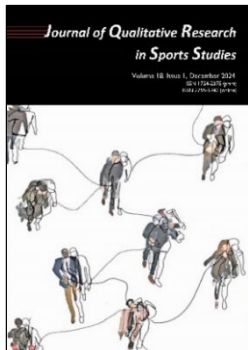


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Game Intelligence in Rugby Union: What do coaches think it is? An exploratory qualitative survey design

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Game Intelligence in Rugby Union: What do coaches think it is? An exploratory qualitative survey design

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Keywords: *game intelligence, coach education, rugby union.*

Abstract

Game Intelligence (GI) is promoted by coaches, pundits and commentators as a key element underpinning high level performance in sport. There is however a limited amount of research in GI in sport, and less in Rugby Union (RU). The purpose of this study, therefore, was to explore rugby coaches' understanding of GI, to establish its key components and to propose a working definition for GI in Rugby Union. Rugby Union coaches (n= 175) completed an online survey which contained a combination of open and closed questions. Participants were asked for their views about GI, with Reflexive Thematic Analysis (RTA) used to interpret their qualitative responses. Consequently, twelve sub-themes and four major themes were constructed that described the various facets of GI in Rugby Union, these being: situational awareness, effective decision-making, knowledge and understanding, and the ability to influence the game. Data also identifies that the development of player GI is seen as a joint responsibility between player and coach. This study is original in that it explores coaches' understanding of GI, then proposes a conceptual model for GI, and further, offers a definition for GI in Rugby Union. It is hoped that this will aid further discussion and research into this crucial but under-developed area of coach education.

Introduction

Game Intelligence (GI) is often promoted as a key element underpinning high level sports performance. Increasingly, this is the case in Rugby Union (RU) where physical and technical abilities have previously dominated discourse around sporting expertise. The best players often appear to possess an innate ability to be in the right place at the right time, anticipating where they need to be to influence the game. These players also appear to have more time than others to display their skills and make the right decisions (Light *et al.*, 2014). Terms such as GI are being used increasingly by TV pundits, commentators and coaches when referring to the attributes of great players. In September 2023, the in-game commentary team for the Rugby World Cup match between France and New Zealand, referred to Beauden

Barret and Richie Mo'unga as having high levels of rugby IQ, describing them being 'very game intelligent players' (Harrison *et al.*, 2023).

Rugby Union is a team invasion game and is an intense physical contest (Ashford *et al.*, 2021). Since its professionalisation in 1995, the physical demands of rugby have increased markedly. This has been mirrored by an increased focus on the development of physical qualities deemed necessary to be effective in the game (size, strength, power, speed etc) (Austin *et al.*, 2011; Cunniffe *et al.*, 2009; Tee *et al.*, 2017). Player anthropometric data has shown that the mass of players (height and weight) has increased across all playing positions in RU since becoming professionalised (Fuller *et al.*, 2013). However, elite international coaches fear that physicality has become too important and that players need to be more skilful, better decision-makers and more intelligent (Ashton, 2009, 2018; Williams, 2021)

Advances in strength and conditioning provision mean that the possession of physical qualities is now deemed a pre-requisite for professional rugby players (McMaster *et al.*, 2014). Crucially, where physical markers may have previously differentiated players, the gains in this area have become more marginalised (O'Connor and Larkin, 2015a). Indeed, at the highest levels of the game, physiological attributes do not differentiate between the successful and less successful athletes in a given position, or between teams (Reilly *et al.*, 2000). Instead, it is believed that perceptual-cognitive skills may be a better determining factor for expert performance (Di Tore *et al.*, 2018; Elferink-Gemser *et al.*, 2010; Gleeson and Kelly, 2020; Memmert, 2011; O'Connor and Larkin, 2015b; Williams and Ford, 2013). What is apparent is that team invasion games are a source of psychological uncertainty and unpredictability for players (Passos *et al.*, 2008; Sunderland and Nevill, 2005). Brian Ashton, a former international RU coach, described RU as a VUCA environment (volatile, uncertain, complex, and ambiguous) (Austin, 2018). In such an environment, just possessing the necessary physical attributes is not enough to succeed, because players need to understand, make-sense of, and navigate a complex and rapidly changing landscape to make effective decisions that will positively impact the game and match outcome (Passos *et al.*, 2008; Richards, 2005).

In summary, well developed perceptual-cognitive skills have become increasingly recognised as being as important, if not more important than physical attributes (Araújo *et al.*, 2019; Klein *et al.*, 1986; Klein, *et al.*, 2010; Raab *et al.*, 2019; Toner *et al.*, 2015; Williams and Jackson, 2019).

Decision-making and Game Intelligence

Decision-making in sport relates to the process of selecting the most appropriate movement response from a range of possible actions, to achieve a specific goal

(Abernethy, 1996; Hastie, 2001; MacMahon and MacPherson, 2009). A primary objective therefore for coaches in team invasion sports is the development of player perceptual-cognitive skills (Williams and Ford, 2013), including player decision-making processes. The parameters of high-performance sport mean that the difference between winning and losing has been reduced to the smallest of margins (Richards *et al.*, 2012). This means that the ability to make rapid, accurate decisions, by effectively utilising appropriate game information, is crucial for successful performance (Abernethy and Russell, 1987; Elferink-Gemser *et al.*, 2004; McGuckian *et al.*, 2018; O'Connor and Larkin, 2015b; Williams and Grant, 1999).

In a VUCA environment, decision-making is influenced by a range of variables (Elferink-Gemser *et al.*, 2004; O'Connor *et al.*, 2018; Richards, 2005) such as a player's ability to attend to the most relevant in-game information (their situational awareness; Endsley, 1995b), their skill level, the team's game strategy, the tactics of the opposition, and the game context e.g. the score, field position, momentum, knowledge of the opposition, and game time remaining (Travassos *et al.*, 2012; Travassos *et al.*, 2013). Furthermore, the time available for players to perceive, access memory and act (make the decision), alters rapidly between different game-play situations (Ashford *et al.*, 2021; Richards *et al.*, 2012).

The research on decision-making in sport is extensive (Araújo *et al.*, 2019; Klein *et al.*, 1986; Klein, *et al.*, 2010; Raab *et al.*, 2019; Toner *et al.*, 2015; Williams and Jackson, 2019). From the literature three clear perspectives emerge: information processing, ecological dynamics, and naturalistic decision-making (Ashford *et al.*, 2021). These perspectives are grounded in fundamentally different views of human behaviour, and the contentious parts of the debate between the advocates of each theoretical paradigm revolve around a player's access to memory representations in the decision-making process (Ashford *et al.*, 2021). Currently, there is no agreed perspective on how players make decisions, or on how coaches might best develop decision-making processes in players (Raab and Araújo, 2019; Williams and Jackson, 2019). The 'it depends' approach to coaching (Collins *et al.*, 2022) suggests that all three methods could be used to design training practices to develop player decision-making depending on the context, such as the needs of the players etc.

Despite extensive literature examining decision-making in sport (Abernethy and Russell, 1987; Elferink-Gemser *et al.*, 2004; McGuckian *et al.*, 2018; Richards, 2005; Williams and Grant, 1999), there is relatively little research into what constitutes GI in team sports, or in any sport. O'Connor and Larkin (2015a) proposed that GI involved two primary components: tactical skill and decision-making. Tactical skill involves both declarative and procedural knowledge (French and Thomas, 1987) and is closely related to decision-making (Elferink-Gemser *et al.*, 2010; Kannekens *et al.*, 2011; O'Connor and Larkin, 2015b; O'Connor *et al.*, 2018).

However, GI is a widely used, yet vague concept. Lennartsson *et al.* (2015) reinforce this view, describing GI in team sports as something ‘very incomprehensible’. They outline that great players are often praised for how they read the game, and for high levels of skill, but it is less obvious as to what characterises GI. Unsurprisingly, against this backdrop, there is no clear definition for what GI looks like within sport, let alone RU. The purpose of this study therefore was to investigate what rugby coaches thought about the GI construct to inform future work in this area.

Methods

The study applied an exploratory cross-sectional design to address the aim which was to gain rugby coaches’ insight into the GI phenomenon. A qualitative interpretivist paradigm was used to underpin this research. Interpretivist research explores the complexity of the social world, through the investigation of individual lived experiences (Bryman, 2012), and for the sense-making of these experiences (Markula and Silk, 2011). It is an approach that has increasingly been applied to studies in the sports coaching field (see Morgan, Mouchet, and Thomas, 2020; Purdy and Potrac, 2016; Thompson, Potrac and Jones, 2015). Furthermore, Sparkes (2012) explains that the interpretivist paradigm allows the researcher(s) to gain deep insights into individual issues within social worlds, constructed by interests, emotions, and values. Data was collected through an online survey, which allowed for the collection of coaches’ opinions of game intelligence in Rugby Union. The survey approach was selected as it is an efficient means to collect data from as many coaches as possible, from all areas of the game.

Participants

175 rugby coaches completed an online survey (figure 1). The participants spanned a wide age range, with 74% of the sample being 26 to 55 years old. Encouragingly, 94% of the participants had completed a formal coaching qualification (Rugby Football Union [RFU] or equivalent). Almost half of the participants (43%) were Level 2 qualified, whilst over a third (38%) were Level 3 coaches, or higher. Coaching experience was varied, but half the sample had more than a decade of coaching experience. Participants were all male, but some coached female players.

The survey elicited responses from those coaching at every stage of the player pathway, from grassroots rugby through to elite (figure 2). Participants were recruited through various routes, such as personal coaching networks and social media, using ‘snowball sampling’ (Gratton and Jones, 2010). To complete the survey, the only pre-requisite was that participants needed to have some Rugby Union coaching experience. This allowed for a wide range of coaches to be accessed, in line with the aims and objectives of the research (Patton, 2002), and for the ‘cultural arena’ to be studied (Rubin and Rubin 2011).

Demographic Characteristics	Age	Frequency
<i>Age of Participant (Years)</i>	16-25	15%
	26-35	18%
	36-45	26%
	46-55	30%
	55-65	9%
	66-75	1%
	75+	1%
	<i>Coaching Level (Formal Qualifications)</i>	Level 1
Level 2		43%
Level 3		27%
Level 4*		11%
None		6%
<i>*One respondent completed the now obsolete RFU Level 5 coaching award.</i>		
<i>Coaching Experience (Years)</i>	2-5	21%
	6-10	24%
	11-15	23%
	16-20	12%
	21-25	11%
	26-30	4%
	30+	6%
<i>Gender (of those coached by participants)</i>	Male	69%
	Female	5%
	Both	26%

Figure 1: Participants’ age, coaching qualification, experience, and gender coached.

Level	Played	Coached
International Rugby	11%	11%
Professional Rugby	14%	10%
Semi-Professional	34%	24%
Talent Pathway (Performance)	9%	39%
School Level Rugby (Performance)	11%	17%
Senior Representative Rugby (Aspirational)	17%	11%
Age-Grade Representative Rugby (Aspirational)	23%	33%
Amateur Senior Rugby	51%	36%
Age-Grade Club Level Rugby: U17 and/or U19	18%	26%
Age-Grade Club Level; Mini-Junior (U7-U16)	17%	41%
School Rugby	21%	32%
University Rugby	11%	12%
<i>*NB: Percentages do not add up to 100% because respondents could select multiple responses.</i>		

Figure 2: Playing experience and coaching level of participants.

Procedure and Instrument

The online survey was designed and distributed via Microsoft Forms, and it took the participants (n=175) between 8 and 18 minutes to complete (M=13 minutes). Once the survey was accessed and before participants were presented with questions, the ethical implication of their involvement with the project was explained, and consent obtained. Participants were informed that their participation in the study was voluntary and that they could withdraw at any time. All data was anonymised. 175 participants consented and completed the survey, a completion rate of 100%.

To the research teams' knowledge, coaches' understanding of GI has not been studied previously. This necessitated the development of a new, original survey to gather the required data to address the study's aim. Following a review of the limited GI literature (Elferink-Gemser *et al.*, 2010; Kannekens *et al.*, 2011; O'Connor and Larkin, 2015a; O'Connor and Larkin, 2015b), extensive discussions between the research team and external coaching experts took place, with several survey drafts written. Pilot versions of the survey and individual questions were developed, modified and sense-checked by each member of the research team, and by external coaching experts. Once a consensus on the relevance of individual questions and the face validity of the survey had been reached, a small pilot study involving 5 RFU qualified coaches was undertaken. This assessed the ease of completion, the quality of responses and any other potential ambiguities. No changes were made to the questions following the pilot study.

The survey covered two areas. Section 1 consisted of six, closed response questions to collect demographic data. These asked participants which age bracket they were, their formal coaching qualifications, their playing and coaching experiences, and whether they coached male or female players. Section 2 then progressed to ask four questions on GI. The first of these was an open response question, asking participants to describe and explain their understanding of the term 'game intelligence'. Follow up questions then asked participants to indicate which attributes they thought could be components of GI. The final question asked participants about whose responsibility it was to develop player GI.

Data Analysis

For the qualitative data received, a Reflexive Thematic Analysis (RTA) was utilised. Thematic Analysis is a widely used method in qualitative sport and exercise research (Braun and Clarke, 2006; 2019) and is a method that involves searching across a data set to identify, analyse and report patterns of inferred meaning from interview data. Moreover, RTA offers an accessible method for exploring and interpreting a qualitative dataset and telling a story about emerging patterns of meaning. A central component of RTA however is that the researcher's position and contribution is necessary, unavoidable, and an integral ingredient of the process.

In summary, the researcher and their subjectivity are tools to be consciously and actively utilised. It is not something to remove, reduce, avoid, or minimise, but a valuable resource to be drawn upon (Braun and Clarke, 2006; 2019). In the present study, the first author is a highly experienced, Level 3 Rugby Union coach, who is currently the Head Coach at a National League Rugby Union club. He has accumulated extensive experience in the coaching of both age-grade elite rugby union, and semi-professional men's Rugby Union. The second author is also a highly experienced Rugby Union coach, with extensive experience in talent development across multiple sports. Finally, the third and fourth authors are practicing sport psychologists with extensive experience conducting research in team sports.

Braun and Clarke (2006; 2019; 2020) proposed a six-stage process for RTA, to facilitate the analysis and help the researcher identify and attend to the important aspects of a thematic analysis. The were applied as follows:

- **Stage 1** involved a familiarization with the data. All 175 responses were read several times before the generation of initial codes, which was stage 2.
- In **Stage 2** the first author worked systematically through each response, identifying aspects that were interesting, and potentially informative in developing themes. Initially, there were 86 raw data codes.
- **Stage 3** involved the early generation of themes with the coded data reviewed and organised, and eventually four major themes with twelve sub-themes were created, with 40 emergent themes. Codes were combined based on similarity of concept, language and/or perceived meaning, and these combinations of codes were interpreted to form meaning for the first author.
- **Stage 4** involved a recursive review of the four major themes in relation to the coded data, and to the entire dataset (Braun and Clarke, 2020). Here, sub themes and themes were refined and modified, and sense checking was undertaken by the second and third authors and by external coaching experts, to ensure that the themes were representative of the dataset, resonating with the coaching community.
- **Stage 5** involved clearly defining and naming each theme. The game intelligence concept model (figure 4) was developed which highlighted the themes generated and their relationships with each other.
- **Stage 6** of Braun and Clarke's (2012; 2019) process is the write up of the themes, including detailed documentation of how themes and sub-themes were developed from the codes, and how these may have altered over time. Figure 3 represents our construction of the GI themes and subthemes.

Constructing a Definition for Game Intelligence

<i>Major Themes</i>			
<i>Situational Awareness</i>	<i>Effective Decision Making</i>	<i>Knowledge and Understanding</i>	<i>Ability to Influence the Game</i>
<i>Subthemes (12)</i>			
<i>Perception Comprehension Projection</i>	<i>Adaptability Problem-Solving Creativity</i>	<i>Procedural Knowledge Declarative Knowledge Experience</i>	<i>Momentum Teammates Referees</i>
<i>Emerging Themes (40)</i>			
<p><i>Perceptual cues.</i></p> <p><i>Read what's in front of you.</i></p> <p><i>Recognise opponents' plan.</i></p> <p><i>The current situation.</i></p> <p><i>Understanding what's happening.</i></p> <p><i>Space (spatial awareness).</i></p> <p><i>Options available.</i></p> <p><i>Opportunities & threats.</i></p> <p><i>Own positioning.</i></p> <p><i>Identification & recognition.</i></p> <p><i>Interpretation of the situation.</i></p> <p><i>(Feeling for) the flow of the game.</i></p> <p><i>Seeing the big picture.</i></p> <p><i>Anticipation & prediction</i></p> <p><i>Intuition.</i></p>	<p><i>Make good / intelligent / effective decisions.</i></p> <p><i>Problem solving. Attend to the best cues.</i></p> <p><i>Unconscious proficiency.</i></p> <p><i>Adaptability/tactical flexion.</i></p> <p><i>Processing of information quickly.</i></p> <p><i>Clarity of thought under pressure.</i></p> <p><i>Intuition on impact of decisions.</i></p> <p><i>Creativity.</i></p>	<p><i>Game objectives / principles.</i></p> <p><i>Individual positional role.</i></p> <p><i>Team game plan/strategy/tactics.</i></p> <p><i>Opposition game plan/strategy/tactics.</i></p> <p><i>What the team needs.</i></p> <p><i>The current in-game situation.</i></p> <p><i>Game momentum.</i></p> <p><i>Skills needed & options available.</i></p> <p><i>The laws of game.</i></p> <p><i>Experience.</i></p> <p><i>What is needed to win.</i></p> <p><i>Personal and positional core skills.</i></p>	<p><i>Change the game.</i></p> <p><i>A positive impact for the team.</i></p> <p><i>A manipulation of opponent(s).</i></p> <p><i>A change in teammate actions.</i></p> <p><i>The referee.</i></p> <p><i>An improvement of others.</i></p> <p><i>A creation of opportunities.</i></p> <p><i>An exploitation of weaknesses.</i></p> <p><i>Control of the situation/game.</i></p> <p><i>A momentum shift.</i></p> <p><i>A game-changing action.</i></p>

Figure 3: representing the construction of GI major themes, subthemes and emerging themes from participant responses.

Results and Discussion

RTA of the qualitative data established four major, inter-related themes. These were situational awareness, effective decision-making, knowledge and understanding, and ability to influence the game. Twelve sub-themes were also identified, represented in figure 4. Each of the four major themes will now be discussed in turn.

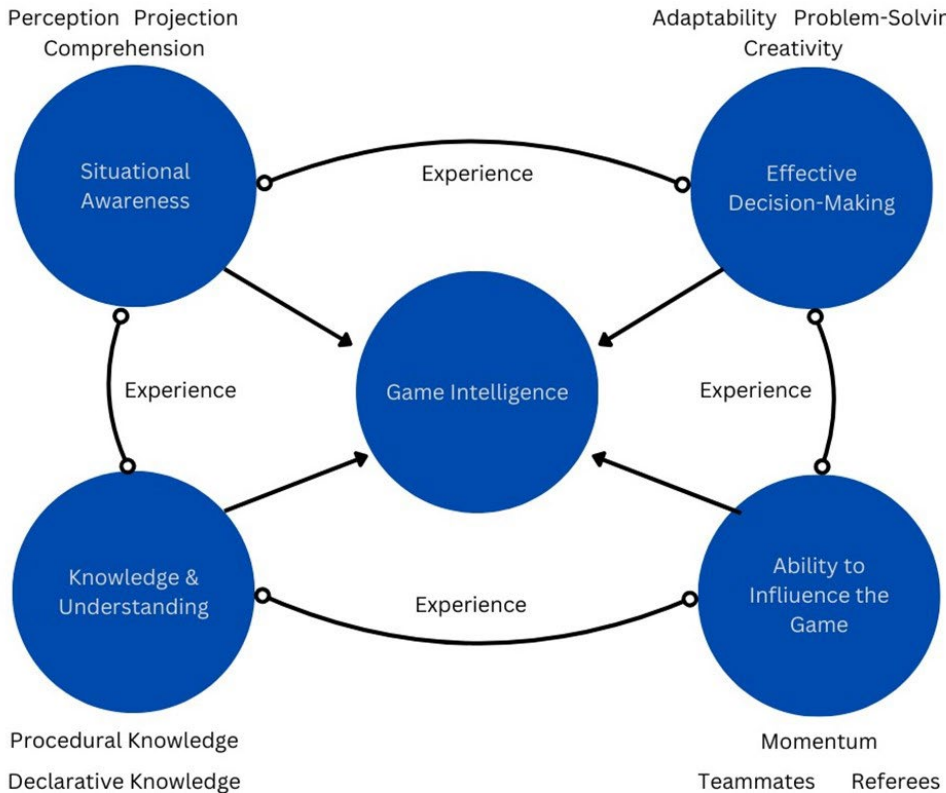


Figure 4: Game intelligence - Inter-related concept model.

Theme 1: Situational Awareness

Situational Awareness (SA) was identified as a primary component of GI. This was supported by many participant responses. For example:

The awareness of options, space and opposition, fast decision-making ability, and exploiting advantages. [Coach 30]

Awareness of the laws, situation and consequences of actions. [Coach 42, Level 2 Coach]

Many respondents linked players' awareness more closely with their ability to make effective decisions:

GI is about game awareness and making the right decisions at the right times in the game. It's the link between management and awareness. [Coach 78, Level 1 Coach]

Further insight was provided by Coach 107 (Level 4 Coach), who outlined that GI involved:

Awareness and knowledge of the sport, the ability to read the game and situation. To make the right decision in the context of the game when under pressure.

Interestingly, although awareness was specifically referenced in many coaches' responses, other terminology and language such as an ability to 'read the game,' 'be aware of... X and Y,' and 'recognise opportunities' were also used frequently. Thus, whilst there is a common theme, the exact language being used may vary from coach to coach. In the first author's rugby coaching experience this is common. Terms are often used interchangeably, often without an understanding the meaning of the term. It is important that this research offers a model of consistency in terminology.

In sports, it is widely accepted that highly developed cognitive-perceptual abilities, such as anticipation, decision-making, and SA, are pre-requisites for expert performance (Abernethy and Russell, 1987; Araújo *et al.*, 2019; 2019b; Elferink-Gemser *et al.*, 2004; Passos *et al.*, 2008; McGuckian *et al.*, 2018; Raab *et al.*, 2019a; Richards, 2005; Richards *et al.*, 2012; Williams and Grant, 1999). In team invasion sports, SA requires players to recognise, select and organise the information received from the environment, and use this information to anticipate what may happen next (Jackson *et al.*, 2009). To better understand SA, Endsley (1995b) proposed a three-level framework: Perception, Comprehension and Projection. Although dated in research terms, Endsley's framework is still viewed as the most relevant framework in understanding SA (Huffman *et al.*, 2022).

Perception, is 'becoming aware of something'. Players can become situationally aware through their senses; vision (what they see), sound (what they hear), and feel (kinesthetics). Although all three are important in the way a player takes information from the environment, vision is arguably the most relied upon in in-game situations. Vision presents players with the cues they need to be able to 'read the game'. Visual search behaviours (scanning) can contribute strongly to improved SA (Huffman *et al.*, 2022, Jordet, 2015; Morley, *et al.*, 2013), and therefore GI. This is because perception is heavily influenced by a person's ability to use vision to monitor the environment. Mason (2020) outlines that perception errors are the most common of all SA errors, owing primarily to a player's failure to recognise or 'see' important environmental cues. Furthermore, it appears that expert performers identify and use different sources of information compared to novice performers (Abernethy *et al.*, 2005; Müller *et al.*, 2005), and that this informs their decision-making (Helsen and Starkes, 1999; Williams, 2000). In RU, each player position has different roles to fulfil in the game-environment, consequently, the way a player perceives a situation

may be influenced by their position and role within the game, the coaching they have received, or their past experiences (Richards *et al.*, 2009). Relating back to the present study, perception was acknowledged, both directly and indirectly, by many participants. For example, Coach 81 (Level 2 Coach) suggested that perception was:

Someone who has the ability to read the game.

Reading the game was common language in many of the definitions of GI from the participants. Again, from the first author's experience, this reflects the language used by coaches in practical coaching settings when describing the psychological skillsets of players. Players who possess high levels of perceptual skill are believed to 'read the play' (O'Connor and Larkin, 2015b). Other examples included:

*The ability to read and interpret the game, affecting your decisions on the pitch.
[Coach 86, Level 2 Coach]*

GI is the ability to read the game as it unfolds and apply solutions to problems that arise. [Coach 136, Level 3 Coach]

Coupled with perception, comprehension is a part of SA (Endsley 1995b). Comprehension is the ability to identify the importance of and understand the meaning of perceived cues (Huffman *et al.*, 2022). An ability to scan the environment is important, but if a player cannot make sense of what they are seeing, SA (and therefore GI) are limited. In this study when asked to define GI, many respondents recognised the importance of a player's ability to comprehend the situation. For example,

*The ability to flex tactically, based on the picture that has been observed at that time.
[Coach 4, Level 3 Coach]*

Recognition and understanding of problems faced within the game, and ideas on how to solve them. [Coach 62, Level 4 Coach]

Ability to understand and make good decisions, based on the cues the game is giving them. [Coach 126, Level 3 Coach]

This reinforces the view that the identification and comprehension of the appropriate in-game cues are crucial in enhancing GI. In relation to comprehension, previous experiences of the situation are also crucial as the concept of SA would align closely with the concept of naturalistic decision-making (Klein *et al.*, 1986; Klein *et al.*, 2010; Richards *et al.*, 2009).

Lastly, projection (Endsley, 1995b) relates to a player's ability to anticipate what may happen next in the game environment (Jackson *et al.*, 2009). Expert performers are better able to analyse the movements of other performers or objects, such as the ball, and predict future movements (Vaeyens *et al.*, 2007a; (Vaeyens *et al.*, 2007b). Many definitions of GI alluded to the importance of anticipation / prediction, for example,

The ability to anticipate the possibilities of the opponent and react, based on this information. [Coach 26, Level 3 Coach]

Ability to predict the shape of the game in the next 10 seconds and act accordingly for the benefit of the team. [Coach 41, Level 2 Coach]

The act of making the right decision based on the picture you see. An intuition about the impact of a decision on future actions. [Coach 57, No Formal Coaching Award]

Although the anticipation of future events is an important component of SA, Passos *et al.* (2008) argue that this is only possible if players are attuned to the relevant in-game cues. This reinforces the importance of the player being able to recognise the most relevant cues, comprehend them, and then act upon them. In summary, it is proposed that SA and its components (perception, comprehension, and projection), are an integral component of GI in RU.

Theme 2: Effective Decision-Making

Effective decision-making is characterised by the consistent and efficient ability to choose the right course of action at the right moment and is a key component of match performance in team sports such as rugby union (Gréhaigne, Godbout, and Boutier, 1999; 2001). Effective decision-making was identified from the participant responses as a primary component of GI. Like SA, effective decision-making was supported by many participant responses. For example:

Reading a game. Decision-making above that of peers- sees what's going on. Know the laws. Plays with heads up/what's in front. [Coach 44, Level 3 Coach]

The ability to make decisions based on the current situation within the game, taking into account the score line, team philosophy, game flow, tactics, principles of play. [Coach 60, Level 3 Coach]

Although decision-making was not a part of Endsley's (1995b) SA framework, decision-making and SA are closely related. Arguably good SA will influence, in part, decision-making where good SA can subsequently contribute to better decision-making (Huffman *et al.*, 2022). Work by Morgan, Mouchet, and Thomas (2020) highlighted the value that Rugby Union coaches placed on effective player decision-making. Their research outlined those coaches who perceived player decision-making to be 'vital,' in all aspects of the game. Their work also supports the point made above, that the factors influencing player decision-making are multi-factorial. Factors such as time on the game clock, the score, the situation on the field and the location of teammates and opposition were considered to influence player decision-making. In other words, SA influences decision-making (Morgan, Mouchet and Thomas, 2020; O'Connor and Larkin, 2015a).

Bouthier (1988) and Mouchet (2014) differentiated between strategy and tactics. Based on their work, strategy refers to the 'game plan' decided upon prior to the

game. Tactics on the other hand, are executed voluntarily during the game, to adapt spontaneously to the opposition and the requirements of the ever-changing game situation. This is an important distinction and clearly demonstrates that there are fundamental differences in the time constraints of strategic and tactical decisions (Grehaigne, Godbout and Bouthier, 1999). During game play, tactical decision-making is paramount and time constrained. Tactics may differ from opponent-to-opponent. For example, in RU, analysis of the opposition ahead of the game might reveal that a team are weak in a particular area, such as defending a driving maul. A strategic decision, ahead of the game, might be to kick to the corners (from penalties) to create opportunities for attacking drive mauls. In-game information might reveal that they are defending the drive maul very well, and a tactical decision (in-game) might be to opt to run the ball, or kick for the posts instead. In summary, tactics can and should be amended in-game, based on the new information about the opposition (Light *et al.*, 2014).

During game play, there are also different time constraints placed on decision-making. For example, a team captain deciding whether to opt to kick for the posts, or kick to touch, after the team is awarded a penalty. There may be anywhere between 10 and 30 seconds, or ‘time-to-action’ (Mouchet, 2005) for the player to be able to perceive, comprehend, project, and decide the best course of action. Conversely, other decisions are made in-the-moment, or ‘at action’ (Mouchet, 2005) with very limited time available. For example, a player deciding on what type of tackle they need to make, as the ball carrier approaches. The different types of decisions that players need to make in RU, were acknowledged by the participants, for example:

The ability to flex tactical deployment based on the picture that has been observed at that time. [Coach 4, Level 3 Coach]

Able to recognise patterns emerging in front of them and react positively for the most part. [Coach 20, Level 3 Coach]

The ability to make decisions based on the current situation within the game, taking into account scoreline, team philosophy, game, flow, tactics, principles of play. [Coach 60, Level 3 Coach]

In summary, effective decision-making has been proposed as a primary component of game intelligence in Rugby Union, and that player decision-making can potentially be improved by improving their SA.

Theme 3: Knowledge and Understanding

Knowledge and understanding are linked closely to both SA and effective decision-making (da Costa *et al.*, 2009), as knowledge and understanding are proposed to underpin SA and DM. Thomas *et al.* (1986) defined sport knowledge as

a complex product of cognitive knowledge about the current situation (SA) and past events (previous experiences), combined with a player's ability to produce the sport skill(s) required. In the present study, many participants referred directly or indirectly to knowledge and understanding as a component of GI, although some views on specifically what knowledge and understanding players needed were vague. For example:

Understanding the laws of the game and how we can apply them in the field of play to our advantage. [Coach 51, Level 3 Coach]

Understanding space and time, and how to manipulate space and people to get the desired effect attack or defence. [Coach 63, Level 2 Coach]

The tactical awareness and unique knowledge of the game to enable decision-making. [Coach 85, Level 2 Coach]

Understanding different types of decision making on the field and understanding which areas of the pitch to play in and playing to the team's style. [Coach 102, Level 2 Coach]

Based on participant responses, the (declarative) knowledge required for in RU rugby included knowledge and understanding of the game objectives, the laws of the game, the principles of play, the team strategy and tactics, and individual positional roles. Declarative knowledge relates to information that can be memorised and then later recalled, exactly as it was memorised (Thomas and Thomas, 1994). The procedural knowledge requirements for the GI rugby player can be divided into subsections (Thomas and Thomas, 1994). *Procedural motor knowledge* refers to a player knowing how to physically perform a skill(s), such as a range of different types of rugby tackle. *Response selection*, on the other hand, would be the knowledge of which type of rugby tackle they need to execute and when, within a given game situation. Thomas and Thomas (1994) suggest that this type of knowledge can display itself as a series of 'if X happens, then I'll do Y' statements, and can be developed through experience. Lastly, *strategic knowledge* (in this context) refers to a player's ability to learn and recall important information (Thomas and Thomas, 1994). For example, if a player wants to improve their passing technique, they might read up on the key technical factors, watch videos and devise a practice to improve. A key attribute here is potentially a player's own self-awareness, although this was not reflected in the survey responses. Knowing where to access the information and apply it in a way that enhances learning (knowledge and understanding), is critical. Gardner (1983) highlighted that there were different forms of intelligence (linguistic, musical, kinaesthetic etc), but when intelligence is described practically as the ability to derive information, learn from experience, adapt to the environment, understand, and correctly use thought and reason (APA, 2023), the importance of learning, and self-awareness around knowing what one needs to learn (declarative, procedural, or both), and what questions to ask, appear to be vital.

Although knowing what to do and doing it are closely linked, it should be noted that just because a player is able to accurately regurgitate knowledge of the laws of the game, the principles of play, or team playbook, this does not necessarily mean that the player will be able to demonstrate this expertise in gameplay (Thomas and Thomas, 1994). Truly knowing the game means being able to demonstrate ‘knowledge-in-action’ (Light and Fawns, 2003) and consists of a combination of declarative and procedural knowledge. McPherson and Thomas (1989) found that expert tennis players had higher skill, more declarative knowledge, and better game performance than novices (at all ages), and that some players with high declarative knowledge did not have the technical skills to execute this knowledge in gameplay. Richards *et al.* (2017) suggested that if a player has limited technical ability, and therefore cannot execute skills effectively, then their exploration and implementation of different tactical options and decision-making in game situations is limited.

In summary, we propose that knowledge and understanding is a key component of GI in RU. GI in RU requires both declarative and procedural knowledge.

Theme 4: Ability to Influence the Game

The ability to influence the game was identified as a primary component of GI. Defining ‘influence’ proved difficult but referred broadly to a player’s ability to impact a game or game situation, in a positive way for the benefit of the team. It is proposed that a player’s influence is closely linked to SA, their ability to make effective decisions consistently (Richards *et al.*, 2012), and that this is based, in part, on the player’s knowledge and understanding. A former international coach inferred influence, using the term ‘change into action’:

Understanding when opportunistic change is required. Having the tools, intent, and freedom to translate change into action in the moment. [Coach 49, Level 5 Coach]

A further example of influence on the game was:

Being able to play within a system but flex to play on instinct if the player spots an opportunity to make a difference. [Coach 59, No Formal Coaching Award]

An ability to influence the game, like effective decision-making, is difficult to measure but can be assessed. For example, when a player is influencing the game positively, in any sport, it is often easy to see. There are obvious ways to influence the game such as scoring tries, or kicking goals, but a player’s influence on a game could be viewed as the result of consistently effective outcomes of the at-action, or time-to action decisions (Mouchet, 2005) that they make in the game, and the effect that these decisions have on game momentum. Momentum in RU refers to the overall flow of the game and tells the story of the game (www.statsperform.com). It is generally understood that if a team has momentum, that they are in control of the game. Sports analytics companies use momentum trackers to predict which team has

the best try scoring opportunities, the superior defence, the best discipline, the least errors, the superior kicking game, the most possession, the best field positions, and the superior set piece. Stats Perform are currently leading the way in RU. Understanding momentum shifts is of paramount importance for coaches and players but usually, the focus is on team momentum. If the focus on momentum could include individual player (in-game) contributions toward momentum (positive or negative), then a player's ability to influence the game might become clearer.

It is worth noting that further research is needed to better understand 'influence' as it is potentially more complex and multi-faceted than simply analysing the game impact of individual decisions made by a player, and their effects on game momentum. For example, a player could positively influence the team during the game by their actions which are often understated, such as a player carrying out their positional role well, for example, a Back-Row Forward ending the game with a very high tackle count, doing the often-unseen understated work. Furthermore, a player might influence the game by the way they lead and/or influence the actions of teammates, influence team tactics, or by the way they are able to speak to and influence the referee. A player might also be an off-field influence, someone who is respected in team meetings, reviews, or who is a 'cultural architect' (Hughes, 2018) for the team. Potentially, there are strong links between influence and leadership. For example, George Ford (Sale Sharks and England Rugby) is often praised for his ability to lead the team. England teammate, Freddie Steward said:

It's almost like having another coach around with Fordy; he's so insightful, both in meetings and on the pitch. [Purewal, 2023]

Scott Robertson, who has recently been appointed as the Head Coach of the New Zealand All Blacks, said of Richie Mo'unga the All-Blacks' Number 10:

When Richie is on, the team is on. He brings out the best from all the players. For me, he is one of the most influential Super Rugby players ever... how he plays the game, his ability to score points consistently year after year in those crucial moments. (Newbould, 2022).

In summary, a player's ability to influence the game is proposed as a primary component of GI, and further research is needed to better understand the characteristics of 'influence' in RU.

Components of Game Intelligence: follow up on the data

In section two of the survey, participants were presented with a list of attributes, or components of game intelligence. They were asked to indicate which of these they thought contributed to GI. This list was based on a review of coaching literature (Cushion, 2013; Harvey *et al.*, 2015; Roberts, 2011), and on the research teams' practical coaching knowledge and experience. The participants were able to select as many components as they wanted. Supporting the GI themes created through RTA

(situational awareness, effective decision-making, knowledge and understanding), analysis of the participant responses to the (closed response) showed that 85% of respondents thought that effective scanning and awareness of the situation was a component of GI (figure 5). Responses to this task led to the development of the situational awareness theme. Similarly, an ability to problem solve (83%), effective and consistent decision making (83%), and a good level of tactical skill (81%) were all viewed as components of GI by the participants. Again, these supported the development of the data relating to the decision-making theme. Finally, 73% of participants indicated that having good knowledge of the game was a component of GI, thus supporting the development of the knowledge and understanding theme.

Component of Game Intelligence	No. of Responses Agreeing	Percentage
Effective Scanning and Awareness of Situation	147	85%
An Ability to Problem Solve	142	83%
Effective and Consistent Decision Making	142	83%
Good Level of Tactical Skill	140	81%
Good Knowledge of the game (rules/principles of play)	124	72%
Creativity	109	63%
An Effective Learner	82	48%
Well Developed Core Skills	82	48%
A Student of the Game (Watches Rugby, Asks Questions)	71	41%
A Good Team Player	66	38%
A Strong Work Ethic	59	34%
An Ability to Follow Coaching Instructions	41	24%
Good Digital Literacy Skills	17	10%
<i>*NB: Percentages do not add up to 100% because respondents could select multiple responses.</i>		

Figure 5: Participant views on the components of GI (ranked by perceived importance).

Interestingly, as shown in figure 5, components of GI relating to a player's ability to learn, their interest in the game and their ability to use computer technology were not valued as highly. In fact, less than half (48%) of respondents felt that GI involved being an effective learner, and only 24% of respondents felt that following coaching instructions was a component of GI. The ability to learn and to acquire knowledge is a core component of intelligence (Gardner, 1983), as illustrated in the discussion of the knowledge and understanding theme. Other areas related to player learning, such as being a student of game (41% agreement) or having a strong work

ethic (34% agreement) were also less prominent but were still valued by over a third of participants. Despite their role in utilising video analysis applications such as *Coach Logic*, *Sports Code* and *Hudl*, digital literacy skills were viewed with lesser importance, with just 10% of respondents valuing this attribute. Finally, less than half of the respondents (48%) felt that a player having well developed core skills contributed toward GI. As explained previously, a limited skill set may hinder player decision-making (Richards *et al.*, 2017), and therefore GI.

Responsibility to develop GI

Figure 6, below, shows the participant responses to the question asking whose responsibility they felt it was to develop player GI. The responses were overwhelmingly in favour of it being a ‘joint responsibility’ (94%), indicating that both coach and player shared the responsibility to improve player GI. Very few participants indicated that GI development was solely the coach’s responsibility (5%), or solely the players (<1%). Although it is difficult to infer without further research, how the idea of ‘shared responsibility’ may go beyond player-coach responsibility, with one participant suggesting that team mates also had a responsibility to help develop a player’s GI. This could be through mechanisms such as peer-to-peer feedback (Liu and Carless, 2007), vicarious experiences (Bandura, 1977, 1986, 1997), or reciprocal learning (Mosston and Ashworth, 2008).

Whose Responsibility is it to Develop Player Game Intelligence?	Percentage
The Coach	<5%
The Player	<1%
Both (Coach and Player)	94%

Figure 6: Participant views on the responsibility to develop GI.

Final Thoughts

On reflection, it is felt that this exploratory study has achieved its core aim to gather the views of a large and varied cohort of RU coaches, that offered wide-ranging representation of the game. That said, all respondents were male coaches, even though 26% of the cohort had coached female players. Future studies should therefore target representation from female coaches. Furthermore, it was evident that in most cases it was the higher-level coaches (Level 3, 4 and 5 qualified) that were able to articulate and explain their thoughts on GI better than the lower-level coaches. This was perhaps based on their coaching experiences, having worked in more performance-based environments with higher level players. Lower-level coaches had a less sophisticated view of GI, with a number stating that they had not heard of the term before, or that it was ‘game sense’. More open questions on the topic of Game Intelligence might have prompted participants to elaborate more on

the different components of GI identified. Another noteworthy point was that many participants recognised decision-making as a component of GI. Further research needs to be undertaken here to understand the underpinning theories coaches hold on decision-making and how these views relate to how they feel their players make decisions. Many responses seemed to align well with naturalistic decision-making ideas, whilst others were more related to ecological dynamics which is unsurprising given that this concept is promoted by many RU coaching associations. With decision making being such a strong theme within GI it would seem appropriate to explore this key area yet further.

Conclusion

This study aimed to explore rugby coaches' understanding of GI, in order to propose a working definition for GI for RU. An online survey approach was utilised because it allowed access to many coaches, representing all areas of the game. It is believed that this study has generated new knowledge in the understanding of GI generally, but also specifically within RU. Of course, the definition is presented with the intention that it will be discussed, critiqued, and that this will facilitate further investigation around its theoretical and practical foundations. It is hoped that the data has shone a light on a commonly quoted but rarely conceptualised facet of rugby, and sport. Based on the research presented in this study, our definition is that:

Game Intelligence in Rugby Union is the ability to make consistently effective decisions, underpinned by high levels of situational awareness, declarative and procedural knowledge and understanding, that consistently lead to a positive influence on the game.

In addition to this, a conceptual model (figure 4) been presented to help understand the inter-related nature of the four primary components. It is believed that this is a first attempt at conceptualizing GI in this way and therefore makes an original contribution to the literature, theory and coaching practice. Furthermore, it was found that the coaches surveyed believed that the development of GI is the responsibility of both the coach and the player and that a player's previous experiences, capacity to learn, and technical skill level potentially contribute to GI. Further research on the concept of GI is required. Whilst using an online survey to 'cast the net wide' was useful in allowing the research team to investigate the GI understanding, a deeper dive into this topic is needed with a more targeted cohort. It would be of interest to investigate whether the definition presented here resonates with professional rugby coaches more widely. Whilst some completed the survey, it is difficult to explore opinions and views further in a survey. Individual interviews with a number of coaches working in the professional game would enable the components of game intelligence to be explored in more applied detail, such as how professional coaches might go about developing these attributes in players.

References

- Austin, S. (2018) *Leadership lessons for the 'VUCA' world of football*. Training Ground Guru [online]. Available at <https://trainingground.guru/articles/leadership-lessons-for-the-vuca-world-of-football> (Accessed 3rd June 2024).
- Abernethy, B. and Russell, D.G. (1987) Expert-novice differences in an applied selective attention task. *Journal of Sport and Exercise Psychology*, 9,4, 326-345.
- Abernethy, B. (1996) Training the visual-perceptual skills of athletes: Insights from the study of motor expertise. *American Journal of Sports Medicine*, 24, 89-92.
- Abernethy, B., Baker, J. and Côté, J. (2005) Transfer of pattern recall skills may contribute to the development of sport expertise. *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition*, 19,6, 705-718.
- American Psychology Association. (2023) *APA Dictionary of Psychology* [online]. Available at: <https://dictionary.apa.org/intelligence> (Accessed 29th September 2023)
- Araújo, D., Hristovski, R., Seifert, L., Carvalho, J. and Davids, K. (2019) Ecological cognition: expert decision-making behaviour in sport. *Int. Review of Sport and Exercise Psychology*, 12,1, 1-25.
- Ashford, M., Abraham, A. and Poolton, J. (2021) What cognitive mechanism, when, where, and why? Exploring the decision making of university and professional rugby union players during competitive matches. *Frontiers in Psychology*, 12, 1608.
- Ashton, B. (2009) *Why can't more players think for themselves?* The Independent. September 12th.
- Ashton, B. (2018) *Giving more power to the players*. Training Ground Guru [online]. Available at <https://trainingground.guru/articles/brian-ashton-giving-more-power-to-the-players> (1.6.2024)
- Austin, D., Gabbett, T. and Jenkins, D. (2011) The physical demands of Super 14 rugby union. *Journal of Science and Medicine in Sport*, 14,3, 259-263.
- Bandura, A. (1977) Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review*, 84,2, 191.
- Bandura, A. (1986) *Social Foundations of Thought and Action*. Englewood Cliffs, NJ.
- Bandura, A. and Wessels, S. (1997) *Self-efficacy*. Cambridge University Press, Cambridge.
- Bouthier, D. (1989) Les conditions cognitives de la formation d'actions sportives collectives. *Le Travail Humain*, 175-182.
- Braun, V. and Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3,2, 77-101.
- Braun, V. and Clarke, V. (2012) *Thematic Analysis*. American Psychological Association, NY.
- Braun, V. and Clarke, V. (2019) Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health*, 11, 4, 589-597.
- Braun, V. and Clarke, V. (2021) One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative Research in Psychology*, 18, 3, 328-352.
- Bryman, A. (2016) *Social Research Methods*. Oxford University Press, Oxford.
- Collins, D., Taylor, J., Ashford, M. and Collins, L. (2022) It depends coaching – The most fundamental, simple and complex principle or a mere copout? *Sports Coaching Review*, 1-21.
- Cunniffe, B., Proctor, W., Baker, J. and Davies, B. (2009) An evaluation of the physiological demands of elite rugby union using global positioning system tracking software. *Journal of Strength and Conditioning Research*. 23, 1195–1203.
- Cushion, C. J. (2013) Applying game centered approaches in coaching: A critical analysis of the 'dilemmas of practice' impacting change. *Sports Coaching Review*, 2,1, 61-76.
- da Costa, I.T., da Silva, J.M G., Greco, P.J. and Mesquita, I. (2009) Tactical principles of soccer: concepts and application. *Motriz*, 15, 3, 657-668.
- Di Tore, A.P., Raiola, G. and D'Isanto, T. (2018) Situation awareness in sports science: Beyond the cognitive paradigm. *Sport Science*, 11, 1, 44-48.

- Elferink-Gemser, M., Visscher, C., Lemmink, K. and Mulder, T. (2004) Relation between multidimensional performance characteristics and level of performance in talented youth field hockey players. *Journal of Sports Sciences*, 22, 11-12, 1053-1063.
- Elferink-Gemser, M.T., Kannekens, R., Lyons, J., Tromp, Y. and Visscher, C. (2010) Knowing what to do and doing it: Differences in self-assessed tactical skills of regional, sub-elite, and elite youth field hockey players. *Journal of Sports Sciences*, 28,5, 521-528.
- Endsley, M. R. (1995a) Measurement of situation awareness in dynamic systems. *Human Factors*, 37,1, 65-84.
- Endsley, M. R. (1995b) Toward a theory of situation awareness in dynamic systems. *Human Factors*, 37,1, 32-64.
- French, K.E., and Thomas, J. R. (1987) The relation off knowledge development to children's basketball performance. *Journal of Sport and Exercise Psychology*, 9, 1, 15-32.
- Fuller, C., Taylor, A., Brooks, J. and Kemp, S. (2013) Changes in the stature, body mass and age of English professional rugby players: a 10-year review. *Journal of Sports Sciences*, 31,7, 795-802.
- Gardner, H. (1983) *Multiple Intelligences*. Palgrave, New York.
- Gleeson, E. and Kelly, S. (2020) Phenomenal decision-making in elite soccer: making the unseen seen. *Science and Medicine in Football*, 4, 1, 1-9.
- Gratton, C. and Jones, I. (2010) Research questions, aims and objectives. *Research Methods for Sports Studies* (2nd ed.). Routledge, New York.
- Gréhaigne, J.F., Godbout, P. and Bouthier, D. (1999) The foundations of tactics and strategy in team sports. *Journal of Teaching in Physical Education*, 18, 2, 159-174.
- Gréhaigne, J. F., Godbout, P. and Bouthier, D. (2001) The teaching and learning of decision making in team sports. *Quest*, 53, 1, 59-76.
- Harrison, M., Kay, B. and Roberts, J. (2023) *Rugby World Cup 2023 Live: France v New Zealand* TV Broadcast: ITV [online]. Available at <https://www.itv.com/watch/rugby-world-cup/2a4138/2a4138a0001> (Accessed 29th August 2023)
- Harvey, S., Lyle, J.W.B. and Muir, B. (2015) Naturalistic decision making in high performance team sport coaching. *International Sport Coaching Journal*, 2, 2, 152-168.
- Hastie, R. (2001) Problems for judgment and decision making. *Review of Psychology*, 52,1, 653-683.
- Helsen, W.F. and Starkes, J.L. (1999) A multidimensional approach to skilled perception and performance in sport. *Applied Cognitive Psychology*, 13, 1, 1-27.
- Huffman, S., Crundall, D., Smith, H. and Mackenzie, A. (2022) Situation Awareness in sports: A scoping review. *Psychology of Sport and Exercise*, 59, 102132.
- Hughes, D. (2018) *The Barcelona way: How to create a high-performance culture*. Pan Macmillan.
- Jackson, L., Chapman, P. and Crundall, D. (2009) What happens next? Predicting other road users' behaviour as a function of driving experience and processing time. *Ergonomics*, 52,2, 154-164.
- Jordet, G. (2015) Psychological characteristics of expert performers (pp. 106-120). In, Baker, J. and Farrow, D. (Eds.) *Routledge Handbook of Sport Expertise*. Routledge, London.
- Kannekens, R., Elferink-Gemser, M. T. and Visscher, C. (2011) Positioning and deciding: key factors for talent development in soccer. *Journal of Medicine and Science in Sports*, 21, 6, 846-852.
- Klein, G., Calderwood, R. and Clinton-Cirocco, A. (1986) September. Rapid decision making on the fire ground. *Proceedings of the Human Factors Society Annual Meeting*, 30, 6, 576-580.
- Klein, G., Calderwood, R. and Clinton-Cirocco, A. (2010) Rapid decision making on the fire ground: original study postscript. *Journal of Cognitive Engineering and Decision Making*, 4, 3, 186-209.
- Lennartsson, J., Lidström, N. and Lindberg, C. (2015) Game intelligence in team sports. *PloS one*, 10, 5, e0125453.
- Light, R. and Fawns, R. (2003) Knowing the game: Integrating speech and action in games teaching through TGfU. *Quest*, 55, 2, 161-176.
- Light, R. L., Harvey, S. and Mouchet, A. (2014) Improving 'at-action' decision-making in team sports through a holistic coaching approach. *Sport, Education and Society*, 19,3, 258-275.

- Liu, N.F. and Carless, D. (2006) Peer feedback: the learning element of peer assessment. *Teaching in Higher Education*, 11, 3, 279-290.
- Markula, P. and Silk, M. (2011) *Qualitative Research for Physical Culture*. Palgrave, London.
- Mason, S. (2020) Practice makes better? Testing a model for training program evaluators in situation awareness. *Evaluation and Program Planning*, 79, 101788.
- McGuckian, T.B., Cole, M.H., Jordet, G., Chalkley, D. and Pepping, G.J. (2018) Don't turn blind! The relationship between exploration before ball possession and on-ball performance in association football. *Frontiers in Psychology*, 9, 2520.
- McMaster, D.T., McGuigan, M.R. and Gill, N.D. (2014) Strength and power training for rugby. *The Science of Rugby*, 19-35.
- McPherson, S.L. and Thomas, J.R. (1989) Relation of knowledge and performance in boys' tennis: Age and expertise. *Journal of Experimental Child Psychology*, 48, 2, 190-211.
- Memmert, D. (2011) Creativity, expertise, and attention: Exploring their development and their relationships. *Journal of Sports Sciences*, 29, 1, 93-102.
- Morley, A.M., Taylor, P.J. and Kurk, H. (2013) Perceptual training in Rugby Union: An imagery intervention with Elite Players. *British Psychological Society Sport and Exercise Psychology Section Annual Conference*, UK.
- Morgan, K., Mouchet, A. and Thomas, G. (2020) Coaches' perceptions of decision making in rugby union. *Physical Education and Sport Pedagogy*, 25, 4, 394-409.
- Mosston, M. and Ashworth, S. (2002) *Teaching Physical Education*. 5th ed. McMillan, London.
- Mouchet, A. (2005) Subjectivity in the articulation between strategy and tactics in team sports: an example in rugby. *Italian Journal of Sport Sciences*, 12,1, 24-33.
- Mouchet, A. (2014) *L'entretien d'explicitation: Usages diversifiés en recherche et en formation*. UPEC: Université Paris Est Créteil, Paris.
- Müller, S., Abernethy, B., and Farrow, D. (2006) How do world-class cricket batsmen anticipate a bowler's intention? *Quarterly Journal of Experimental Psychology*, 59, 12, 2162-2186.
- Newbould, C (2022) *All Blacks: Richie Mo'unga to leave New Zealand Rugby in 2024 after signing three-year deal with Japanese club*. Planet Rugby [online]. Available at: <https://www.planetrugby.com/news/all-blacks-richie-mounga-to-leave-new-zealand-rugby-in-2024-after-signing-three-year-deal-with-japanese-club> (Accessed 19th June 2024)
- O'Connor, D. and Larkin, P. (2015a) Decision making and tactical knowledge: An Australian perspective in the development of youth football players. (pp. 218-228). In, Favero, T., Drust, B. and Dawson, B. (Eds.) *International Research in Science and Soccer II*. Routledge, London
- O'Connor, D. and Larkin, P.(2015b) Decision Making for Rugby. (pp. 102-111). In, Till, K. and Jones, B. (Eds.) *Science of Sport: Rugby*. The Crowood Press, Ramsbury, Wiltshire.
- O'Connor, D., Wardak, D., Goodyear, P., Larkin, P. and Williams, M. (2018) Conceptualising decision-making and its development. *Science and Medicine in Football*, 2, 4, 261-271.
- Passos, P., Araújo, D., Davids, K. and Shuttleworth, R. (2008) Manipulating constraints to train decision making in rugby union. *Int. Journal of Sports Science and Coaching*, 3,1,125-140.
- Patton, M.Q. (2002) Two decades of developments in qualitative inquiry: A personal, experiential perspective. *Qualitative Social Work*, 1, 3, 261-283.
- Purdy, L.G. and Potrac, P. (2016) Am I just not good enough? The creation, development and questioning of a high performance coaching identity. *Sport, Education and Society*, 21,5, 778-795
- Purewal, N. (2023) *George Ford 'like another coach' for England* Freddie Stewart. Evening Standard [online]. Available at <https://www.standard.co.uk/sport/rugby/england-ford-stewart-six-nations-2023-ireland-b1067432.html> (Accessed 2nd October 2023).
- Raab, M. and Araújo, D. (2019) Embodied cognition with and without mental representations: The case of embodied choices in sports. *Frontiers in Psychology*, 10, 1825.
- Raab, M., Bar-Eli, M., Plessner, H. and Araujo, D. (2019) The past, present and future of research on judgment and decision making in sport. *Psychology of Sport and Exercise*, 42, 25-32.

- Reilly, T., Williams, A.M., Nevill, A. and Franks, A. (2000) A multidisciplinary approach to talent identification in soccer. *Journal of Sports Sciences*, 18,9, 695-702.
- Richards, P. (2005) *Empowering the decision-making process in the competitive sport environment through using reflective practice. Can performance intelligence be taught*. At: 4th Carfax International Conference on Reflective Practice, Gloucester, June.
- Richards, P., Mascarenhas, D.R. and Collins, D. (2009) Implementing reflective practice approaches with elite team athletes: Parameters of success. *Reflective Practice*, 10, 3, 353-363.
- Richards, P., Collins, D. and Mascarenhas, D.R. (2012) Developing rapid high-pressure team decision-making skills. The integration of slow deliberate reflective learning within the competitive performance environment (in netball). *Reflective Practice*, 13,3, 407-424.
- Richards, P., Collins, D. and Mascarenhas, D. (2017) Developing team decision-making: a holistic framework integrating both on-field and off-field pedagogical coaching process. *Sport Coaching Review*, 6, 1, 57-75.
- Roberts, S.J. (2011) Teaching games for understanding: The difficulties and challenges experienced by participation cricket coaches. *Physical Education and Sport Pedagogy*, 16, 1, 33-48.
- Rubin, H.J. and Rubin, I.S. (2011) *Qualitative Interviewing: The Art of Hearing Data*. Sage, London.
- Sparkes, A.C. (2012) The paradigms debate: An extended review and a celebration of difference. *Research In Physical Education and Sport*, 9-60.
- Stats Perform (N.D). New Data Insights for the Rugby World Cup 2023 [online]. Available at <https://www.statsperform.com/resource/world-rugby-in-collaboration-capgemini-and-opta-are-providing-new-data-insights-for-the-rugby-world-cup-2023/> (Accessed 16th January 2024).
- Sunderland, C. and Nevill, M. E. (2005) High-intensity intermittent running and field hockey skill performance in the heat. *Journal of Sports Sciences*, 23, 5, 531-540.
- Tee, J.C., Lambert, M.I. and Coopoo, Y. (2017) Impact of fatigue on positional movements during a professional rugby union match. *Journal of Sports Physiology and Performance*, 12, 4, 554-561.
- Thomas, J., French, K. and Humphries, C. (1986) Knowledge development and sports performance: directions for motor behavior research. *Journal of Sport and Exercise Psychology*, 8,4, 259-272.
- Thomas, K.T. and Thomas, J.R. (1994) Developing expertise in sport: The relation of knowledge and performance. *International Journal of Sport Psychology*, 25, 295-295.
- Thompson, A., Potrac, P. and Jones, R. (2015) 'I found out the hard way': Micro-political workings in professional football. *Sport, Education and Society*, 20, 8, 976-994.
- Toner, J., Montero, B.G. and Moran, A. (2015) Considering the role of cognitive control in expert performance. *Phenomenology and the Cognitive Sciences*, 14, 1127-1144.
- Travassos, B., Araujo, D., Davids, K., Vilar, L., Esteves, P. and Vanda, C. (2012) Informational constraints shape emergent functional behaviours during performance of interceptive actions in team sports. *Psychology of Sport and Exercise*, 13, 2, 216-223.
- Travassos, B., Araujo, D., Davids, K., O'Hara, K., Leitão, J. and Cortinhas, A. (2013) Expertise effects on decision-making in sport are constrained by requisite response behaviours - A meta-analysis. *Psychology of Sport and Exercise*, 14, 2, 211-219.
- Vaeyens, R., Lenoir, M., Williams, A.M., Mazyn, L. and Philippaerts, R.M. (2007a) The effects of task constraints on visual search behavior and decision-making skill in youth soccer players. *Journal of Sport and Exercise Psychology*, 29, 2, 147-169.
- Vaeyens, R., Lenoir, M., Williams, A.M. and Philippaerts, R.M. (2007b) Mechanisms underpinning successful decision making in skilled youth soccer players: An analysis of visual search behaviors. *Journal of Motor Behavior*, 39, 5, 395-408.
- Williams, A.M. and Grant, A. (1999) Training perceptual skill in sport. *International Journal of Sport Psychology*, 30, 2, 194-220.
- Williams, A.M. (2000) Perceptual skill in team games: theory and practice. *INSEP 2000*, 15-16.
- Williams, A.M. and Ford, P.R. (2013) 'Game intelligence': anticipation and decision making. (pp. 117-133). In, Williams, M., Ford, P. and Drust, B. *Science and Soccer*. Routledge, London.
- Williams, A. and Jackson, R. (2019) *Anticipation and Decision Making in Sport*. Routledge, London.

Williams, S. (2021) Eddie Jones is right; power is only part of the answer. *The Rugby Paper* Jan 10th.

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Reviewer Comments

Dynamic decision making in rapidly changing situations has been a vibrant topic of research for psychologists and business and/or leadership professionals for many decades. However, in this turn towards sport, especially in team games such as rugby, the authors acknowledge the qualities of better players who might otherwise be called a ‘natural’, or ‘gifted’, able to ‘read the play’ or having some ultra perceptive ‘game-sense’ that sets them apart as a player. What is of particular interest in this research is the authors’ quest to find out if this ‘Game Intelligence’ can be taught by coaches, taking this fascinating topic into Coach Education. Thus, the questions of; what is GI? and how is GI recognised? are the just start of another challenge, how might GI be taught to others? An advantage the researchers have is that the large sample of coaching staff they have approached in their data collection, will be already attuned to the kind of qualities they are being asked about, but as coaches may have little idea that such ‘natural’ qualities can be taught, or at least honed in the majority of players who are committed to the game. So, the question these authors are trying to fathom out is how best to go about teaching Game Intelligence, bringing a pedagogical twist to their psychological mission which is highly original. Consequently, this paper and the initial model of thinking they present here, has huge potential to influence coach education in rugby and other dynamic team sports.