncertainty' (top right hand quadrant in Figure 1) characterised the way we sought to design player interactions in practice, ensuring that they felt 'safe' (i.e., empowered) to explore performance solutions which may or may not be effective, under practice constraints which simulated the challenges of the competitive environment (i.e., creating problems and decisions for players to resolve). In this respect, it is important to understand what is meant by 'controlled chaos' in practice designs: it is not the random variation associated with the technical definition of a chaotic system, but rather is used here to refer to 'constrained variation' designed in by a team of practitioners seeking to simulate the challenges of the competitive performance environment in Rugby Union.

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To help facilitate practice designs, I regularly manipulate (i.e., vary) constraints within practice tasks, such as time, space, opponent tactics, defensive formations and interpersonal distances between players and the ball. Here, I share some specific examples of how the XXXX coaching group integrated 'continuity of attacking play principles' into our training sessions. The overarching aim of the examples was to design practice tasks that enabled the manifestation of our attacking principles of play in order to embed learning into context. This is important, as the principles alone (i.e., considered and practiced in isolation) are somewhat limited, thus we endeavoured to foster a constant relationship between our attacking principles and the way we designed practice. The intent of this was ultimately to help players manage the emerging pressures (both physically and situationally) of the competitive game environment; an area highlighted above as needing improvement from the 2019 season.

Practice Task 1: Continuity Play (Keeping the Ball Alive)

Task goal and design

Working in smaller groups (with total numbers ranging from 8 and beyond), this activity invited players to explore ways of performing continuity skills to keep the ball in motion. Specifically, players were encouraged to explore ways of:

1) Evading opponents
2) Offloading and passing (i.e., before and post contact)
3) Performing supporting play actions
4) Coordinating between each other based on local interactions to continuously drive synergy formation.

The activity consisted of two sub-groups: Group 1, the Defenders (four players), were required to spread themselves randomly across the playing channels (25m long x 5-10m wide), while Group 2, the Attackers, broke up into foursomes and placed themselves at the top end of the first channel. The activity started with an attacking foursome advancing the ball forward down the first channel,

then immediately turning around and working back up the second channel. The defenders could only move forward or sideways within the same channel – they could not spread into other channels, which, numbers permitting, was defended by another set of four players. Once the first foursome reached the end of channel 1, the next foursome could go, with this process being repeated. Regulation Rugby rulings governed play and were enforced throughout.

Why was this practice design used?

Firstly, by working in smaller groups of four and constraining the space within a channel, I found the players were able to gain maximal exposure to ball and opponent interaction in a representative manner – simplifying a full game, but still faithfully preserving fundamental information sources that shape player actions (Verheijen, 2014). Secondly, by allowing the defenders to randomly position themselves, I actively encouraged 'repetition without repetition' (Bernstein, 1967), in which the continuously dynamic positioning of the defenders required the attackers to adapt behaviours to maintain continuous play.

A separate caveat here is that I encourage other coaches reading this to appreciate that such an approach looks different each time a repetition is performed. Thus, as long as the task intent is achieved and the task is designed in a representative manner, how the repetition is performed should not be a point of concern. Further, while the task goal actively encouraged players to search for ways of continuing the play through offloading, passing and support play, the movement solutions available to the players were not delimited to just these actions. Moreover, players were encouraged to search, discover and exploit the most inviting means of advancing the ball forward as quickly as possible. Lastly, in addition to the physical pressure imposed from the opposition, I sought to design in affective constraints. Notably, if the practice broke down due to a passing error resulting in a turnover, or the defence was able to generate a turnover, the attacking foursome were required to stop and start the task again, thereby adding performance pressure to keep the ball in motion.

While acknowledging transition components are central to our attacking principles, this activity was not the place for its practice, which leads us to the second example.

Practice Task 2: Team play

Task goal and design

This activity intended to challenge an attacking team's capability to demonstrate continuity of ball movement as they explored ways to breach the defensive line and score. This activity intent was grounded in match contexts, with two opposing teams of up to 15 players being used on a full field. However, this activity should not be confused as simply being match play, as a few constraints were manipulated to promote the continuity of ball movement for the attacking team. For example, the activity was initiated in an unstructured, yet controlled and chaotic situation (e.g. a ball being randomly kicked or passed into a field position favouring the attacking team). The attacking team were then challenged to advance the ball up the field toward their try-line in an effort to score. In accord with our principles of attack, the players were free to achieve this task goal and keep the ball in motion by exploring a range of different running, passing and/or kicking actions. Importantly, transition moments from turnovers and kicks (i.e., attack to defence and defence to attack) were frequently enabled in this activity, thereby encouraging the game to be played in a state of continual movement and chaos. To generate turnovers, I would often randomly call a penalty and loss of possession for the offence, or add another ball into the activity, giving it the defending team (note, these are non-exhaustive examples). The ball carrier was afforded an allowance to be touched twice from an opponent: one touch afforded an opportunity to immediately play the ball (pass or offload) whilst remaining on feet, while the second touch simulated a tackle, in which the player dropped to the ground to 'pop pass' the ball.

In addition to these design features, I routinely manipulated task constraints to challenge and channel the problem-solving of the team in possession of the ball. Whilst non-exhaustive, I have listed some examples of these constraints and their rationale below. However, I would like to stress

the importance for coaches manipulating constraints to appreciate the rationale behind why they are doing so. Such reasoning, I have found, enables greater clarity with the constraints needing to be manipulated to encourage, promote or challenge certain movement solutions in practice.

- The attacking team must pass the ball at least twice on each sequence of play. While risking over-constraining, I found constraining the number of passes during a sequence encouraged the continuity principles of passing and support, leading to an emergence of more offloads.
- Manipulating the playing numbers both in attack and defence. I found this channelled the attention of the players and helped them to identify when they possessed a number superiority (overload) or inferiority when in attack (and thereby defence). This, I found, encouraged a deeper situational awareness, with the players learning to identify when they had an overload in attack, focusing on how to exploit it to score or gain territory.
- Varying the width of the field. I found this helped the players search for, create and then exploit available space. Further, by making the field wider, the players were encouraged to 'stretch' the defence when attacking, creating gaps in the defensive line they could probe and explore.
- Manipulate the number of phases 'allowed' to gain territory and score. I found that when phase numbers were reduced, attacking players were challenged to find more creative ways of gaining territory (e.g. by 'kicking') relative to when an unlimited number of phase attempts were allowed. This encouraged them to explore movement solutions they would not usually consider, thereby extending their action capabilities.

Preliminary on field results from these attacking principles and practice designs at the XXXX

While I wish to state that these game principles for attack are still being refined through practice tasks such as those listed above, I do think it is important to finish this paper with a brief pragmatic insight into some of the results we have already observed at the Queensland Reds in the 2020 Super Rugby season. At the time of writing this paper, the first seven rounds of the Super Rugby

competition had been completed, and given the global pandemic pausing the competition, I will only touch on empirical support for these attacking principles from these completed games.

Table 1 shows descriptive, mean, comparisons of some key indicators of our attack from the 2019 and current 2020 seasons. Of particular note, we averaged 140 passes (ranked 12th in the competition) and nine offloads (ranked 14th in the competition) per match in the 2019 season. Thus far, we have seen these values improve this season to an average of 157 passes (ranked 3rd in the competition) and 16 offloads (ranked 2nd in the competition). Of further note, we are scoring nearly 1.5 more tries on average per game relative to the 2019 season, which increased our competition ranking in this indicator from 9th to 2nd. Indeed, while positive, these results are merely descriptive and could have been impacted by a range of additional factors (such as playing roster changes between the 2019 and 2020 seasons, and/or team continuity throughout the 2020 season). As such, they need to be interpreted though a pragmatic and preliminary lens. Nonetheless, the initial on field performance in response to our (re)designed and integrated attacking principles, grounded within an ecological dynamics framework, is incredibly promising.

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Concluding Remarks

This paper offered a unique case example to the sport science literature with applied pedagogical insights into how a professional sporting organisation has actively sought to align its practice within an ecological dynamics framework. Specifically, in response to a thorough review of their 2019 season, this case exemplified how the Queensland Reds went about redesigning and integrating a set of attacking principles of play that guided athlete behaviours, while affording them the freedom to search, discover and exploit in response to a range of dynamically changing constraints. This paper presents some unique preliminary evidence to support the integration and practice of these principles, with future work being needed to more comprehensively substantiate their positive impact. Nonetheless, this paper offers a first-hand experience of an expert coach who set out to

integrate an ecological way of performance preparation in professional sport. Although the case example is specific to Rugby Union, the learnings are transferrable to other practitioners interested in understanding how to support performance preparation through the theoretical guidance of ecological dynamics. Specifically, the first-hand perspectives elaborated on by the attack coach throughout this paper should act as a guide for other coaches interested in establishing a preparation for performance framework aligned to an ecological dynamics framework. Moreover, the practice task examples detailed should act as a mediator for understanding how non-linear pedagogical concepts predicated on ecological dynamics, such as a constraints manipulation, can be brought to life in practice.

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The first author is a current employee of the organisation cited within this case exemplar. No other authors declare any potential conflicts of interest.

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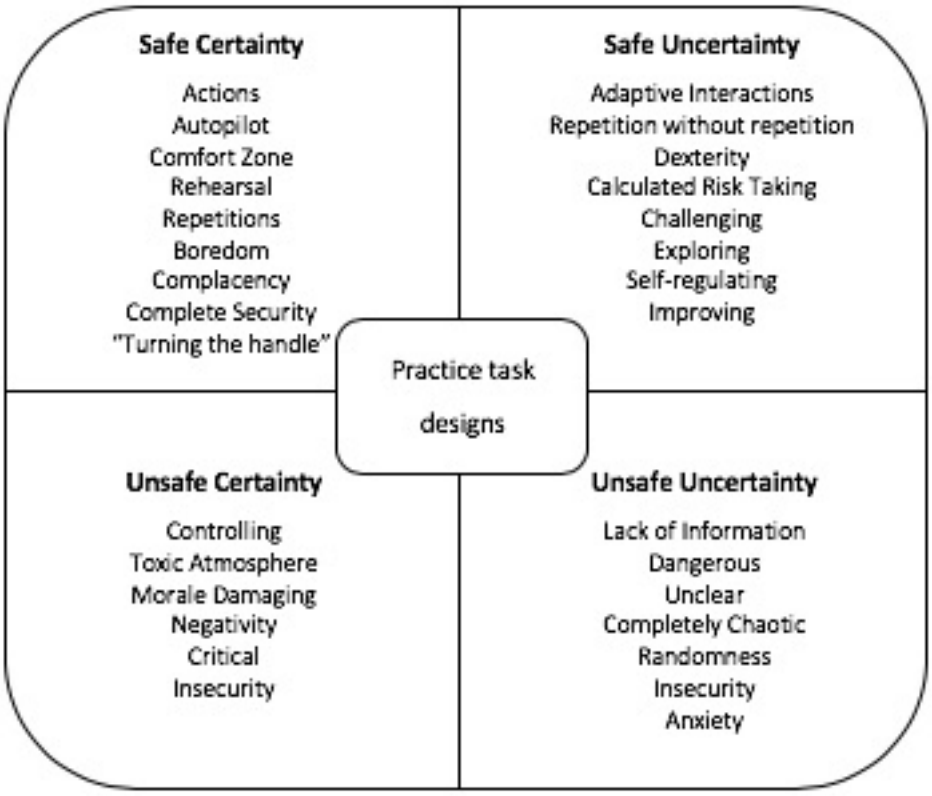

Figure 1. The safe uncertain quadrant for training task designs

Table 1. Average attacking performance indicators from the 2019 and 2020 (rounds 1-7) Super Rugby seasons

	2019 season		2020 (rounds 1-7) season		
Indicators	**Average**	**Ranking**	**Average**	**Ranking**	**Change in 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

Note: These statistics were obtained from Opta Sports and can be found publicly (www.foxsports.com.au/rugby/super-rugby/stats).