

Look Who's Talking - In-game Communications Analysis as an Indicator of Recognition Primed Decision Making in Elite Australian Rules Football Umpires

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ABSTRACT

Officials in sport operate in a naturalistic environment making rapid decisions under stress. In sport, decision making research has identified consistent results between the three different 'variations' of the Recognition Primed Decision (RPD) model. This paper presents the findings from a study applying the RPD model to the decision making of Australian Rules Football (AFL) umpires. **Method:** Audible communication instances from AFL Field umpires were transcribed. The data was coded into 'decision moments'; each decision moment was analysed to identify if the decision conformed to one of the three RPD model variations. **Results:** Within the 6025 communication instances 887 decision moments were identified. 78% of the decision moments were classified as Variation 1, 18% as Variation 2 and 3.5 % as Variation 3. **Discussion:** Decision making in AFL umpires is characterized by a similar RPD breakdown as decision making by players in sport. AFL umpires RPD variation is influenced by the game situation and type of adjudication being made.

KEYWORDS

Judgement and Decision Making, Expertise, Officials in Sport, Australian Rules Football, Communications Technology,

INTRODUCTION

Officials in Sport (OIS) – referees, umpires, judges and stewards are an often-studied profession for naturalistic researchers (Hancock & Ste-Marie, 2014; MacMahon & Plessner, 2008; Mallo, Frutos, Juárez, & Navarro, 2012; Mascarenhas, Collins, Mortimer, & Morris, 2005; McLennan & Omodei, 1996; Rix-Lievre, Recope, Boyer, & Grimonprez, 2013). Studying OIS performance allows researchers to understand phenomena which happen in the real world (G. Klein, 1993, 1998, 2008; Orasanu & Connolly, 1993). Further, naturalistic research in sport, including the study of OIS, emphasizes the way individuals, teams and systems conduct tasks, meet goals and make decisions (Kermarrec & Bossard, 2014; G. Klein, 1998; Macquet, 2009; Macquet & Fleurance, 2007; Orasanu & Connolly, 1993). Despite the previous studies mentioned, little research has explicitly examined decision making in OIS teams (Neville & Salmon, Under Review).

The Recognition Primed Decision (RPD) model, with its genesis in the study of how a fire ground commander (fire fighter) makes a rapid decision, establishes that decisions are made through priming (Gary Klein, Calderwood, & Clinton-Cirocco, 2010). In the RPD model an individual or team will have sufficient knowledge or expertise in the task to quickly match or compare different options. The model describes three approaches or variations for naturalistic decision making: Variation one – Simple Match (V1) states that experts will rely on experience and intuition to quickly match and select the most appropriate option. Variation two - Simulation/Diagnose(V2) occurs when no immediate option exists and the decision maker is required to spend time simulating or evaluating different options. Finally, variation three - Evaluate (V3) is used when modifications are required to possible decision actions in order for them to work (G. Klein, 1993).

Despite the lack of research focussing on decision making in OIS, studying the RPD model in sport has provided insights into the performance of players in Basketball, Football, Handball and Volleyball. Results have identified that different sports exhibit a similar breakdown between the three variations (for a summary see Kermarrec and Bossard (2014)). Typically, participants have been found to exhibit V1, or 'simple match' strategies between 80-85% of the time (Kermarrec & Bossard, 2014). In a recent study, however, results identified that defensive soccer players, who are required to be more reactive than proactive when making decisions, have a V1/V2/V3 of 60%/16%/24% split with less of a reliance on V1 (60%) compared to players in other sports (Kermarrec & Bossard, 2014).

When investigating OIS performance, naturalistic research has examined the factors impacting decision making. For example, studies have examined the impact of factors such as emotion (Rix-Lievre et al, 2013), training

(Mascarenhas et al, 2005), and positioning (Mallo et al, 2012) on decision making. Recent studies have also examined the role of team cognition in decision making (e.g. Boyer et al, 2013). The extent to which OIS follow similar decision making strategies to players is not clear. For example, when players on a field have more time to consider their options the frequency of simulation (V2) increases. (Kermarrec & Bossard, 2014). Are officials able to simulate or diagnose a situation and make a decision or does their role as instant arbiters of rule infringements lead to a dominance of V1?

OiS are constantly making adjudications of the game, performing a number of tasks, decisions and non-decisions in a rapid nature. Like the players in the game, OIS are performing in a dynamic environment under multiple stresses. While Cardin, Bossard, and Buche (2013) state that in sport the “quality of decision is ... seen as the ability of an athlete to act at any moment of the game quickly and efficiently;” for OIS performance and effectiveness is influenced as much by time as it is by accuracy. This subtle difference occurs because the dynamics of the environment for the umpire are manifestly different. The players acting as “protagonists” (Cardin et al., 2013) have their behaviour and decision making influenced by many pressures, including time, game situation and desire to beat the opposing team; Umpires, as the supporting cast, need only to adjudicate accurately without unduly delaying the protagonists’ ability to continue the game.

The aim of this paper is to present the findings from an exploratory study of decision making in Australian Rules Football (AFL) officials. The aim of the study was to examine verbal in-game communication of umpires and determine if the communication represents how a decision is made with respect to the RPD model. Finally, the study aimed to identify if AFL umpires decision making follows a similar pattern to players or if, due to their role in the game as the support cast, their decision making is different.

Officiating Australian Rules Football

AFL is a fast paced ball sport where two teams of 18 players compete to score points (through goals and ‘behinds’) on an oval shaped field (illustrated in Figure 1) over four quarters of twenty minutes playing time. Players are required to kick an oval shaped ball through the Goals to score six points; if they miss to either side of the Goals (known as Behinds) or if the ball is not kicked through the Goals or Behinds the attacking team scores one point. There is no off-side and players hold notional positions as forwards (six players), midfielders (six players) and defenders (six players) (Australian Football League, 2014). The field is divided, through ground markings, into ‘zones’ known as attacking 50m arc, centre square and defending 50m arc. Players advance the ball towards the opposition’s goal via kick or hand passes. A ‘mark’ occurs when a receiving player catches a kicked pass of over 15 metres in length before the ball hits the ground. While there are numerous infringement rules, at the basic level the laws of the game ensure that the players head, shoulders, back and legs are protected; while attacking players are limited in how they are required to dispose of the ball, with illegal disposals also adjudicated.

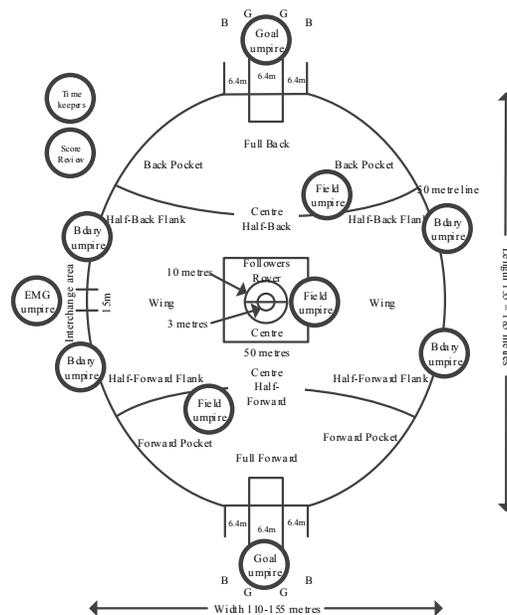


Figure 1 - AFL field dimensions with notional playing and umpiring positions (Australian Football League, 2014)

There are nine on-field umpires in AFL: three Field Umpires, one in each zone, four Boundary Umpires and two Goal Umpires, one at each end. The on-field umpiring team is supported at ground level by a reserve Field Umpire (known as the Emergency Umpire) and reserve Goal Umpire as well as, in the stands, official timekeepers and a score review umpire who has access to instant replays.

The Filed Umpires adjudicate all marks and rule infringements. An indication of a mark by an umpire allows a player to stop the flow of play and take an unpressured kick. An umpire is required to decide if the ball has been touched and if it has travelled the required distance for a mark to be paid. When an umpire decides a rule infringement has occurred a Free Kick is awarded to the offended team. If a contest is adjudged fair and within the rules, the umpire will call 'play on.'

The Boundary Umpires adjudicate when a ball leaves the field of play. If the ball leaves the playing surface 'on the full' from a player's foot then the opposition is awarded a Free Kick, termed Out of Bounds on the Full (OOBF), in (nearly) all other cases the boundary umpire will return the ball to play through a Boundary Throw In (BTI).

The Goal Umpires adjudicate when a ball goes through the Goals or Behinds. The Goal Umpires also keep the official score of the game and provide scoring signals to the players, umpires and spectators. Goal Umpires are assisted by Boundary Umpires, Field Umpires and a video review system (termed Score Review) for scoring decisions if ambiguity exists.

Field and Boundary Umpires communicate to the players using a whistle and short verbal communications. Typically, a single whistle is used to stop the flow of the game, while a double whistle is used to get a player's attention when the game has been stopped. Through the course of a game the three Field Umpires, two Goal Umpires, the Emergency Umpire and timekeepers use a radio communication system to provide open, real-time continuous communication. The study, while interested in all members of the AFL umpiring team, focused its research on the three Field umpires.

METHOD

Data Collection

The Australian Football League Umpiring Department provided the authors with audio/visual recordings of three AFL games from the 2014 AFL Premiership Season. The vision of the game was the same as the host television broadcasters; the audio tracks, however, had the television commentary removed providing an uninterrupted stream of the umpires' communications which were recorded via the standard match communications system currently worn by AFL umpires.

Participants

For the purpose of the study, the subjects were eight male AFL Field Umpires. The combined experience of the umpires was 928 ($\mu = 116$; $\sigma = 77.8$) AFL games at the beginning of the 2014 AFL Premiership Season. Due to manner in which the data was obtained it was not possible to gather information regarding the age of the participating umpires.

Materials

The communication made by the umpires was captured by the radio communications equipment and recorded in synchronisation with the live television broadcast onto a DVD. The VLC media player and Microsoft Excel was used to conduct the transcription and data analysis.

Data Analysis

Each game was transcribed verbatim from the recorded footage. One analyst then reviewed the footage and transcripts to identify instances of communication during the games. Each umpire communication was transcribed as a 'communication instance', defined as a word, phrase or use of the whistle made by an umpire or any other communication picked up by the umpires' microphone. For each communication instance the game, quarter and time stamp was recorded as well as the area on the playing field where the communication occurred. Each communication instance was coded to identify sequences of communications which represented decision moments in the game. A decision moment was defined as a moment when a field umpire had to decide to intervene on the game; to inject a decision which would alter the regular flow of the game.

The decision moments, as a verbal record of decision made by the umpiring team, were then coded by one analyst as one of the three variations in the RPD model as presented by (G. Klein, 1993, 1998). Coding occurred through assessing the set of communication instances contained within each decision moment. For reliability purposes a second analyst also coded the decision moments as one of the three RPD variations. Comparison of both analysts coding revealed an agreement of 94%. For those decision moments on which the analysts did not agree consensus was achieved through further discussion.

RESULTS

Frequency of Communication Instances

Table 1 shows frequency counts of the 15 most recorded communication instances across the three games analysed. In total 6025 communication instances were identified of which there 960 unique and 64 were repeated

10 or more times. The use of the whistle is the most frequent communication instance followed by the use of the verbal play on instruction and inter-umpiring team control instructions such as 'you' and 'me'. The control instructions are used to indicate, within the team, which umpire is responsible for making decisions at any one moment.

Decision Moments

Table 2 presents a breakdown of the decision moments identified in the transcribed data. The decision moments are separated based on the type of event in the game that they are related to - marks, Free Kicks and stop ball situations (Ball Ups, ball out of play moments and scoring resets).

As shown in Table 2, just over 56% of the decision moments were mark decisions whereby the umpire determines whether a mark has been made. The next most frequent decision moment across the three games related to Boundary Throw In decisions, followed by Free Kicks, Kick Ins, and Ball Up decisions.

Table 1. Frequency of the most used communication instances per quarter (Q1...Q4) and game (G1,G2,G3). Communications instances in italics represent umpire to umpire communications.

Communication Instance	Game 1				Total	Game 2				Total	Game 3				Total	
	Q1	Q2	Q3	Q4		Q1	Q2	Q3	Q4		Q1	Q2	Q3	Q4		
Whistle	76	98	81	83	338	101	89	90	84	364	93	93	99	84	369	1071
'Play on'	85	86	71	94	336	91	81	78	57	307	97	77	83	89	346	989
'You'	39	31	32	32	134	40	33	30	27	130	37	28	35	31	131	395
'Me'	35	37	44	36	152	14	19	13	28	74	28	23	32	32	115	341
'Thank you'	12	6	6	4	28	7	14	15	12	48	24	16	21	33	94	170
'Yep'	16	12	16	12	56	14	13	16	13	56	12	16	12	15	55	167
'All clear'	17	11	14	9	51	7	13	17	12	49	11	15	13	11	50	150
Double whistle	9	7	8	11	35	12	12	8	12	44	6	6	13	9	34	113
'Thanks [player]'	5	9	7	2	23	2	9	9	14	34	7	8	5	10	30	87
'[player]'	4	1	4	-	9	3	6	11	14	34	6	14	10	4	34	77
Goal restart	10	6	9	6	31	4	3	11	5	23	6	5	6	6	23	77
'Move it on'	2	4	6	7	19	10	8	8	5	31	4	4	12	6	26	76
'Good [umpire]'	8	12	10	10	40	6	1	5	1	13	3	4	3	4	14	67
'Backing back'	12	3	9	6	30	6	4	11	10	31	-	-	2	2	4	65
'Mark's here'	7	3	4	1	15	1	2	4	5	12	5	9	3	5	22	49

Table 2. Decision moments instances per quarter (Q1...Q4) and game (G1,G2,G3)

Decision Moment	Game 1				Total	Game 2				Total	Game 3				Total	
	Q1	Q2	Q3	Q4		Q1	Q2	Q3	Q4		Q1	Q2	Q3	Q4		
Mark	35	40	36	44	155	47	49	35	32	163	50	43	38	49	180	498
BTI	8	15	10	9	42	15	8	7	12	42	12	15	12	7	46	130
Free	11	10	10	8	39	9	6	11	9	35	7	6	12	7	32	106
Kick In	6	5	4	4	19	3	8	5	7	23	6	10	6	6	28	70
Ball Up	4	2	7	5	18	3	5	8	9	25	4	3	7	6	20	63
OOFB	1	2	-	1	4	2	1	1	1	5	-	2	-	3	5	14
Recall	-	-	-	-	-	-	2	1	-	3	-	-	-	1	1	4
SR	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1
Other	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	1
Total	65	74	67	71	277	79	79	69	70	297	79	79	76	79	313	887

RPD Variation

Tables 3 and 4 present the number of decision moments associated with each variation in the RPD – V1 - simple match, V2 - simulate/diagnose and V3 - evaluate. **Error! Not a valid bookmark self-reference.** presents the variation breakdown for each game per quarter, while Table 4 presents the breakdown against the different decision moments.

Table 3 shows that 78% of the decisions occurring across the three games were characteristic of V1, with just over 18% representing V2 and 3.5% V3.

Table 4 shows that the majority of V1 decisions were marks and game resets ('Boundary Throw In' and point 'Kick In'). V2 decisions were split between game resets ('Ball Up' and 'Out of Bounds on the Full') and Free Kicks. Free Kicks were also the most dominant decision moment in V3.

DISCUSSION

This study is the first in a sequence examining the nature of AFL umpire decision making during three elite level AFL games. The findings provide some interesting points around the characteristics of AFL umpire decision making. In the following discussion these are discussed through a RPD lens.

Table 3. Breakdown of RPD Variation by quarter

	Variation 1 (Simple Match)		Variation 2 (Simulate/diagnose)		Variation 3 (Evaluate)		Total
	Raw	%	Raw	%	Raw	%	
<i>Game 1</i>							
Q1	49	75.4%	14	21.5%	2	3.1%	65
Q2	60	81.2%	12	16.2%	2	2.7%	74
Q3	50	74.6%	17	25.4%	-	-	67
Q4	56	80.3%	10	14.1%	4	5.6%	71
Game Total	216	78.0%	53	19.6%	8	2.9%	277
<i>Game 2</i>							
Q1	64	81.1%	11	13.9%	4	5.1%	79
Q2	65	82.3%	13	16.5%	1	1.3%	79
Q3	44	64.7%	17	25.0%	7	10.3%	68
Q4	51	72.9%	17	24.3%	2	2.9%	70
Game Total	224	75.7%	58	19.6%	14	4.7%	296
<i>Game 3</i>							
Q1	68	86.1%	11	13.9%	-	-	79
Q2	67	84.8%	11	13.9%	1	1.3%	79
Q3	56	73.7%	13	17.1%	7	9.2%	76
Q4	62	78.5%	16	20.3%	1	1.3%	79
Game Total	253	80.8%	51	16.3%	9	2.9%	313
Total	693	78.2%	162	18.3%	31	3.5%	886¹

Table 4. Breakdown of RPD variation by decision moment

	Variation 1 (Simple match)		Variation 2 (Simulate/diagnose)		Variation 3 (Evaluate)		Total
	Raw	%	Raw	%	Raw	%	
Mark	495	99.4%	-	-	3	0.6%	498
BTI	129	99.2%	-	-	1	0.8%	130
Free Kick	-	-	83	78.3%	23	21.7%	106
Kick In	69	98.6%	-	-	1	1.4%	70
Ball Up	-	-	61	96.8%	2	3.2%	63
OOFB	-	-	14	100%	-	-	14
Recall	-	-	4	100%	-	-	4
Score Review	-	-	-	-	1	100%	1
Total	693	78.2%	162	18.3%	31	3.5%	886

Verbal articulation of AFL Umpires

The use of the whistle was the most prominent verbal articulation in the data; providing clear moments where the umpires intervenes and verbalizes their decision making. The whistle is used to indicate an intervention in the game – either a mark or Free Kick. It is also used as a form of call and response between Field and Boundary umpires to first indicate and then acknowledge that the ball has gone out of play. Finally, it is used to encourage a player to move the ball on and restart play (Double whistle) after an intervention moment.

The verbal articulation to play on was the next most common communications instance. Play on was used an indicator to the players that they play is live, that the game can continue and that no rule breach has occurred. That is, when an umpire encountered situations (or contests) where two or more players were legally competing for the ball the umpire called play on to inform them that no intervention would occur. Using play on in this context is considered a non-decision, where a decision to not intervene is made and then verbalized to the players. Play on is also used to inform players that, after an intervention moment, the game is live again and that a contest between competing players is permitted. In the data the use of play on in these contexts was not universal as not every non-decision or non-intervention moment required the umpire to call play on.

The prevalent use of play on shows that when an umpire is primed by a contest between two players the default (or simple match) of the umpire is to let play continue and call play on. It is only after a contest does not meet the play on criteria, a rule breach for example, that an umpire intervenes through the use of the whistle. Although it was not possible to identify all instances of non-intervention, the count of play on (989) noticeably outnumbers any single type of decision moment, suggesting that when an umpire is primed by a contest between two players their simple match is to call play on.

The RPD model applied to AFL Umpires

Analysis of the decision moments indicated that, in the three games analysed, the umpires followed a 78.2/18.3/3.5% split between the three variations in the RPD model. The split suggests that the majority of AFL umpire decision making comprises V1 or simple match decisions. For V1 decisions (78.2%) analysis showed

¹ The decision moment coded as 'other,' a scuffle between players, did not require an intervention by the umpires and was not included in the RPD analysis.

that the majority of the mark, boundary throw in and kick in decision moments conformed to the simple match criteria. With a mark, an umpire is primed by the kicking of the ball by one player and pays a mark if the ball is caught without anything complicating the situation. Similar priming criteria exists when the ball crosses the boundary or is kicked in following a behind being scored.

Decision moments using V2 (18.3%) included three distinct contexts – Free Kick, Ball Up and OOB. For a Free Kick, an umpire has to adjudicate that a rule breach has occurred and that an intervention is required. While it may be possible that a contest between two players prime an umpire towards a rule breach the frequent use of play on reveals that an umpire's default strategy is to let the play continue; implying a consideration of another option, such as a rule breach.

More interestingly, the ball up decision moment, where an umpire decides that the play has stopped and needs to be reset (similar to jump ball in basketball or a drop ball in soccer) reveals a verbal simulation of options before a decision action. Within a ball up decision moment an umpire can be heard calling play on for several contests before the whistle is sounded for a ball up. For example one decision moment contain the following instances "Play on, play on, play on, [whistle], my ball, I'll have it." Each use of play on indicates that the umpire has considered the contest to be fair. After the third play on call the umpire decided the ball had stopped moving and the play needed to be reset. In this respect the umpire has taken time to consider different options to intervene before deciding to act. The OOB decision moment occurs when the ball is kicked out of bounds without being touched or hitting the ground, a trigger for a Free Kick to the opposing team. OOB instances, as seen in Table 2, occur infrequently in a game; and, similar to the Free Kick and ball up decision moments, the umpire first considers how the ball has left the playing field before deciding on OOB.

Finally, the small number of V3 (3.5%) decision moments occurred when the verbal communication provided by the umpiring team indicated changes to the original course of action. The intervention of another umpire suggests that the umpiring team had to engage in further evaluation of the situation following an original V1 or V2 decision. In the instance of a mark decision moment, for example, the course of action for a regular mark changed when a defending play interfered with the attacking player after the mark was taken; resulting in a metreage penalty being applied to the defending team. For Free Kicks, instances included players electing to take advantage or a non-controlling umpire paying a Free Kick in the zone of the controlling umpire. The V3 Free Kick decision moments resulted in umpires having to communicate an alternate course of action to that which happen for regular Free Kicks, indicating modifications to the decision actions of an umpire.

It is notable that the findings from the present study are similar to those that have examined decision making in other sports. The finding that 78% of decision moments were characteristic of the V1 - simple match variation of RPD, is similar to the findings from studies in Volleyball (Macquet, 2009) and Ice Hockey (Bossard, De Keukelaere, Cormier, Pasco, & Kermarrec, 2010; Mulligan, McCracken, & Hodges, 2012); however, it is notable that this is the first study to examine OIS as opposed to players. The high percentage of V1 decisions indicates that as instant arbiters of rule infringements, AFL umpires decision making is dominated by simple matches. When comparing the split between V2 and V3 it was identified that AFL Umpires favour V2 (18.3%). The relatively low proportion ascribed to V3 (3.5%) may be accounted by the fact that AFL umpires, as support actors in the game, have less capacity, either through time or other stressors, to modify existing decision actions.

Team decision making

An interesting phenomena observed through the analysis of the data was the degree to which members of the umpiring team were able to coordinate decision making through the use of the communications equipment. In the decision moments which conformed to V3 the data identified multiple umpires providing instructions to the controlling (or deciding) umpire. It is possible that such communication facilitated more accurate decision making due to the pooling of the experience and perspectives of the other team members. Additionally, the data has identified that the communications technology has allowed the entire team to know what is going on where 'the play' was occurring. In relation to the RPD model, this finding demonstrates the important role that teamwork, communications and communications technology have to play in V3 decision making. V1 and V2; however, can proceed as an individual function.

Further Research

Whilst further examination of OIS decision making across sports is recommended, a limitation of the present study is that it examined decision making through umpire communications and game vision only, without obtaining the perspective of the decision maker. The limitation can be overcome through conducting self-confrontation interviews using techniques such as critical decision method or verbal protocols with the participants.

Self-confrontation interviews will allow researchers to understand the impact the communications technology has on the decision making processes. Further research is also required into the degree to which AFL umpires conduct a single decision action or implement multiple successive decision actions using some form of anticipatory thinking (G Klein, Snowden, & Pin, 2011). Does a single decision moment consist of an umpire

stepping between the different variations of the RPD model? Self-confrontation interviews currently appear to be the only way to test such a hypothesis.

As the audio feed in the original data has been synchronized with vision of the game, the ability to time stamp each communication instance and decision moment provides a rich data set to enable quantification of the rapid decision making of the umpires. While it is commonly accepted that the RPD model describes how a rapid decision is made (G. Klein, 1993), the combination of verbalized in-the-moment decision making and time stamp communication instances allows for an understanding of how quick a rapid decision is made in the context of AFL and sport.

CONCLUSIONS

It is concluded that umpiring in AFL involves all three variations of RPD; however, the majority of decisions reflect V1 – simple match. In addition, despite significant differences across sports, there appear to be similarities between the breakdown of RPD variations adopted by officials in AFL and players in other sports such as volleyball and ice hockey. Suggesting that, despite their role as supporting actors in sport, OIS make use similar decision making strategies.

In relation to AFL, it is concluded that the umpires verbalize a number of non-decision ‘play on’ calls through the course of a game, implying that umpires are primed to not make a rule adjudication (and award a Free Kick). AFL umpires also demonstrated an ability to use communication technology as a means to evaluate more complex decision moments.

Using real time in-game communication technology has enabled researchers to understand the naturalistic decision making without any direct intervention in the tasks being undertaken. Further, due to the training and tasks requirements of AFL Umpires, the verbalized data has provided a unique way to capture ‘in-the-moment’ decision making.

Finally, this study demonstrates how research into the naturalistic decision making of OIS provides a low risk non-invasive domain to test, explore and extend decision making and team work models, which in turn can be translated to other safety critical areas.

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