

# **Match analyses of the 2006 and 2008 Super 14 Rugby Union Tournaments**



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B.A. Hons. (Sport Science)

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the degree Magister Artium at the Potchefstroom Campus of the  
North-West University

Supervisor: Prof. D.D.J. Malan

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## FOREWORD

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I want to start this section to express my sincere appreciation to the following people. I acknowledge that this dissertation would have never materialized without your input in my life.

First of all, I would like to thank my **Heavenly Father** for the heaps of patients, all the love, tons of blessings and continuous direction I receive from Him daily.

Secondly, I would like to thank all of my family and friends for their continuous support and love. Particularly my wife **Gayle**, my *iron man* **Möller** and *little princess Ataya* (The 3 most important people in my life).

Thirdly, I would like to thank my supervisor, **Prof Dawie Malan** for his advice and belief in me, as well as the expertise and effort that he so selflessly has shared with me over the past eight years.

Then I want to thank all my **colleagues** as well as **Dr Suria Ellis** for her contribution with the statistical data processing and **Mrs Cecilia van der Walt** for her assistance with the language editing.

# DEDICATION

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This dissertation is dedicated to my mother,  
**LINDA VAN DEN BERG,**  
Who always believed in me, endlessly praying for me, continuously  
loving me, and financially supported my studies, even during  
difficult times.

**John 3:27**

“A man can receive nothing unless it has been given to him from  
heaven.”

Pieter van den Berg

May 2010

# DECLARATION

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The co-author of the two articles, which form part of this dissertation, Prof, D.D.J. Malan (Supervisor), hereby gives permission to the candidate, Mr. P.H. van den Berg to include the two articles as part of the Masters dissertation. The contribution (advisory and supportive) of the co-author was kept within reasonable limits, thereby enabling the candidate to submit this dissertation for examination purposes. This dissertation, therefore, serves as partial fulfilment of the requirements for the Magister Artium degree in Sport Science within the school of Biokinetics, Recreation and Sport Science in the Faculty of Health Sciences at the North-West University (Potchefstroom Campus).

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Prof. D.D. J. Malan

Supervisor and co-author

# CONGRESS PRESENTATION

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The following presentation, based on this dissertation, has been delivered:

Van den Berg, P.H. & Malan, D.D.J. Match analysis of the 2006 Super 14 rugby union tournament. *Oral presentation at the 4<sup>TH</sup> ICHPER.SD Africa regional congress at the University of Botswana, Gaborone, 2008.*

Van den Berg, P.H. & Malan, D.D.J. Video analysis in rugby union. *Poster presentation at the 3<sup>ed</sup> SARECON congress held in Durban, South Africa, 2010.*

## SUMMARY

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Video analysis and more specifically, computer notational analyses (CNA), are considered by many scientists to be of great value for research purposes. It has also provided proof of the ability and contribution of CNA to evaluate the way match-play in a sport such as rugby has evolved through the years and to determine which performance indicators (PIs) are present in this sport code. CNA can also assist in determining the influence of such PIs on match performance. Based on this research application, rugby union turning professional in 1995 and the regular introduction of new laws in the game brought about the necessity for a more scientific approach in rugby union match analysis. This led the research team to the following objectives: To determine a) The effect of the experimental law variations (ELVs) introduced in rugby during 2008 on the PI-s; b) The frequency of the different PIs during matches played in the 2006 season; and c) The ability to evaluate performance (match outcome) and ranking of the teams.

All the Super 14 rugby games (n=370) in the 2006 and 2008 seasons were recorded on video and analysed. The following PIs were analysed: turn-overs, percentage good scrums, percentage good line-outs, percentage tackles made, drop goals, penalty goals, rucks lost, rucks won, tries scored, line breaks, passes made, turn-overs, off-loads in the tackle, meters gained, penalties conceded, kicks from hand and percentage tries converted.

Descriptive statistics were calculated of each PI for each of the rugby teams, followed by independent t-tests to determine significance of differences between the 2006 and 2008 data. Additionally, forward stepwise discriminant analysis and forward stepwise multiple regression analysis were performed to determine which of the PIs influenced the ranking and performance of the different teams. Due to the fact that this was an inferential study, significance of differences were reflected by practical significance as determined by means of effect sizes.

With regard to the ELVs, the study determined that a large practical significant decrease occurred in the frequency of scrums and line-outs from the 2006 to 2008 competition.

In contrast to this, the number of tackles made, meters gained and penalties conceded all showed a large practically significant increase over the same compared competition seasons.

Meters gained, kicks from hand, line breaks and percentage tackles made were identified as the PIs which discriminated most accurately between successful and less successful Super 14 rugby union teams. Furthermore, meters gained, kicks from hand and line breaks were identified as the PIs which emerged as the best predictors (practical significant) of team ranking among the Super 14 rugby union teams during the competition.

In conclusion, the results from this study therefore outlined the importance of the different PIs as predictors of performance and the ranking of the Super 14 rugby union teams. The increase in action activities and decrease in static activities between the 2006 and 2008 season suggests that the IRB have succeeded in addressing their objective of increasing the appeal of the game with the introduction of the ELVs.

# OPSOMMING

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Video-analise en meer spesifiek, rekenaarnotasië-analise (RNA), word deur talle wetenskaplikes beskou as van groot waarde vir navorsingsdoeleindes. Dit het ook bewyse gelewer van die vermoë van RNA om die evolusie van die spel in 'n sport soos rugby deur die jare te evalueer, en om vas te stel watter prestasie-indikators (PI's) in dié sportsoort voorkom. RNA kan ook meehelp om die invloed van sodanige PI's op wedstrydprestasie te bepaal. Omrede rugby-unie in 1995 professionele status verkry het en die reëls gereëld verander, het die noodsaaklikheid en behoefte vir 'n meer wetenskaplike benadering in rugby-unie ontstaan. *Dit het die navorsingspan tot die volgende doelwitte gelei, naamlik om te bepaal: a) wat die effek is van die "experimental law changes (ELVs)" wat gedurende 2008 geïmplementeer was; b) wat die frekwensie is van die verskillende PI's tydens wedstryde wat in die 2006-en 2008 seisoene gespeel is; en c) wat die vermoë is van PI's om prestasie (wedstryduitkoms) en rangorde van die spanne te voorspel.*

Al die Super 14 rugbywedstryde ( $n=370$ ) in die 2006-seisoen en die 2008-seisoen is op video vasgelê en geanaliseer. Die volgende PI's is geanaliseer: omgekeerde balbesit, persentasie goeie skrumme, persentasie goeie lynstane, persentasie doodvatte, skepskoppe, strafdoelle, skrumme verloor, skrumme gewen, drieë gedruk, lynbreuke, aangeë gemaak, omgekeerde balbesit, uitgee in die doodvatte, meters gewen, strafkoppe verdoel, skoppe uit die hand en persentasie drieë verdoel.

Beskrywende statistiek is van elke PI vir elk van die rugbyspanne bereken, gevolg deur onafhanklike t-toetse om betekenisvolheid van verskille tussen die 2006- en 2008-data te bepaal. Hierbenewens is voorwaarts stapsgewyse diskriminantanalise en voorwaartse stapsgewyse meervoudigeregressie-analise gedoen om vas te stel watter van die PI's die rangorde-prestasie van die verskillende spanne beïnvloed het. Weens die feit dat dit 'n inferensiële studie was, is betekenisvolheid van verskille weergegee deur praktiese betekenisvolheid soos bepaal deur middel van effekgroottes.



Ten opsigte van die ELV's het hierdie studie vasgestel dat 'n groot praktiese betekenisvolle afname in die frekwensie van skrumme en lynstane van die 2006- tot 2008-kompetisie voorgekom het. In teenstelling hiermee het die aantal doodvatte, meters gewen en strafskoppe verdoel almal 'n groot praktiese betekenisvolle toename oor dieselfde vergeleke kompetisie-seisoene getoon.

Meters gewen, skoppe uit die hand lynbreuke en persentasie doodvatte is as die PI's wat die akkuraatste tussen suksesvolle en minder suksesvolle Super 14-uniespanne onderskei het. Verder is meters gewen, skoppe uit die hand uit en lynbreuke geïdentifiseer as die PI's wat as die beste voorspellers (prakties betekenisvol) van 'n span se rangorde is.

Ten besluite het die resultate van hierdie studie dus die belangrikheid van die verskillende PI's as voorspellers van prestasie en die rangorde van die Super 14 rugbyunie-spanne uitgestippel. Die toename in aksieaktiwiteite en afname in statiese aktiwiteite tussen die 2006-seisoen en die 2008-seisoen dui daarop dat die IRB daarin geslaag het om hul doelwit om die aantreklikheid van die spel te verhoog met die inbring van die ELV's.

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### CHAPTER 1

**Figure 1:** Organigram of factors and relevant PIs involved in the success of rugby union

### CHAPTER 3

**Figure 1:** Organigram of factors and relevant PIs involved in the success of rugby union

**Figure 2:** Percentage contribution of the most important PIs to the ranking of the 2006 Super 14 rugby union teams

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## ABBREVIATIONS

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PI	-	Performance Indicator
PIs	-	Performance Indicators
ELV	-	Experimental Law Variation
ELVs	-	Experimental Law Variations
IRB	-	International Rugby Board

# CHAPTER 1





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# PROBLEM STATEMENT, OBJECTIVES AND HYPOTHYSES

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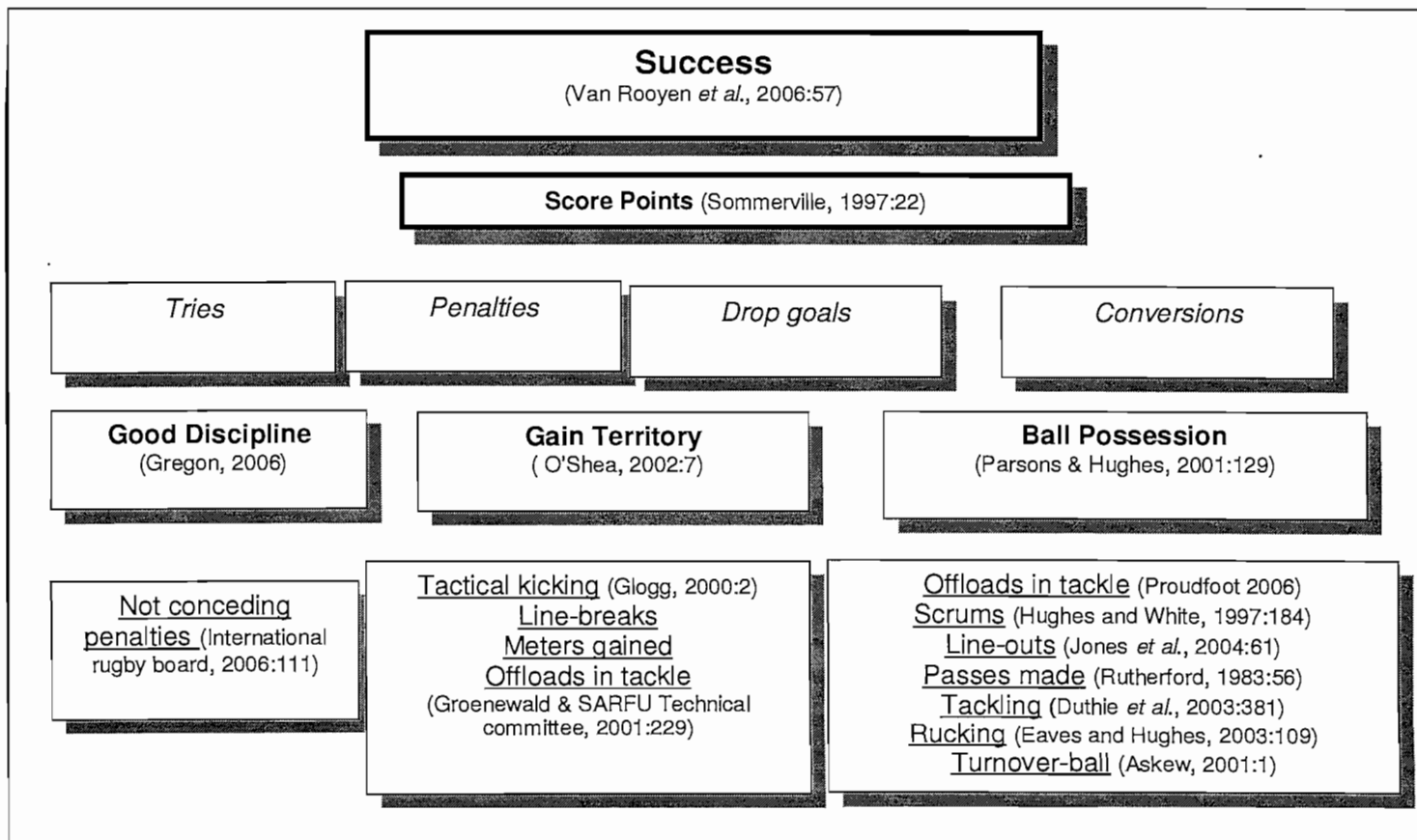
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1. PROBLEM STATEMENT
  2. OBJECTIVES
  3. HYPOTHESIS
  4. STRUTURE OF THE DISSERTATATION
  5. REFERENCES
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## 1. PROBLEM STATEMENT

Internationally, Rugby Union is renowned as a winter sport, ranked second in capaciousness after soccer (Bathgate *et al.*, 2002:265). The extent of participation in rugby union, together with the fact that the sport has turned professional in 1995 has increased the need for a more scientific approach that explores the different elements in the game of rugby union (Duthie *et al.*, 2003:974; James *et al.*, 2005:63 and Mellalieu *et al.*, 2008:791). Newell (2002:1) and Mallet (2006:122) consider technology, and more specifically video analysis, as one such a scientific approach. Hughes and Franks (2007:81) state that video analysis can be used to analyse general match, technical, tactical and biomechanical indicators. To analyse general match indicators, Hughes and Williams (1988:254), Botha (2005:16) and White (2005:104) recommended that computer notational analysis (CNA) should be used in this regard. Despite the concerns of, Handcock (1993:7) and Greenwood (2004:33) who pointed out that CNA is complex and difficult to use as well as Lames and McGarry (2007:65) who questioned the reliability of CNA results due to variation in conditions and other factors, Rees (1996:26), Reed and O'Donoghue (2005:13) as well as Eaves *et al.* (2005:59) argued the value and advantages of CNA, such as objectivity to be considered essential for team sports that strive to enhance performance.

The major purposes of notational analysis are to indicate which areas or activities in a match requires improvement as well as the evaluation of players, to name but two (Hughes, 1988:1587). Hughes and Bartlett (2007:167) indicated that notational analysts are inclined to study the patterns of play by analysing the action variables that should relate to performance. These action variables are known as performance indicators (PIs) and it is suggested that research should focus on the development and utilization of these PIs (Hughes & Bartlett, 2002:740; Baca, 2006:148; O'Donoghue, 2006:2; Pool, 2006:117).

In a recent study Coetzee and Van den Berg (2007:60) identified the importance of such PIs as performance predictors in South African tertiary institution rugby teams. The following diagram indicates which factors, including PIs (underlined), are considered by several researchers (also in table) as important for rugby union teams to achieve success.



**Figure 1: Table representing the organigram of success in rugby union and the relevant PI.**

Van Rooyen *et al.* (2006:57) states that success in rugby is measured by winning the match and in order to do so, teams must score points; thus beating the opposition. Points can be accumulated by the following number of ways: *tries, conversions, penalties* and *drop goals*. All of these can be decisive in determining the outcome of a game (Phythian, 1995:51; Sommerville, 1997:22). Research suggested that three aspects need to be considered when rugby teams wish to score points namely: a) a team needs **ball possession** (Rutherford, 1983:56; Parsons & Hughes, 2001:129), b) they need to **gain territory** in such a way that they can score points (O'Shea, 2002:7) and c) they need good **discipline** to prevent the opposition from gaining points through penalties (Gregon, 2006). Thus for a team to score points and be successful they need **ball possession**, good **discipline** and **to gain territory**. All achieved by specific PI.

When a team concedes penalties, the opposition may gain an opportunity to kick a goal, which in turn can lead directly to points for the opposition (International Rugby Board, 2006:111). Conceding penalties due to bad **discipline** therefore does have an effect on the outcome of the match. Laird and Lorimer (2004:78) determined that 75% of tries scored in the international matches during the 2003 rugby season came from ball possession gained in the opponents' half; thus emphasizing the importance for a team to **gain territory**. This is done with good tactical kicking (Glogg, 2000:2) or maintaining continuity by means of either line-breaks, meters gained or off-loading in the tackle, (Groenewald & SARFU Technical Committee, 2001:229).

Off-loading in the tackle can also be seen as a way to retain **ball possession**. Other PIs that enable a team to gain good ball possession includes scrums and line-outs (set pieces) which were also highlighted by Hughes and White (1997:184) in their analysis of the 1991 Rugby World Cup. They found that successful teams managed their set pieces significantly better than those of the less successful teams. A study done on European rugby teams showed that only two out of twenty two variables, namely opposition line-outs won and number of tries scored significantly discriminated between more and less successful teams (Jones *et al.*, 2004:61), hence the remark that activities such as set pieces have a definite influence on the final outcome of a rugby game (Hutchinson, 2005).

Other PIs that might influence a team's number of **ball possessions** included passes made, rucks and turnovers (Groenewald & SARFU Technical Committee,

2001:12). According to Rutherford (1983:56), teams that mastered handling skills best will have an advantage over their opponents. Rucking is another facet of play that has a direct influence on the amount of ball possessions a team can obtain. Teams that are not able to protect the ball during rucks will lose their **ball possession** to the opposing team and may even concede points against them due to the turn-over ball (Rugby Football Union, 2004). This was supported by Askew (2001:1) who determined that 17 out of the 19 tries scored during the first weekend of the 2001 Six Nations Rugby tournament were the direct result of turn-over balls. In addition to this Eaves and Hughes (2003:109) have determined that the number of rucks during a match from the 1992-1998 season had doubled by the 2000 period; hence emphasizing the importance of rucking.

Good defence (tackling) is also regarded as a critical component for success in the game of rugby (Biscombe & Drewett, 1998:45; Duthie *et al.*, 2003:381). Good defence may improve a team's chances of gaining good **ball possession** and preventing the opposition from **gaining territory**. Luger and Pook (2004:116) determined that rugby players are making twice as many tackles during a game than was the case during the 1996 Five Nations Championships. Good defence also emerged as the best predictor of ranking among the top eight ranked tertiary institution rugby teams in South Africa (Coetzee & Van den Berg, 2007:60).

In an interview with Matthew Proudfoot (2006) international player and a very successful South African club rugby coach, all the above-mentioned PIs were confirmed to be considered very important by coaches and trainers striving for success. Eaves and Hughes (2003:104) explained that in the strive for success in rugby it is important for coaches and trainers to adapt their current training programs, especially when changes occur in the profile of the sport. When the IRB (International Rugby Board) decided to implement new experimental law variations (ELVs) during the 2008 Super 14 Rugby Union Tournament, the possibility of change in the profile of the sport became apparent (IRB, 2008). The main purpose of these changes was to ensure that the game evolves to comply with the needs of the players, coaches and spectators and also to address certain safety issues. These ELVs have been on trial in several other small rugby competitions around the world for example, Scotland - Scottish Super Cup, England - County Championship, Australia – Australian Rugby Championship and South Africa – Currie Cup.

The results of these trials indicated that more tries were scored, contesting for the ball increased and positive feedback from players and referees indicated that the enjoyment of the game increased. On the other hand the number of PI stayed more or less the same (IRB, 2008). These findings led to the following research question: a) Did the ELVs succeed in changing the flow of play during matches in order to make rugby more appealing to spectators? Other research questions that emerged due to the value of the data examining the nature of PI in rugby and its relationship to rugby performances are posed: b) What is the frequency of the different PI during the 2006 and 2008 Super 14 Rugby Union Tournaments?, c) Which PI discriminate significantly between successful (top seven) and less successful (bottom seven) Super 14 rugby union teams?, d) Which PI significantly predict the ranking of the Super 14 rugby union teams?

The analyses of these PI might give coaches, players and sport scientists a better understanding of which PI occur in a rugby game, how often each PI appears and the effect it has on the outcome of the game. These answers may help the role-players to prioritize the amount of time they intend spending on the different PIs in their training programs, depending on the importance of these different PIs towards competitive match play, which may lead to the evaluation of players and teams accordingly. The answer to the last question could enable coaches, players and sport scientists to classify rugby teams of different performance levels.

## **2. OBJECTIVES**

The objectives of this study are to:

- ☒ Determine if the ELVs succeeded in changing the flow of play during matches in order to make rugby more appealing to spectators?
- ☒ Determine the frequency of different PIs in the 2006 and 2008 Super 14 Rugby Union Tournaments.
- ☒ Determine which PIs discriminate between the successful (top seven) and less successful (bottom seven) Super 14 rugby union teams.
- ☒ Determine which PIs significantly predict the ranking of the Super 14 rugby union teams.

### **3. HYPOTHESES.**

The study is based on the following hypotheses:

- ⊗ The ELVs succeeded in changing the flow of play during matches in order to make rugby more appealing to spectators.
- ⊗ The frequency of different PIs will differ significantly between the 2006 and 2008 Super 14 Rugby Union Tournaments.
- ⊗ Offloads in the tackle and good defence will discriminate significantly between successful (top seven) and less successful (bottom seven) Super 14 rugby union teams.
- ⊗ Offloads in the tackle, tactical kicking and good defence will predict the ranking of the Super 14 rugby union teams.

### **4. STRUCTURE OF THE DISSERTATION**

The dissertation is presented in an article format that was approved by the Senate of the North-West University and consists of five chapters: References is provided at the end of the chapter in accordance with the guidelines of the North–West University.

- |                  |   |
|------------------|---|
| <b>Chapter 1</b> | Research proposal that includes the problem statement, objectives and hypothesis.   |
| <b>Chapter 2</b> | Literature overview: Video analyses of rugby union. References are provided at the end of the chapter in accordance with the guidelines of the North –West University.  |
| <b>Chapter 3</b> | Match analysis of the 2006 Super 14 rugby tournament. This article will be submitted for publication in the African journal for physical, health education, recreation and dance. References are provided at the end of the chapter in accordance with the guidelines of the North – West University.                   |
| <b>Chapter 4</b> | The effect of the ELVs on the Super 14 Rugby Union Tournament. This article will be submitted for publication in the South African journal for research in sport, physical education and recreation. References are provided at the end of the chapter in accordance with the guidelines of the North –West University. |
| <b>Chapter 5</b> | Summary, conclusions and recommendations.   |

**Appendix** All the instructions for authors from the two relevant journals and an explanation of the ELVs.

## 5. REFERENCES.

ASKEW, T. 2001. Decision-making in attack. (*In* Larder, P. 3<sup>rd</sup> ed. Principles and practice. London : National coaching development. Ref.3.13.)

BACA, A. 2006. Innovative diagnostic methods in elite sport. *International Journal of Performance Analysis in sport*, 6(2):148-156, November.

BATHGATE, A., BEST, J.P., CRAIG, G. & JAMIESON, M. 2002. A prospective study of injuries to elite Australian rugby union players. *British Journal of Sports Medicine*, 36(4):265-269, August.

BISCOMBE, T. & DREWETT, P. 1998. Rugby: steps to success. 3<sup>rd</sup> ed. Champaign : Human Kinetic Publishers. 159 p.

BOTHA, Z. 2005. Science and sport: Athletes and sports teams turn to technology to gain winning edge. *Engineering News*: 16, 11 Feb.

COETZEE, B. & VAN DEN BERG, P. H. 2007. Game analysis of the eight top ranked tertiary institution rugby teams in South Africa. *Journal of Human Movement Studies*, 52(1):49-63.

DUTHIE, G., PYNE, D. & HOOPER, S. 2003. Applied physiology and game analysis of rugby union. *Journal of Sport Medicine*, 33(13):973-991.

EAVES, S. & HUGHES, M. 2003. Patterns of play of international rugby union teams before and after the introduction of professional status. *International Journal of Performance Analysis*, 3(2):103-111, December.

EAVES, S.J., HUGHES, M.D. & LAMB, K. L. 2005. The consequences of the introduction of playing status on game action variables in international northern hemisphere rugby union football. *International Journal of Performance Analysis in Sport*, 5(2):58-86, November.

GLOGG, M. 2000. Kicking: the bastard art. (In Larder, P. 3<sup>rd</sup> ed. Principles and practice. London : National Coaching Development. p. 1-2.)

GREENWOOD, J. 2004. Think rugby: A guide to purposeful team play. 4<sup>th</sup> ed. London: Adam and Charles Black. 232 p.

GREGON, G. 2006. Discipline, the key against Kiwis. [Web:] [http://www.planet-rugby.com/news/story\\_52711.shtml](http://www.planet-rugby.com/news/story_52711.shtml) [Date of use: 7 Aug. 2006].

GROENEWALD, B. & SARFU TECHNICAL COMMITTEE. 2001. Advanced rugby techniques and tactics. Newlands : Saldanha. 308 p.

HANDCOCK, P. 1993. Physical preparation for rugby union. *Journal of Physical Education*, New Zealand, 26(3):7-9.

HUGHES, M. 1988. Computerized notation analysis in field games. *Ergonomics*, 31(11):1585-1592.

HUGHES, M. & WILLIAMS, D. 1988. The development and application of a computerized rugby union notation system. *Journal of Sport Science*, 6:254-255.

HUGHES, M. & BARTLETT, R.M. 2002. The use of performance indicators in performance analysis. *Journal of Sport Sciences*, 20:739-754.

HUGHES, M. & BARTLETT, R.M. 2007. Notational Analysis of Sport. (In Hughes, M & Franks, I.M., eds. The use of performance indicators in performance analysis. London and New York : Routledge. p. 166-188.)

HUGHES, M. & FRANKS, I.M. 2007. Notational Analysis of Sport. (In Hughes, M & Franks, I.M., eds. Notational Analysis – a review of the literature. London and New York : Routledge. p. 59-106.)

HUTCHINSON, A. 2005. Coaching the set piece. Rugby coaching notes. [Web:] <http://www.eurekastreet.com> [Date of access: 10 May 2006].

INTERNATIONAL RUGBY BOARD. 2006. SA Rugby Rulebook 2006. Newlands : Phillips. 142p.



INTERNATIONAL RUGBY BOARD. 2008. Remember 2004? The genesis of ELV programme. [Web:] <http://www.irb.com/newsmedia/features/newsid=2023005.html> [Date of access: 24 June 2008].

JAMES, N., MELLALIEU, S., JONES, D. & NICHOLAS, M. P. 2005. The development of position-specific performance indicators in professional rugby union. *Journal of Sports Sciences*, 23(1):63-72.

JONES, N.M.P., MELLALIEU, S.D. & JAMES, N. 2004. Team performance indicators as a function of winning and losing in rugby union. *International Journal of Performance Analysis in Sport*, 4(1):61-71, August.

LAIRD, P. & LORIMER, R. 2004. An examination of try scoring in rugby union: a review of international rugby statistics. *International Journal of Performance Analysis in Sport*, 4(1):72-80, August.

LAMES, M. & McGARRY, T. 2007. On the search for reliable performance indicators in game sports. *International Journal of Performance Analysis in Sport*, 7(1):62-78, January.

LUGER, D. & POOK, P. 2004. Complete conditioning for rugby. London : Human Kinetic Publishers. 184 p.

MALLET, N. 2006. Data drive. *SA Rugby*, 111:122, Apr.

MELLALIEU, S., TREWARTHA, G. & STOKES, K. 2008. Science and rugby union. *Journal of Sport Sciences*, 26(8):791-794, June.

NEWELL, K. 2002. High tech u. *Coach and Athletic Director*, 72(2):1-5, September.

O'DONOGHUE, P. 2006. The use of feedback videos in sport. *International Journal of Performance Analysis in Sport*, 6(2):1-14, November.

O'SHEA, B.P. 2002. Level 1 coaching manual. 3<sup>rd</sup> ed. Australia : Ausport. 102 p.

PARSONS, A. & HUGHES, M. 2001. Performance profiles of male rugby union players. (In Hughes, M. & Franks, I., eds. Proceedings of the computer science and sport III and performance analysis of sport V conference, UWIC, Cardiff, Wales. p. 129-136.)

- PHYTHIAN, T. 1995. Maximizing the chance of converting a try. *Australian Senior Mathematics Journal*, 16(2):51-52.
- POOL, G. 2006. Rugby: Verstaan die spel. Stellenbosch : Rapid Access. 226 p.
- PROUDFOOT, M. 2006. Verbal communication. Potchefstroom.
- REED, D. & O'DONOGHUE, P. 2005. Development and application of computer-based prediction methods. *International Journal of Performance Analysis in Sport*, 5(3):12-28, December.
- REES, D. 1996. Let's go to the video! *Coach & Athletic Director*, 65(6):26-27, January.
- RUGBY FOOTBALL UNION. 2004. Rugby football union handbook online 2003 - 2004. [Web:]  
<http://www.rfu.com/microsite/handbooks/index.cfm?fuseaction=handbook.home>  
[Date of access 22 May. 2006].
- RUTHERFORD, D. 1983. International rugby for players, coaches and spectators. London: Heinemann. 143 p.
- SOMMERVILLE, D. 1997. The encyclopaedia of rugby union. 10<sup>th</sup> ed. Great Britain : Aurum. 192 p.
- VAN ROOYEN, M.K., LAMBERT, M.I. & NOAKES, T.D. 2006. A retrospective analysis of the IRB statistics and video analysis of match play to explain the performance of four teams in the 2003 rugby world cup, *International Journal of Performance Analysis in Sport*, 6(1):57-72, June.
- WHITE, J. 2005. Action replay. *Fifteen* : 104-108, February.

## CHAPTER 2



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# VIDEO ANALYSIS IN RUGBY UNION

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1. INTRODUCTION
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## 1. INTRODUCTION

Change towards the improvement of sport performance can only occur with the player experiencing some form of feedback (Coker *et al.*, 2006:29). This feedback may be intrinsic or extrinsic. Intrinsic feedback can be defined as information that is gained by the athlete's own sensory system (Coker *et al.*, 2006:29). Extrinsic feedback, on the other hand, can be divided into knowledge of performance or knowledge of results, where knowledge of performance focuses on the patterns of actions that are needed to complete a skill while knowledge of results concentrates on information regarding the results of an action (Franks, 2007:59). Traditionally, these extrinsic forms of feedback were given by the coaches and the accuracy of the feedback depended on the efficiency of the relevant coach to identify the tactical and technical flaws of the relevant players. When introduced in the sporting world, this method was regarded as being very subjective and the potential of videos and computer software programmes were immediately recognised as a more reliable method for analysing sport (Rees, 1996:26 and Newell, 2004:54). Baca (2006:148) also encouraged the use of modern information and communication technologies due to its contribution to the effectiveness towards the improvement of sport performance.

The introduction of video analysis can be regarded as the most common form of communication technology currently used to assist with the improvement of performance in sport.

## **2. THE USE OF VIDEO ANALYSIS IN RUGBY UNION**

Video analysis can be used for either notational or biomechanical analysis in sport (Bartlett, 2001:123). Even though the systematic techniques of observation are used by both forms of analysis to provide feedback to the coaches and athletes, there are marked differences. Computer notational analysis (also referred to as CNA) focuses on gross movement patterns in team sports, investigating strategy and tactics by means of technical and tactical performance indicators. In contrast to CNA, biomechanical analysts prefer to focus on the fine details of the movement technique of individual athletes/players (Bartlett, 2001:123).

Despite biomechanical analysts having focussed mainly on athletes in individual sports, some studies were also done on the biomechanical analysis of rugby union. From the literature it seems that biomechanical research focused mainly on three major topics in rugby union. Firstly, studies were done on the forces present during scrums to determine the most effective scrum techniques and the possible dangers related to the incidence of injuries. These studies were all conducted where a force plate was mounted on the scrum machine (Milburn, 1990:47; Milburn 1993:168 & Gianotti *et al.*, 2008:427). The second group of studies concentrated on the occurrence/incidence of injuries and its prevention, especially with regard to the contact events during a match (Wilson *et al.*, 1999:153; McIntosh *et al.*, 2003:63 & Patton *et al.*, 2006:185). The third group of biomechanical research focused on the technical application of different skills in order to improve performance, such as the studies done by Phythian (1995:51) Griffiths and Hughes (2005:102), Bezodis *et al.* (2007:171), Young (2007:185), Trewartha *et al.* (2008:845) and Pavely *et al.* (2009:136). It is important to note that the present study only refers to the importance and place of biomechanics in rugby union research, but does not elaborate on it, since it does not form part of the scope of the study.

As previously mentioned, one can make use of notational analysis in order to analyse sport, and especially team sports. Two basic forms of notational analyses exist. The one is done by hand and the other by means of computers (software packages).

Hand notation is considered the cheapest method and very accessible, due to the fact that only pen and paper are required. However, the biggest disadvantage of hand notational analysis was highlighted by Hughes and Franks (2007:80) who explained the time consuming nature of the process. This might be the main reason why the only noteworthy research available on hand notation, was a study done by Eaves *et al.* (2008b:44). They investigated the effect of rule changes in rugby league and found that the rules implemented in both 1993 and 1996 significantly increased the time it took players to clear a ruck. CNA, on the other hand, has been used extensively in three specific research fields, namely: 1) Time-motion analysis; 2) The use of performance indicators to determine success; and 3) The use of performance indicators to investigate how the game has evolved due to its professional status and regular law changes. However, Bartlett (2001:123) did warn that all researchers should be wary of the reliability and danger issues related to these types of research.

### **3. RELIABILITY ISSUES OF CNA**

Handcock (1993:7) identified how difficult it is to analyse team sports. Since then, several reliability issues related to CNA have been investigated. Hughes *et al.* (2001:20) did a study to answer questions on the reliability of the performance profile of teams. They found that at least seven matches had to be analysed before the results could be considered a normative representation of the specific population. In a time-motion analysis study done by Duthie *et al.* (2003:973) they investigated the reliability of the analysis done on stationary, walking, jogging, striding, sprinting and static activities. In the study, the same matches were analysed twice, a month apart. Moderate to poor reliability was found for the total time spent on each activity and good to poor reliability was found when the frequency of each activity was investigated. They concluded that time-motion analysis could be considered as a good method to evaluate performances in sport as long as the time that elapsed between the matches as well as the reliability of the observations were taken into consideration. Roberts *et al.* (2006:388) and Dogramaci and Watsford (2006:73) compared two different methods of time-motion analysis to determine which one is the most reliable. Roberts *et al.* (2006:388) compared the reliability factor between the traditional notational system and a digitizing method of analysis. With the digitizing method several cameras were placed around the field, each one concentrating on a specific area of the field. The study found the digitizing method to be more reliable, but because of the costs involving this specific method, most

studies dealing with video analysis still use the traditional notational method of analysis with the camera/s following one specific player or players in a game. Dogramaci and Watsford (2006:73), on the other hand, compared the results of the different activities between match-play time and clock-play time in team sports. They found that match-play time could be considered more accurate than clock-play time and that overall distance covered was significantly more in match-play time than that of clock-play time.

Lames and McGarry (2006:62) investigated the reliability of studies that used performance indicators to predict performance. They found that such performance indicators could not be considered reliable due to the huge amount of interaction of activities that affect them. O'Donoghue (2007:46) did a similar study, and despite sharing the concerns of the previous researchers, believed that with certain recommendations a fairly reliable outcome from CNA could be possible. These recommendations were as follows:

- a) Identify the performance indicators of interest as precisely as possible;
- b) Indicate the values of each performance indicator;
- c) Use reliable statistics;
- d) Train the operators;
- e) Make use of inter and intra-operator tests;
- f) If the level of reliability is poor, one should try to simplify the selected performance indicators.

The most recent study, in which CNA was used to determine reliability of sport techniques, was done by Williams *et al.* (2007:85) who compared the reliability of real-time and lapsed-time analysis. They found that lapsed-time analysis could be considered more reliable than real-time analysis and argued that the ability of lapsed-time analysts to examine the same footage several times should be considered the biggest advantage. Despite this argument, Van der Vliet (2008:9) still considered real-time analysis in sport as the key to success in sport performance.

Several other researchers such as Hughes and Williams (1988:255), Rees (1996:26), Newell (2004:54), Pope (2004:38), Botha (2005:16), Reed and O'Donoghue

(2005:12) and Baca, (2006:148) emphasized the importance of video analysis in sport and added objectivity as the biggest advantage. Mallett (2006:122), the international coach of the Italian rugby team since 2006, and White (2005:106), coach of the Rugby World Cup winning team, the South African Springboks in 2007, concurred with the previous studies and believe that performance in a game such as rugby could directly be improved by making use of video analysis. Reed and O'Donoghue (2005:12) also investigated the development and application of CNA and determined that the ability of computer systems to handle vast amounts of data simultaneously would be more reliable than any possible human attempt. The aforementioned literature does therefore indicate that the reliability of CNA could be considered acceptable when specific guidelines are followed. The possibilities of CNA as research tool is therefore palpable when the advantages there-of are taken into consideration.

#### **4. THE ROLE OF CNA IN RUGBY UNION**

It was indicated in the previous paragraph that CNA plays an important role in the video analysis of rugby union matches. Based on this assumption, a total of thirty eight (38) relevant articles will be used in the rest of the discussion. The summary of the articles will be divided into three groups with regard to their respective outcomes in mind. Each group will include a table that lists the title, authors, year of publication, the population and either activities or performance indicators, followed by a discussion on the corresponding findings by the selection of articles in the group.

##### **4.1 Time-motion analysis**

Time-motion analysis is used when the duration, type and frequency of the different activities are analysed in order to determine the work-to-rest (work:rest) ratio's of the corresponding team. The information gathered from the analysis is then used to give feedback to the coach and players and to assist in the construction of sport-specific conditioning programmes. Table 1 presents the studies that were done on time-motion analysis followed by a discussion on the findings of the relevant literature.



**Table 1: The use of time-motion analysis to determine various match-play activities of rugby union**

Title	Authors	Year	Population	Match-play activities
Analysis of the physical demands of international rugby union.	McLean, D.A.	1992	5 Games 1989-1990 five Nations rugby tests	Standing Walking Run with elongated stride Jogging Sprint Non-run intense activity
Applied physiology of rugby league.	Brewer, J & Davis, J	1995	2 x Elite rugby matches 4 x 13 Players 4 playing positions	Standing Walking forward & backward Cruise forward & backward Jog forward & backward Sprint Scrum Play the ball Sprint /Tackle Sprint/Step/Tackle Sprint/Pass Sprint/Step/Pass Sprint to Tackle Jog to Tackle Stand and Tackle Jog and Pass Stand and pass
Heart rate, blood lactate and kinematic data of elite colts (under 19) rugby union players during competition.	Deutsch, M.U.; Maw, G.J.; Jenkins, D. & Reaburn, P.	1998	24 players from U/19 Brisbane rugby competition 4 sets of playing positions	Utility Cruising Walking Sprinting Jogging
Activity analysis of English premiership rugby football union refereeing.	Martin, J.; Smith, N.C.; Tolfrey, K. & Jones, A.M.	2001	9 elite referees	Standing Walking Jogging Sprinting Running with elongated stride Walking backward
Time-motion analysis of elite touch players.	O'Connor	2002	30 male +20 female Australian squad 2 matches @ gender	Stationary Walking Jogging forward Running Backward Sideways Sprint Recovery
Time-motion analysis of 2001 and 2002 Super 14 tournament.	Duthie, G.M.; Pyne, D.B. & Hooper, S.L.	2005	16 Games 3 Australian based rugby teams 4 sets of playing positions	Standing Striding Walking Sprinting Jogging Static exertion Tackling Jumping Lifting
Characteristics of effective ball carries in Super 14 rugby.	Sayers, M.G.L. & Washington-King, J.	2005	48 Super 14 rugby matches 90 players 4 sets of playing positions	Stationary Cruising Walking Sprinting Jogging
Sprint patterns in rugby union players during competition.	Duthie, G.M.; Pyne, D.B.; Marsh, D.J. & Hooper, S.L.	2006	17 rugby players	Standing Walking Jogging Striding
Motion analyses of adolescent rugby union players: Linking training and game demands among under 16 players.	Hartwig, T., Naughton, G. & Searl, J.	2006	Training: 14.5 hours @ 22 players Game: 11 hours @ 12 players	Stationary, Walk, Jog, Stride, Sprint, Maxim sprinting. Exercise load.
Time-motion analysis of professional rugby union players during match-	Deutsch, M.U.; Kearney, G.A.	2007	8 Super 12 rugby games 29 Otago players	Jumping Cruising Scrummaging Utility Sprinting Jogging

play.	& Rehrer, N.J.			
Defining the volume and intensity of sport participation in adolescent rugby union players.	Hartwig, T., Naughton, G. & Searl, J.	2008	75 players Motion analysis 2@week 14-18 years	Elite group 10 weeks Representatives 6 weeks School boys 12 weeks
The physical demands of elite English rugby union.	Roberts, S. P., Trewartha, G., Higgitt, R.J., El-ABD, J & Stokes, K.A.	2008	Tight forwards (n=8), Loose forwards (n=6), Inside backs (n= 7), Outside backs (n=8)	Standing, walking, jogging, static exertion, low intensity running and high intensity running.

From the above-mentioned research indicated in Table 1 it is necessary to elaborate more on the findings of the relevant research as to how it related to the match-play activities and the flow of the games. McLean (1992:285) found that the work:rest ratio between the teams differed from 1:1 to 1:1.9. A scrum, line-out, ruck and maul (all considered high-intensity activities) occurred every 33 seconds on average and the ball was in play for 29 of the 80 minutes of the match. Brewer and Davis (1995:129) determined that individual players covered a total distance ranging from 5 km to 8 km. Hartwig *et al.* (2008:94) used time-motion analysis in their study to determine the work rate (by determining the distance the players covered during practice) of three different groups of adolescent rugby players. Their findings indicated that the group with the most other physical activity responsibilities covered significantly less distance during training sessions. They concluded that rugby players could increase their work rate if they would decrease other physical orientated activities (Hartwig *et al.*, 2008:94). Hartwig *et al.* (2006:16) also did a study on adolescent rugby players to investigate the work done during training sessions compared with work required during match-play. They found that the players had to travel significantly longer distances during matches than was the case during practice sessions. Deutch *et al.* (1998:561) found that outside backs covered a significantly longer total distance (~5 750 m) than any of the forwards (~4 400 m). They also found that forwards are more involved in high-intensity static activities than backline players. Outside backs cover a significantly longer distance *sprinting* than inside backs and the backline players cover a significantly longer distance *walking and sprinting* than the forwards. A study done by Duthie *et al.* (2005:523) correlates with the previous findings and determined that forwards spend more time with static exertion than the backs. The backline players *sprint* more often and for more extended periods than the forwards, but also enjoy longer *rest periods*. This also correlates very well with the study done by Roberts *et al.* (2008:825) who also determined that the forwards spent more time on static exertion activities and that the backs covered longer distances and spent more time running at high intensities. Another interesting fact found was that all the players

travelled longer distances in the first 10 minutes than thereafter. Martin *et al.* (2001:1069), who investigated the time movement of rugby union referees, found that the total distance covered during a match was approximately 8 581 m. There was a total of 672 transitions of activities throughout the match. The referees spent 76% of the time during a match either standing still or walking. O'Connor (2002:126), on the other hand, investigated touch rugby players and found that both male and female touch players spent 66.5% to 69.6% of their time predominantly either running or jogging. Sayers and Washington-King (2005:92) used time-motion analysis in a different way. They determined that successful teams received passes at a higher speed and continued that specific speed with more ease than the less successful teams. They also found that players tend to more than often receive a ball at a cruising speed and *run* with moderate intensity. Another study undertaken by Duthie *et al.* (2006:208) determined that forwards reached a *sprint* speed of above 90% maximum 5 times during a match on average whilst backline players achieved the same –intensity of play 9 times per match on average. This higher frequency of *sprinting* of the backs was seen by the researchers as a definite indication to Sport Scientists to differentiate when they do speed training with a team. Deutch *et al.* (2007:461) used the activities listed in the table to look into the correlation between those activities and the different positions. A definite correlation was found between the players' positions and the activities that specific position was most involved in. From the above-mentioned literature review it can be concluded that rugby can be regarded as a sport with intermittent high- intensity play for the different positions of play and that players should be conditioned accordingly.

The literature review also revealed that time-motion analysis is not the only aspect that is investigated with CNA. As previously mentioned, CNA, in conjunction with performance indicators, is used to determine changes in the game as well as to predict the success in the outcome of the game.

#### **4.2 The effect of performance indicators on match-play success and changes in rugby union matches**

Performance indicators can be defined as “a selection or combination of action variables that aims at defining some or all aspects of a performance” – specifically applicable to rugby matches (Hughes & Bartlett, 2002:739). They can be classified into scoring indicators and indicators related to the quality of the performance during play (Hughes & Bartlett, 2007:169). Performance indicators can also be used to compile performance profiles for a specific sport code (Hughes *et al.*, 2001:4).

Hughes and Bartlett (2002:739) and O'Donoghue (2008:145) suggested that the performance indicators used in any study should be chosen with care and that ratio's rather than frequency should be used in this regard.

**Table 2: The effect of performance indicators on the match-play success and changes in rugby union**

Title	Authors	Year	Population	Performance indicators (amount)
Developmental and application of a computerized rugby union notational system.	Hughes, M. & Williams, D.	1988	5 matches France, Scotland, Ireland, England & Wales	Passes, ran the ball & possessions
Computerized notation analysis of rugby union to examine the effects of law changes upon the patterns of play by international teams.	Hughes, M. & Clarke, A.	1994	18 matches	Possessions Rucks and Mauls Tries scored Rucks by 6 men Mauls by 7 men
Team performance indicators as a function of winning and losing in rugby union.	Jones, N.M.P., Mellalieu, S.D. & James, N.	2002	20 Matches	% successful scrums, % successful line-outs, % successful rucks, % successful mauls, % successful tackles, % successful offloads, % successful turnovers won, % successful line breaks, successful place kicks, errors made in three zones, tries scored, time in possession & errors made
Creating and monitoring meaningful individual ratings	Bracewell, P.J., Meyer, D. & Ganesh, S.	2003	130 actions	Tackles, turnovers, meters gained, kicks & beaten defence
Patterns of play of international rugby union teams before and after the introduction of professional status.	Eaves, S.J. & Hughes, M.	2003	16 matches from the 6 Nations tournaments	Rucks, time of rucks, activities & time of activities
Quantitative and qualitative evaluation of scoring opportunities by South Africa in World Cup Rugby 2003.	Boddington, M. & Lambert, M.	2004	5 matches in 2003 World Cup	Position on field where movement started before scoring points, Time when points were scored
The consequences of the introduction of professional playing status on game action variables in International Northern Hemisphere rugby union football.	Eaves, S.J., Hughes, M. & Lamb, K.L.	2005	24 Five nation matches	Line-outs, kicks , passes, offloads, rucks, mauls, scrums, Phase activities and Set pieces
The development of position-specific performance indicators in professional rugby union.	James, N., Mellalieu, S.D. & Jones, N.M.P.	2005	22 matches European rugby	% successful tackles % successful ball carries, % successful passes, turnovers won,

				tries scored & penalties
The effect of rule changes on match and ball in play time in rugby union.	Williams, J., Hughes, M. & O'Donoghue, P.	2005	469 Matches	Match time & Ball in time play
Re-Examination of importance of kick-off and 50m restart kick in play in rugby union.	Nakagawa, A.	2006	20 International matches	Kick offs and restarts
A comparison of performance indicators between the four South African teams and the winners of the 2005 Super 12 Rugby competition. What separates top from bottom?	Prim, S., Van Rooyen, M. & Lambert, M.	2006	9 Super 12 matches	Defensive recycle time, Offensive recycle time, % tackles made, offloads, opposition offloads, turnovers, turnovers conceded, points difference and tries scored.
Movement time as a predictor of success in the 2003 rugby world cup tournament.	Van Rooyen, M.K. & Noakes, T.D.	2006	25 matches 4 Countries	Time ball in possession of team
A retrospective analysis of the IRB statistics and video analysis of match play to explain the performance of four teams in the 2003 Rugby world cup.	Van Rooyen, M.K., Lambert, M.I. & Noakes, T.D.	2006	26 Matches at world Cup	Tries scored, Conversions scored, Penalties scored, drop goals scored, Scrums for, Possession for and territory for
Changes in player characteristics and match activities in Bledisloe Cup rugby union from 1972 to 2004.	Quarrie, Q.L. & Hopkins, W.G.	2007	26 matches	Scrums, rucks, mauls, tackles, line-outs, passes, kicks, scores, penalties awarded, ball in play time and match time
Game analysis of the eight top ranked tertiary institution rugby teams in South Africa.	Coetzee, B. & van den berg, P.H.	2007	14 games University teams	Time in play, % good line-outs, & good scrums, & good tackles, Kick offs and contact with ground
Scoring profiles and defence performance analysis in rugby union.	Sasaki, K., Furukawa, T., Murakami, J., Shimozono, H., Nagamatsu, M., Miyao, M., Yamamoto, T., Watanabe, I., Yasugahira, ah., Saito, T., Ueno, Y., Katsuta, T. & Kono, I.	2007	198 matches of the top Japanese league	Tries, Start area for try, phases for a try, time spend in each phase
Ruck frequency as a predictor of success in the 2007 rugby world cup tournament.	Van Rooyen, M.K., Diedrick, E. & Noaks, T.	2010	48 matches of the 2007 rugby world cup	Rucks, points scored

Based on the literature cited in Table 2, the following related findings can be reflected. Hughes and Williams (1988: 255) found no significant differences when they compared the frequency of performance indicators between the Five Nations rugby teams taking part in the 1986/1987 seasons. However, when they paired the England and Wales teams and compared their data of those of the other nations combined, a significant difference was found for the number of passes made during a match. Their conclusion was that the five nation teams made use of different game plans to play different types of rugby. Hughes and Clarke (1994:180) investigated how the performance indicators were affected by the law changes implemented in 1993. They found that the frequency of rucks formed by six men, the frequency rucks formed by seven men and the number of passes made throughout a match rose significantly. The other performance indicators did not show any significant changes due to the related changes in the laws of the game. In using certain performance indicators, Jones *et al.* (2002:61) found that only tries scored and percentage successful line-outs discriminated significantly between successful and less-successful teams. Bracewell *et al.* (2003:19) analysed the performance indicators to determine specific ratings for each player according to their involvement in the identified performance indicators. They found this method of analysis to be reliable and a possible option for coaches to use with player selections. Professionalism also had an impact on the performance indicators in rugby. Eaves and Hughes (2003:103) determined that rucks, time of rucks and the frequency of activities increased after the introduction of professionalism; hence a more compelling demand on the physiological preparation of the players since the sport turned professional. Another study done on the effect the professional era had on the performance indicators, found that significantly less line-outs, kicks, mauls, set pieces and phase positions took place after rugby turned professional. Significantly more rucks and passes also occurred after the sport turned professional (Eaves *et al.*, 2005:58). Boddington and Lambert (2004:32) found that during the 2003 Rugby World Cup Tournament, South Africa needed more time in possession in the first half than in the second half to score points. South Africa also scored most of their points from line-outs on the left side of the field more or less on the half-way line. James *et al.* (2005:63) investigated positional differences with regards to performance indicators. They found significant differences between all the positions and their involvement in the performance indicators listed in the table. They also found significant differences when they looked into a number of different players in a specific position with regard to the performance

indicators. The researchers therefore suggested that due to individuality, a larger sample size of players should be used, than was the case for this specific study.

Williams *et al.* (2005:1) found that both match-time and ball-time-in-play increased significantly since the law changes that were introduced by the International Rugby Board in 1999. Nakagawa (2006:273) determined that despite all the law changes and professionalism which occurred between 1994 and 2005, the relevance of the kick-off as important performance indicator remained the same. In a study done by Prim *et al.* (2006:132) performance indicators of all the South African teams were compared with those of the New Zealand Crusaders team (tournament champions). Of all the performance indicators listed, only number of tries scored differed significantly between the groups. Van Rooyen and Noakes (2006:31) found that all movements (team has ball in hand) during the 2003 Rugby World Cup, observed by the research team were less than 20 seconds and that a team could greatly enhance their chance of scoring points if they could extend a movement to longer than 80 seconds. In this case the time a team managed to keep the ball in possession during attack was considered a performance indicator. Van Rooyen *et al.* (2006:57) did a study where the performance indicators of the top three rugby nations during the 2003 Rugby World Cup were compared with that of South Africa. However, no significant differences were found between the performance indicators of the various teams. Quarrie and Hopkins (2007:895) examined the changes in performance indicators during the Bledisloe Cup from 1972 up to 2004. They found results similar to those of Eaves and Hughes (2003:103) and Eaves *et al.* (2005:58) with an increase in the number of rucks and passes made. Quarrie and Hopkins (2007:895) also found an increase in tackles, tries and ball-in-play time, with a decrease in the number of line-outs, mauls and kicks. Coetzee and Van den Berg (2007:49) investigated the direct effect of performance indicators on team performance and found that the percentage good defence, line-outs, scrums and kick-offs contributed most towards the ranking of the respective teams. This correlates with findings of Nakagawa (2006:273), who also emphasized the importance of the kick-offs. Sasaki *et al.* (2007:46) determined that despite the performance indicators listed during the game, only the time spent on an activity before tries were scored, differentiated significantly. Tries scored from set pieces took longer than those from turn-over ball, even though the set pieces were closer to the try line. The most recent study using performance indicators to analyse rugby union matches was done by Van Rooyen *et al.* (2010:33). They found a correlation between the percentage rucks formed and the

points difference between the two teams. This meant that the more rucks a team could form, the better their chances of scoring points. From the above-mentioned literature review it can be concluded that rugby union consist of various different performance indicators which make the analysis of the sport far more difficult than most other types of sport. It has also indicated that performance indicators can be used to determine both performance and the effect certain types of change have on the game.

### 4.3 The use of CNA to investigate other role players relevant to rugby union

O'Donoghue (2006:12) investigated the different applications of computer analysis that are present in sport. He found that although most research focused on the fields of time-motion analysis and the identification of performance indicators, the officials, coaches and all other facets relevant to rugby union could benefit from CNA research. The following section will report on and discuss other CNA-relevant research.

**Table 3: The use of other CNA-relevant research related to rugby union.**

Title	Authors	Publication year	Population	Additional
The accuracy, agreement and coherence of decision-making in rugby union officials.	Mascarenhas, D.R.D., Collins, D. & Mortimer, P.	2002	45 male referees and 13 referee coaches and 47 touch judges and 27 referee assessors	Dissicion making
Pre-performance routine consistency: temporal analysis of goal kicking in the rugby World Cup	Jackson, R.C.	2003	572 place kick during 1999 rugby world cup	Concentration time, situational pressure & physical preparation times
A comparative analysis of professional rugby league football playing patttns between Australia and the United Kingdom	Eaves, S. & Broad, G.	2007	12 Rugby League Matches from both the English super league and the Australian national rugby league	Zone on field where most time is spend, Types of tackles used.
Contact events in rugby union and their	Fuller, C.W., Brooks, J.H.M., Cancea, R.J., Hall, J.H. & Kemp, S.P.T.	2007	50 matches English premier rugby clubs	Tackle, Ruck, Maul, Collision and Scrum



propensity to cause injury.				
Assessing the impact of the season and rule changes on specific match and tactical variables in professional rugby league football in the United Kingdom	Eaves, S.J., Hughes, M.D. & Lamb, K.L.	2008a	48 matches	Passes, Tackles & Kicking
Playing demands of sevens rugby during the 2005 rugby world cup sevens tournament	Van Rooyen, M., Lombard, C. & Noaks, T.D.	2008a	47 matches of 2005 World Cup	Time ball in possession, movements per match, scoring movements & turnover movements
Tackle injuries in professional rugby union	Quarrie, K.L.	2008	434 matches	Height and direction of tackle, speed of tackler and ball carrier
The quantification of contacts with impact during professional rugby matches.	Van Rooyen, M., Rock, K., Prim, S. & Lambert, M.	2008b	7 Matches in professional provincial competition	Frequency contact situation for each player.
Impact of the International Rugby Board's experimental law variations on the incidence and nature of match injuries in southern hemisphere professional rugby union	Fuller, C.W., Raftery, M., Readhead, C., Targett, S.G.R. & Molloy, M.G.	2009	27 Teams in 2008 Super 14 and Vodacom matches	Injury incidence, severity, location, type and cause = New Laws

Based on the research reflected in Table 3, several CNA-related issues were identified and need to be highlighted. Mascarenhas (2002:253) did a study in which the ability of referees to make the correct decision based on a video clip was evaluated. All the participants watched a real-time video clip and had to explain how they would act on what they saw as if it was a live match. The results indicated a very low accuracy count. Jackson (2003:803) examined 572 place kicks during the 1999 Rugby World Cup. Concentration and physical preparation time were analysed from

video recordings. Players involved in matches where the scores of the two teams were close used more time during the concentration phase than in the other matches. However, there were no significant differences between the physical preparation time of unsuccessful and successful teams. Eaves *et al.* (2008a:104) did a study on rugby league similar to the one they did in 2005 on rugby union. Both studies indicated that there were significantly less kicks in open play. Their latest study found that since the law changes, significantly less mistakes were made on defence. However, it did not seem that the rule changes had any effect on the other performance indicators present in rugby league. Eaves and Broad (2007:54) also did a study with regard to rugby league and they found Australian teams to play a more expansive game than their Northern Hemisphere opponents. This assumption was made because whilst the United Kingdom team spent most of their time in the middle zone, the Australian team played their rugby mostly in either the attack or defensive zones. Another interesting finding was that both countries used the turtle tackle significantly more than any other form of tackle. In a study on seven-a-side rugby, Van Rooyen *et al.* (2008a:114) found that the ball was in play for an average of seven minutes and eighteen seconds. They also concluded that a team needed to maintain ball possession for at least sixty seconds to be successful. This finding is similar to that of Van Rooyen and Noakes (2006:31) who determined that rugby union teams need to maintain ball possession for sixty to eighty seconds in order to be successful.

Video analysis was also used in the investigation of match-play injuries and factors related to such injuries. Quarrie and Hopkins (2008:1705) used video recordings of 14 249 tackles to determine the type of tackle as well as the outcome of the tackle in relation to match-play injuries. The head was the most injured site and tacklers were more injury-prone to tackles below the hips with the ball carriers more treated for injuries resulting from tackles that were higher than waist height. In total, 1 348 injuries occurred that could be treated on the field and 211 injuries had required the injured player to be replaced.

Video recordings/analyses were also used to determine the number of contact situations in rugby matches (Van Rooyen *et al.*, 2008b:113). The forwards were involved in 257 contact situations per match with the backs only in 125. The most impact situations were when the players made contact with the ground (108) and the least when the players made contact from line-outs (2). Van Rooyen *et al.*

(2008b:113) concluded that these results could help players to prepare better for the contact situations during matches. Fuller *et al.* (2007:862) used notational analysis on performance indicators to determine the interaction between match-play contact events and injuries. Tackles and rucks were the most common contact-orientated events. Although most injuries were caused by tackles, the scrums and collisions were regarded as the biggest threat. Fuller *et al.* (2009:232) investigated the effect of the International Rugby Board's decision to enforce the experimental law variations (ELVs) in 2008 on the occurrence of injuries. They found no significant differences between the injury occurrence before and after the introduction of the ELVs.

In summary the above-mentioned literature clearly indicates the advantages of video analysis with regards to developing, and understanding the game of rugby union.

## 5. REFERENCES

BACA, A. 2006. Innovative diagnostic methods in elite sport. *International Journal of Performance Analysis in Sport*, 6(2):148-156, November.

BARTLETT, R. 2001. Performance analysis: can bringing together biomechanics and notational analysis benefit coaches? *International Journal of Performance Analysis in Sport*, 1(1):122-126, July.

BEZODIS, N., TREWARTHA, G., WILSON, C. & IRWIN, G. 2007. Contributions of the non-kicking-side arm to rugby place-kicking technique. *Sports Biomechanics*, 6(2):171-186, May.

BODDINGTON, M. & LAMBERT, M. 2004. Quantitative and qualitative evaluation of scoring opportunities by South Africa in World Cup rugby 2003. *International Journal of Performance Analysis in Sport*, 4(2):32-25, December.

BOTHA, Z. 2005. Science and sport: Athletes and sports teams turn to technology to gain winning edge. *Engineering News* : 16, 11 Feb.

BRACEWELL, P.J., MEYER, D. & GANESH, D. 2003. Creating and monitoring meaningful individual rugby ratings. *Research letters in the Information and Mathematical Sciences*, 4:19-21.

BREWER, J. & DAVIES, J. 1995. Applied physiology of rugby league. *Sports Medicine*, 20(3):129-135.

COKER, C.A., FISCHMAN, M.G. & OXENDINE, J.B. 2006. (In Williams, J.M. ed. Applied sport psychology. New York : McGraw-Hill. p.17-39.)

COETZEE, B. & VAN DEN BERG, P. H. 2007. Game analysis of the eight top ranked tertiary institution rugby teams in South Africa. *Journal of Human Movement Studies*, 52(1):49-63.

DEUTSCH, M.U., MAW, G.J., JENKINS, D. & REABURN, P. 1998. Heart rate, blood lactate and kinematic data of elite colts (under-19) rugby union players during competition. *Journal of Sports Sciences*, 16(6):561-570.

DEUTSCH, M.U., KEARNEY, G.A. & REHRER, N.J. 2007. Time-motion analysis of professional rugby union players during match-play. *Journal of Sports Sciences*, 25(4):461-472, February.

DOGRAMACI, S.N. & WATSFORD, M.L. 2006. A comparison of two methods for time-motion analysis in team sports. *International Journal of Performance Analysis in Sport*, 6(1):73-83, June.

DUTHIE, G., PYNE, D. & HOOPER, S. 2003. Applied physiology and game analysis of rugby union. *Sports Medicine*, 33(13):973-991.

DUTHIE, G., PYNE, D. & HOOPER, S. 2005. Time motion analysis of 2001 and 2002 super 12 rugby. *Journal of Sports Sciences*, 23(5):523-530.

DUTHIE, G., PYNE, D., MARSH, D.J. & HOOPER, S. 2006. Sprint patterns in rugby union players during competition. *Journal of Strength and Conditioning research*, 20(1):208-214, February.

EAVES, S. & HUGHES, M. 2003. Patterns of play of international rugby union teams before and after the introduction of professional status. *International Journal of Performance Analysis in Sport*, 3(2):103-111, December.

EAVES, S.J., HUGHES, M.D. & LAMB, K. L. 2005. The consequences of the introduction of playing status on game action variables in international northern hemisphere rugby union football. *International Journal of Performance Analysis in Sport*, 5(2):58-86, November.

EAVES, S. & BROAD, G. 2007. A comparative analysis of professional rugby league football playing patterns between Australia and the United Kingdom. *International Journal of Performance Analysis in Sport*, 7(3):54-66, Oct.

EAVES, S.J., HUGHES, M.D. & LAMB, K. L. 2008a. Assessing the impact of the season and rule changes on specific match and tactical variables in professional rugby league football in the United Kingdom. *International Journal of Performance Analysis in Sport*, 8(3):104-118.

EAVES, S.J., LAMB, K. L. & HUGHES, M.D. 2008b. The impact rule and playing season changes on time variables in professional rugby league in the United Kingdom. *International Journal of Performance Analysis in Sport*, 8(2):44-54, July.

FRANKS, I.M. 2007. Notational Analysis of Sport. (In Hughes, M & Franks, I.M. eds. Notational Analysis – a review of the literature. London and New York : Routledge. p.59-106.)

FULLER, C.W., BROOKS, J.H.M., CANCEA R.J., HALL J. & KEMP S.P.T. 2007. Contact events in rugby union and their propensity to cause injury. *British Journal of Sport Medicine*, 41:862-867, May.

FULLER, C.W., RAFTERY, M., READHEAD, C., TARGETT, G.R. & MOLLOY, M.G. 2009. Impact of the International rugby board's experimental law variations on the incidence and nature of match injuries in southern hemisphere professional rugby union. *South African Medical Journal*, 99(4):232-237, April.

GIANOTTI, S., HUME, P.A., HOPKINS, W.G., HARAWIRA, J. & TRUMAN, T. 2008. Interim evaluation of the effect of a new scrum law on neck and back injuries in rugby union. *British Journal of Sports Medicine*, 42(6):427-430, April.

GRIFITHS, I.W. & HUGHES, M.D. 2005. Kinematic analysis of rugby union line-out throw. *Journal of Sport and Exercise Sciences*, 23(2):102-103, February.

HANDCOCK, P. 1993. Physical preparation for rugby union. *Journal of Physical Education*, New Zealand, 26(3):7-9.

HARTWIG, T.B., NAUGHTON, G. & SEARL, J. 2006. Motion analyses of adolescent rugby union players: Linking training and game demands among under 16 players. *Journal of Science and Medicine in Sports*, 9(1):16, Dec.

HARTWIG, T.B., NAUGHTON, G. & SEARL, J. 2008. Defining the volume and intensity of sport participation in adolescent rugby union players. *International Journal of Sports Physiology and Performance*, 3:94-106.

HUGHES, M. & WILLIAMS, D. 1988. The development and application of a computerized rugby union notation system. *Journal of Sports Sciences*, 6:254-255.

HUGHES, M. & CLARKE, A. 1994. Computerized notation analysis of rugby union to examine the effects of law changes upon the patterns of play by international teams. *Journal of Sports Sciences*, 12(2):180-180.

HUGHES, M., EVANS, S. & WELLS, J. 2001. Establishing normative profiles in performance analysis. *International Journal of Performance Analysis in Sport*, 1(1):1-21, July.

HUGHES, M. & BARTLETT, R.M. 2002. The use of performance indicators in performance analysis. *Journal of Sports Sciences*, 20:739-754.

HUGHES, M. & BARTLETT, R.M. 2007. Notational Analysis of Sport. (In Hughes, M & Franks, I.M., eds. The use of performance indicators in performance analysis. London and New York : Routledge. p. 166-188.)

HUGHES, M. & FRANKS, I.M. 2007. Notational Analysis of Sport. (In Hughes, M & Franks, I.M. eds. Notational Analysis – a review of the literature. London and New York : Routledge. p.59-106.)

JACKSON, R.C. 2003. Pre-performance routine consistency: temporal analysis of goal kicking in the rugby union World Cup, *Journal of Sports Sciences*, 21:803-814.

JAMES, N., MELLALIUE, S.D. & JONES, N. M.P. 2005. The development of position-specific performance indicators in professional rugby union. *Journal of Sports Sciences*, 23:63-72.

JONES, N.M.P., MELLALIEU, S.D. & JAMES, N. 2002. Team performance indicators as a function of winning and losing in rugby union. *International Journal of Performance Analysis in Sport*, 4(1):61-71, August.

LAMES, M. & McGARRY, T. 2006. On the search for reliable performance indicators in game sports. *International Journal of Performance Analysis in Sport*, 7(1):62-78, January.

MALLET, N. 2006. Data drive. SA rugby, *Fifteen*: 111-122, Apr.

MARTIN, J., SMITH, N.C., TOLFREY, K. & JONES, A.M. 2001. Activity analysis of English premiership rugby football union refereeing. *Ergonomics*, 44(12):1069-1075.

MASCARENAS, D.R.D., COLLINS, D. & MORTIMER, P. 2002. The accuracy, agreement and coherence of decision-making in rugby union officials. *Journal of Sport Behaviour*, 28(3):253-270.

MCINTOSH, A., MCCRORY, P., FRENCH, C. & BEST, J. 2003. Video analysis of injury causation in rugby union football. *Journal of Science and Medicine in Sport*, 6(4):63.

MCLEAN, D.A. 1992. Analysis of the physical demands of international rugby union. *Journal of Sports Sciences*, 10:285-296.

MILBURN, P.D. 1990. The kinetics of rugby union scrummaging. *Journal of Sport Sciences*, 8(1):47-60, Spring.

MILBURN, P.D. 1993. Biomechanics of rugby union scrummaging: Technical and safety issues. *Sport medicine*, 16(3):168-179.

NAKAGAWA, A. 2006. Re-examination of importance of kick-off and 50m restart kick play in rugby football games. *International Journal of Sport and Health Sciences*, 4:271-285.

NEWELL, K. 2004. Winning solutions. *Coach and Athletic Director*, 74(2):54-60, Sep.

O'CONNOR, D. 2002. Time-motion analysis of elite touch players. (In Spinks, W., ed. Proceedings of the science and football IV conference, London : Routledge, p. 126-131.)

O'DONOGHUE, P. 2006. The use of feedback videos in sport. *International Journal of Performance Analysis in Sport*, 6(2):1-14, November.

O'DONOGHUE, P. 2007. Reliability issues in performance analysis. *International Journal of Performance Analysis in Sport*, 7(1):35-48, January.

O'DONOGHUE, P. 2008. Principal components analysis in the selection of key performance indicators in sport. *International Journal of Performance Analysis in Sport*, 8(3):145-155, November.

PATTON, M.S., JOHNSTONE, A.J. & SMITH, F.W. 2006. A complex fracture of the talus following a rugby union line-out. *Journal of Science and Medicine in Sport*, 9(1):185-189.

PAVELY, S., ADAMS, R.D., FRANCESCO, T., LARKHAM, S. & MAHER, C.G. 2009. Execution and outcome differences between passes to the left and right made by first grade rugby union players. *Physical Therapy in Sport*, 10(4):136-142.

PHYTHIAN, T. 1995. Maximising the chance of converting a try. *Australian Senior Mathematics Journal*, 16(2):51-52.

POPE, C. 2004. Pitch perfect. *Professional Engineering*, 17(13):38-38, July.



PRIM, S., VAN ROOYEN, M. & LAMBERT, M. 2006. A comparison of performance indicators between the four South African teams and the winners of the 2005 Super 12 rugby competition. What separates top from bottom? *International Journal of Performance Analysis in Sport*, 6(2):126-133.

QUARRIE, K.L. & HOPKINS, W.G. 2007. Changes in player characteristics and match activities in Bledisloe cup rugby union from 1972 to 2004. *Journal of sports sciences*, 25(8):895-903, June.

QUARRIE, K.L. & HOPKINS, W.G. 2008. Tackle injuries in professional rugby union. *The American Journal of Sports Medicine*, 36(9):1705-1716, May.

REED, D. & O'DONOGHUE, P. 2005. Development and application of computer-based prediction methods. *International Journal of Performance Analysis in Sport*, 5(3):12-28, December.

REES, D. 1996. Let's go to the video! *Coach and Athletic Director*, 65(6):26-27, January.

ROBERTS, S. TREWARTHA, G. & STOKES, K. 2006. A comparison of time-motion analysis methods for field-based sports. *International Journal of Sports Physiology and Performance*, 1:388-399.

ROBERTS, P.S., TREWARTHA, G., HIGGETT, R.J., EL-ABD, J. & STOKES, K.A. 2008. The physical demands of elite English rugby union. *Journal of Sport Sciences*, 26(6):825-833, June.

SASAKI, K., FURUKAWA, T., MURAKAMI, J., SHIMOZONO, H., NAGAMATSU, M. MIYAO, M., YAMAMOTO, T., WATANABE, I., YASUGAHIRA, H., SAITO, T., UENO, Y., KATSUTA, T. & KONO, I. 2007. Scoring profiles and defence performance analysis in rugby union. *International Journal of Performance Analysis in Sport*, 7(3):46-53, October.

SAYERS, M.G.L. & WASHINGTON-KING, J. 2005. Characteristics of effective ball carries in Super 12 rugby. *International Journal of Performance Analysis in Sport*, 5(3):92-106, December.

TREWARTHA, G., CASANOVA, R. & WILSON, C. 2008. A kinematic analysis of rugby line-out throwing. *Journal of Sports Sciences*, 26(8):845-854.

VAN DER VLIET, R. 2008. Directe feedback: sleutel tot succes. *Sportgericht*, 62(4):9-12.

VAN ROOYEN, M.K. & NOAKES, T.D. 2006. Movement time as a predictor of success in the 2003 rugby World Cup tournament. *International Journal of Performance Analysis in Sport*, 6(1):30-39, June.

VAN ROOYEN, M.K., LAMBERT, M.I. & NOAKES, T.D. 2006. A retrospective analysis of the IRB statistics and video analysis of match play to explain the performance of four teams in the 2003 rugby world cup. *International Journal of Performance Analysis in Sport*, 6(1):57-72, June.

VAN ROOYEN, M.K., LOMBARD, C. & NOAKES, T.D. 2008a. Playing demands of sevens rugby during the 2005 rugby World Cup sevens tournament. *International Journal of Performance Analysis in Sport*, 8(2):114-123, July.

VAN ROOYEN, M.K., ROCK, K., PRIM, S. & LAMBERT, M. 2008b. The quantification of contacts with impact during professional rugby matches. *International Journal of Performance Analysis in Sport*, 8(1):113-126, February.

VAN ROOYEN, M.K., DIEDERICK, E. & NOAKES, T.D. 2010. Ruck frequency as a predictor of success in the 2007 rugby World Cup tournament. *International Journal of Performance Analysis in Sport*, 10(1):33-46, April.

WHITE, J. 2005. Action replay. Fifteen: 104-108, February.

WILLIAMS, J., HUGHES, M. & O'DONOGHUE, P. 2005. The effect of rule changes on match and ball in play time in rugby union. *International Journal of Performance Analysis in Sport*, 5(3):1-11, December.

WILLIAMS, J., HUGHES, M., O'DONOGHUE, P. & DAVIES, G. 2007. A reliability study of a real-time and lapsed time application for rugby union. *International Journal of Performance Analysis in Sport*, 7(1):80-97, January.

WILSON, B.D., QUARRIE, K.L., MILBURN, P.D. & CHALMERS, D.J. 1999. The nature and circumstances of tackle injuries in rugby union. *Journal of Science and Medicine in Sport*, 2(2):153-162.

YOUNG, W.M. 2007. The effect of ball-carrying technique and experience on sprinting in rugby union. *Journal of Sports Sciences*, 25(2):185-192.

## CHAPTER 3



**Title**

Match analysis of the 2006 Super 14 Rugby Union Tournament.

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**Running title**

Analysis 2006 Super 14 rugby union

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# **MATCH ANALYSIS OF THE 2006 SUPER 14 RUGBY UNION TOURNAMENT**

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## **2. ABSTRACT**

The aims of this study were firstly to determine the frequency and duration of different performance indicators of the Super 14 rugby teams during the 2006 tournament; secondly, to determine which performance indicators discriminate between the successful (top seven) and less successful (bottom seven) Super 14 rugby teams and thirdly, to determine which performance indicators predict the ranking of the Super 14 rugby teams of 2006. All the teams of the 2006 Super 14 rugby tournament were used in this study. Hundred and eighty five games were recorded on video and analysed by means of the Opta Sports Data software package (Opta Sportsdata Limited, Harrogate, United Kingdom). The cluster analysis reduced the amount of test variables (16) to only 9. The results of the forward stepwise discriminant analyses revealed that the following performance indicators were the

most important discriminators between the successful and less successful rugby teams: meters gained ( $F = 11.08$ ), kicks out of hand ( $F = 5.9$ ), line-breaks ( $F = 4.97$ ) and percentage tackles made ( $F = 2.85$ ). The classification matrix showed that the prediction functions were on average 92.86% accurate in classifying the rugby teams into the two original groups. Lastly, the forward stepwise multiple regression analyses determined that, line breaks (8%), kicks out of hand (28%), rucks won (3%), percentage tackles made (6%) and meters gained (46%) contributed the most to the variance (91%) in team rankings.

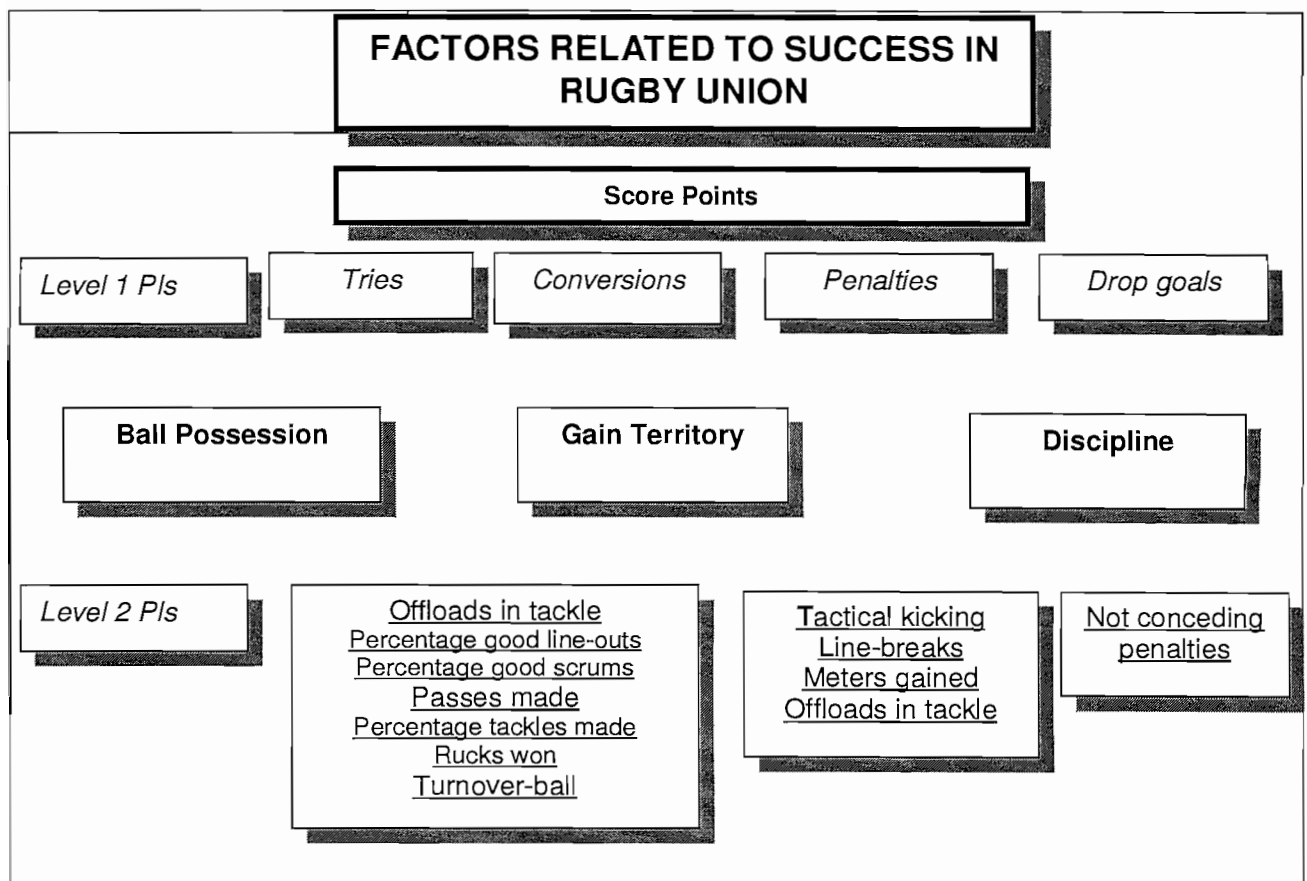
### 3. INTRODUCTION

Internationally, Rugby Union is renowned as a winter sport, ranked second in capaciousness after soccer (Bathgate, Best, Craig & Jameson, 2002). The extent of participation in rugby union, together with the fact that the sport has turned professional in 1995, has increased the *need for a more scientific approach that explores the different elements in the game of rugby union* (Nicholas, 1997; Duthie, Pyne & Hooper, 2003; James, Mellalieu, Jones & Nicholas, 2005). Newell (2002) and Mallet (2006) consider technology, and more specifically video analysis, as one such a scientific approach. Hughes and Franks (2007) stated that video analysis can be used to analyse general match, technical, tactical and biomechanical indicators. To analyse general match indicators, Hughes and Williams (1988), Botha (2005) and White (2005) recommended that computerised notational analysis (CNA) should be used in this regard. These statements were made despite the concerns of Handcock (1993) and Greenwood (2004) who pointed out that CNA is complex and difficult to use as well as Lames and McGarry (2007) who questioned the reliability of CNA results due to variation in conditions and other factors. In contrast to this Rees (1996), Reed and O'Donoghue (2005) as well as Eaves, Hughes and Lamb (2005) indicated that CNA are considered essential for team sports such as rugby that strive to enhance performance, naming objectivity as just one of many advantages.

The major purposes of notational analysis are to indicate which areas or activities in a match requires improvement as well as the evaluation of players, to name but two (Hughes, 1988). Hughes and Bartlett (2007) also indicated that notational analysts are inclined to study the patterns of play by analysing the so called "action variables" that should relate to performance. These action variables are known as performance indicators (PIs) and it is recommended that research should focus on the

development and utilization of these PIs (Hughes & Bartlett, 2002; Baca, 2006; O'Donoghue, 2006; Pool, 2006).

In a recent study Coetzee and Van den Berg (2007) identified the importance of such PIs as performance predictors in South African tertiary institution rugby teams. The following diagram indicates which factors, including PIs (underlined), are considered by several researchers (also indicated in figure) as important for rugby union teams to achieve success.



**Figure 1: Organigram of factors and relevant PIs involved in the success of rugby union**

Van Rooyen, Lambert and Noakes (2006) stated that success in rugby is measured by winning the match and, in order to do so, teams must score points; thus beating the opposition. Points can be accumulated by the following number of ways: *tries*, *conversions*, *penalties* and *drop goals*. All of these can be decisive in determining the outcome of a game (Phythian, 1995; Sommerville, 1997). Research suggested that three aspects need to be considered when rugby teams wish to score points namely:



a) **ball possession** (Rutherford, 1983; Parsons & Hughes, 2001, Van Rooyen, Lambert & Noakes, 2006), b) to **gain territory** in such a way that they can score points (O'Shea, 2002) and c) good **discipline** to prevent the opposition from gaining points through penalties (Gregon, 2006). Thus for a team to score points and be successful they need **ball possession**, good **discipline** and **to gain territory**. All achieved by specific related PIs.

When a team concedes penalties, due to bad **discipline** the opposition may gain an opportunity to kick a goal, which in turn can lead directly to points for the opposition (International Rugby Board, 2006). Laird and Lorimer (2004) determined that 75% of tries scored in the international matches during the 2003 rugby season came from ball possession gained in the opponents' half; thus emphasizing the importance for a team to **gain territory**. This is done with good tactical kicking (Glogg, 2000) or maintaining continuity by means of either line-breaks, meters gained or off-loading in the tackle, (Groenewald & SARFU Technical Committee, 2001).

Off-loading in the tackle can also be seen as a way to retain **ball possession**. Other PIs that enable a team to gain good ball possession includes scrums and line-outs (set pieces) which were also highlighted by Hughes and White (1997) in their analysis of the 1991 Rugby World Cup. They found that successful teams managed their set pieces significantly better than those of the less successful teams. A study done on European rugby teams showed that only two out of twenty two PIs, namely opposition line-outs won and number of tries scored significantly discriminated between more and less successful teams (Jones, Mellalieu, James, 2004), hence the remark that activities such as set pieces have a definite influence on the final outcome of a rugby game (Hutchinson, 2005).

Other PIs that may influence a team's number of **ball possessions** include passes made, rucks and turnovers (Groenewald & SARFU Technical Committee, 2001). According to Rutherford (1983), teams that mastered handling skills best will have an advantage over their opponents. Rucking is another facet of play that has a direct influence on the amount of ball possessions a team can obtain. Teams that are not able to protect the ball during rucks will lose their **ball possession** to the opposing team and may even concede points against them due to the turn-over ball (Rugby Football Union, 2004). This was supported by Askew (2001) who determined that 17 out of the 19 tries scored during the first weekend of the 2001 Six Nations Rugby

tournament were the direct result of turn-over balls. In addition to this Eaves and Hughes (2003) have determined that the number of rucks during a match from the 1992-1998 season had doubled by the 2000 period; hence emphasizing the importance of rucking.

Good defence (tackling) is also regarded as a critical component for success in the game of rugby (Biscombe & Drewett, 1998; Duthie et al., 2003). Good defence may improve a team's chances of gaining good **ball possession** and preventing the opposition from **gaining territory**. Luger and Pook (2004) determined that rugby players are making twice as many tackles during a game than was the case during the 1996 Five Nations Championships. Good defence also emerged as the best predictor of ranking among the top eight ranked tertiary institution rugby teams in South Africa (Coetzee & Van den Berg, 2007).

In an interview with Matthew Proudfoot (2006) international player and a successful South African club rugby coach, all the above-mentioned PIs were confirmed as very important by coaches and trainers striving for success. (Proudfoot coached the North West University first rugby team to victory in all four major club tournaments namely, the Pirates grand challenge, Intervarsity, FNB Super bowl and the National club Championship during the 2006/07 season).

The purpose of this study is, therefore, to determine a) the frequency of the different PIs during the 2006 and 2008 Super 14 rugby union tournament., b) which PIs discriminate significantly between successful (top seven) and less successful (bottom seven) Super 14 rugby union teams?, c) which PIs significantly predict the ranking of the Super 14 rugby union teams?

The results of this study can give coaches, players and sport scientists a better understanding of which PIs occur in a rugby game, how often each PIs appears and the effect it has on the outcome of the game. These answers may help the role-players to prioritize the amount of time they intend spending on the different PIs in their training programs, depending on the importance of these different PIs towards competitive match-play, which may lead to the evaluation of players and teams accordingly. The answer to the last question could enable coaches, players and sport scientists to classify rugby teams of different performance levels.

## **4. METHOD & MATERIALS**

### **4.1 Research design**

The design of this study was an observational, descriptive and *ex post facto* design.

### **4.2 Sample population**

The video recordings of all the Super 14 rugby games of the 2006 rugby season were used in this study. Due to the fact that this data was freely available to the public, no ethical permission was needed from the various teams. These included the following teams in order of the final ranking that was achieved at the end of the 2006 season: Crusaders, Hurricanes, Waratahs, Bulls, Sharks, Brumbies, Chiefs, Blues, Highlanders, Cheetahs, Stormers, Reds, Cats and Western Force (Harmse, 2006).

### **4.3 Procedures of testing**

In total one hundred and eighty five games were recorded on video and analyzed by Opta sports data (Opta Sportsdata Limited, Harrogate, United Kingdom) during the 2006 season. The analyses were performed by the Opta Sportsdata Company itself and provided to SARugby.com (2006). Written permission was obtained from the publishers of this data to be used for research purposes. Based on the data, the following PIs were analyzed: (frequency were obtained for all the categories except for when percentages are explicitly indicated) turnover-ball, percentage good scrums, percentage good line-outs, percentage tackles made, drop goals, penalty goals, rucks lost, rucks won, tries scored, line breaks, passes made, off-loads in the tackle, meters gained, penalties conceded, kicks from hand and percentage tries converted (SARugby.com, 2006). Scrums and line-outs were considered good if the first ball receiver managed to handle the ball without making a mistake. The results of the calculations on these PIs were used with regard to the ranking of the different teams according to the final log position that was achieved at the end of the 2006 season: Crusaders, Hurricanes, Waratahs, Bulls, Sharks, Brumbies, Chiefs, Blues, Highlanders, Cheetahs, Stormers, Reds, Cats and Western Force (Harmse, 2006).

### **4.4 Statistical Procedures**

The Statistical Consultation Service of The North-West University was used to assist in the analyses of the data. The Statistical Data Processing package (Statsoft Inc., 2007) was used to process the data. According to Steyn *et al.* (2003:356), the assumption can be made that the data are a normal approximation when the sample size exceeds 30, as in

this case. Descriptive statistics of each variable for all the rugby teams were calculated. This was followed by determining the effect sizes of the different match profile variables for the two independent groups, namely the top seven (successful) versus the bottom seven (less successful) Super 14 rugby union teams. A cluster analysis was also done to determine which PIs could be grouped together in order to reduce the number of variables, followed by a forward stepwise discriminant analysis on the data that emerged from the cluster analysis to determine the PIs that discriminated significantly between the two groups of players. Finally, a forward stepwise multiple regression analysis was used to determine the contribution by each of the different PIs to the ranking of the rugby teams.

Due to the fact that this is an inferential study meaning that the total group of participants were used and not a random selection, the p-value of  $< 0.5$  will not be used to determine significant differences. Instead, practical significance will be determined for each statistical analysis. The level of significance for the different PIs of the two independent groups, namely the top seven (successful) versus the bottom seven (less successful) Super 14 rugby union teams were determined by the d-value in conjunction with Cohen's effect sizes (Cohen, 1988). The level of significance for the stepwise discriminant analysis was determined by the prediction accuracy of the classification matrix that followed the analysis and lastly, to determine significance of the results from the forward stepwise regression, the R-square values were used.

## **5. RESULTS AND DISCUSSION**

The descriptive statistics of all the Super 14 rugby teams are presented in Table 1. The effect sizes for the different match profile variables of the two independent groups, namely the top seven (successful) versus the bottom seven (less successful) Super 14 rugby union teams are also presented in this table.

**TABLE 1: Descriptive statistics and the effect sizes of the different performance indicators of two independent groups, namely the top seven (successful) versus the bottom seven (less successful) Super 14 rugby union teams during the 2006 season**

PIs	Successful rugby teams n = 7		Less successful rugby teams n = 7		p-value	d-value
	$\overline{x}$	SD	$\overline{x}$	SD		
<b>Level 1 PIs</b>						
Tries	41.57	5.53	25.29	3.77	0.00003	2.9 <sup>AAA</sup>
Penalty goals	30.86	3.93	27.71	4.54	0.19127	0.693 <sup>AA</sup>
Drop goals	1.14	1.07	0.71	0.76	0.40345	0.401 <sup>A</sup>
%Converted Tries	72.84	4.89	72.11	8.27	0.84463	0.088
<b>Level 2 PIs</b>						
Penalties conceded	140	13.87	137.57	15.45	0.76223	0.157
Tactical kicking	389.57	49.65	353.43	44.42	0.17671	0.728 <sup>AA</sup>
Line-breaks	172.14	47.62	136.71	31.69	0.12716	0.744 <sup>AA</sup>
Meters Gained	5759	647.89	4858.1	626.72	0.02140	1.39 <sup>AAA</sup>
Offloads	95.29	31.42	89.43	16.42	0.66979	0.19
% Scrums (poor/good x 100)	92.83	1.77	90.97	2.22	0.09373	0.595 <sup>AA</sup>
% Line-outs (poor/good x 100)	80.42	4.04	84.03	4.32	0.13221	0.835 <sup>AA</sup>
Passes Made	1484.7	271.32	1366.1	92.76	0.29539	0.437 <sup>A</sup>
Rucks won	858.86	90.97	765.57	71.34	0.05408	1.025 <sup>AAA</sup>
Rucks lost	51.71	9.12	46.71	7.57	0.28621	0.548 <sup>AA</sup>
Drop goals	1.14	1.07	0.71	0.76	0.40345	0.401 <sup>A</sup>
% Defence (poor/good x 100)	88.63	1.42	86.95	2.27	0.12242	0.741 <sup>AA</sup>
Turnovers	189.57	7.61	196	22.72	0.49130	0.283

Effect sizes d-value (d = 0.3 = small effect<sup>A</sup> ; d = 0.5 medium effect<sup>AA</sup> and d = 0.8 large effect<sup>AAA</sup>)

The comparison of the successful and less successful rugby teams revealed that the successful rugby teams performed practically significant better in the amount of meters they gained, amount of rucks won and the amount of tries they scored ( $d \geq 0.8$ ) compared to the less successful teams. A practical significant difference of medium effect were found in the number of line-breaks, number of rucks lost, percentage good line-outs, percentage good scrums, percentage good defence,

number of kicks out of hand and number of successful penalty goals between the successful and less successful teams [ $d = (0.79 - 0.5)$ ]. However, before conclusions about the above-mentioned results can be made, one must first determine which of the PIs discriminated the most between the two groups.

In an attempt to only use variables that are not related to each other and to retain only the relevant variables for a forward stepwise discriminant analysis, a cluster analysis was performed. The cluster analysis reduced the PIs from 16 to 9, which included the following: meters gained, passes made, rucks won, kicks from the hand, line breaks, percentage tackles made, penalties conceded, drop goals and turnovers.

A subsequent forward stepwise discriminant analysis was performed in those PIs which emerged from the cluster analysis. The results of this analysis are presented in Table 2.

**TABLE 2: Results of the forward stepwise discriminant analysis on PIs that discriminate between successful and less-successful rugby teams**

PIs	F-remove	p-value
Meters gained	11.08*	0.009**
Kicks from hand (frequency)	5.91*	0.0379*
Line-breaks (frequency)	4.97	0.052
Defence (poor/good x 100) (%)	2.85	0.1258

The primary variables that were responsible for the separation of the two groups of rugby teams are: meters gained, kicks from the hand, line breaks and quality of defence.

To establish practical significance for the results of the stepwise discriminant analysis, a further classification matrix was performed. This led to prediction functions that would be able to discriminate between the successful and less successful Super 14 rugby union teams. The following functions emerged from the classification matrix:

Successful rugby teams (group 1-G1) =  $(0.16 \times \text{Meters gained}) + (1 \times \text{Kicks from hand}) + (-3.07 \times \text{Line-breaks}) + (45.04 \times \text{Percentage tackles made}) - 2396.72$ .

Less successful rugby teams (group 2-G2) =  $(0.15 \times \text{Meters gained}) + (0.94 \times \text{Kicks from hand}) + (-2.95 \times \text{Line-breaks}) + (43.94 \times \text{Percentage tackles made}) - 2250.43$ .

The results of the classification matrix are presented in Table 3.

**TABLE 3: The classification matrix of the two groups of rugby teams to indicate what percentage of the teams can be classified into their respective original groups through the use of the prediction formulas**

Group	Percent Correct - I	G 1	G2
G1: Successful rugby teams	85.71	6	1
G2: Less successful rugby teams	100.00	0	7
Total (matches by 14 teams)	92.86*	6	8

\* I  $\geq 35$  = practical significant

The results of the classification matrix showed that the prediction functions were 92.86% accurate in classifying the rugby teams into their respective groups. Hence, the finding that the PIs which were included in the prediction functions was indeed accurate discriminators of the Super 14 rugby union teams of different ranking status.

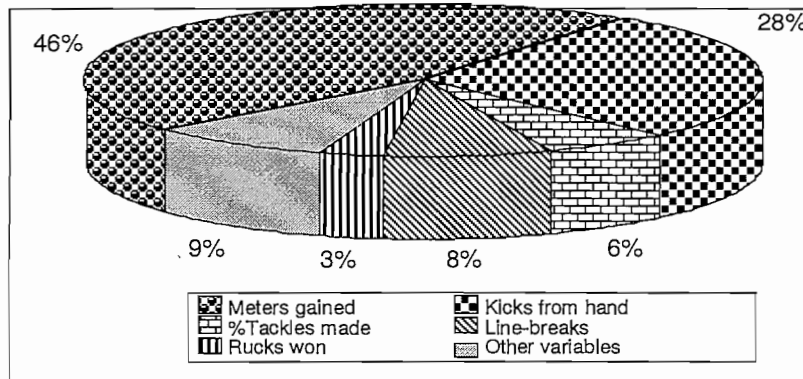
In the next step a forward stepwise multiple regression was done in order to determine which PIs contributed the most to the ranking of the rugby teams. The results of this analysis are presented in Table 4

**TABLE 4: Forward stepwise multiple regression in which only those PIs which emerged from the cluster analysis were used**

Pis	F – to entr/rem	Multiple R-square	R <sup>2</sup> change	p-value
Defence (poor/good x 100) (%)	2.72	0.8	0.06	0.130
Line-breaks (number)	5.52	0.74	0.08*	0.0433
Rucks won (number)	1.94	0.79	0.03	0.2011
Meters gained (number)	10.08	0.46	0.46**	0.0079
Tactical kicking (number)	12.09	0.74	0.28**	0.005

R<sup>2</sup> = 0.13  $\geq$  small, 0.13- 0.25 = medium and  $\geq 0.25$  big effect

The percentage contribution of the emerged match profile characteristics to the ranking of the rugby teams is also graphically presented in Figure 2.



**FIGURE 2: Percentage contribution of the most important PIs to the ranking of the 2006 Super 14 rugby union teams**

The results of the forward stepwise multiple regression analysis as presented in Figure 2 show that the rankings that were achieved by the rugby teams were significantly influenced by meters gained (46%), tactical kicking (28%). Although not significant the line-breaks (8%), percentage tackles made (6%), and rucks won (3%) also influenced the ranking of the respective teams. Overall the results also show that the PIs tested have a bigger rugby performance prediction power (91%) compared to that of PI (9%) not considered in this study.

The importance of meters gained as the largest discriminator and contributor to rugby performances was highlighted by O'Shea, (2002) who stated that the main objective in rugby is to advance with the ball over the opposition's goal line. Furthermore Greenwood, (2004) pointed out that teams must gain territory to be effective. Additionally the ability to carry the ball is regarded as a prerequisite for winning rugby (Pool, 2006). It is therefore understandable that meters gained emerged as the biggest discriminator to rank performance.

According to Tainton (2000) tactical kicking can influence a team's performance directly, while Hynard (2000) consider a good tactical kick as a major weapon in a team's ability to perform. The reason for this may be that teams can easily gain territory with the minimum effort using tactical kicking with the possibility of turn-over ball in the opposition's half as to launch an attack. Especially if one considers how easy turn-over balls are achieved, it is understandable why kicking can play such a big part in successful teams.



The fact that line-breaks was also identified as the third largest, non-significant discriminator and significant contributor to ranking, can probably be attributed to the fact that line-breaks will allow players to catch the opposition's defence unorganised and creating opportunities to score tries. In this regard several researchers have pointed out that line-breaks are an essential match profile characteristic of successful rugby teams (Honan, 2000; Diamond, 2002; Everts, 2003; Sayers & Washington-King, 2005).

Lastly, defence [(poor/good) x100] was identified as the fourth largest discriminator (figure 2) and contributor to rugby teams performance (although non-significantly), Biscombe and Drewett (1998) stated that as much as 50% of a match consists of defensive movements and tackling. Similarly White (2007) is of the opinion that teams will only perform well if they defend their territory successfully. The fact that the Australian rugby team only conceded 3 tries during the 1991 World Cup and South Africa on average only conceded 11 points throughout the 1995 World Cup due to good defence, both winning those respective tournaments, confirms the importance of good defence.

The additional 9% PIs that are not determined which predicts ranking is not unexpected. The researchers expected that other PIs (not tested) will also play a role in the prediction of rugby performance such as the anthropometric make-up of the rugby players (Olds, 2001), psychological strategies (Abbott and Easson, 2002) and game plans (Luger and Pook, 2004) The value of this study are highlighted by the fact that 91% of the investigated PIs can be related to the Super 14 rugby teams during the 2006 competition.

## **6. CONCLUSION AND RECOMMENDATIONS**

In conclusion, this study revealed that meters gained, kicks from hand, line breaks and percentage tackles made are the PIs that discriminate accurately (92.86%) between successful and less successful Super 14 rugby union teams during the 2006 competition. Furthermore, the PIs which emerged as the biggest predictors (practical significant) of ranking among the 2006 Super 14 rugby union teams were in order of contribution: meters gained (46%), followed by kicks from hand (28%) line breaks (8%), percentage tackles made (6%) and rucks won (3%) where the last two variables were not significant.

The study, therefore, outlined the importance of different PIs as performance predictors in the ranking of Super 14 rugby union teams. To the researchers' knowledge, this is the first study that has investigated the exact contribution of the different PIs to the performance of Super 14 rugby union teams.

Recommendations from this study is to analyse the influence of the PIs according to their position on the field or even to do similar studies based on other types of sport.

## 7. REFERENCES

ABBOTT, A. & EASSON, B. (2002). The mental profile. In G. Hale and D. Collins (Eds.), *Rugby tough*. (pp. 17-33.) Champaign, IL: Human Kinetics Publishers.

ASKEW, T. (2001). Decision-making in attack. In P. Larder (Ed.), *Principles and practice*. (Ref.3.13) London: National coaching development.

BACA, A. (2006). Innovative diagnostic methods in elite sport. *International Journal of Performance Analysis in Sport*, 6(2), 148-156.

BATHGATE, A., BEST, J.P., CRAIG, G. & JAMIESON, M. (2002). A prospective study of injuries to elite Australian rugby union players. *British Journal of Sports Medicine*, 36(4), 265 - 269.

BISCOMBE, T. & DREWETT, P. (1998). Rugby: steps to success. (3<sup>rd</sup> ed.) (pp.159). Champaign, Ill.: Human Kinetics Publishers.

BOTHA, Z. (2005). Science and sport: Athletes and sports teams turn to technology to gain winning edge. *Engineering News*, 16, 11.

COETZEE, B. & VAN DEN BERG, P. H. (2007). Game analysis of the eight top ranked tertiary institution rugby teams in South Africa. *Journal of Human Movement Studies*, 52(1), 49-63.

COHEN, J. (1988). Statistical power analysis for the behavioural sciences. (2<sup>nd</sup> ed.) (pp.567). Hillsdale: Erlbaum.

DIAMOND, D. (2002). Positive thoughts on attack In B. Hale and D. Collins (Eds.) *Attacking backlineplay*. (Ref.3.4.), National Coaching Development. London Champaign, IL. Human Kinetics Publishers.

DUTHIE, G., PYNE, D. & HOOPER, S. (2003). Applied physiology and game analysis of rugby union. *Journal of Sport Medicine*, 33(13), 973-991.

EAVES, S.J., HUGHES, M.D. & LAMB, K. L. (2005). The consequences of the introduction of playing status on game action variables in international northern hemisphere rugby union football. *International Journal of Performance Analysis in Sport*, 5(2), 58-86.

- EAVES, S. & HUGHES, M. (2003). Patterns of play of international rugby union teams before and after the introduction of professional status. *International Journal of Performance Analysis in Sport* 3(2), 103-111.
- EVERTS, A. (2003). A scientific analysis of running lines in rugby. Pretoria:PU (Verhandelng – M.A.) 178 p.
- GLOGG, M. (2000). Kicking: the bastard art. In P. Larder (Eds.) National Coaching Development. (pp.1-2.). London Champaign, IL. Human Kinetics Publishers.
- GREENWOOD, J. (2004). Think rugby: A guide to purposeful team play. (4<sup>th</sup> ed.) (pp.232). London: Adam and Charles Black.
- GREGON, G. (2006). Discipline, the key against Kiwis, at [http://www.planet-rugby.com/news/story\\_52711.shtml](http://www.planet-rugby.com/news/story_52711.shtml). Aug. 2006
- GROENEWALD, B. & SARFU TECHNICAL COMMITTEE. (2001). Advanced rugby techniques and tactics.(pp. 208). Newlands: Saldanha.
- HANDCOCK, P. (1993). Physical preparation for rugby union. *Journal of Physical Education*, New Zealand, 26(3), 7-9.
- HARMSE, J.J. (2006). Sport. Rapport:1, May. 7.
- HONEN, B. (2000). Attacking Rugby. In B. Hale and D. Collins (Eds.) Attacking backlineplay . (Ref.3.3.), National Coaching Development. London Champaign, IL. Human Kinetics Publishers.
- HUGHES, M. (1988). Computerized notation analysis in field games. *Ergonomics*, 31(11), 1585-1592.
- HUGHES, M. & WILLIAMS, D. (1988). The development and application of a computerized rugby union notation system. *Journal of Sport Science*, 6:254-255.
- HUGHES, M.D. & WHITE, P. (1997). An analysis of forward play in the 1991 rugby union World Cup for men. In M.D. Hughes, (Ed.), *Notational Analysis of Sport -I and II*. (pp. 183-191). Cardiff: University of Wales Institute.
- HUGHES, M. & BARTLETT, R.M. (2002). The use of performance indicators in performance analysis. *Journal of Sport Sciences*, 20:739-754.
- HUGHES, M. & BARTLETT, R.M. (2007). Notational Analysis of Sport. In M. Hughes & I.M. Franks, (Eds.), *The use of performance indicators in performance analysis*. (pp. 166-188). London and New York: Routledge.
- HUGHES, M. & FRANKS, I.M. (2007). Notational Analysis of Sport. In M. Hughes & I.M. Franks (Eds.), *Notational Analysis – a review of the literature*. (pp. 59-106). London and New York: Routledge.
- HUTCHINSON, A. (2005). Coaching the set piece. Rugby coaching notes, at <http://www.eurekastreet.com>. May 2006.

HYNARD, M. (2000). Introducing basic kicking tactics. In B. Hale and D. Collins (Eds.) *Attacking backlineplay*. (Ref.3.15.). National Coaching Development. London Champaign, IL. Human Kinetics Publishers.

INTERNATIONAL RUGBY BOARD. (2006). *SA Rugby Rulebook 2006*. (pp.142). Newlands: Phillips.

JAMES, N., MELLALIEU, S., JONES, D. & NICHOLAS, M. P. (2005). The development of position-specific performance indicators in professional rugby union. *Journal of Sports Sciences*, 23(1), 63-72.

JONES, N.M.P., MELLALIEU, S.D. & JAMES, N. (2004). Team performance indicators as a function of winning and losing in rugby union. *International Journal of Performance Analysis in Sport*, 4(1), 61-71.

LAIRD, P. & LORIMER, R. (2004). An examination of try scoring in rugby union: a review of international rugby statistics. *International Journal of Performance Analysis in Sport*, 4(1), 72-80.

LAMES, M. & MCGARRY, T. (2007). On the search for reliable performance indicators in game sports. *International Journal of Performance Analysis in Sport*, 7(1), 62-78.

LUGER, D. & POOK, P. (2004). *Complete conditioning for rugby*. (pp.184). London: Human Kinetics Publishers.

MALLET, N. (2006). Data drive. *SA rugby*, 111, 122.

NEWELL, K. (2002). High tech u. *Coach and Athletic Director*, 72(2), 1-5.

NICHOLAS, C.W. (1997). Anthropometric and physiological characteristics of rugby union football players. *Sports Medicine*, 23(6), 375-396.

O'DONOGHUE, P. (2006). The use of feedback videos in sport. *International Journal of Performance Analysis in Sport*, 6(2), 1-14.

OLDS, T. (2001). The evolution of physique in male rugby union players in the twentieth century. *Journal of Sports Sciences*, 19(4), 253-262.

O'SHEA, B.P. (2002). *Level 1 coaching manual*. (3<sup>rd</sup> ed.) (pp.102). Australia: Ausport.

PARSONS, A. & HUGHES, M. (2001). Performance profiles of male rugby union players. In M. Hughes & I. Franks (Eds.) *Proceedings of the computer science and sport III and performance analysis of sport V conference* (pp. 129-136). UWIC, Cardiff, Wales.

PHYTHIAN, T. (1995). Maximizing the chance of converting a try. *Australian Senior Mathematics Journal*, 16(2), 51-52.

POOL, G. (2006). *Rugby: verstaan die spel*. (p.226). Stellenbosch: Rapid Access.

- PROUDFOOT, M. (2006). Verbal communication. Potchefstroom.
- REED, D. & O'DONOGHUE, P. (2005). Development and application of computer-based prediction methods. *International Journal of Performance Analysis in Sport*, 5(3), 12-28.
- REES, D. (1996). Let's go to the video! *Coach & athletic director*, 65(6), 26-27.
- RUGBY FOOTBALL UNION. (2004). Rugby football union handbook online 2003-2004. at <http://www.rfu.com/microsite/handbooks/index.cfm?fuseaction=handbook.home>. May. 2006.
- RUTHERFORD, D. (1983). International rugby for players, coaches and spectators. (pp. 143). London: Heinemann.
- SAYERS, M.G.L. & WASHINGTON-KING, J. (2005). Characteristics of effective ball carries in Super 12 rugby. *International Journal of Performance Analysis in Sport*, 5(3), 92-106.
- SARUGBY.COM. (2006). Stats centre, at [http://www.sarugby.com/news/Stats\\_Centre/catid=14.html](http://www.sarugby.com/news/Stats_Centre/catid=14.html). August. 2006.
- SOMMERVILLE, D. (1997). The encyclopedia of rugby union. (10<sup>th</sup> ed.) (pp.192). Great Britain: Aurum.
- STEYN, A.G.W., SMIT, C.F., DU TOIT, S.H.C. & STRASHEIM, C. (2003). Modern statistics in practice. (5<sup>th</sup> ed.) (pp.761). Pretoria: Van Schaik Publishers
- STATSOFT, INC. (2007). Statistica (data analysis software system), version7 [www.statsoft.com](http://www.statsoft.com). July 2008.
- TAINTON, M. (2000). Kicking: with Mark Tainton. In Larder, P. (Ed.) Principles and practice. (p. 1-2.). National Coaching Development. London Champaign, IL. Human Kinetics Publishers.
- VAN ROOYEN, M.K., LAMBERT, M.I. & NOAKES, T.D. (2006). A retrospective analysis of the IRB statistics and video analysis of match play to explain the performance of four teams in the 2003 rugby world cup, *International Journal of Performance Analysis in Sport*, 6(1), 57-72.
- WHITE, J. (2005). Action replay. *Fifteen*: 104-108.
- WHITE, J. (2007). Van Mandela tot Mark Cueto. *Beeld*. 22 Oct.

## CHAPTER 4



**Title**

The effect of the ELVs on the Super 14 rugby union tournament.

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**Running title**

The effect of ELVs on Super 14

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# **THE EFFECT OF THE ELVs ON THE SUPER 14 RUGBY UNION TOURNAMENTS**

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## **2. SUMMARY**

The aim of this study was to determine whether the experimental law variations (ELV) succeeded in changing the flow of rugby union matches to make it more appealing to spectators. All the teams of the 2006 and 2008 Super 14 rugby tournament were used in this study. Three hundred and seventy games were recorded on video and analysed by means of the Opta Sports Data software package (Opta Sportsdata Limited, Harrogate, United Kingdom, 2005). The frequency of the following performance indicators were used to address the aim in this study: Scrums, tackles, line-outs, meters gained, passes made, penalties conceded, tries scored, rucks formed and defence beaten. The frequency of performance indicators from the various seasons was compared. The results obtained were then used in



mathematical calculations to determine the practical significance with the use of Cohan's effect sizes. The number of scrums and line-outs decreased with a large practical significant value ( $d \geq 0.8$ ). In contrast to this, the number of tackles made, meters gained and penalties conceded all increased with a large practical significant value over the two seasons. A medium effect size value was found for frequency of rucks, beat defence and passes made. The increase in action activities and decrease in static activities suggest that the IRB have succeeded in addressing their objective of increasing the appeal of the game with the introduction of the ELVs.

**KEY WORDS:** rugby union, game analysis, rule changes, performance indicators

### 3. INTRODUCTION

Rugby union turned professional in 1995, which caused this sport to increase in popularity (Fuller *et al.*, 2007). This increase is probably nowhere so eminent as in South Africa (Spamer & De la Port, 2006), Australia (Bathgate *et al.*, 2001) and New Zealand (Quarrie *et al.*, 1995). It is these three nations who compete annually in the Super 14 Rugby Union Tournament through their respective regional teams. The popularity of the sport and competitive nature of this competition has led to a more profound professional approach and endless debates.

One such a debatable topic arose with the International Rugby Board (IRB) introducing the Experimental Law Variations (ELVs) in the 2008 Super 14 rugby union tournament (Lapasset, 2008). Sheridan (2007) reminds us that sport consistently changes over time due to either technological advances and/or rule changes. According to Kew (1987) rule changes can be accredited to either sustaining the viability of the sport or to maintaining the effect of the relevant sport.

The reasons given by the IRB for the introduction of the ELVs was firstly to enhance the appeal of the game and secondly to try to decrease match-related injuries (Fuller *et al.*, 2009). Until presently, extensive research has been done on match-related injuries with the studies of Quarrie *et al.* (1996), Fuller *et al.* (2007), Gianotti *et al.* (2008) and Quarrie and Hopkins (2008), to name but a few. Fuller *et al.* (2009) also conducted a study in which the correlation between the ELVs and injury occurrence/prevention were investigated. The injury occurrence during the 2008 Super 14 and Vodacom provincial rugby competitions (that also made use of the

ELVs) was compared. These results were also compared with the English premiership competition in the Northern Hemisphere (that did not make use of the ELVs). With regard to injury occurrence, no significant differences were found between the rugby matches played in the two hemispheres. However, this study did not give any attention to the other reason for introducing the ELVs, which beckons the question: Did the ELVs make rugby more appealing to the spectators?

Eaves *et al.* (2005) and Williams *et al.* (2005) conducted studies in which they examined the effect of rule changes on specific sport codes. Both indicated computer notational analysis (CNA) to be the best method for examining rugby match data. Although Handcock (1993) and Hughes and Franks (2007) warned that game sports are notoriously difficult to analyse, the value of CNA is expressed by several researchers (Botha, 2005 and Baca, 2006). Hughes and Williams (1988), Rees (1996), Newell (2004), Reed and O'Donoghue (2005) and Eaves *et al.* (2005) concurred and added objectivity as the biggest advantage of CNA. Eaves *et al.* (2005) also stated that with the use of CNA, researchers have often discovered that the desired results for introducing new rules were seldom achieved.

CNA focuses either on time-motion analysis, in which the time and different movement activities are analysed, such as the work done by Duthie *et al.* (2005), Roberts *et al.* (2006) and Deutch *et al.* (2007), or on the physiological and skills requirements of the individual participants in rugby union such as work done by Duthie *et al.* (2003), Scott *et al.* (2003), De La Porte and Spamer (2006) and Plotz and Spamer (2006). McLean (1992), however, stated that the game must be analysed in totality instead of concentrating on individuals or individual actions, due to the fact that the game is intermittent. In addition, O'Donoghue (2006) stated that CNA could be a great asset to the analysis of performance indicators. Hughes and Bartlett (2002) concurred and strongly advised that the focus should be redirected to determining how performance indicators could influence the game despite the warnings of Lames and McGarry (2007) and O'Donoghue (2007) who noted that the reliability factor when performance indicators are analysed are very inconsistent. Despite his scepticism, O'Donoghue (2006) did acknowledge that CNA could be a great asset to the analysis of performance indicators (referred to as PIs). In this regard performance indicators can be defined as "a selection or combination of action variables that aims to define some or all aspects of a performance" – especially applicable during rugby matches (Hughes & Bartlett, 2002).

Performance indicators can be classified into scoring indicators and indicators related to the quality of the performance (Hughes & Bartlett, 2007). These performance indicators are used in either media coverage or match classifications. Match classifications are analyses in which the relevant performance indicators are measured against previous performances of the same team or those of the opposition. According to Hughes *et al.* (2001), performance indicators can also be used to compile performance profiles for a specific sport code. Such a profile can then further be used to analyse the sport code. However, choosing the correct performance indicators to analyse sport is crucial (O'Donoghue, 2008).

Previous research that examined rugby union with the aid of performance indicators produced diverse findings. By using performance indicators to examine how rugby union has changed since the introduction of professional status, Eaves and Hughes (2003) found significant differences with regard to the frequency of rucks and ball-in-play. Bracewell *et al.* (2003) used various performance indicators to develop a system that could be used to rate the performance of different players. Coetzee and Van den Berg (2007) investigated which performance indicators discriminated most between the successful and less successful South African tertiary institution rugby teams during the 2004 Varsity Cup. The results indicated that % tackles made, % good line-outs, % good scrums and number of kick-offs discriminated best between successful and less successful teams. Sasaki *et al.* (2007) investigated the effect of performance indicators with relation to scoring and found that bad defence and turnover ball possession played a large part in scoring tries. Hughes and White (1997) used performance indicators to compare the patterns in play of the forwards between successful and less successful teams. They found that frontline players in successful teams performed better than those in the less successful teams with regard to line-outs, rucks and mauls.

As previously mentioned, the process of selecting the correct performance indicators in order to analyse the match is very important. Jones *et al.* (2002) conducted a study in which a list was compiled to determine the performance indicators that affected performance in rugby union. The list was compiled in the following manner: First the performance indicators used by previous studies were gathered. Then a panel of three computer notational analysts with 40 years of combined experience and three elite coaches with 50 years of combined experience examined the list critically. Their

findings, together with Hughes and Bartlett's advice that ratios or percentages have to be used for some performance indicators (2002), were all considered to draft the following list of performance indicators: % successful scrums, % successful line-outs, % successful rucks, % successful tackles made, % line-breaks, passes made, penalties conceded and tries scored.

Based on the list of performance indicators mentioned above, the aim of this study is therefore to use CNA to determine whether the ELVs applied in one season of the Super 14 rugby union tournament (2008) succeeded in changing the flow of play during matches in order to make rugby more appealing to spectators. This study did, however, only concentrate on quantities and not ratios as suggested by Hughes and Bartlett (2002), because performance was not so much evaluated as the profile of the sport itself.

The results of this study could give a good indication of the ELVs' effectiveness in making rugby union Super 14 matches more appealing to spectators.

## **4. METHOD**

### **4.1 Research design**

The design of this study was an observational, descriptive and *ex post facto* design.

### **4.2 Sample population**

All the Super 14 rugby teams who participated in the competition during the 2006 and 2008 rugby season were used in this study. These included the following teams in alphabetical order: Blues, Brumbies, Bulls, Cats, Cheetahs, Chiefs, Crusaders, Highlanders, Hurricanes, Reds Sharks, Stormers, Waratahs and Western Force (Harmse, 2006).

### **4.3 Procedures of data management:**

Three hundred and seventy games were recorded on video and analysed by means of the Opta Sports Data software package (Opta Sportsdata Limited, Harrogate, United Kingdom). The analyses were performed by the Opta Sportsdata Company itself. The 2006 data were provided to SARugby.com (2006) and the 2008 data were provided directly to the researchers. Written permission was obtained from SARugby.com to use their data for research purposes. The reason for disregarding

the data of the 2007 Super 14 season was that New Zealand chose to withhold all their national players from most of the tournaments in 2007 due to the Rugby World Cup also taking place in that year.

#### 4.4 Statistical Procedures

The Statistical Consultation Services of The North-West University determined the statistical methods and procedures for the analyses of the research data. The Statistical Data Processing package (Statsoft Inc., 2009) was used to process the data. Initially a power calculation was done to determine the stability of the data based on the size of the tested population. Hughes *et al.* (2001) suggested that a sample size of at least seven matches had to be analysed in order to consider the data as normative. Analysing three hundred and seventy games does therefore give an acceptable stability rating. The power calculation was followed by descriptive statistics, and an independent t-test was done to determine the statistically significant differences between the performance indicators of the two seasons. Due to the fact that this is an inferential study, the p-value of  $< 0.5$  was not used to determine significant differences. Instead, practical significance of differences between the variables was determined by means of Cohen's effect sizes (ES): an ES of 0.8 or larger is regarded as a large practical significance, an ES between 0.79 and 0.21 as medium and an ES of 0.2 or smaller as small (Cohen, 1988).

### 5. RESULTS & DISCUSSION

The descriptive statistics of the performance indicators for all the rugby teams of both the 2006 and 2008 Super 14 rugby union seasons are presented in Table 1. The independent t-test results as well as the practically significant values, determined by means of Cohen's effect sizes, are also indicated.

**TABLE 1: Descriptive statistics and the independent t-test results of the different performance indicators for the 2006 and 2008 Super 14 rugby seasons**

Performance Indicator (frequency)	2006 Mean	2008 Mean	Cohen's effect size = d
Scrum	142.29	130.79	0.94 <sup>ΔΔΔ</sup>
Tackles	1322.36	1418.78	0.97 <sup>ΔΔΔ</sup>
Line-outs	216.86	167.5	2.18 <sup>ΔΔΔ</sup>
Meters gained	5342.36	6208.93	1.09 <sup>ΔΔΔ</sup>
Passes	1437.29	1548.64	0.49 <sup>ΔΔ</sup>
Penalties conceded	140.14	155.97	0.86 <sup>ΔΔΔ</sup>
Tries scored	33.5	34.5	0.12
Rucks won	820.29	874.7	0.49 <sup>ΔΔ</sup>
Beat defence	155.14	172	0.42 <sup>ΔΔ</sup>

ES = <sup>Δ</sup> d < 0,2=small; <sup>ΔΔ</sup> d = 0,2 - 0,79=medium; <sup>ΔΔΔ</sup> d ≥ 0,8=large

The comparison of the performance indicators between the 2006 and 2008 Super 14 seasons indicated that the number of scrums and line-outs decreased practically significantly ( $d \geq 0.8$ ). In contrast to this, the number of tackles made, meters gained and penalties conceded all increased with a large practical significance ( $d \geq 0.8$ ) over the two seasons. Moderate practical significance was found in comparing rucks won, beat defence and passes made, where the 2008 season had the highest frequency in all of these performance indicators.

The large practical significant decrease in the frequency of scrums found in this study ( $d=0.95$ ) was in line with that found by Eaves *et al.* (2005) and Quarrie and Hopkins (2007). Both these studies, however, found a non-significant but moderate decrease in the frequency of scrums. They believed that the reason for this decrease may be accredited to the fact that players spend more time training handling skills and pitch technologies that made handling easier. In addition to this, referees also played the advantage rule more often in order to create less static activities during play (as indicated by the significant increase in meters gained), thus increasing the flow of the game to the advantage of the spectators. The decrease in scrum frequency does raise some concerns, especially with Milburn (1993) and Gianotti *et al.* (2008) who emphasized the importance of scrums, claiming that scrimmaging epitomises the physical nature of rugby. The reasons for the decrease in scrums may be due to the new ELV 20 that restricts the opposition to a 5-meter off-side line. This allows more space and time for the backline players to run with the ball which in turn probably

leads to fewer handling errors. Another reason for the decrease in scrums may be related to ELVs 7-10 which were all configured to ensure clean line-out balls; thus reducing handling errors in the line-out with less scrums resulting from it. The medium practical significant decrease in line-outs found in this study ( $d= 2.18$ ) correlates with the findings of Eaves et al. (2005) who found significantly less line-outs during the professional era (after 1995) compared to the amateur era (before 1995). Although no significant decreases were found by Quarrie and Hopkins (2007), a decrease in line-outs of a moderate value were detected. They accredited this decrease in line-outs to rule changes that caused teams to contest the opposition's ball more with a larger percentage of success. The reason for the decrease in line-outs in this study may be explained with ELV 5 which had the intention of less line-outs due to safer quick throw-in balls and ELVs 7-10 which make competing for the opposition line-out difficult, encouraging teams not to kick the ball out, knowing that it may lead to the loss of ball possession.

The large practical significant increase of penalties ( $d=0.86$ ) found in this study, does not correlate with the results of Van Rooyen *et al.* (2006). The latter study investigated which performance indicators discriminated between four teams during the 2003 Rugby World Cup tournament and found no significant differences. The reason for the difference in findings of this study and that of Van Rooyen *et al.* (2006) may be that the current study compared the penalty count over two different seasons with law changes in-between, where Van Rooyen's study compared the penalty count for different teams in the same season. It is therefore the researchers' assumption that the penalty count significantly increased in this study, because the players were still adapting to the new laws.

A large practical significant increase was also found for tackles made ( $d=0.97$ ) and meters gained ( $d=1.09$ ). In line with this finding, Quarrie and Hopkins (2006) found a large increase in the frequency of tackles made since rugby turned professional in 1995. To the knowledge of the researchers, no studies could be found where meters gained were examined. Coetzee and Van den Berg (2007) did, however, determine that there was a statistically significant difference for successful tackles made between successful and less successful South African tertiary-level rugby teams. The reason for the increase in tackles and meters gained may both be due to the ELVs 4 and 5. These laws encourage players to take a quick throw-in of the ball and prevent them from kicking the ball directly into touch. This probably leads to more

counterattacks which in turn lead to more tackles made and meters gained during the match. Despite the fact that numerous performance indicators were practically significantly different, it did not have any significant effect on the number of tries scored.

## 6. CONCLUSION AND RECOMMENDATIONS

In conclusion, this study demonstrated a practically significant decrease in the number of scrums and line-outs between the 2006 and 2008 Super 14 season. There was also a practically significant increase for the frequency tackles made, meters gained and penalties conceded. Values of medium size were found for frequency of rucks, beat defence and passes made.

The practical significant decrease in static activities (scrums and line-outs) as well as the practical significant increase in action-related activities (tackles made and meters gained) indicated that the effect of the new laws on rugby union is eminent. Owen and Weatherston (2004) suggested that rule changes could also be seen as one of the best methods of improving the appeal of a sport code. It does appear that the ELVs led to a more action-orientated game, which in turn led to a more flowing game, more action activities and hence more attractive rugby being played in favour of the spectators, despite the increase of penalties. One can only assume that the appeal of the game will increase even more among the spectators once the players have adapted to the new laws, and the penalty count has decreased. It is, however, still the belief of the researchers that the IRB have succeeded in addressing their objective of increasing the appeal of the game with the introduction of the ELVs.

Further recommendations are that future studies should investigate the time it took the players to adapt to new laws and what effect that adaptation time had on the popularity of the game. Another interesting study could be to determine how many times the laws of rugby union have changed in correlation with other sports.

## 7. REFERENCES

BACA, A. 2006. Innovative diagnostic methods in elite sport. *International Journal of Performance Analysis in Sport*, 6(2):148-156, November.



BATHGATE, A., BEST, J.P., CRAIG, G. & JAMIESON, M. 2001. A prospective study of injuries to elite Australian rugby union players. *British Journal of Sports Medicine*, 36(4):265, August.

BOTHA, Z. 2005. Science and sport: Athletes and sports teams turn to technology to gain winning edge. *Engineering News*: 16, 11 Feb.

BRACEWELL, P.J., MEYER, D. & GANESH, D. 2003. Creating and monitoring meaningful individual rugby ratings. *Research Letters in the Information and Mathematical Sciences*, 4:19-21.

COETZEE, B. & VAN DEN BERG, P. H. 2007. Game analysis of the eight top ranked tertiary institution rugby teams in South Africa. *Journal of Human Movement Studies*, 52(1):49-63.

COHEN, J. 1988. Statistical power analysis for the behavioural sciences. 2<sup>nd</sup> ed. Hillsdale : Erlbaum, 567 p.

DE LA PORTE, Y. & SPAMER, E.J. 2006. The physical and game skills profile of the elite South African schoolboy rugby player. *Journal of Human Movement Studies*, 51:291-306.

DEUTSCH, M.U., KEARNEY, G.A. & REHRER, N.J. 2007. Time-motion analysis of professional rugby union players during match-play. *Journal of Sports Sciences*, 25(4):461-472, February.

DUTHIE, G., PYNE, D. & HOOPER, S. 2003. Applied physiology and game analysis of rugby union. *Sports Medicine*, 33(13):973-991.

DUTHIE, G., PYNE, D. & HOOPER, S. 2005. Time motion analysis of 2001 and 2002 super 12 rugby. *Journal of Sports Sciences*, 23(5):523-530.

EAVES, S. & HUGHES, M. 2003. Patterns of play of international rugby union teams before and after the introduction of professional status. *International Journal of Performance Analysis in Sport*, 3(2):103-111, December.

EAVES, S.J., HUGHES, M.D. & LAMB, K. L. 2005. The consequences of the introduction of playing status on game action variables in international northern hemisphere rugby union football. *International Journal of Performance Analysis in Sport*, 5(2):58-86, November.

FULLER, C.W., BROOKS, J.H.M., CANCEA R.J., HALL J. & KEMP S.P.T. 2007. Contact events in rugby union and their propensity to cause injury. *British Journal of Sport Medicine*, 41:862-867, May.

FULLER, C.W., RAFTERY, M., READHEAD, C., TARGETT, G.R. & MOLLOY, M.G. 2009. Impact of the International rugby board's experimental law variations on the incidence and nature of match injuries in southern hemisphere professional rugby union. *South African Medical Journal*, 99(4):232-237, April.

GIANOTTI, S., HUME, P.A., HOPKINS, W.G., HARAWIRA, J. & TRUMAN, T. 2008. Interim evaluation of the effect of a new scrum law on neck and back injuries in rugby union. *British Journal of Sports Medicine*, 42(6):427-430, April.

HANDCOCK, P. 1993. Physical preparation for rugby union. *Journal of Physical Education*, New Zealand, 26(3):7-9.

HARMSE, J.J. 2006. Sport. Rapport:1, May, 7.

HUGHES, M. & WILLIAMS, D. 1988. The development and application of a computerized rugby union notation system. *Journal of Sports Sciences*, 6:254-255.

HUGHES, M.D. & WHITE, P. 1997. An analysis of forward play in the 1991 rugby union World Cup for men. (In Hughes, M.D., ed. Notational Analysis of Sport -I and II. Cardiff : University of Wales Institute. p. 183-191.)

HUGHES, M., EVANS, S. & WELLS, J. 2001. Establishing normative profiles in performance analysis. *International Journal of Performance Analysis in Sport*, 1(1):1-21, July.

HUGHES, M. & BARTLETT, R.M. 2002. The use of performance indicators in performance analysis. *Journal of Sports Sciences*, 20:739-754.

HUGHES, M. & BARTLETT, R.M. 2007. Notational Analysis of Sport. (In Hughes, M & Franks, I.M., eds. The use of performance indicators in performance analysis. London and New York: Routledge. p. 166-188.)

HUGHES, M. & FRANKS, I.M. 2007. Notational Analysis of Sport. (In Hughes, M & Franks, I.M., eds. Notational Analysis – a review of the literature. London and New York : Routledge. p. 59-106.)

JONES, N.M.P., MELLALIEU, S.D. & JAMES, N. 2002. Team performance indicators as a function of winning and losing in rugby union. *International Journal of Performance Analysis in Sport*, 4(1):61-71, August.

KEW, F. 1987. Contested rules: An explanation of how games changed. *International Review for the Sociology of Sport*, 22(2):125-135.

LAMES, M. & McGARRY, T. 2006. On the search for reliable performance indicators in game sports. *International Journal of Performance Analysis in Sport*, 7(1):62-78, January.

LAPPASET, B. 2008. The international rugby board guide to experimental law variations [Web:]  
<https://portal.irb.com/Training/Shared%20Docs%20%20ENG/ELV%20guide/ELV%20Guide%20EN.pdf> [Date of use: 6 Jan.2010].

MCLEAN, D.A. 1992. Analysis of the physical demands of international rugby union. *Journal of Sports Sciences*, 10:285-296.

MILBURN, P.D. 1993. Biomechanics of rugby union scrummaging: Technical and safety issues. *Sport Medicine*, 16(3):168-179.

NEWELL, K. 2004. Winning solutions. *Coach and Athletic director*, 74(2):54-60, Sep.

O'DONOGHUE, P. 2006. The use of feedback videos in sport. *International Journal of Performance Analysis in Sport*, 6(2):1-14, November.

O'DONOGHUE, P. 2007. Reliability issues in performance analysis. *International Journal of Performance Analysis in Sport*, 7(1):1-14, January.

O'DONOGHUE, P. 2008. Principal components analysis in the selection of key performance indicators in sport. *International Journal of Performance Analysis in Sport*, 8(3):145-155, November.

OWEN, P.D. & WEATHERSTON, C.R. 2004. Uncertainty of outcome and super 12 rugby union attendance: Application of a general-to-specific modelling strategy. *Journal of Sports Economics*, 5(4):347-370.

PLOTZ, A.F. & SPAMER, M.J. 2006. A comparison of talented South African and English youth rugby players with reference to game specific-, anthropometric-, physical and motor variables. *South African Journal for Research in Sport, Physical Education and Recreation*, 28(1):101-107.

QUARRIE, K.L., HANDCOCK, P., WALLER, A.E., CHALMERS, D.J., TOOMEYS, M.J. & WILSON, B.D. 1995. The New Zealand rugby injury and performance project. III. Anthropometric and physical performance characteristics of players. *British Journal of Sports Medicine*, 29(4):263-270.

QUARRIE, K.L., HANDCOCK, P., WALLER, A.E., TOOMEYS, M.J. & CHALMERS, D.J. 1996. The New Zealand rugby injury and performance project. *British Journal of Sports Medicine*, 30:53-56.

QUARRIE, K.L. & HOPKINS, W.G. 2007. Changes in player characteristics and match activities in Bledisloe cup rugby union from 1972 to 2004. *Journal of Sports Sciences*, 25(8):895-903, June.

QUARRIE, K.L. & HOPKINS, W.G. 2008. Tackle injuries in professional rugby union. *The American Journal of Sports Medicine*, 36(9):1705-1716, May.

ROBERTS, S., TREWARTHA, G. & STOKES, K. 2006. A comparison of time-motion analysis methods for field-based sports. *International Journal of Sports Physiology and Performance*, 1:388-399.

REED, D. & O'DONOGHUE, P. 2005. Development and application of computer-based prediction methods. *International Journal of Performance Analysis in Sport*, 5(3):12-28, December.

REES, D. 1996. Let's go to the video! *Coach and Athletic Director*, 65(6):26-27, January.

SARUGBY.COM. 2006. Stats centre. [Web:] [http://www.sarugby.com/news/Stats\\_Centre/catid=14.html](http://www.sarugby.com/news/Stats_Centre/catid=14.html) [Date of access: 7 Aug. 2006].

SASAKI, K., FURUKAWA, T., MURAKAMI, J., SHIMOZONO, H., NAGAMATSU, M., MIYAO, M., YAMAMOTO, T., WATANABE, I., YASUGAHIRA, H., SAITO, T., UENO, Y., KATSUTA, T. & KONO, I. 2007. Scoring profiles and defence performance analysis in rugby union. *International Journal of Performance Analysis in Sport*, 7(3):46-53, October.

SCOTT, A.C., ROE, N., COATS, A.J.S. & PIEPOLI, M.F. 2003. Aerobic exercise physiology in a professional rugby union team. *International Journal of Cardiology*, 87:173-177.

SPAMER, E.J. & DE LA PORT, Y. 2006. Anthropometric, physical, motor and game-specific profiles of elite u 16 and u 18 year-old South African schoolboy rugby players. *International Journal of Fundamental and Applied Kinesiology*, 38(2):176-184, December.

SHERIDAN, H. 2007. Evaluating technical and technological innovations in sport: Why fair play isn't enough? *Journal of Sport and Social Issues*, 31(2):179-194, May.

STATSOFT, INC. 2009. Statistica (data analysis software system), version 7 [www.statsoft.com](http://www.statsoft.com). Date of access: 14 January 2010.

VAN ROOYEN, M.K., LAMBERT, M.I. & NOAKES, T.D. 2006. A retrospective analysis of the IRB statistics and video analysis of match play to explain the performance of four teams in the 2003 rugby world cup, *International Journal of Performance Analysis in Sport*, 6(1):57-72, June.

WILLIAMS, J., HUGHES, M. & O'DONOGHUE, P. 2005. The effect of rule changes on match and ball in play time in rugby union. *International Journal of Performance Analysis in Sport*, 5(3):1-11, December.

## CHAPTER 5



# SUMMARY, CONCLUSION AND RECOMENDATIONS

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1. SUMMARY
  2. CONCLUSION
  3. RECOMMENDATIONS
- 

## 1. SUMMARY

The purpose of this study was firstly to determine whether the experimental law variations (ELVs) succeeded in changing the flow of play during matches in order to make rugby more appealing to spectators. Secondly, to determine the frequency of different performance indicators (PIs) in the 2006 and 2008 Super 14 rugby union tournaments. Thirdly, to determine which PIs discriminate between the successful (top seven) and less successful (bottom seven) Super 14 rugby union teams during the 2006 competition. Lastly, to determine which PIs significantly predict the ranking of the Super 14 rugby union teams. Chapter 1 provided a brief summary of the problem statement that underlies the research questions of the study as well as the objectives, hypotheses and structure of the study.

A literature overview titled "Computer notational analyses in rugby union" was presented in Chapter 2. The purpose of this literature overview was to give an overview of the research related to the application of CNA in rugby union. Thirty-eight relevant articles were identified and reported on. The overview revealed that CNA is used extensively in three specific research fields within rugby, namely 1) Time-motion analyses; 2) The use of performance indicators to determine success (outcome of the game); and 3) The use of performance indicators to investigate the how the game has evolved due to law changes and professionalism. It is also important to note that reliability issues do exist with regard to this type of analysis. However, the literature did indicate that the reliability of CNA as a method for



analysing the game of rugby could be considered acceptable if specific guidelines were to be followed. It can also be concluded that CNA could be considered a viable research tool in game analysis, particularly when the advantages are taken into consideration. With regard to time-motion analysis the literature indicated that rugby may be regarded as a sport with intermittent high-intensity play for different player positions and that such players should be conditioned accordingly. Based on the literature review it was also indicated that the game of rugby union consists of various performance indicators which make the analysis of the game far more difficult than most other types of sport. It does, however, seem that performance indicators could be used to determine both the performance and ranking of the analysed teams as well as to determine the effect certain types of changes have on the game. In summary, the literature clearly supports the advantages of CNA with regards to developing and understanding the game of rugby union.

Chapter 3 consisted of the first research article titled "Match analysis of the 2006 Super 14 rugby union tournament". The purpose of this study was firstly to determine the frequency and duration of different PIs of the Super 14 rugby teams during the 2006 tournament; secondly, to determine which match-profile variables discriminate between the successful (top seven) and less successful (bottom seven) Super 14 rugby teams and thirdly, to determine which PIs predict the ranking of the Super 14 rugby teams during the 2006 competition. With regard to these questions this study revealed that meters gained, kicks from hand, line breaks and percentage tackles made were the PIs which discriminated accurately (92.86%) between successful and less successful Super 14 rugby union teams. Furthermore, the PIs which emerged as the best predictors (practical significant) of ranking among the Super 14 rugby union teams were (in order of contribution): meters gained (46%), kicks from hand (28%) and line breaks (8%). The results from this study therefore outlined the importance of the different PIs as performance predictors in the ranking of the 2006 Super 14 rugby union teams.

The second article titled "The effect of the ELVs on the Super 14 rugby union tournament" was presented in Chapter 4. The aim of this study was to determine whether the experimental law variations (ELV) introduced in 2008 succeeded in changing the flow of rugby union matches to make it more appealing to spectators. A **decrease** in the frequency of scrums ( $d = 0.94$ ) and line-outs ( $d = 2.18$ ) were detected between the PIs of the two seasons with a large practical significant value. In

contrast to this, the number of tackles made ( $d=0.97$ ), meters gained ( $d=1.09$ ) and penalties conceded ( $d=0.86$ ) all showed a large practically significant **increase** over the two seasons. The increase in the so-called action-related activities and decrease in static-related activities suggest that the IRB have succeeded in addressing their objective of increasing the appeal of the game with the introduction of the ELVs after the 2006 competition. It is the researchers' view that the frequency of penalties would decrease as the players get use to the new laws of the game.

The first article presented in Chapter 3 will be submitted for publication in the *African journal for physical, health education, recreation and dance*. The second article presented in Chapter 4 will be submitted for publication in the *South African journal for research in sport, physical education and recreation*.

## 2. CONCLUSION

The conclusions drawn from this research are presented in accordance with the hypotheses stated in Chapter 1.

Hypothesis 1: *The ELVs succeeded in changing the flow of play during matches in order to make rugby more appealing to spectators.*

Hypothesis 1 is accepted, when the results from Chapter 4 are taken into consideration. The practically significant increase in meters gained and tackles made as well as the significant decrease in scrums and line-outs do indicate that the action-related activities increased while the static-related activities showed a decrease. This indicates that the ELVs succeeded in changing the flow of play during matches in order to make rugby more appealing to spectators.

Hypothesis 2: *The frequency of different PIs will differ significantly between the 2006 and 2008 Super 14 rugby union tournaments.*

Hypothesis 2 is also accepted because five of the nine PIs calculated during the 2006 Super 14 season did differ significantly from the PIs that occurred during the 2008 Super 14 season

Hypothesis 3: *Offloads in the tackle and good defence will discriminate significantly between successful (top seven) and less successful (bottom seven) super 14 rugby union teams.*

Hypothesis 3 is partially accepted. The reason is that although tackles significantly discriminated between successful and less successful teams, off-loads in the tackle did not. The other PIs that discriminated significantly between successful and less successful teams were meters gained, kicks from hand and line breaks.

Hypothesis 4: *Offloads in the tackle, tactical kicking and good defence will predict the ranking of the Super 14 rugby union teams.*

Hypothesis 4 is also partially accepted, because although tactical kicking predicted the ranking of the Super 14 rugby union teams, the other expected PIs were insignificant. Meters gained and line breaks did, on the other hand, affect the prediction of the teams' rankings significantly.

### 3. RECOMMENDATIONS

From the results of this study, the following statements are supported.

- ✚ PIs can be used when different changes in the game such as amateurism to professionalism as well as law changes are investigated;
- ✚ PIs can be used to determine the ranking of teams with relation to performance.
- ✚ PIs can be used with success to determine performance (outcomes of the game) in rugby union.
- ✚ The reliability of CNA can be acceptable if certain ground rules are followed.

Certain shortcomings were identified regarding this study:

- ✚ Due to the fact that the data of the PIs were collected by a private company, no inter-intra tests could be done to establish reliability of the data analysis.
- ✚ With the data from the 2007 season amicable due to the best players not taking part because of the 2007 World Cup, a considerable time-span of 2 years occurred between the analyses.
- ✚ Due to the complexity of rugby union all the PIs such as weather conditions, home ground advantage and so forth were not taken into consideration.

It is, therefore recommended that more studies should focus on PIs and the effect they have on the performance outcomes of rugby matches so as to identify the best PIs related to the game of rugby.

## APPENDIX



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# Appendix

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## APPENDIX A

SUBMISSION GUIDELINES FOR THE JOURNAL: South African journal for research in sport, physical education and recreation.

## APPENDIX B

SUBMISSION GUIDELINES FOR THE JOURNAL: The African journal for physical, health education, recreation and dance.

## APPENDIX C

THE IRB GUIDE TO EXPERIMENTAL LAW VARIATIONS

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# APPENDIX A

## SUBMISSION GUIDELINES FOR THE JOURNAL: South African journal for research in sport, physical education and recreation.

*South African Journal for Research In Sport, Physical Education and Recreation*

### INFORMATION FOR AUTHORS

The *South African Journal for Research in Sport, Physical Education and Recreation* is published by the Stellenbosch University. Contributions from the fields of Sport Science, Movement Education, Recreation/Leisure Studies, Exercise Science and Dance Studies will be considered for publication. The articles submitted will be administered by the appropriate Subject Review Editor and evaluated by two or more referees. The decision as to whether a particular article is to be published or not, rests with the Editorial Board.

#### SUBMISSION

Manuscripts should be typed with one and a half spacing in 12-point Times New Roman letter size and printed on A4-size white paper in laser quality. The original manuscript (clearly indicated) and three copies of the manuscript must be submitted. Length must not exceed 20 pages (tables, figures, references, etc. included). Original manuscripts may be submitted in English or Afrikaans and should be sent to:

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#### CONDITIONS

A signed declaration in respect of the originality must accompany each manuscript. On submission of the manuscript, the author shall present a written statement that the article has not been published or is not being presented for publication elsewhere. Should the article be taken from a Master's thesis or Doctoral dissertation, academic ethic requires that the student will be the first author. The author should also ensure that the LANGUAGE of the manuscript has been thoroughly edited at the time of submission (in British English). The name, address and telephone number of the person who has done the language editing must be provided. On receiving a written notification from the Managing Editor that the article has been accepted, a final hard copy of the manuscript and a diskette (virus checked) should be submitted using MS WORD as a DOC-file (see Figures). It can also be sent per e-mail as an attached file.

#### PREPARATION OF MANUSCRIPT

##### Title page

The first page of each manuscript should indicate the *title* in English and Afrikaans (will be translated for foreign authors), the *names* (title, first name in full and other initials, surname) of the author(s), the *telephone* numbers (work & home), *facsimile* number, *e-mail* address (if available) and the *field of study*. The mailing address of the first named author and the institution where the work was conducted should be provided in full. A short title of not more

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Each manuscript must be accompanied by an abstract of approximately 150-200 words in *English* and should be set on a *separate page* as a SINGLE paragraph (one and a half spacing). A list of three to seven key words in *English* is required for indexing purposes and should be typed below the abstract.

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#### Text

Start the text on a new page with the title of the article (centred and *without* the names of the authors). Follow the style of the most recent issue of the journal regarding the use of headings and subheadings. Use only one space between sentences.

#### Tables and figures

Tables and figures should be numbered in *Arabic* numerals (1, 2, etc.). Tables require a heading at the *top* and figures a legend *below* and separate from the figure. Indicate where the tables or figures must feature in the text (if handed in separately). *Note:* Use the decimal POINT (not the decimal comma).

#### References

In the *text* the Harvard method must be adopted by providing the author's surname and the date placed in parentheses. *For example:* Daly (1970); King and Loathes (1985); (Botha & Sonn, 2002); McGuines *et al.* (1986) or (Daly, 1970: 80) when Daly is not part of the sentence. More than one reference must be arranged chronologically. Note that *et al.* is used in the body of the text when there are more than two authors, but never in the list of references.

#### List of references

Only the references cited in the text should be listed alphabetically according to surname (last name) of authors (capitals) after the body of text under the heading, References (capitals) starting on a new page. In the case of articles published in *JOURNALS*, references listed should include the surnames and initials (capitals) of all authors, the date of the publication in parentheses, the full title of the article, the full title of the journal (italics), the volume number, the serial number in parentheses (omitted only if the said journal does not use issue numbers), followed by a colon and the first and last page numbers separated by a hyphen.

#### Example:

VAN WYK, G.J. & AMOORE, J.N. (1995). A practical solution for calculating instantaneous values of tension in the extensor muscles of the knee joint during extension and flexion. *South African Journal for Research in Sport, Physical Education and Recreation*, 18(1): 77-97.

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Example:

JEWETT, A.E.; BAIN, L.L. & ENNIS, C.E. (1995). *The curriculum process in Physical Education* (2<sup>nd</sup> ed.), Madison, WI: WCB Brown & Benchmark.

For a CHAPTER from a book, the page numbers of the chapter cited must be provided in parentheses (not italics) after the title of the book. For further details, authors should consult the most recent publication of this Journal for other examples.

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The corresponding author will receive a complimentary copy of the journal and five reprints of the article. The original manuscripts and illustrations will be discarded one month after publication unless a request is received to return the original to the first-named author. Page charges of R80 per page are payable on receipt of an account issued by the editor.

## APPENDIX B

### SUBMISSION GUIDELINES FOR THE JOURNAL: The African journal for physical, health education, recreation and dance.

#### GUIDELINES FOR AUTHORS

The African Journal for Physical, Health Education, Recreation and Dance (AJPHERD) is a peer-reviewed journal established to:

- i) provide a forum for physical educators, health educators, specialists in human movement studies and dance, as well as other sport-related professionals in Africa, the opportunity to report their research findings based on African settings and experiences, and also to exchange ideas among themselves.
- ii) afford the professionals and other interested individuals in these disciplines the opportunity to learn more about the practice of the disciplines in different parts of the continent.
- iii) create an awareness in the rest of the world about the professional practice in the disciplines in Africa.

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AJPHERD publishes research papers that contribute to knowledge and practice, and also develops theory either as new information, reviews, confirmation of previous findings, application of new teaching/coaching techniques and research notes. Letters to the editor relating to the materials previously published in AJPHERD could be submitted within 3 months after publication of the article in question. Such letter will be referred to the corresponding author and both the letter and response will be published concurrently in a subsequent issue of the journal.

Manuscripts are considered for publication in AJPHERD based on the understanding that they have not been published or submitted for publication in any other journal. In submitting papers for publication, corresponding authors should make such declarations. Where part of a paper has been published or presented at congresses, seminars or symposia, reference to that publication should be made in the acknowledgement section of the manuscript.

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Author(s') institutional addresses, including telephone and fax numbers.

Corresponding author's contact details, including e-mail address.

A short running title of not more than 6 words.

**Abstract**

An abstract of 200-250 words is required with up to a maximum of 5 words provided below the abstract. Abstract must be typed on a separate page using single line spacing, with the purpose of the study, methods, major results and conclusions concisely presented. Abbreviations should either be defined or excluded.

**Text**

Text should carry the following designated headings: Introduction, materials and methods, results, discussion, acknowledgement, references and appendices (if appropriate).

**Introduction**

The introduction should start on a new page and in addition to comprehensively giving the background of the study should clearly state the problem and purpose of the study. Authors should cite relevant references to support the basis of the study. A concise but informative and critical literature review is required.

**Materials and Methods**

This section should provide sufficient and relevant information regarding study participants, instrumentation, research design, validity and reliability estimates, data collection procedures, statistical methods and data analysis techniques used. Qualitative research techniques are also acceptable.

**Results**

Findings should be presented precisely and clearly. Tables and figures must be presented separately or at the end of the manuscript and their appropriate locations in the text indicated. The results section should not contain materials that are appropriate for presentation under the discussion section. Formulas, units and quantities should be expressed in the *systeme internationale (SI)* units. Colour printing of figures and tables is expensive and could be done upon request authors' expense.

**Discussion**

The discussion section should reflect only important aspects of the study and its major conclusions. Information presented in the results section should not be repeated under the discussion. Relevant references should be cited in order to justify the findings of the study. Overall, the discussion should be critical and tactfully written.

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The American Psychological Association (APA) format should be used for referencing. Only references cited in the text should be alphabetically listed in the reference section at the end of the article. References should not be numbered either in the text or in the reference list.

Authors are advised to consider the following examples in referencing:

Examples of citations in body of the text:-

## 117 GUIDELINES FOR AUTHORS

For one or two authors; Kruger (2003) and Travill and Lloyd (1998). These references should be cited as follows when indicated at the end of a statement: (Kruger, 2003); (Travill & Lloyd, 1998).

For three or more authors cited for the first time in the text; Monyeki, Brits, Mantsena and Toriola (2002) or when cited at the end of a statement as in the preceding example; (Monyeki, Brits, Mantsena & Toriola, 2002). For subsequent citations of the same reference it suffices to cite this particular reference as: Monyeki et al. (2002).

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Journal references should include the surname and initials of the author(s), year of publication, title of paper, name of the journal in which the paper has been published, volume and number of journal issue and page numbers.

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For two authors: Johnson, A.G. & O'Kefee, L.M. (2003). Analysis of performance factors in provincial table tennis players. *Journal of Sport Performance*, 2(3), 12-31.

For multiple authors: Kemper, G.A., McPherson, A.B., Toledo, I. & Abdullah, I.I. (1996). Kinematic analysis of forehand smash in badminton. *Science of Racket Sports*, 24(2), 99-112.

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Book references should specify the surname and initials of the author(s), year of publication of the book, title, edition, page numbers written in brackets, city where book was published and name of publishers. Chapter references should include the name(s) of the editor(s) and other specific information provided in the third example below:

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For chapter references in a book: Adams, L.L. & Neveling, I.A. (2004). Body fat characteristics of sumo wrestlers. In J.K. Manny and F.O. Boyd (Eds.), *Advances in Kinanthropometry* (pp. 21-29). Johannesburg, South Africa: The Publishers Company Ltd.

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Electronic sources should be easily accessible. Details of Internet website links should also be provided fully. Consider the following example:

Wilson, G.A. (1997). Does sport sponsorship have a direct effect on product sales? *The Cyber-Journal of Sport Marketing (online)*, October, 1(4), at <http://www.cad.gu.au/cjism/wilson.html>, February 1997.

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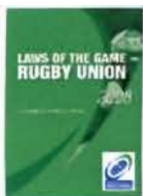
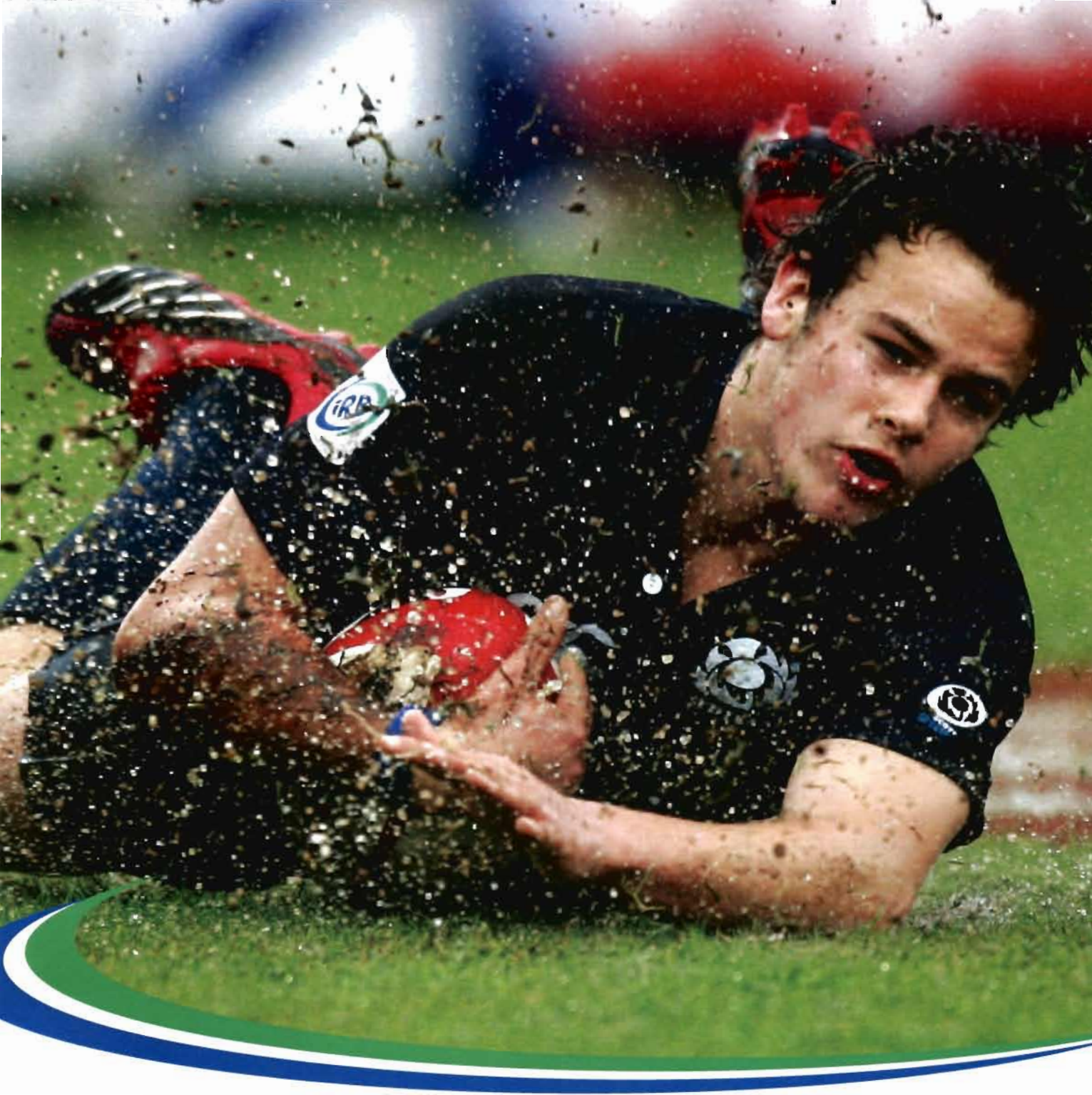
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## **APPENDIX C**

### **THE IRB GUIDE TO EXPERIMENTAL LAW VARIATIONS**



# The IRB Guide to **Experimental Law Variations**

August 2008







## Foreword by Bernard Lapasset, IRB Chairman

I welcomed the decision by the IRB Council in 2004 to review the Laws of the Game following recommendations that came out of the Conference on the Playing of the Game that was held in Auckland after Rugby World Cup 2003. Subsequently, a lot of hard work has been undertaken by an IRB Laws Project Group which has studied a group of Experimental Law Variations (ELVs) with the assistance of a number of our Member Unions. This ongoing co-operation is much appreciated.

Following this unprecedented work, Council has now approved a global trial at all levels of the Game of certain Experimental Law Variations (ELVs) beginning on August 1, 2008. This decision to implement a global trial represents an important milestone for the future of the Game.

The trial will involve 13 ELVs that have been undergoing practical on field experimentation in approved tournaments around the world over the last two years. This guide introduces these 13 ELVs.

The Laws Project Group will closely monitor the global trial over the next 12 months with the assistance of Member Unions. Then, next year, Council will review all the ELVs that will have undergone trials before deciding if all or any of the ELVs should be accepted into full Law.

### Bernard Lapasset

*Chairman, International Rugby Board*

#### Important notes:

- the Laws of the Game, unless specifically amended by the ELVs, remain unaltered
- the ELVs also apply to the Sevens and Under 19 Variations

### Experimental Law Variations Summary

#### Law 6 - Match Officials

- |   |   |
|---|---|
| 1 | Assistant referees are able to assist the referee in any way that the referee requires. |
|---|---|

#### Law 17 - Maul

- |   |   |
|---|---|
| 2 | Remove reference to head and shoulders not being lower than hips. |
| 3 | Players are able to defend a maul by pulling it down.             |

#### Law 19 - Touch and Lineout

- |    |  |
|----|--|
| 4  | If a team puts the ball back into its own 22 and the ball is subsequently kicked directly into touch, there is no gain in ground.  |
| 5  | A quick throw in may be thrown in straight or towards the throwing team's own goal line.   |
| 6  | There is no restriction on the number of players from either team who can participate in the lineout.  |
| 7  | The receiver at the lineout must be 2 metres away from the lineout.  |
| 8  | The player who is in opposition to the player throwing in the ball must stand in the area between the 5-metre line and the touch line but must be 2 metres away from the 5-metre line. |
| 9  | Lineout players may pre-grip a jumper before the ball is thrown in.  |
| 10 | The lifting of lineout players is permitted.   |

#### Law 20 - Scrum

- |    |   |
|----|---|
| 11 | Introduction of an offside line 5 metres behind the hindmost feet of the scrum. |
| 12 | Identification of scrum half offside lines.                                     |

#### Law 22 - Corner Posts

- |    |  |
|----|--|
| 13 | The corner posts are no longer considered to be touch-in-goal except when the ball is grounded against the post. |
|----|--|



## Disclaimer

This *IRB Guide to Experimental Law Variations* product has been developed in the context of the Laws applying to accident and injury prevention and medical practice in Ireland and the information and guidelines incorporated on these matters are made available strictly on the basis that the IRB (including its operating entity IRFB Services (Ireland) Limited and other associated entities) does not accept any liability to any person or entity for loss, cost or damage howsoever arising out of any reliance on and/or use of the information and/or guidelines contained in this *IRB Guide to Experimental Law Variations* product.

## Experimental Law Variation 1

## Law 6 - Match Officials

*Assistant referees are able to assist the referee in any way that the referee requires.*

### What this means for the Game

When appointed by a match organiser, e.g. a Rugby Union, SANZAR, ERC, etc., qualified touch judges will be known as assistant referees and can, at the discretion of the referee, be assigned additional responsibilities.

This Experimental Law Variation is designed to allow assistant referees to provide additional information to the referee to assist in decision making.



## Law text

### Law 6 MATCH OFFICIALS

Every match is under the control of **match officials** who consist of the referee and two touch judges or assistant referees. **Additional persons**, as authorised by the match organisers, may include the referee, reserve touch judge and/or assistant referee, an official to assist the referee in making decisions by using technological devices, the time keeper, the match doctor, the team doctors, the non-playing members of the teams and the ball persons.

A touch judge may be appointed by a match organiser or a team involved in a match and is responsible for signalling, touch, touch-in-goal and the success or otherwise of kicks at goal.

An assistant referee may be appointed by a match organiser and is responsible for signalling, touch, touch-in-goal, the success or otherwise of kicks at goal and indicating foul play. An assistant referee will also provide assistance to the referee in the performance of any of the referee's duties as directed by the referee.



## Experimental Law Variation 2


*Remove reference to head and shoulders not being lower than hips.*

### What this means for the Game

Failure of players to keep their heads and shoulders above their hips throughout the maul will no longer constitute an offence.



This Experimental Law Variation is necessary because of Experimental Law Variation 3 (see page 5).

## Law 17 - Maul

Line of hips

Head and shoulders lower than hips

UNDER CURRENT LAW:	<b>ILLEGAL</b> 
UNDER ELV:	<b>LEGAL</b> 

### Law text

*Law 17.2 JOINING A MAUL*

#### Clause (a) removed:

(a) Players joining a maul must have their heads and shoulders no lower than their hips.

~~Penalty: Free kick~~





## Experimental Law Variation 3

## Law 17 - Maul

*Players are able to defend a maul by pulling it down.*

### What this means for the Game

A defending team may pull the maul to the ground.

To do this, the defender must grasp an opposing player in the maul anywhere between the shoulders and the hips and then pull that player to the ground.

If the maul is brought down by any other action it is regarded as a collapse which remains illegal.



### Law text

#### Law 17.5 SUCCESSFUL END TO A MAUL

(a) A maul ends successfully when the ball, or a player with the ball, leaves the maul. A maul ends successfully when the ball is on the ground, or is on or over the goal line.

(b) A player may pull a maul to the ground providing that player does so by pulling an opponent in the maul down from the shoulders to the hips.

**Penalty:** Penalty kick

#### Law 17.6 UNSUCCESSFUL END TO A MAUL

(a) A maul ends unsuccessfully if the ball becomes unplayable, or the maul collapses or is pulled down and the ball does not emerge. A scrum is ordered.



## Experimental Law Variation 4

## Law 19 - Touch and Lineout

*If a team puts the ball back into its own 22 and the ball is subsequently kicked directly into touch, there is no gain in ground.*

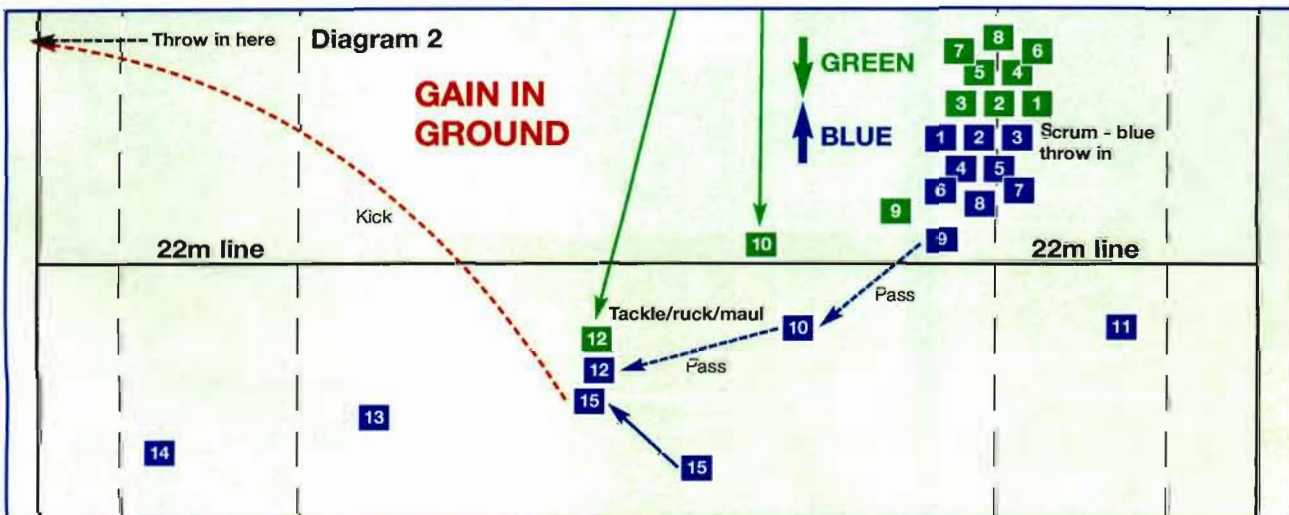
### What this means for the Game

Teams will no longer be able to pass or play the ball back into their own 22 and then kick directly to touch in order to gain ground.

In diagram 1, the ball has been passed back into the 22. After two passes and a kick directly to touch the ball has not touched an opposition player, and there has not been a tackle, ruck or maul, so the lineout will take place opposite where the player kicked the ball.

In diagram 2, the ball has been passed back into the own 22, a tackle, ruck or maul has occurred, and then a kick directly to touch has been made, the lineout will take place where the ball went into touch.

This Experimental Law Variation is designed to ensure that defending teams do not have an unfair advantage over attacking teams. It encourages tactical kicking and counter-attacking skills.





## Law text

### Law 19.1 THROW IN



#### NO GAIN IN GROUND

- (a) **Outside a team's 22, a team member kicks directly into touch.** Except for a penalty kick, when a player anywhere in the field of play who is outside the 22 kicks directly into touch, there is no gain in ground. The throw in is taken either at the place opposite where the player kicked the ball, or at the place where it went into touch, whichever is nearer that player's goal line.
- (b) **When a team causes the ball to be put into that team's 22.** When a defending player plays the ball from outside the 22 and it goes into that player's 22 or in-goal area without touching an opposition player and then that player or another player from that team kicks the ball directly into touch before it touches an opposition player, or a tackle takes place or a ruck or maul is formed, there is no gain in ground. This applies when a defending player moves back behind the 22 metre line to take a quick throw-in and then the ball is kicked directly into touch.
- (c) **Defending team takes the ball into that team's 22 at a scrum or lineout.** When a defending team throws the ball into a scrum or lineout outside that team's 22 and the ball then crosses into the team's 22 without touching an opposition player and then a player from the defending team kicks the ball directly into touch before it touches an opposition player, or a tackle takes place or a ruck or maul is formed, there is no gain in ground.

#### GAIN IN GROUND

- (d) **Player takes the ball into that team's 22.** When a defending player plays the ball from outside the 22 and it goes into that player's 22 or in-goal area and it touches an opposition player, or a tackle takes place or a ruck or maul is formed, and then the ball is kicked by a player of that team directly in touch, the throw in is where the ball went into touch.
- (e) **Ball put into a player's 22 by the opposition.** When the ball is put into a team's 22 by the opposition, without having touched (or been touched by) a player of the defending team before crossing the 22 and the ball is then kicked into touch by the defending team, the throw in is where the ball went into touch.
- (f) **Kicks indirectly into touch.** When a player anywhere in the playing area kicks indirectly into touch so that the ball bounces in the field of play the throw in is taken where the ball went into touch.

When a player anywhere in the playing area kicks the ball so that it touches or is touched by an opposition player and then goes indirectly into touch so that the ball bounces in the field of play the throw in is taken where the ball went into touch.

When a player anywhere in the playing area kicks the ball so that it touches or is touched by an opposition player and then goes directly into touch the throw in is taken in line with where the opposition player touched the ball or where the ball crossed the touch line if that is nearer the opposition player's goal line.

## Experimental Law Variation 5

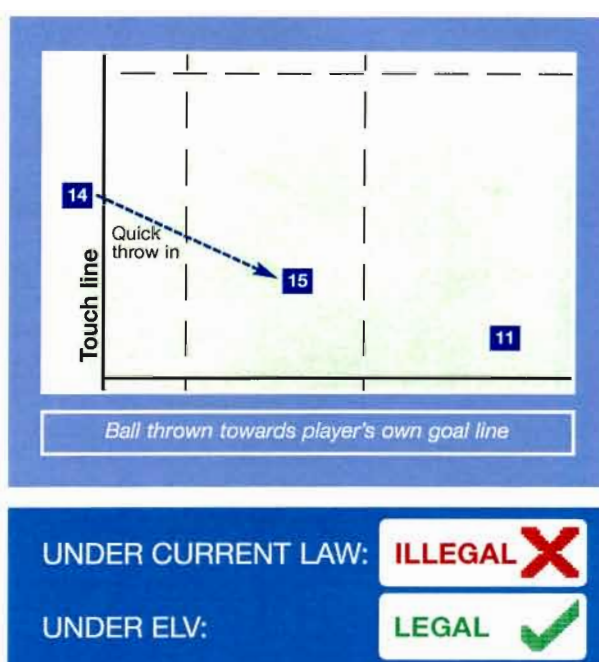
## Law 19 - Touch and Lineout

*A quick throw in may be thrown in straight or towards the throwing team's own goal line.*

### What this means for the Game

When taking a quick throw in, a player will no longer be required to throw the ball straight along the line of touch. If an advantage can be gained by throwing the ball directly to a team-mate who is behind the line of touch, this will be legal. The ball must still travel 5 metres before it touches the ground or another player.

This Experimental Law Variation is designed to increase the likelihood of a quick throw in providing a positive opportunity for the team taking the throw in to run the ball rather than opting for the lineout.



### Law text

#### Law 19.2 QUICK THROW IN

- (e) At a quick throw in, if the player throws the ball in the direction of the opposition's goal line or if the ball does not travel at least five metres along or behind the line of touch before it touches the ground or a player, or if the player steps into the field of play when the ball is thrown, then the quick throw in is disallowed. The opposing team chooses to throw in at either a lineout where the quick throw in was attempted, or a scrum on the 15-metre line at that place. If they too throw in the ball incorrectly at the lineout, a scrum is formed on the 15-metre line. The team that first threw in the ball throws in the ball at the scrum.
- (f) At a quick throw in a player may throw the ball in straight along the line of touch or towards that player's goal line.





## Experimental Law Variation 6

## Law 19 - Touch and Lineout

*There is no restriction on the number of players from either team who can participate in the lineout.*

### What this means for the Game

At a lineout the team who is not throwing in the ball will no longer have their number of lineout players governed by the number of lineout players chosen by the team throwing in the ball. As long as there are at least two players from each team to form a lineout, and all lineout players fit between the 5-metre and 15-metre lines, there is no further restriction on numbers.

This Experimental Law Variation is designed to allow teams more flexibility in their tactics at the lineout.



### Law text

#### Law 19.7 FORMING A LINEOUT

- (a) **Minimum.** At least two players from each team must form a lineout. A team must not voluntarily fail to form a lineout.

**Penalty:** Free Kick on the 15-metre line

- (b) **Maximum.** There is no restriction to the number of players from each team participating in the lineout. Each team can decide how many players participate in the lineout and there is no requirement for there to be an equal number of participants from each team.



## Experimental Law Variations 7 & 8

## Law 19 - Touch and Lineout

*The receiver at the lineout must be 2 metres away from the lineout.*

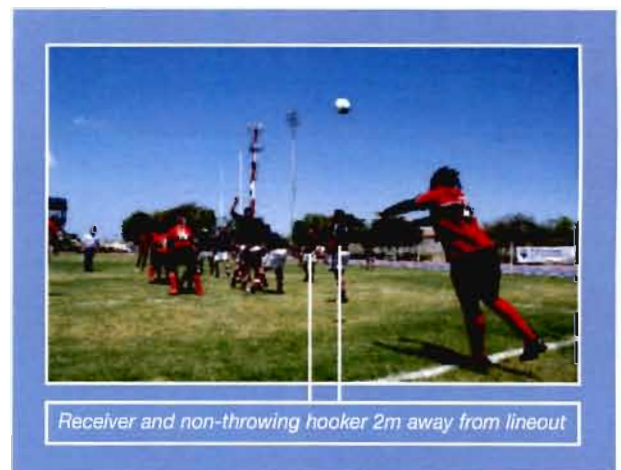
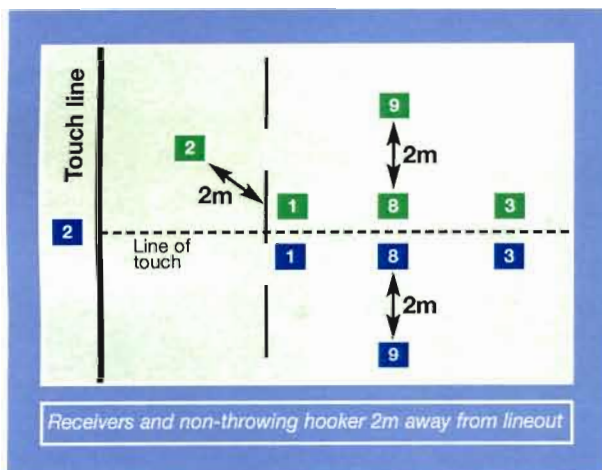
*The player who is in opposition to the player throwing in the ball must stand in the area between the 5-metre line and the touch line but must be 2 metres away from the 5-metre line.*

### What this means for the Game

If a team chooses to have a receiver (a player in position to catch the ball when lineout players pass or knock the ball back from the lineout) that player must be 2 metres away from the lineout itself.

Similarly, the defending team must have a player in immediate opposition to the player throwing in and that player must stay 2 metres away from the 5 metre line.

These Experimental Law Variations are designed to assist the referee in providing a clear 2 metre zone around the lineout. The referee will be able to clearly identify which player is the receiver and will be able to clearly see that the player immediately opposing the thrower is not a lineout player.



### Law text

#### Law 19.7 FORMING A LINEOUT

- (e) **Where the receiver must stand.** The receiver must stand at least two metres towards that player's goal line from that player's team-mates who are lineout players and between five and fifteen metres from the touch line.

**Penalty:** Free Kick on the 15-metre line

- (f) **Player between touch and five metres.** The team not throwing in must have a player standing between the touch line and the 5-metre line on that team's side of the line of touch when the lineout is formed. That player must stand at least two metres from the five metres line.





## Experimental Law Variation 9

## Law 19 - Touch and Lineout

*Lineout players may pre-grip a jumper before the ball is thrown in.*

### What this means for the Game

Players will no longer be required to wait until the player throwing in has released the ball before they grip a player who will jump to catch the ball.



*Player pre-gripped before thrower releases the ball*

UNDER CURRENT LAW: **ILLEGAL** 

UNDER ELV: **LEGAL** 

### Law text

#### *Law 19.9 OPTIONS AVAILABLE AT A LINEOUT*

- (e) **Pre-gripping is permitted.** Players who are going to lift or support a team-mate jumping for the ball may pre-grip that team-mate providing they do not pre-grip below the shorts from behind and below the thighs from the front.

**Penalty:** Free Kick on the 15-metre line



## Experimental Law Variation 10

## Law 19 - Touch and Lineout

*The lifting of lineout players is permitted.*

### What this means for the Game

Players will be able to lift team-mates in the lineout. However, support players must wait until the ball has left the hands of the player throwing it in before lifting their team-mate.



*Player lifted by team-mates after the ball has been released by the thrower*

UNDER CURRENT LAW:

**ILLEGAL** 

UNDER ELV:

**LEGAL** 

### Law text

#### Law 19.9 OPTIONS AVAILABLE AT A LINEOUT

- (f) **Lifting and supporting.** Players may assist a team-mate in jumping for the ball by lifting and supporting that player providing that the lifting and/or supporting players do not support the jumping team-mate below the shorts from behind or below the thighs from the front.

**Penalty:** Free Kick on the 15-metre line

- (h) **Jumping, supporting or lifting before the ball is thrown.** A player must not jump or be lifted or supported before the ball has left the hands of the player throwing in.

**Penalty:** Free Kick on the 15-metre line





## Experimental Law Variation 11

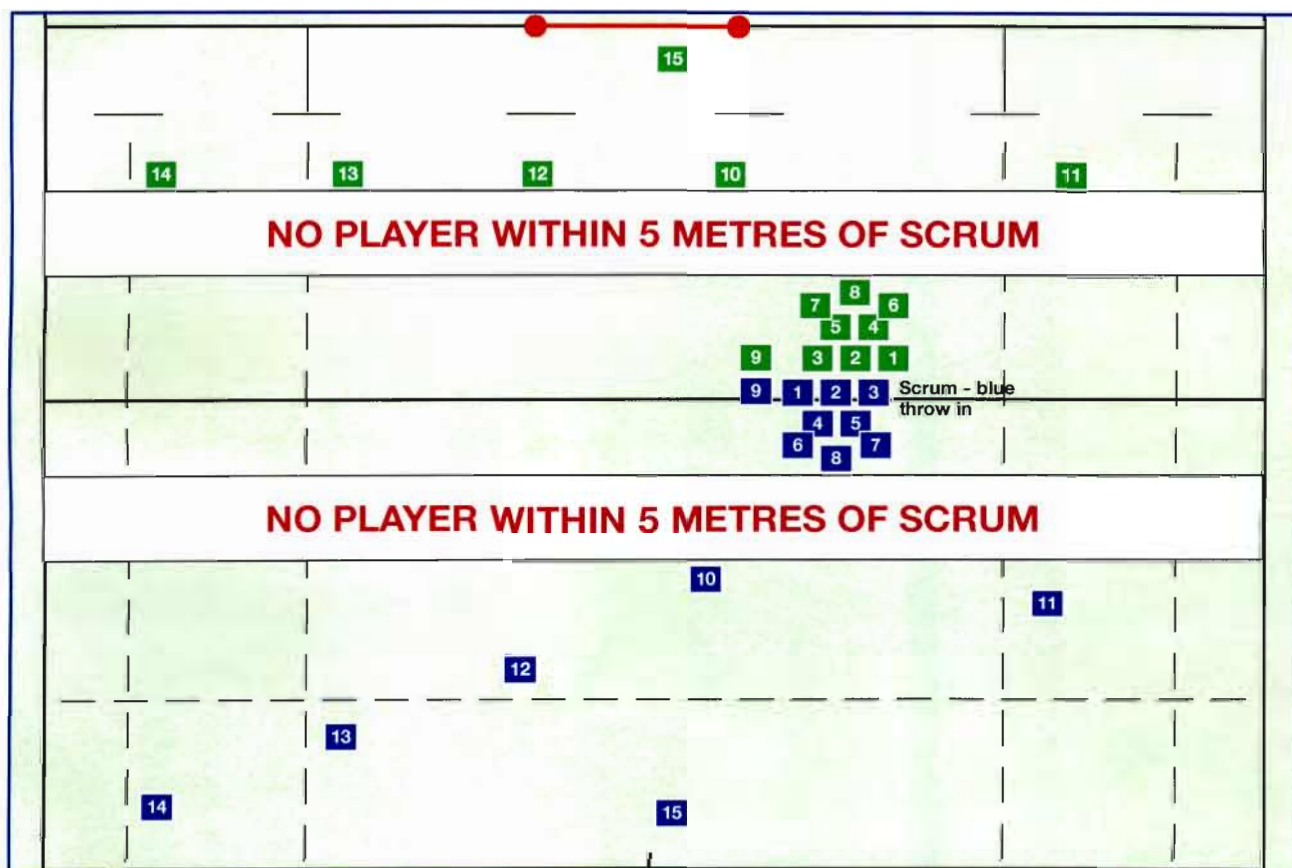
## Law 20 - Scrum

*Introduction of an offside line 5 metres behind the hindmost feet of the scrum.*

### What this means for the Game

At the scrum, both back lines (all non-participants in the scrum) must be back 5 metres from the hindmost feet of the scrum.

This Experimental Law Variation is designed to increase the space available to the team who wins the ball at the scrum. By having all the forwards committed at the scrum itself and 10 metres between the back lines, significant space is created in which to build an attack.



### Law text

#### Law 20.12 OFFSIDE AT THE SCRUM

- (g) **Offside for players not in the scrum.** Players who are not in the scrum and who are not the team's scrum half, are offside if they remain in front of their offside line or overstep the offside line which is a line parallel to the goal lines and 5 metres behind the hindmost player of each team in a scrum.

**Penalty:** Penalty Kick on the offside line



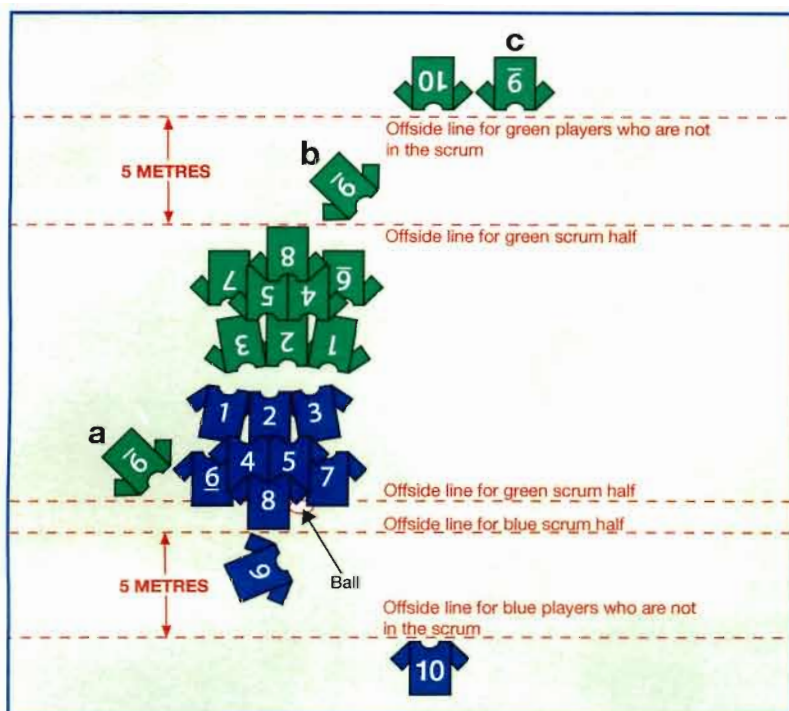
## Experimental Law Variation 12

## Law 20 - Scrum

*Identification of scrum half offside lines.*

### What this means for the Game

As a result of the introduction of the 5 metre offside line at the scrum, there is a need to establish the offside lines which apply to a scrum half.



#### Example a

The non-ball-winning scrum half can follow the ball. The scrum half must stay behind the ball which is the offside line.

#### Example b

The non-ball-winning scrum half may also move to the offside line at the hindmost foot of the scrum but must not move away from the scrum and must not overstep that offside line. The non-ball-winning scrum half can move between the positions **a** and **b**.

#### Example c

The non-ball-winning scrum half may decide to move to or beyond the offside line 5 metres behind the hindmost foot of that player's team, but once there, must remain behind the offside line until the scrum is over.

### Law text

#### Law 20.12 OFFSIDE AT THE SCRUM

- (d) The scrum half whose team does not win possession of the ball must not move to the opposite side of the scrum and overstep the offside line. For that scrum half that runs through the hindmost foot of that player's team in the scrum.

**Penalty:** Penalty Kick

- (e) The scrum half whose team does not win possession of the ball must not move away from the scrum and then remain in front of the offside line. For that scrum half that runs through the hindmost foot of that player's team in the scrum.

**Penalty:** Penalty Kick





## Experimental Law Variation 13

## Law 22 - Corner Posts

*The corner posts are no longer considered to be in touch-in-goal except when the ball is grounded against the post.*

### What this means for the Game



*Player touches corner post before ball is grounded*

UNDER CURRENT LAW:

NO TRY



UNDER ELV:

TRY



A try will no longer be disallowed if the ball carrier touches the corner post before grounding the ball as long as that player has not otherwise been in touch.

A try will still be disallowed if the ball is grounded against the corner post.

If the ball hits the corner post and bounces back into the playing area, the game continues.

This Experimental Law Variation is designed to avoid tries being disallowed simply because a player has taken out the corner post. It will also serve to simplify the role of the Television Match Official who will no longer need to discern whether the player made contact with the corner post before grounding the ball.

### Law text

#### *Law 22.12 BALL OR PLAYER TOUCHING A FLAG OR FLAG (CORNER) POST*

If the ball or a player carrying the ball touches a flag or a flag (corner) post at the intersection of the touch-in-goal line and the goal line or at the intersection of the touch-in-goal line and dead ball line without otherwise being in touch or touch-in-goal, the ball is not out of play, unless it is first grounded against a flag post.



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## **The IRB Guide to Experimental Law Variations**

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