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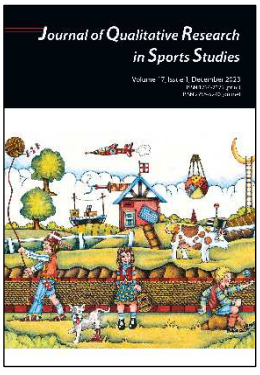

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Decision-making in rugby and implications for coach education: the elicited case of naturalistic, differentiated and disruptive decision-making

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Decision-making in rugby and implications for coach education: the elicited case of naturalistic, differentiated and disruptive decision-making

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Keywords: *Shared mental models, coach developer, sensemaking, team sports*

Abstract

Decision-making in team sports has attracted significant interest over recent decades by those in pursuit of excellence. None more so than by the three authors who have worked, researched, and supported coach and athlete development in this area cumulatively for over 60 years. This paper therefore presents an amalgamation of learning in the form of a retrospective narrative discussion around the key tenants of Decision Making (DM) with the sport of rugby union being utilised as the exemplar. Specifically, here the first author is asked to reflect upon his life in sport as a rugby player, coach and coach education tutor against various DM frameworks and debates which have shaped his own development. The second and third authors act as critical friends and provide additional research context within each section's discussion. Interestingly a landscape is presented where Decision Making emphasis has generally been placed upon the offensive phase of the game which has in-turn driven coaching pedagogy and attention of those engaged in these sports. The authors therefore propose that this focus is too limiting, and that coach education provision needs to explore decision-making in more depth to differentiate the types of decisions being made and the DM processes that underpin them. They describe the merit of Naturalistic Decision Making and the use of Shared Mental Models as valuable lenses by which to view DM in team sports and on which to base future coach learning. Finally, the authors introduce an additional element to the team DM arena, that of Disruptive Decision Making and offer rugby exemplars of how NDM and SMMs can provide the foundations upon which coaches should base their practice. The authors make a call to action for coaching to address a wider taxonomy of decision-making within team sports' training and match contexts. Recommendations are then provided for how coach education might better develop the DM practices of both coaches and their athletes.

Introduction

Rugby like all team sports shares the complexity and challenges of understanding in-action competitive DM. The complexity of the DM process within

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a coaching context presents coaches and applied specialists with a range of multifaceted challenges. Each DM challenge requires a bespoke approach to understanding the individual, team, situation, and context in which they are all executed (Richards, Mascarenhas and Collins, 2009). A major challenge therefore facing coaches and specialists working within the professional game, is to understand the complexities of not only DM, but the specific types of DM skills required in the sport and how we integrate this understanding into the coaching process. Recent research into rugby union is starting to highlight the importance of DM development (Morgan, Mouchet and Thomas, 2020; O'Connor and Larkin, 2015) and offers coaches valuable insights and frameworks on which to reflect and guide their future practice (Light, Harvey and Mouchet, 2014; Mouchet, 2005; Mouchet and Duffy, 2018). Despite this progress the authors are still aware of issues around the content, philosophical basis and focus of many rugby coach education programmes and therefore aim to shed further light on what could be included to inform and develop future practice in both player and coach DM. Therefore this paper presents a phenomenological account of current rugby DM coaching and coach education practice, and recommendations for change are made based on the experiences, work, and research of the three authors. In turn the paper presents; an overview of current rugby coach education practice, a debate on the complexity of DM within this context, alternative DM paradigms that could add value to practice, a new area of DM exploration, and then finally discusses the implications of this paper's findings.

Methods

Phenomenology as a methodology adopts a subjective epistemological position, aligned with Husserl's (1999) descriptive phenomenology, that promotes and then interprets the participants' lived experience (Allen-Collinson, 2009). Our research takes this approach to study the experiences of the first author whilst enacting, coaching, or educating about, rugby decision making. We have developed this phenomenological outlook to respond to existing calls to 'look inside' coaches lived experiences when trying to explain and understand the decision making (DM) process (Lyle and Vergeer, 2014), as well as researchers' requests for an approach that can more effectively account for the subjective dimensions of coaching in real contexts (Light *et al.,* 2014). A challenge to researchers working in phenomenology, however, is to identify the most appropriate data collection methods to gain access to the subjective human experience in sport situations (Varela and Shear, 1999). Within rugby this has often been through the use of personal narratives (Grecic, 2017; Mouchet *et al.,* 2014; Mouchet and Duffy, 2018; Wilkinson and Grecic, 2019). The value of personal narrative is well established in sports coaching research with Smith and Sparkes (2016) arguing that it provides a valuable alternative to positivist methods. Jones (2009) goes further and suggests that personal narrative offers a

deeper enquiry into what the coach may see, think and feel, going beyond the surface level of coaching and its social interactions. Such narratives can be elicited in various forms. For the purpose of this study, we explored a number of different forms of interview research used in sport to gain deeper insights and facilitate learning (Cronin and Armour, 2017; Jenkins, 2018; Thomas and Grecic, 2020). We selected the explicitation interview method (Vermersch, 2009) for describing the practice of introspection as it had been used in rugby decision making research previously (Mouchet *et al.,* 2019), and it allowed reflections on specific singular events (DM episodes, coaching acts, and individual education courses). Of course, this is not a new idea within the sports coaching and decision-making domains. Often deep retrospective interviews have been utilised to dig deeper into coaching behaviours (Gilbert *et al.,* 2009; Partington and Cushion, 2013; Stone *et al.,* 2021) as well as how high-level coaches / experts make their decisions (Collins *et al.,* 2015. What is novel about our approach however is the use of critical friends during the interview process to shape the first author's reflections against key singular events that would best inform practice and extrapolate forward into the future of rugby coach education. The co-authors, both of whom have over 30 years' experience of working and researching in sports coaching, play the role of 'devil's advocates' as they probe into the 'what' and 'how' of the first author perceptions to facilitate deeper interpretation of the 'why' and ultimately his re-conceptualisation of DM practice.

Trustworthiness: In line with the method selected we note the view of Vermersch (2012) who offered specific internal measures to judge the value of the research. These 'checks' serve to validate the fact that the subject, when he speaks about his experience, feels subjectively in touch with it. Specifically the measures to judge such work are; 'singularity' – that each event is a single act that was accessed and reflected upon; 'presentification' – that there are sufficient details to offer the depth of perception of the lived experience; and 'memory' – there is evidence of the subject's ownership of their reflections (I… we… did / felt / thought X or Y) (Vermersch, 2012). Additionally, if readers are seeking further specific criteria that are appropriate to judging this study given its particular qualitative focus and purpose, we direct them to Smith and McGannon (2018) and their evaluation around the depth of description we present, how the data makes the reader feel, and the study's findings' potential for naturalised generalisation (Smith, 2017).

Results and Discussion

The results below are based on elicitation questioning surrounding 4 specific DM contexts and events in the first author's playing, coaching and coach educating career. Key memories and interpretations from each experience were further explored following discussion with the co-authors. Segments of responses and selected deeper reflections are presented to shine a light into the first author's world.

The topics raised are then supported by key academic literature and current learning about the topic so that the wider playing and coaching fraternity can see how our research endeavour links into decision making in rugby.

Event 1:	**'The catalyst for exploration'**
Role:	**Player**
Context:	**Top of table clash to decide the title – 22nd November 2003**

Q: Can you describe when you became interested and most aware of decision making in rugby?

Yeah. Well, you see, to illustrate what I'm talking about, it was the top of the table clash. We actually played on the same day in 2003 when England won the World Cup. That's how I remember it so vividly because the World Cup final kicked off early and then we played it straight after. Both teams had won eight games, so I thought it was a big top of the table clash but unfortunately, we came out second best, but just by a couple of points, because of me and my decision.

Q: So how were you coached decision making as a player?

No, not a lot to be honest. Our coaches at the time were ex-players who were good motivators. They were good trainers as such, as I like to call them *the trainers* rather than coaches. We never really got coached any sort of decision making. We were told that we had to play a certain way and there was a certain game plan that we had to stick to and we had to be in a certain part of the field for certain phases and stuff. So, we didn't really get that much autonomy when it came to making decisions. It was more we had to play it to a script.

Q: And how did that make you feel as a player at that time?

At that time to be honest with you, I probably liked it. When I played a bit at a lower level, we were just sort of chucked out onto the pitch. So, it was more, like it felt a lot more organized. And at the time, I think a lot of the higher-level teams were playing to scripts but it was sort of the first time I had. So, in a way it felt good. It felt like we were playing to what we thought our strengths were [pause]. Umm, but it was also in a lot of the games we played, (it) was also the strengths of the opposition as well, and we didn't really have any sort of coaching or training in how to make decisions on what to look for to make the decisions. If you know what I mean?

Q: I think so… can I take you back to one particular decision you recall…

Yes, I can remember one, it actually haunts me to this day to be honest, because if I had done what I thought was right to do at the time, we probably would have won the game. We only got beat by a few points… It was a kick forward and we chased the kick down. I think the scrum half flicked the ball up to another player who passed the ball out to me, and there was me and another player outside of me in support and he was, … he was like a rocket. The game plan was to get the ball wide and to get the ball to this player. And I remember getting the ball and thinking I've got to get the ball to him. Even though we only had one (defender to beat) and there was two of us against one. Their fullback was coming across from the right-hand side and I remember thinking to myself, 'you know the game plan', got to get the ball to Alan. And then, as I went to pass, I saw

the defender slip off me. As soon as I saw him slipping off me (and moving so he could make a tackle on Alan) I knew it was too late. I had already made the decision and the ball was leaving my hands. Whereas normally if I saw that, i.e. I saw them running and over pursuing, I would have just looked (faking a pass) and then come back with the ball myself, and go in under the post (to score). I would definitely have beaten them. But because of what was I was thinking about - playing to the script, making sure I got it to the right people, I gave it (the ball) to Alan but the player who ran straight past me made the tackle because he had a good angle on him. But, you know, even to this day, I still have nightmares about it because I know I could have just pulled it back and gone under the posts and scored.

Reflection: *My interest in decision-making is constantly growing and this incident stimulated that interest even further. Looking back, I was hugely unprepared as a player, given the complexity of the game and the decisions that players are expected to make. It is criminal how unprepared we as players and the coaches were at the time. There were other key incidents too and light bulb moments when I finally realised that I could make decisions on the pitch and influence the game whilst it was happening. I remember vividly a 10 (play maker on opposing team) giving me the run-around by making-decisions based on where I was positioned and what I was doing (as an opposing defender). He was scanning for me all the time, but I realised what he was doing and tricked him by giving him false cues. Looking back these are the things that drove my interest in decision-making and the search to learn how to do it better.*

Arguably, one of the toughest and most physically demanding of team sports rugby union is a dynamic, territorial, high-impact collision sport that requires its players to possess a variety of sport specific motor skills such as passing, catching, kicking and tackling (Dunn, 2006). Physical qualities such as speed, strength, power and aerobic endurance are also essential to rugby performance (Tierney and Simms, 2018). Furthermore, in line with the dynamic nature of the sport, players need the ability to make rapid, effective decisions to give themselves and their team the best chance of success (Tierney and Simms, 2018). Therefore, DM in rugby union is as important as it is complex, with outcomes significant to the team's overall chances of success. This complexity is the direct consequence of two teams of 15 players competing in a match, within the pre-determined laws of the game, both teams working towards the same performance goals of scoring more points than the other. Outwitting the opposition and winning the match requires the integration of physical, technical, tactical and psychological components. The complexities of competitive sport are built from a combination of patterns of action and behaviours within a continuously changing environment (Passos *et al.,* 2008). Players are faced with complex in-game DM in dynamic environments (Zsambok*,* 1997) where time pressures and limited information affect players to make quick decisions to good consequences (Amalberti, 2007; Klein *et al,* 2007; Klein, 1993).

Traditional concepts have often defined DM as a 'bit of a gamble', a kind of utility analysis where a number of options are assessed against certain information and an action choice is selected by its perceived likelihood of success (Schraagen, Klein, and Hoffman, 2008). A large amount of DM research, however, seems to focus on motor control and argues that individuals possessing superior motor skills often display a greater ability to anticipate the intentions of their opponents and therefore choose a more effective action in response (Roca, Ford, McRobert, and Williams, 2011). While these theories of DM offer value and certainly must be considered, they are all too often explored controlled laboratory experiments, and therefore do not explore DM in a real-world context. Conversely, in uncertain and ambiguous operational settings, decisions must be made in highly complex situations and under extreme time constraints that make them very difficult to replicate in a controlled laboratory setting (Orasanu and Connelly, 1993). More specifically, we argue that the various types of DM processes within rugby (and other team sports) require differentiating and classifying so that they can be better explored and developed. Such classification of DM would include:

1) Differentiating individual and team DM
2) Individual and team intersecting DM
3) DM in closed context (e.g., line outs, set plays)
4) DM in open context (e.g., open play)

Recognising this complexity of DM in rugby union we would further sub-divide attention to the following categories:

a) In possession DM
b) Out of possession DM
c) DM in transition

We recognise that the emphasis of research in team sports has predominantly been on the 'in-possession' aspects of DM with little, if any work, focusing on the opposition DM within the 'out of possession' phase of the game (Richards, Penrose and Turner, 2015).

Event 2:	**'Looking for help'**
Role:	**Coach Education Learner**
Context:	**Advanced and Performance Coach Award Assessment Days**

Q: After your playing career you took up coaching. What did DM practice look like in at the start of your coaching journey?

There was one particular time we were playing, it was Jed Forest against Galashiels. A big local derby and we actually did end up winning the game, but only just. And there was a decision made but funnily enough, it wasn't by me, but I was well, I was trying to make the decision. Because I kind of guessed what the guys were gonna do, we had

quite an easy (penalty) kick that would take us like a try ahead if you know what I mean. And I tried to make that decision and get them to kick for goal and they didn't. They decided to go to the corner and he just completely screwed his kick and kicked the ball dead. So… So I wasn't very happy about that but, basically it was that I tried my best as a coach to allow the players to make decisions on the field themselves as I knew it was the right thing to do. The only thing was, in all the training I had had as a coach, I'd never really been coached on how to coach decision making.

Reflection: *I always wanted my players to make good decisions and to play what's in front of them, but I knew I didn't really understand how to work on this in training. As a coach I was making a lot of the decisions for them, just as my coaches did for me, in the warm-up, pre-game, during the game, and penalty options. I developed a huge interest in decision-making and started to research it and try different methods of coaching it. At my next club, I started to have team discussions before and after training about decision-making and the players really bought into it. It seemed to provoke a lot of thought and the players seemed to start making better decisions during game play, in training as well as in games. We won 100% of our league games that year, so it obviously worked in some way, but I still didn't know if what I was doing was correct?*

Q: You later developed your coaching by taking the higher advanced and performance awards. Can you look back on those specific courses and events and how they delivered DM content?

On the Level 3 (Advanced Coach course) I honestly can't remember anything being done about decision making and, like I said earlier, decision making was a real interest of mine. It has been for years. I think I probably understood the game emphasis across the levels. A lot of a Level 1, Level 2 and a fair bit of Level 3 to be honest is about the game, about actually playing the game and coaching the game as such. When you get to the Level 4 (Performance Coach course) it is a little bit more about analysis and real details of the game rather than just playing. I can't actually remember anything being said about actual decision making. I do remember the reasons that got me interested (in decision making on the courses) was because they used to say 'this is a decision-making activity' or 'decision making drill' right? So, you needed as a coach to have some decision making for your Level 2 assessment for instance. And then they would give you, they would literally give you a book with different drills on how to coach decision making. I would just sit looking at them and think to myself. How on earth is that teaching decision making? Yeah. And I'm not even making a decision. I'm doing what they're telling us to do - out of a book.

It didn't ring true like. It just wasn't decision making. It was putting you into a situation where (the player) had to make a decision, but it wasn't actually coaching you how to help the player make that decision correctly, how to facilitate that with your players.

Reflection: *Over my career I have taken and passed all the levels of the rugby union's coaching awards on offer in the UK (Level 1,2,3,4). I have also delivered and co-delivered these awards as an RFU and SRU coach educator. Although the lack of decision-making content entirely at the lower levels can be justified as the*

basics of safety, organisation and planning take precedence, it is such a key area of the sport that its omission worries me and almost reinforces some very outdated views that rugby is simply about being able to perform well established moves, skills and structures. In recent years these lower level courses have concentrated more on the coaching process, developing relationships, creating learning environments, ensuring psychological safety etc., but how to facilitate and support decision making is still glaringly missing from the curriculum. In my experiences there is a focus on testing players decisions but not delving into what, how or why we make those decisions. Only one view is offered to the coach, ecological dynamics, constraints led, environmentally initiated. It is also deemed the decision making is good if the outcome was what coach had pre-determined for that activity, and there is nothing mentioned on what contributed to the decision-making. I always reflected on these sessions and thought about the complexity of the game and realised there was no discussion about the importance of experience, cognition, or memory.

Q: Were there any specific theories of DM promoted and explained during the course?

Yeah, yeah, yeah. It was all about constraints. It was all that was covered. Basically, the the course information said that it's all based on constraints. But (the RFU) is (the only organisation) where you can get that qualification (to coach rugby at higher levels) if you coach decision making the way they are. If you don't it's then they'll say, well, that's not how you've been told how to coach decision making. So, it's almost indoctrinated into you how to coach decisions.

Q: What about when you went on the highest-level coaching course (Level 4 Performance Coach Award)?

The only decision making that really was touched on was X. He was one of the tutors on the course as it happened. Again, I never realized at the time, but now looking back and knowing what I know now, it was almost shoved down my throat. It was more like affordance driven, like how the environment drives the decision making, i.e. it was more constraint led. So putting certain constraints on the games to force certain scenarios and force players into the making certain decisions - all based on dynamical systems.

To be fair, I wasn't that aware of any anything else at the time. I remember I used to think to myself about it all the time, about how or what I could do to make my decision making as a player better. Of course, at that time I thought the Level 4 is going to teach me how I could coach decision making to my players and make them better decision makers. That's why I got so interested in it. And then I basically went along with it again, this is what everybody has to do because it’s your badge at the end of the day, if you don't do it (their way).

Q: And do you still think and coach that way, using the ideas you learnt on those courses?

Not at all. I still had my experiences that had given me an idea of what was actually needed. I also started to think about doing a Prof Doc to develop my thoughts on decision making and explore decision making through experience or through memory or through,

> cognitive stuff. I remember saying to me it's a little bit of everything, whereas some theories say it's just hard and fast. I think you need a little bit of everything, you know, mental models, situation recognition, I think situation recognition is absolutely huge in in team sports, just recognizing situations, understanding situations.

Reflection: *While completing the Level 4 coaching course, the game was broken down into specialist technical or tactical areas and presented in the classroom via lectures, specialist coaches and guest speakers. I remember thinking to myself, if at the highest levels of competition decision-making is key to success, then why is there only one approach skimmed over during the course?*

Within the Rugby Football Union (RFU) competency-based certification awards, there appears to be a mismatch between the performance demands facing coaches and the professional development available to prepare practitioners to coach within the modern game (Thomas and Grecic, 2020; Wilkinson and Grecic, 2021). Research suggests that competency-based courses seem to fall short in meeting the development needs of elite coaches, particularly their ability to address 1) the complexity of DM within rugby from a playing perspective, and 2) the theoretical mechanism, enabling rugby union coaches to understand how they themselves, can most effectively develop DM skill in their performers (Collins, Burke, Martindale, and Cruikshank, 2015). Such shortcomings and limitations are presented by Collins *et al,* (2015) as a failure to consider the wider complexities of DM in rugby. Cushion (2009) however argues that these coach development programmes are designed to develop coaches' understanding of pedagogy and education, that subsequently allow them to deliver high quality practice sessions in a positive learning environment. We argue that such context although informing pedagogy and technical skill development, does so in isolation of the subject matter of DM.

Those working in rugby union, as in all team sports, share the complexity and challenge of understanding in-action competitive DM. The complexity of the DM process within a coaching context presents coaches and applied specialists with a range of multifaceted challenges. Each DM challenge requires a bespoke approach to understanding the individual, team, situation and context in which they are all executed (Richards, Mascarenhas and Collins, 2009). The major challenge therefore facing coaches and specialists working within the professional game, is to understand the complexities of not only DM, but the specific types of DM skills required in the sport and how this knowledge can be integrated into the coaching process. At present we argue that the competency-based focus of many sports' coaching qualifications and frameworks such as the RFU's Advanced Coaching and Performance Coaching Awards, and other sports who also adopt the United Kingdom Coaching Certificate (UKCC) framework, do not facilitate the opportunity to embed 'in-game' DM. Indeed, many of sport's governing body courses have traditionally considered the coaching act, and specific areas such as DM, as generic

processes. In this way the applied content of the coach education curriculum can be perceived as one dimensional, with the delivery methods chosen deemed suitable for all coaches, in all circumstances, regardless of their respective sport. Of course common sense would tell us otherwise (Lyle, 2002), and we present the argument that such a 'one size fits all approach' is limiting the ability of coaches to effectively coach DM. Thankfully coaches' bespoke needs are finally being recognised by studies such as the recent UK Sport Pathway Coaching Position Statement (UK Sport, 2020). Here we believe that the ability to develop DM skills of coaches and performers, in the precise context they are needed, should be one of the key areas addressed by future coach learning.

Grehaigne, Godbout, and Bouthier, (2001) note that despite the importance of effective DM for successful team performance outcomes DM appears to be given very little emphasis in many sports' coaching accreditations other than being linked to pedagogical practices embedded within an ecological systems and non-linear framework (Kinnerk *et al.,* 2018; Light and Evans, 2020; Stone *et al.,* 2020). Nowhere is this more evident than within the English RFU's higher-level coaching awards (Advanced Coaching, and Performance Coaching Awards, previously L3 and L4 respectively on the UK Coaching Framework). Within these awards there is no explicit reference to DM development within the RFU's coach developer's tutor packs, although in line with Gredhaigne *et al.'s* (2001) observation, analysis of tutor resources does highlight a singular ecological dynamical system explanation of skill acquisition for player in-game DM (Davids *et al.,* 2013; Passos *et al.,* 2008; Renshaw *et al.,* 2009). Although this ecological theory can make a valuable contribution to performers' development, we argue that it is limited and does not address the full complexity of the DM process, but rather offers a singular lens by which to view the concept of decisions. These two concepts, decisions and decision making (DM) are fundamentally different. Decisions are the course of action taken, whilst DM is the process through which the decision is made. Within coach education, understanding the process of DM is essential, as focusing on the decision outcome can be flawed, as no one singular decision is definitively correct. There may in fact be several options to achieving the desired outcome. Unfortunately a streamlined approach using a single theoretical framework is frequently witnessed within coach education, and specifically with the approach taken to develop DM skills in performers. Although the ecological approach is undoubtedly valuable in rugby given the importance of players being able to react to the uncertain and ever-changing decision at-action environment (Mouchet and Duffy, 2018; Passos *et al.,* 2008), the theory needs to be integrated with other approaches that present a clear outline to how DM skills can be developed. Richards *et al.,* (2016) warn against exploring one theory only in isolation as this will inflate its contribution to the concept of DM. It is therefore proposed that sport and rugby union specifically should consider a broader

range of concepts and theories. We propose that Naturalistic Decision Making (NDM) should be more fully utilised to underpin work in this domain. NDM provides an integrated range of models and theories (Richards and Collins, 2020) which address cues and situational factors and explains how these are both executed at an individual and team level (Richards *et al.,* 2009) through the process of sensemaking (Richards *et al.,* 2012). This would seem to be of great value for all those wishing to gain a greater insight into how best develop DM in rugby.

What is Naturalistic Decision Making (NDM)?

NDM has been described as making decisions by the application of experience in unclear, dynamic field settings that are recognisable and important to the decision makers (Lipshitz, Klein, Orasanu and Salas, 2001; Zsambok and Klein, 1997). In other words, NDM is the study of how people function in their normal, real-world surroundings or at least a simulated scenario, preserving important aspects of their normal setting, actually make decisions (Zsambok and Klein, 1997). It is argued that experienced decision makers do not actually compare available options from a list of possibilities, but through previous knowledge and experience, recognise patterns and evaluate subsequent options by envisaging the possible outcomes of the situation (Klein and Hoffman, 2008). The decision maker assesses possibilities and advances by anticipation to minimise the complexity of the situation and instead of using reflective processes to save resources, a more independent level of behaviour is applied (Macquet and Fleurance, 2007).

Decision complexities in sport: integrating theory and practice

The relevance of NDM is essential to both understanding aspects of DM in sport (in possession, out of possession and transition; Richards *et al*., 2009) with a range of theoretical approaches of NDM being of significant to informing the discussion. The following section will therefore provide a brief overview of these approaches. However, it is relevant to outline that the key theoretical approaches which will be explored later in this paper: *Recognition Primed Decision Model*, Klein (1993); *Situation Awareness*, Endsley (1988); *Sensemaking*, Dervin (1983) and *Mental Models* Johnson-Laird's (1983); *Shared Mental Models* (SMM), Cannon-Bowers, Salas and Converse's (1993) should not be viewed in isolation of each other. Richards and Collins (2022) proposed that the theoretical approaches from NDM all make a valuable contribution to enhancing our understanding of DM processes and should be explored collectively, in doing so the complexity of DM in sport can be more effectively understood. DM is undoubtedly of significance in the world of elite sport. As mentioned earlier, Kaya, (2014) argues that the quality of the DM by the participants, individually and collectively, determines the level of success. The following discussion will present an overview of NDM approaches in context of rugby before the theoretical foundations provided below are presented in context of

'out of possession' dimension of the game. Data from Morgan *et al.,* (2020) study highlighted various methods that coaches working with the French national rugby teams utilised to facilitate more effective DM utilising pre, during and post competition / training coaching interventions. An interesting finding of their study was a focus 'on the ball' rather than on wider aspects of the game. Indeed, from the first author's experience when he has been exposed to sporadic DM training sessions in rugby, there also has seemed to be a major emphasis on coaching DM from the perspective of when 'in-possession' of the ball and in an attacking context, i.e., beating a defender in a 2 v 1 situation, attacking from the set-piece or playing with fast multi-phase ball. We recognise this is undoubtedly an essential part of the game and must be coached, however, there seems to be a shortfall in coaching effective DM when not in possession of the ball, and during the transition phase of possession. Work by Richards, Penrose and Turner (2015) and more recently Richards *et al*., (2019) outlined that although attacking ('in possession') and defensive aspects ('out of possession') of the game share commonalities, these two phases of the game (including the third phase of transition) require different thought processes as information is engaged with differently within the DM process.

Competitive sports in general regularly exhibit dynamic settings that display a number of parallels to those that are studied using the NDM approach. The parallel, dynamic setting of a rugby match mimics the characteristics of uncertainty, high stakes, shifting and conflicting goals, multiple participants, and intense time constraints (Macquet, 2009; Zsambok and Klein, 1997) and justify the value of NDM as a paradigmatic approach to DM in rugby union. For example, while operating in open 'phase' play, the attacking team can generate momentum by producing quick ruck ball (recycling the ball back into play from a contest for the ball on the ground), where the time between a tackle being made and the ball being moved away from the ruck may consistently be as quick as 1.5 seconds. This means that the defence must be able to reset, recognise cues and tactical patterns, understand the situation and problems faced and react accordingly within seconds, and all this staying within the laws of the game. We propose that understanding the theoretical concepts that underpins these processes, enables coaches to design and construct an effective pedagogical approach that effectively develop DM in their players and teams.

Event 3:	**'Passing on knowledge'**
Role:	**Coach Education Tutor**
Context:	**Advanced Coach Award Delivery Session (2016)**

Reflection: *Even on the Level 4 course (Performance Coaching Award) how we were introduced to decision-making concepts and theories was very disappointing. It seemed very one dimensional and biased to promoting one 'ideal'*

way of developing players' decision-making through the use of the ecological / constraints approach. We were given supporting research papers to read, presentations to watch and were lectured on the benefits and value of this approach. Much of the coaching behaviours promoted seemed more appropriate to when working with young children or lower level players. Examples of where this had been used with elite players and teams such as the All Blacks didn't take into account our own circumstances and needs but presented this approach as the panacea to all our coaching desires. I've tried this approach in the past with my players, but it has given me more headaches and conflicts than help and support. Some players don't want to be left to work it out for themselves or be guided to reach a certain outcome. They want to know, to feel, to understand and the courses didn't prepare me to best facilitate that learning.

Q: Following the examples you've given at events as a player, coach, coach delegate etc. is there anything else that you would like coaches to be more aware of to do with decision making?

> Yes, well, first and foremost, I think it would be I'd like the coaching culture to be more aware of different ideas of decision making and also, you know… the disruption of decision making. The driver behind my thoughts about decision making is that when two teams play, if every coach in England has gone through the RFU Coaching awards and manual, every coach in England will coach decision making the same way. But, generally speaking, again, from all the research I've done on decision making and probably through my own experiences, the better make better teams decisions and they are generally more successful than the teams that don't make them.
>
> So I still want to coach my players to be better decision makers. But how can I get an advantage? How can I find an edge and get an advantage over the opposition? And one of the things I was thinking of was, well, if successful decision makers make good decisions, if I can do something as a team within the laws of the game to disrupt the decision making of the opposition and make them make bad decisions, its gonna lessen their chances of success. And obviously it's our strength and also increases our chances of success. And that's really what it is.

Reflection: *As a coach tutor tasked with delivering the concept it was very frustrating, what about introducing other concepts and theories surrounding decision-making? The lack of focus on decision-making and how the game has moved on leaves a huge gap in the coaching curriculum. The Level 4 breaks down the game into specific areas with numerous modules providing detailed technical and tactical knowledge and ideas to coaches, most of which were very thought provoking and promoted innovative coaching. I really enjoy watching other coaches' coach, I watch lots of games and pre- or post-match interviews with players and coaches. My interest in decision-making led me to think, in general, if good decision-making equals success, then coaches and players can influence and disrupt the oppositions decision-making, then surely that will decrease the opposition's chances of success against us? This led to my interest growing in how coaches can*

influence and disrupt their opponents, what strategies do they use pre-, during and post match? This is a new area and should be covered in coach education, I call it Disruptive Decision Making.

Disruption of Decision-Making (DDM)

In the context of elite sport and striving to gain a competitive advantage, athletes and coaches will regularly attempt to exploit their opposition by intentionally causing a disruption to their DM flow (out of possession coaching). This requires the coach to minimise process losses and maximise process gains. It appears that teams will intentionally plan to gain advantages by implementing strategies to cause disruption to the DM of their opposition when they do not have possession. This can force the opposition into states of self-doubt and nervousness, creating anxiety and ultimately poor DM, causing performance errors and resulting with a reduction in their chances of success. Interestingly, however when we hear the word 'disruption', we instinctively think of its negative connotation, which is not always the case. The term disruption can be defined in the Oxford Dictionary of English (2010) as '… a disturbance or a problem that interrupts an event, an activity or a process'. Therefore, it is important to stress that these disruptive tactics and strategies are not violations of the laws of the game and are not to be perceived in any way relating to the promotion of cheating, but instead are recognised as part of high-performance sport. The challenge facing elite teams is not only to design tactical play and to outperform the opposition, but to also be able to deal with the disruptive tactical play implemented by the opposing team.

In recognising that a large percentage of time in rugby involves teams engaging in the 'out of possession' phase of the game, the average being in Super Rugby competition when teams will spend just over 18 minutes or 46% of ball in play time, in the 'in possession' phase of play (Super Rugby, 2020), suggesting that over half the game is spent in 'out-of-possession' and transition phases (56%). Therefore, it is essential that we understand what is occurring in these phases. As highlighted above during a period of being out of possession, a team will be trying to disrupt the opposition to regain possession. For the purpose of this paper, disruptive decision-making (DDM) can be defined as a deliberate process, which can be executed in any context including competition, with the objective of gaining a competitive advantage by disrupting the tactical decision-making of the opposition. Disruption can be of a psychomotor, psychosocial or psychological nature and can be applied both overtly and covertly.

It may however be necessary here to clarify exactly why DDM has been defined in this way. DDM is pertinent to elite rugby union and many coaches will meticulously plan adversative interventions or disruptive strategies for use at different stages of competition. These can occur either before the match, during the

match, immediately after or a combination of all three. As articulated in the above definition of DDM, such strategies can be planned and implemented before competition (in the days / hours leading up to the match), during the match, or post-competition (immediately after the match). For example, attempts to use psychological interventions such as 'mind games' or 'gamesmanship' (Howe, 2004; Wright, 1992) may be employed to gain a psychological advantage before competition. Coach education can therefore support the coach with differentiating the different types of DM as outlined in this paper. Specifically, with DDM coach education can assist the coach with understanding how to 'manage match day performance' (before and after the game) in relation to DDM and also how to manage DDM within the game, which is a particular focus for this paper.

Managing DDM in the game incorporates the NDM theories outlined above for in possession play. The complexity of the situation is still driven by Shared Mental Models as players actively seek to identify the cues (Recognition Primed Decision theory) which are related to tactical plans (Situational Awareness) that have been agreed as a team (sensemaking). For example, a team out of possession might try to disrupt the opposition's DM by showing a picture of defensive weakness in a certain area of the pitch, therefore inviting the opposition to attack that area or misleading them into a situation where the ball carrier will be isolated, and the defence can regain possession of the ball. In engaging in this type of disruption the defensive team is perceiving information about the team in possession and contextualising this within their own tactical plan (SMM), with the objective of regaining possession. This short overview relating to the scenario, disguises the complexity of this process, but it is hoped that the intricacy of the situation can be appreciated by the reader and will be addressed in more detail in future papers. However, the point which is pertinent here, is that the comprehension of such complex aspects of play requires a high level of engagement and learning through the process of coach education. Therefore, by presenting only a singular lens from one theoretical framework, as part of a coach education course, does not equip coaches with the skills to effectively coach all aspects of DM within a rugby context.

Event 4:	**'Applying learning and experience'**
Role:	**Experienced Coach**
Context:	**New squad's first training camp**

Q: Moving forward to your present coaching practice and DM, can you talk me thought what your work looks like now in this area?

> With the Army (rugby team), because I get them for a full week, we have lots of meetings, forwards meetings, team meetings and we do team building. We talk through things a lot, about why and how we're trying to develop it (decision making).

In the talks I try to give them a mental picture of what we actually want from them in certain situations. I'm not dictating to them what they're doing, but it's like, you know, in this situation, we need to come up with a way for doing x, y or z. As one specific instance, the hooker (forward player who hooks the ball back at a scrum), I would sit down with (the players) and say right, if they lose a hooker to a yellow card for 10 minutes how are we going to play now? What will you do and what will you change? And a lot of the time the players will say to me well, you know, it depends. What they do depends on whether one of the back rows may be able to play there, so he might just slip straight in and hook and I'll say 'Right, so what would we do in the scrum? How are we going to attack them? What can we do differently. I'll talk to players and try to draw it out of them what they know and what they can do. But also because of the time I've got, I'd also sit and talk to players to help them make those decisions. But they would be made before the game if you like, almost like rehearsed decision making.

Q: That's interesting, but do you also prepare them to be able to make decisions in the game?

Yes, yes, definitely. Well, we'll do that in training. I'll put time constraints on different things. We do a lot of scenario work. So, I'll say a likely scenario on the field, may be you know, that we're four points down, it's the final two minutes of the Army v Navy game and we have to score a try. We're in this position. We've got a man down. We've got two men in the bin. How would we plan and go through different scenarios and then sometimes the players will come up with an idea and come up with an option to play a certain way or do a certain thing. And I'll probably not agree with it or I haven't agreed with them all, so I'll say we'll look at it. Let's have a look and see what it is, how that looks, see how it feels. The players then go through it and then if it's executed well, I'll get them straight back into the little huddle and just see how does that feel? You know, do you think that will work with a live defence? Right. We're going to put more pressure on you here, so I'm letting the defence up against them (much closer).

On the attack I just do different scenarios too and put them in to play around with timings and letting people go offside, having certain people who can just go beyond the laws so they can just do whatever they want and then we work on how we're going to counteract that. If it happens in the game.

Reflection: *My interest in decision-making and all the reading I have done to find out more is clearly evident in my coaching practice. The decision-making concepts, theories and new ideas that I have researched while working on my Professional Doctorate are fully applied in the way that I work with my players on and off the pitch. We work together on developing mental models and shared mental models. Also, I spend a lot of time talking to the players and reviewing their individual and team performances with an explicit focus on decision-making, directing awareness, highlighting relevant cues. I am always looking to develop new training practices to prime players and give a greater depth of understanding. All the things I never had as a player. Lastly, I have a huge interest in using decision-making, or maybe more specifically disruptive decision making where we work to develop any practices, such as deception, cue distortion, or psychological intervention, pre-match, during or post-match to gain a strategic advantage. I have*

researched a number of decision-making concepts, and recognise that all have at least some value, however I have really nailed my colours to the naturalistic decision-making ideology.

We acknowledge and recognise the importance of the ability to react to uncertainty in competitive situations whether caused by tactical disruption or other means and want to address the complexity of this process in more depth, to support the development of coaches and players alike. The complexity of DM requires a multitude of lenses to understand how DM presents in sport. From a strategic level, there is the need to design and operationalise Shared Mental Models (SMM) which shape the performance vision or 'alpha vision' (Richards, Collins, and Mascarenhas 2016), and therefore inform what information is attended to and the decisions that are made. This in itself is an extremely complicated activity and requires dual 'top-down' and 'bottom-up' processes, which integrates the experiences of players, coaching staff and specialists. The reader is referred to Richards and Collins (2020) for a theoretical account of the paradigms involved. In addition, the integrating reflective practice to develop team DM (see the five-stage model by Richards, Collins and Mascarenhas, 2016) provides a clear staged approach to developing DM skills for all phases of the game, including in-possession, out of possession and transition.

Mental Models (MM) and Shared Mental Models (SMM)

A fundamental theory supporting the effective delivery of pedagogical process aimed at developing DM skills relates to the construction of Mental Models (MM) and Shared Mental Models (SMM). SMMs not only provide a blueprint to inform the progression of practices, but also shape the content of what information in the performance setting is attended to. A Shared Mental Model (SMM) can be defined as (Cannon-Bowers *et al.,* 1993:221):

> Knowledge structures held by team members that enable them to form accurate explanations and expectations, and, in turn, coordinate their actions and adapt their behaviours to the demands of the task and other team members.

A large amount of literature surrounding mental models (MM) concentrate on individual cognitive performance, acquiring systems knowledge, and individual systems interaction (Salas, Stout and Cannon-Bowers, 1994), nevertheless, such research also highlights that the concept of SMMs may be applied to facilitate coordinating actions within a team setting, assisting teammates to predict what each other need and do in order to function together as a team (Jonker, Birna Van Riemsdijk, and Vermeulen, 2010). As such, it is argued that team performance is heavily reliant on team members sharing an understanding of the team itself, team objectives, the roles of teammates, individual roles, and the task to be executed

(Richards *et al.,* 2016). Team members therefore draw on common or shared understanding of the situation, in the form of a SMM.

Within a coaching context research has indicated that the integration of a SMM into the performance setting not only provides a framework to shape pedagogical delivery, but also accelerates and improves the DM skills of the individuals and team collectively (Richards *et al.,* 2012). The coach's initial vision of performance (SMM) which is constructed at the start of the performance cycle contains the detail of what aspects of performance will be developed during the season. This vision has been referred to as the 'alpha version' (Richards *et al.,* 2009). The 'alpha vision' (SMM, or performance vision) is sub-divided into smaller performance 'chunks'. These performance chunks (normally 3-5 components) are those items that have been identified by the coach as being essential in securing performance success and that can delivered in a progressive and sequential manner. For example, in rugby one might be playing from receiving a deep kick and a second might be attacking from a lineout. These sub-components of the performance vision (alpha vision) contain the detail or roles of team players, skills-sets and what information is needing to be attended to (Richards *et al.,* 2016). Interaction between the coaches and the players, empowers the players to understand and adapt the 'alpha version', and align it to their own ideas and agreed perspectives as a team, resulting in subsequently giving ownership of the 'in action' version of the performance vision, known as the 'beta version' (Richards *et al.,* 2012). The beta vision of performance (formally the alpha vision) acts as a blueprint to structure pedagogical practices and shape what content information is attended to and priorities during a rugby match/training and which integrates the players perspective.

SMMs are integral to efficient group interaction, team training and competent performance (Cannon-Bowers *et al.,* 1993; Klimoski and Mohammed, 1994; Richards *et al.,* 2012). SMMs are argued to have great importance for effective shared situation awareness (Endsley, 1995; Endsley and Jones, 2001) which is deemed essential for teams performing tasks in rapidly shifting, real world environments, such as emergency response groups, military units and high-performance sports teams (Young and McNeese, 1995). Hence, a coach's understanding of how to design and develop SMMs will improve both the effectiveness and outcome of coaching pedagogy. SMMs are relevant as they enable performance decisions to be agreed as a team, and understood in detail and complexity. SMMs also enable the phase of the decision to be examined in detail (Richards *et al.,* 2009; 2012) providing a vehicle for both the integration of theory, and therefore an enhanced understanding of how that knowledge can be used by practitioners to develop decision-making skills in individuals and teams.

Recognition Primed Decision-making (RPD): Klein's (1993) RPD model demonstrates how experience and pattern recognition is used in the DM process, to avoid time-consuming investigative strategies associated with traditional judgement and DM, where there is a necessity to select the most appropriate response from a large range of options (Klein, 1993; Klein and Hoffman, 2008). The RPD model depends heavily on the experience and expertise of the individual, acknowledging a typical human perception process known as pattern recognition (Youguo *et al.,* 2008). This generally refers to the process of comprehending interesting patterns and cues, and matching it with (recognising) information already stored in long term memory as a MM or SMM. In simple terms, the decision-maker deliberately assesses a mental representation (MM), and forms expectations of future states. Recognising a representative course of action and responds appropriately (Klein, 1997). From a shared or team perspective, as individuals become more aligned in their understanding of the team and its objectives, SMMs are further developed (Converse, Cannon-Bowers and Salas, 1991) which adds further support to the inclusion of SMMs as a theoretical concept that is essential for coaches to understand in multiple contexts, but more especially within the coaching and development of DM. Integrating RPD into the coaching curriculum would enable coaches to connect SMM to visual search patterns, as information deemed to be important in the performance environment can be primed and used to accelerate the operationalisation of in game DM (Richards, *et al.,* 2012).

Situational Awareness (SA): Endsley's (1988) model of SA is described as the collecting of information from the environment, and the comprehension of this information in context of the performance setting. Formally, SA has been defined as 'the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future' (Endsley, 1988 p. 97). SA theory outlines three levels of situational awareness. Level 1 involves the perceptual elements within the situation. Without possessing the fundamental ability to perceive cues, patterns or any other important information within the performance setting will increase the chances of forming an inaccurate representation of the situation (Endsley, 2000). However, Sarter and Woods (1991) argued that a relatively inexperienced practitioner might be able to achieve Level 1 SA and possess a basic perception of the situation when there is no pressure, fatigue or other distractions applied. Level 2 refers to the understanding and integrating the information and is frequently referred to as comprehension. SA is a construct that incorporates far more than 'just' perception, including the combination and interpretation of information with relevance to the practitioner's objectives (Sarter and Woods, 1991). Someone possessing Level 2 SA will have the ability to, through the process of pattern recognition, understanding and evaluation, develop effective meaning and significance from synthesising the Level 1 data

received. Finally, the most advanced level of Endsley's (1988) model of SA, Level 3 requires the projection of future status and actions of situational elements. Quite simply, someone possessing Level 3 SA could be described as 'being ahead of the game' (Sarter and Woods, 1991) and have the ability to predict the most likely future outcomes within the operational environment and virtually eliminate any shocks or surprises (Endsley, 1995). This will be executed by incorporating the ability to understand the meaning of the presented data and compare it with a set of operational objectives in order to effectively predict future states that will be valuable to DM (Endsley, 1995; Sarter and Woods, 1991).

Rugby players must show a constant awareness of their surroundings and visual displays presented by the opposition to achieve SA (James and Patrick, 2004). Valuable information will be displayed to the players in the form of offensive / defensive set-ups, formations, field position, ball location, type of ball (set piece / phase or transition), player location, velocity, ability, and match (weather) conditions. Perception, and comprehension of these presented 'pictures' are essential to anticipation, DM and future actions. For example, a defender within the defensive line must perceive their direct opponent's movements and actions while maintaining focus on their defensive duties and simultaneously perceiving other, both offensive and defensive players' movements, ball location / movement / speed and direction. Success for the defence would require the defensive players to make sense of the presented information, as such that the opponent's movements may be coordinated with other attacking players and ball movement (James and Patrick, 2004). This information is compared to the opposition's previous actions and behaviours in similar situations, and subsequently supports the DM process facilitating the anticipation of the likely outcomes of the opponents attacking strike. The inclusion of the theoretical understanding of SA into the Coach Education curriculum would therefore not only enhance the understanding of coaches to develop more effective on field decision-making but also layer the complexity of information in a progressive and logical manner.

Sensemaking: Weick (1995) referred to sensemaking as 'how we structure the unknown so as to be able to act in it' (Ancona, 2011:3). Simply described, sensemaking is how people 'bridge the gaps' and make sense of situations, it's how they construct information that is missing and make decisions on how best to use that information (Dervin, 1983). Within a sporting context sensemaking is essential within the DM process. Richards *et al.,* (2009; 2012) outlined that sensemaking has two key components of noticing (attending to key information) and framing (framing the information in context of the tactical philosophy of the team). The integration of sensemaking into the coaching process empowers the performer (and members of the team collectively), to be guided to perceiving key information in the performance

setting, in context of the game plan and tactical playing philosophy. Sensemaking is therefore informed and driven by the SMMs, which shape what information the players and team need to prioritise and attend to. Additionally, Klein *et al.,* (2007) described sensemaking as the framing and re-framing of information and postulated that sensemaking commences as soon as there is a perception of defective data or an unexpected event within the existing frame.

The theoretical concepts outlined above are relevant for all phases of the game, in possession, out of possession and transition. As noted previously, over recent years, researchers have directed their attention to applying these theories to attacking aspects of the game. This influenced and enhanced our understanding of how to coach 'in possession' DM. Coaches therefore need to differentiate how we coach in possession and out of possession phases of the game, and as a result coach education is required to provide the pedagogical understanding of what this involves and how it is done. To address this challenge, the paper will next consider out of possession phase in relation to DM and specifically the role of disruption of DM before concluding with recommendations for coach educators and coaching programmes.

Recommendations to enhance decision-making in rugby coach education

Looking back on events, reflections, and interpretations provides a valuable lens to look forward into the DM needs of the sport and coach education in particular. Coach education should improve the coach's ability to establish and develop their knowledge and understanding of how to create an integrated vision of performance (an 'alpha' vision, see Richards *et al.,* 2009).

Establish the ability of coaches to: 1) Design SMMs and 2) develop a team SMM to shape and guide the DM of players. Specifically, this will provide coaches with a structure to guide how their 'alpha vision' and subsequent 'beta vision' (with constant collaboration of coaches and senior players) can be used to form their own club's blueprint to coaching, and structure training sessions that can effectively develop DM skills. Also, outlining what information is important, what information is attended to, and how it is prioritised (Richards *et al.,* 2016). Specifically, what is important here is the sense of empowerment and player buy in to the creation and maintenance of SMMs (Richards *et al.,* 2012). Developing the coach's recognition that DM is bespoke to phases of the game, match situations and areas of the field. For example, the process of DM in rugby will differ between a set piece situation, where the setting is less deviating and controlled; and any transition (counterattack) or multiple phase aspect of the game that is more uncontrolled and chaotic.

Develop coaches' understanding of SMM: the way they are designed and how they are constructed, coaches will be able to develop a proposal, which can be used to structure the content of DM practices that they deliver to their team. Such a

blueprint could and should be used by their National Governing Body's coach developers in partnership with their coaching candidates to help structure and develop the content of DM modules within their coach education courses.

Conclusion

The Explicitation interview method provided a valuable insight from lived experience, supplemented by facilitated reflection and critical friends' commentary. Findings have identified a number of key learning points that could be considered to support and enhance how the sport is coached. A major challenge of DM in rugby union (as with many team sports) is the numerous situations and phases which present themselves, all requiring a different type of decision to be made, either in a more linear controlled situation such as set piece (scrums, lineouts, kick-off's), or a more dynamic, chaotic situation such as open play. This distinction in itself requires coaches to differentiate the skills within their coaching pedagogy, as to how they design their learning environment. Furthermore, coaches are encouraged to differentiate how coaching in different phases of the game is addressed, for example offensive, defensive and transition play. The complexity of understanding this taxonomy of decision-making requires a closer alignment from practice and theory as pedagogical practice can be designed more effectively if they are informed by theory. As coach education frameworks are perceived as one of the major influencers that provide guidance on how to coach, it is essential that such coach education programmes provide the content for not only the design of practical exercises, but the theory that underpins the rationale of those exercises. Additionally, we argue that a further sub-division is needed, where decision-making is explored at a granular level resulting in the identification of range of decision-making skills required in sports. This would enable coach education to not only support the development of new coaches entering into sport but also enhance the practice of more experienced coaches and support their continued learning in this domain. This paper therefore highlights the valuable role that coach education plays in this process but the requirement that they do so, not from a 'one size' fits all lens but one that recognises the complexity of the concept of DM.

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Reviewer Comments

This paper affords a rare, first-person glimpse into the complexities of decision making in rugby union. The narrative-interview style makes the reasoning clear and accessible, often on contentious issues such as education and autonomy in the game, and beyond. Given that decision making in sporting contexts is often not very clear, this exposition allows the reader to follow a thread of motives that can be traced between the narrative response and detailed reflection. Good methodological choices to conduct this research are key to yielding these valuable insights. The transition in perspectives from player to coach in rugby union is especially impactful, providing strong evidence to support the authors' claims to include decision making in formal coach education programmes from grass-roots to elite levels. This has the potential to improve experiences of playing, coaching and spectating in high-quality sport.